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Discovering Computers

**Tools, Apps, Devices, and the Impact of
Technology**

Dedication

With heartfelt thanks to my husband, Bill, and children, Jackie and Ricky ... for their endless support, devotion, assistance, understanding, and patience during my work on this and all other projects throughout my career. I love you all dearly.

Thanks also to Sue, Steve, Jennifer, and Mark. It's a pleasure to work with such a dedicated team.

— *Misty E. Vermaat*

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— *Susan L. Sebok*

For my wife, Traci, and my children, Maddy and Sam, whose support and love are incredibly motivating. Thanks to my parents for their endless encouragement, and to Linda Linardos, who was instrumental in starting my writing career.

— *Steven M. Freund*

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— *Jennifer T. Campbell*

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— *Mark Frydenberg*

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We dedicate this book to the memory of Thomas J. Cashman (4/29/32 – 1/7/15). As one of the founders of the Shelly Cashman Series, Tom partnered with Gary Shelly to write and publish their first computer education textbook in 1969, revolutionizing the introductory computing course and changing the path of computing course materials. From 1969 through his retirement in 2008, Tom served as educator, author, leader, and inspiration to his fellow authors and Shelly Cashman Series team members. His mark on the series and the introductory computing market is indelible and he will be both remembered and missed.

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**Discovering Computers: Tools, Apps, Devices,
and the Impact of Technology**

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Tools, Apps, Devices, and the Impact of Technology

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Chapter 2: DNS Servers • IP Addresses
Chapter 3: Touch Screen Technology • Voice Recognition Technology
Chapter 4: Compression Algorithms • Filtering Data
Chapter 5: Digital Forensics • Encryption Algorithms
Chapter 6: Coding Schemes and Number Systems • How Data Is Written To RAM
Chapter 7: Biometric Input • How 3-D Printers Work
Chapter 8: How Data Is Recovered • RAID Levels
Chapter 9: Benchmarking • Virtualization
Chapter 10: Network Topologies: Star, Bus, Ring • OSI Reference Model
Chapter 11: Types of Databases, Database Design, and the Normalization Process • Process and Object Modeling • Programming Logic
Chapter 12: 3-D Graphics • Bioinformatics

HOW TO: YOUR TURN ASSIGNMENTS – APP ADVENTURES

Chapter 1: Health • Fitness
Chapter 2: Messaging Apps
Chapter 3: News • Sports • Weather
Chapter 4: Office (Email, Calendar, To-Do Lists)
Chapter 5: Retail

Chapter 6: Media Sharing
Chapter 7: Travel and Tourism
Chapter 8: Reference and Information
Chapter 9: Mapping
Chapter 10: Streaming Audio and Video
Chapter 11: Scanning
Chapter 12: Banking and Finance

TECHNOLOGY INNOVATOR

Chapter 1: Apple • Facebook • Microsoft • Twitter
Chapter 2: Arianna Huffington • LinkedIn • Tim Berners-Lee • Yahoo!
Chapter 3: Dell/Michael Dell • Nintendo • Samsung • Sony
Chapter 4: Adobe Systems • Dan Bricklin • eBay/PayPal • Google/Sergey Brin/Larry Page
Chapter 5: AVG • Intel Security • LoJack • Symantec
Chapter 6: Intel and Gordon Moore • AMD • Nvidia • VMWare
Chapter 7: Logitech • QR Code Inventors • HP
Chapter 8: Pinterest/Ben Silbermann • Seagate/Al Shugart • SanDisk • Amazon/Jeff Bezos
Chapter 9: Linus Torvalds • Red Hat • Sun • IBM
Chapter 10: Robert Metcalfe • AT&T and Verizon • Cisco
Chapter 11: E. F. Codd • Oracle/Larry Ellison • Lenovo • Electronic Arts
Chapter 12: Wikimedia Foundation/Jimmy Wales • Ray Kurzweil • Meg Whitman • Salesforce

TECHNOLOGY TREND

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Chapter 2: Responsive Web Design • Uses of Bookmarking Sites
Chapter 3: Bitcoin • Volunteer Computing
Chapter 4: Evernote • Instagram • iTunes U
Chapter 5: Cloud Security • Uses of Face Recognition Technology
Chapter 6: Medical Robotics • Self-Driving Cars
Chapter 7: Drones • Assistive Technologies
Chapter 8: Digitizing Nondigital Media • Digitizing Media with RECAPTCHA
Chapter 9: Linux Powering the Internet of Things • Mobile versus Desktop Operating System Usage
Chapter 10: Wireless Charging • Geocaching
Chapter 11: Forensic Databases • Custom Crime Fighting Software • Programs behind Mars Rover
Chapter 12: Crowd Sourcing • Monitoring Health Status

Preface

The Shelly Cashman Series® offers the finest textbooks in computer education. We are proud of the fact that the previous seventeen editions of this textbook have been the most widely used in computer education. With this edition of *Discovering Computers*, we have implemented significant improvements based on current computer trends and comments made by instructors and students. *Discovering Computers: Tools, Apps, Devices, and the Impact of Technology* continues with the innovation, quality, and reliability you have come to expect from the Shelly Cashman Series.

In *Discovering Computers: Tools, Apps, Devices, and the Impact of Technology* you will find an educationally sound, highly visual, interactive, and easy-to-follow pedagogy that, with the help of animated figures, relevant video, and interactive activities in the e-book, presents an in-depth treatment of introductory computer subjects. Readers will finish the course with a solid understanding of computers, how to use computers, and how to access information on the web.

Objectives of This Text, eReader, and CourseMate Web site

Discovering Computers: Tools, Apps, Devices, and the Impact of Technology is intended for use as a stand-alone solution

or in combination with an applications, Internet, or programming textbook in a full-semester introductory technology course. No experience with computers is assumed. The objectives of this offering are to:

- Present the most-up-to-date technology in an ever-changing discipline
- Give readers an in-depth understanding of why computers are essential in business and society
- Teach the fundamentals of and terms associated with computers and mobile devices, the Internet, programs and apps, and digital safety and security
- Present the material in a visually appealing, interactive, and exciting manner that motivates readers to learn
- Provide exercises, assignments, and interactive learning activities that allow readers to learn by actually using computers, mobile devices, and the Internet
- Present strategies for purchasing desktop computers, mobile computers, and mobile devices
- Provide additional learning materials and reinforcement online
- Offer distance-education providers a textbook with a meaningful and exercise-rich digital learning experience

Hallmarks of Discovering Computers

To date, more than six million readers have learned about computers using *Discovering Computers*. With the online integration and interactivity, step-by-step visual drawings and photographs, unparalleled currency, and the Shelly and Cashman touch, this book will make your computer concepts course exciting and dynamic. Hallmarks of Shelly Cashman Series *Discovering Computers* include:

A Proven Pedagogy

Careful explanations of complex concepts, educationally-sound elements, and reinforcement highlight this proven method of presentation.

A Visually Appealing Book that Maintains Student Interest

The latest technology, photos, drawings, and text are combined artfully to produce a visually appealing and easy-to-understand book. Many of the figures include a

step-by-step presentation, which simplifies the more complex technology concepts. Pictures and drawings reflect the latest trends in computer technology.

Latest Technologies and Terms

The technologies and terms readers see in *Discovering Computers* are those they will encounter when they start using computers and mobile devices personally and professionally. Only the latest applications are shown throughout the book.

Web Integrated

This book uses the web as a major learning tool. The purpose of integrating the web into the book is to (1) offer students additional information and currency on important topics; (2) use its interactive capabilities to offer creative reinforcement; (3) make available alternative learning techniques with games and quizzes;

Distinguishing Features

Discovering Computers: Tools, Apps, Devices, and the Impact of Technology includes a variety of compelling features, certain to engage and challenge students, making learning with *Discovering Computers* an enriched experience. These compelling features include:

- NEW!** • **Introducing Today's Technologies.** This new introductory chapter details how to succeed in this course by setting the stage for the rich resources available in the text and online to support learning.
- NEW!** • **Technology Timeline.** This engaging visual provides milestones in technology history.
- NEW!** • **Cloud and Skills Coverage.** An integrated approach to cloud computing and search skills appears throughout the text shows how to apply these concepts to learning.
- NEW!** • **Career Coverage.** Career information is covered, including using social media to jumpstart your technology career.
- NEW!** • **Discover More Online.** Free resources and premium content include currency updates and additional detailed topical content.
- **Strong Content.** Based on market research, assessment of organization of each chapter's content, *Discovering Computers* has been restructured and reorganized to improve retention of material and promote transference of knowledge. The text's visually engaging presentation showcases current technology as well as course fundamentals in order to reinforce classroom and real-world applications.

- **Balanced Presentation.** The print book provides students with what they need to know to be successful digital citizens in the classroom and beyond. Online resources address timely content and expand on the print text with content appropriate for Information Technology majors. Readers can choose to utilize this digital-only content, empowering each to fit the content to their specific needs and goals for the course.
- **Thematic Approach.** Chapter boxes, marginal elements, and accompanying online content are linked by common themes to facilitate class discussions and help students make connections. These connections shed light on the integral role technology plays in business and society.
- **Media Engagement.** Enrichment content is available online to enhance student knowledge and understanding through additional free resources and premium content. Developed by the authors, this content provides deeper understanding and encourages learning by doing, as well as offering practical skill development.
- **Reinforcement and Support.** End-of-chapter student assignments, along with the accompanying CourseMate website, offer students an exceptional learning solution in addition to significant practice opportunities in the form of study guide materials, flash cards, practice tests and critical thinking opportunities.

(4) underscore the relevance of the web as a fundamental information tool that can be used in all facets of society; (5) introduce students to web-based research; and (6) offer instructors the opportunity to organize and administer their traditional campus-based or distance-education-based courses on the web using various learning management systems.

Extensive End-of-Chapter Student Assignments

A notable strength of *Discovering Computers* is the extensive student assignments and activities at the end of each chapter. Well-structured student assignments can make the difference between students merely participating in a class and students retaining the

information they learn. End-of-chapter student assignments include the following:

- Study Guide exercises reinforce material for the exams
- Key Terms page reviews chapter terms
- Checkpoint exercises test knowledge of chapter concepts
- How To: Your Turn exercises require that students learn new practical skills
- Problem Solving exercises require that students seek solutions to practical technology problems
- Internet Research exercises require that students search for information on the web
- Critical Thinking exercises challenge student assessment and decision-making skills

Instructor Resources

The Instructor Resources include both teaching and testing aids.

Instructor's Manual Includes lecture notes summarizing the chapter sections, figures and boxed elements found in every chapter, teacher tips, classroom activities, lab activities, and quick quizzes in Microsoft Word files.



Syllabus Customizable sample syllabi that cover policies, assignments, exams, and other course information.

Solutions to Exercises Includes solutions for all end-of-chapter student assignments.

PowerPoint Presentations A one-click-per-slide presentation system that provides PowerPoint slides for every subject in each chapter.

Test Bank and Test Engine Cengage Learning Testing Powered by Cognero is a flexible, online system that allows you to author, edit, and manage test bank content from multiple Cengage Learning solutions and to create multiple test versions. It works on any operating system or browser with no special installs or downloads needed, allowing you to create tests from anywhere with Internet access. Multi-language support, an equation editor and unlimited metadata help ensure your tests are complete and compliant, and it enables you to import and export content into other systems. The *Discovering Computers* Test Bank includes multiple for every chapter, featuring objective-based and critical thinking question types, and including page number references and figure references as appropriate.

Free Resources Available on the student companion website accessed via www.cengagebrain.com, additional free resources for each chapter allow students to discover more materials and deeper content online to enrich learning.

Computer Concepts CourseMate

The Computer Concepts CourseMate for *Discovering Computers* is the most expansive digital website for any computer concepts text in the market today. The content in the CourseMate solution is integrated into each page of the text, giving students easy access to current information on important topics, reinforcements activities, and alternative learning techniques.

These interactive activities are captured within the CourseMate EngagementTracker, making it easy to assess students' retention of concepts.

MindTap

Typical courses often require students to juggle a variety of print and digital resources, as well as an array of platforms, access codes, logins, and homework systems. Now all of those resources are available in one personal learning experience called MindTap. MindTap is a cloud-based, interactive, customizable, and complete online course. More than an e-book, and different than a learning management system, each MindTap course is built upon authoritative Cengage Learning content, accessible anytime, anywhere.

Additional Online Material

SAM: Skills Assessment Manager

Get workplace-ready with SAM, the market-leading proficiency-based assessment and training solution for Microsoft Office! SAM's active, hands-on environment helps students master Microsoft Office skills and computer concepts that are essential to academic and career success, delivering the most comprehensive online learning solution for your course.

Through skill-based assessments, interactive trainings, business-centric projects, and comprehensive remediation, SAM engages students in mastering the latest Microsoft Office programs on their own, giving instructors more time to focus on teaching. Computer concepts labs supplement instruction of important technology-related topics and issues through engaging simulations and interactive, auto-graded assessments. With enhancements, including streamlined course setup, more robust grading and reporting features, and the integration of fully interactive MindTap Readers containing Cengage Learning's premier textbook content, SAM provides the best teaching and learning solution for your course.

CourseCasts: Learning on the Go

Always available... always relevant Our fast-paced world is driven by technology. You know because you are an active participant — always on the go, always keeping up with technological trends, and always learning new ways to embrace technology to power your life. Let CourseCasts, hosted by Ken Baldauf of Florida State University, be your guide to weekly updates in this ever-changing space. These timely, relevant podcasts are produced weekly and are available for download at <http://coursecasts.course.com> or directly from iTunes (search by CourseCasts). CourseCasts are a perfect solution to getting students (and even instructors) to learn on the go!

Visual Walkthrough of the Book

Current. Relevant. Innovative.

Chapter Opener
familiarize students with the material in each chapter.

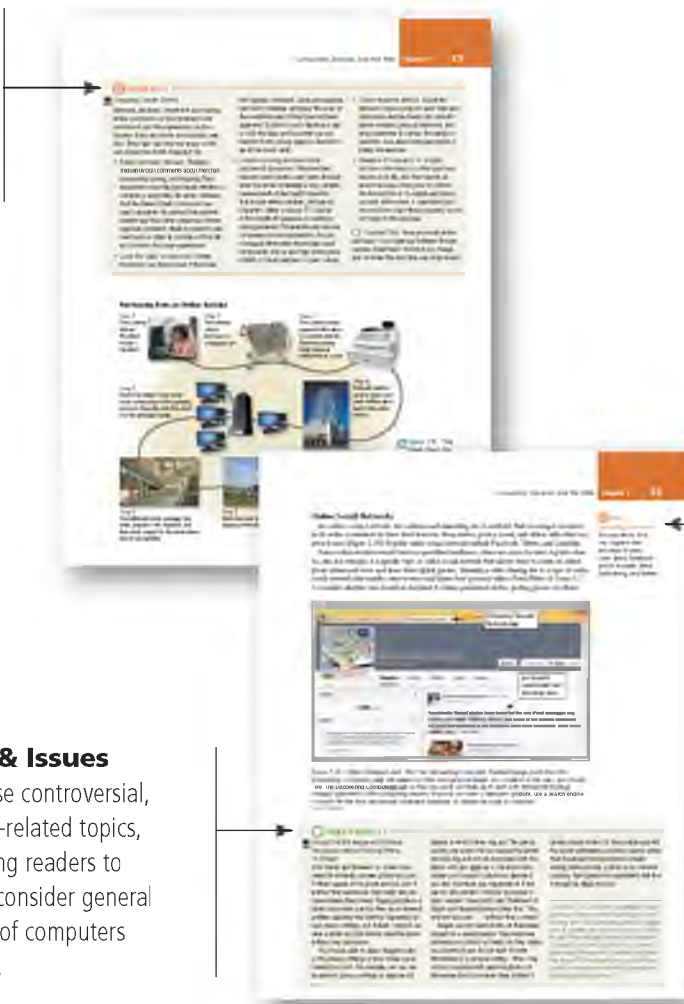
How To
features enable readers to learn new practical skills.

Consider This
features provide readers with critical thinking opportunities.

Mini Features
throughout the text explore various real world topics to deepen concept understanding.

Secure IT

features allow students to broaden their knowledge with details regarding security issues they will face.



Ethics & Issues

boxes raise controversial, computer-related topics, challenging readers to carefully consider general concerns of computers in society.

By The Way (BTW)

marginal elements assist readers in broadening their knowledge.

Now You Should Know

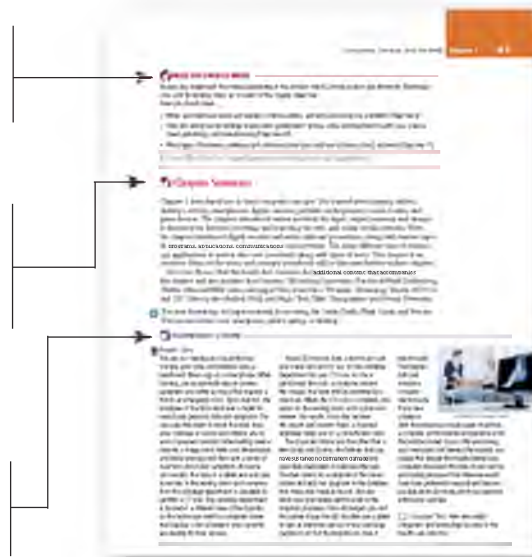
feature provides assessment opportunity and integrates directly to chapter learning objectives to assess learning outcomes.

Chapter Summary

allows another review of materials presented in the chapter to reinforce learning and provide additional self-assessment opportunities.

Technology @ Work

features put chapter information to practical use and provide context within students' lives.



End-of-Chapter Student Assignments

Study Guide

materials reinforce chapter content.

44 Chapter 1 Introducing Today's Technologies

Study Guide

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers, create a document that contains the answers, record answers as audio or video using a webcam, smartphone, or portable media player, post answers on a blog, wiki, or website, or highlight answers in the book/eBook.

1. Define the term, digital literacy.
2. Define the terms, computer, hardware, and user.
3. Differentiate between a PC and a mobile computer. A laptop also is known as a(n) _____ computer.
4. Describe the characteristics and features of a tablet. List several touch screen gestures.
5. Explain the difference between a desktop and an all-in-one. What additional meaning does the term, desktop, sometimes have?
6. Define the term, server. What services does a server provide?
7. Explain whether or not a mobile device is a computer.
8. List characteristics of a smartphone.
9. Differentiate among voice, text, picture, and video messages.
10. Describe the purpose of these mobile devices: digital cameras, portable and digital media players, eBook readers, wearable devices, and game devices.
11. Describe the trend of digital device convergence and how it affects technology in home automation.
12. Differentiate between data and information. Give an example of each.
13. Describe input and output. List several types of input and output devices.
14. Describe the purpose of a pointing device. Give an example of a pointing device you can use to input and view output for a computer.
15. Differentiate between memory and storage.
16. Describe data, instructions, and information on a computer.
17. Describe cloud storage. Describe the types of services and storage providers.
18. Describe a backup plan. How do backup plans differ between personal computers and servers?
19. Identify reasons people use the Internet between the web and the Internet.
20. Describe a worldwide collection of electronic documents. What is each electronic document called?
21. What is a browser? Describe the purpose of a search engine.
22. Explain the purpose of an online social network.
23. Differentiate between the services and uses of Facebook, Twitter, and LinkedIn.
24. List services of the Internet that facilitate communications.
25. Define the term, malware. List ways you can protect yourself from malware.
26. What privacy risks are involved with using technology? List guidelines for creating a strong password.
27. Explain physical and behavioral health risks associated with using computers.
28. Describe strategies that support green computing.
29. Define the term, software. Software also is called a(n) ____.
30. Define the term, operating system. List popular operating systems for computers and mobile devices.
31. Differentiate between desktop, web, and mobile apps.
32. List the steps involved in installing programs.
33. Explain how to locate, install, and run programs. What is the role of a software developer?
34. Define the term, communications device. List examples of wireless communications technologies.
35. Define the term, hot spot. Give two examples and describe how each is used.
36. Describe how homes and businesses use networks.
37. Identify issues surrounding accessing an unsecured network.
38. Explain what occurs when you synchronize computers and mobile devices.
39. List ways that school use technology to enhance education.
40. Identify how the following industries use technology: government, financial, retail, entertainment, health care, science, travel, publishing, and manufacturing.
41. Describe how you might use blogs, wikis, and podcasts to publish content.
42. Differentiate among the following technology user types: home user, small/home office user, mobile user, power user, and enterprise user.
43. Describe how technology is used in the health care industry.

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to complete the Checkpoint exercises interactively, complete the self-assessment in the Test Prep resource from your smartphone, tablet, laptop, or desktop, and then take the Practice Test.

True/False

- Mark T for true and F for false.
1. Electronic components in computers process data using instructions, which are the steps that tell the computer how to perform a particular task. (4)
 2. An all-in-one contains a separate cover. (6)
 3. Smartphones typically communicate wirelessly with other devices or computers. (7)
 4. Data conveys meaning to users, and information is a collection of unprocessed items, which can include text, numbers, images, audio, and video. (12)
 5. A header is a type of input device. (14)
 6. A scanner is a light-emitting output device. (14)
 7. Although some forms of memory are permanent, most memory keeps data and _____ temporarily, meaning its contents are erased when the computer is turned off. (16)
 8. A solid-state drive contains one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information. (17)
 9. The terms, web and Internet, are interchangeable. (21)
 10. One way to protect your computer from malware is to scan any removable media before using it. (25)
 11. Operating systems are a widely recognized example of system software. (26)
 12. You usually do not need to install web apps before you can run them. (28)

Multiple Choice

- Select the best answer.
1. A(n) _____ is any hardware component that allows you to enter data and instructions into a computer or mobile device. (12)
 - a. output device
 - b. communications
 - c. input device
 - d. display
 2. Which of the following is *not* an example of an output device? (14)
 - a. scanner
 - b. printer
 - c. display
 - d. speaker
 3. _____ consists of electronic components that store instructions waiting to be executed and the data needed by those instructions. (16)
 - a. Storage
 - b. Cloud storage
 - c. Solid-state drives
 - d. Memory
 4. _____ is an Internet service that provides remote storage to computer users. (18)
 - a. Smart TV
 - b. Cloud storage
 - c. Solid-state drive (SSD)
 - d. Bluetooth
 5. A computer that delivers requested webpages to your computer or mobile device is a(n) _____. (21)
 - a. VoIP computer
 - b. web server
 - c. FTP device
 - d. hard drive
 6. _____ is software that enables users with an Internet connection to access and view webpages on a computer or mobile device. (21)
 - a. search engine
 - b. Wi-Fi
 - c. browser
 - d. digital media player
 7. _____ uses short-range radio signals to enable computers and devices to communicate with each other. (22)
 - a. Cellular radio
 - b. Bluetooth
 - c. Wi-Fi
 - d. A hot spot
 8. A(n) _____ is a collaborative website that allows users to create, add to, modify, or delete the content via their browser. (40)
 - a. podcast
 - b. blog
 - c. online social network
 - d. wiki

Checkpoint

activities provide multiple-choice, true/false, matching, and consider this exercises to reinforce understanding of the topics presented in the chapter.

Problem Solving

activities call on students to relate concepts to their own lives, both personally and professionally, as well as provide a collaboration opportunity.

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Problem Solving

The Problem Solving exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The Collaboration exercises should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problem in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in a print, blog, podcast, video, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resources used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

1. **Shopping for Software** You are shopping for software that will assist you with your home's interior design. The package for the program you would like to purchase states that it was designed for the most recent version of Windows, but an older version is installed on your computer. How can you determine whether the program will run on your computer?
2. **Bad Directions** You are driving to your friend's house and are using your smartphone for directions. While approaching your destination, you realize that your smartphone app instructed you to turn the wrong way on your friend's street. How could this have happened?
3. **Bank Account Postings** While reviewing your checking account balance online, you notice that debit card purchases have not posted to your account for the past several days. Because you use online banking to balance your account, you become concerned about your unknown account balance. What steps will you take to correct this situation?
4. **Trial Expired** You have been using an app on your mobile device for a 30-day trial period. Now that the 30 days have expired, the app is requesting that you to pay to continue accessing your data. What are your next steps? What steps could you have taken to preserve your data before the trial period expired?
5. **Problematic Camera** After charging your digital camera battery overnight, you insert the battery and turn on the camera only to find that it is reporting a low battery. Seconds later, the camera shuts off automatically. What might be wrong?

Professional

6. **Discarding Old Computer Equipment** Your company has given you a new laptop to replace your current, outdated desktop. Because of the negative environmental impact of discarding the old computer in the trash, your supervisor asked you to suggest options for its disposal. How will you respond?
7. **Dead Battery** While traveling for business, you realize that you forgot to bring the battery charger for your laptop. Knowing that you need to use the laptop to give a presentation tomorrow, what steps will you take tonight to make sure you have enough battery power?
8. **Cannot Share Photos** You are attempting to send photos of a house for sale in an email message to your real estate partner. Each time you attempt to send the email message, you receive an automatic response stating that the files are too large. What are your next steps?
9. **Incorrect Sign-In Credentials** Upon returning to the office from a well-deserved two-week vacation, you turn on your computer. When you enter your user name and password, an error message appears stating that your password is incorrect. What are your next steps?
10. **Synchronization Error** You added appointments to the calendar on your computer, but these appointments are not synchronizing with your smartphone. Your calendar has synchronized with your smartphone in the past, but it has stopped working without explanation. What are your next steps?

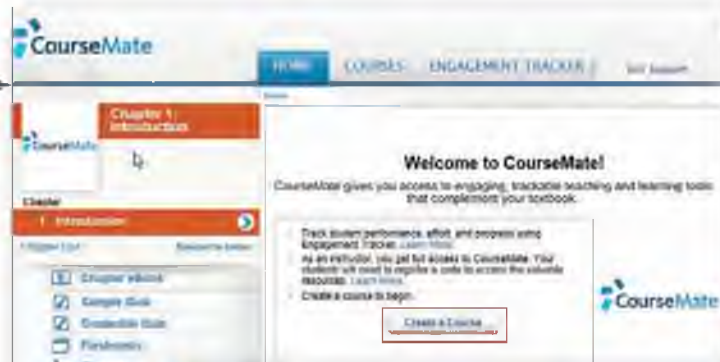
Collaboration

11. **Technology in Health Care** Your primary care physician is moving from a shared office so that he can open his own practice. He mentioned that he would like to use technology in his office that not only will improve the patient experience, but also make his job easier. Form a team of three people to determine the types of technology your doctor can use in his new office. One team member should research the types of technology that can help improve patient check-in and billing. Another team member should research the types of technology your doctor can use while he is working with patients, and the third team member should research any additional technology that can be used in the office to improve the patient experience. Compile your findings in a report and submit it to your instructor.

Visual Walkthrough of the Computer Concepts CourseMate, MindTap, and Free Resources

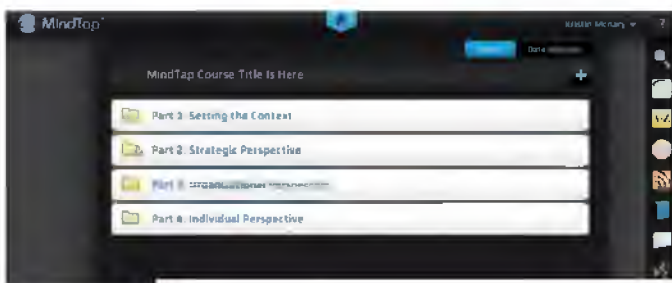
CourseMate

Introduce the most current technology into the classroom with the Computer Concepts CourseMate. An integrated MindTap eReader and a wide range of online learning games, quizzes, practice tests, and web links expand on the topics covered in the text with hands-on reinforcement. Visit www.cengagebrain.com to register your access code and access your course and the premium resources assigned by your instructor.



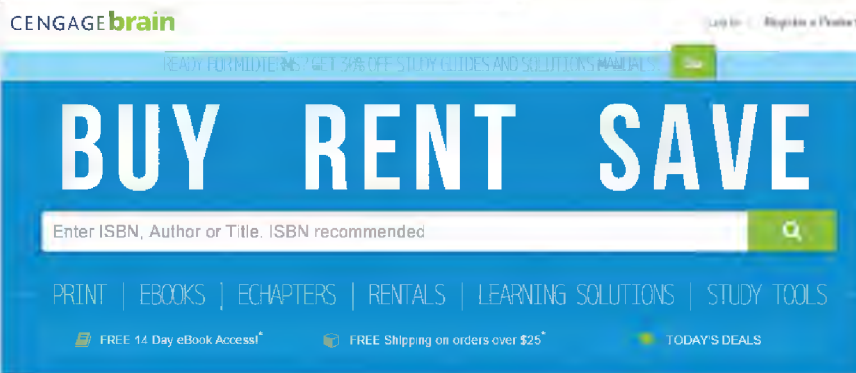
Engagement Tracker

Engagement Tracker makes assessing students easy by tracking student progress on the interactive activities. Clear and visual reports illustrate the class progress as a whole.



MindTap

MindTap is a personalized teaching experience with relevant assignments that guide students to analyze, apply, and improve thinking, allowing you to measure skills and outcomes with ease.



Free Resources on CengageBrain

Start with locating *Discovering Computers* on www.cengagebrain.com in order to access the free resources found on the student resources page.

SUCCEEDING IN THIS COURSE: Tips and Pointers

Intro



You can improve your digital literacy by reading this book and accessing its associated online content.

Introduction

This introductory chapter is designed to prepare you to succeed in this course. It begins with a discussion of browsing the web, followed by overview of the book and its associated additional online content, which familiarizes you with the meanings of references and symbols that appear throughout the book. Next is a brief buyer's guide that you can use to purchase a desktop, laptop, or tablet for use during the semester. Finally is an abbreviated set of exercises designed to acquaint you with the resources you will be expected to use in Chapter 1.

Keep in mind that this chapter uses a variety of terms that are described in more depth in Chapter 1 and throughout the book. These terms also are defined in this book's index. If you need additional information about a particular topic, refer to the appropriate chapter.

Browsing the Web

Each chapter in this book contains topics, elements, and assignments that presume you already know how to use a browser. As you may know, a browser is software that enables you to access and view webpages on a computer or mobile device that has an Internet connection. Some widely used browsers include Internet Explorer, Firefox, Safari, and Chrome. Read How To 1 for instructions about using a browser to display a webpage on a computer or mobile device.

HOW TO 1**Use a Browser to Display a Webpage**

The following steps describe how to use a browser to display a webpage on a computer or mobile device:

1. Run a browser. (Chapter 1 discusses running programs and apps.)
2. If necessary, tap or click the address bar to select it and any previously displayed web address it may contain. (A web address is a unique address that identifies a webpage.)
3. In the address bar, type the web address of the webpage you want to visit and then press the ENTER key or tap or click the Go (or similar) button to display the webpage. For example, www.cengagebrain.com is a valid web address, which displays the CengageBrain webpage shown in the figure below. (Chapter 2 discusses the components of a web address.)
4. If necessary, scroll to view the entire webpage. You can scroll either by sliding

your finger across a touch screen or by using a pointing device, such as a mouse, to drag the scroll bar.

5. Tap or click links on the webpage to navigate to the link's destination.

Consider This: What should you do if the web address you enter does not display a webpage or you receive an error message?

**CONSIDER THIS****What does the  icon mean that appears in the book?**

This icon denotes that the questions or exercises that follow require critical thinking. Your instructor may assign or expect you to discuss in class any of these questions that appear throughout the chapters.

Book and Online Content

As a student in this course, you should be aware that the material located in the pages of this book includes content you should know to be successful as a student and as a digital citizen. Other content is available online only as free resources or premium content. The free resources are available at no additional cost with your book purchase, whereas the premium content may or may not have been included with your purchase, as determined by your instructor. Please see the preface or your instructor for details related to the location of the free resources and the premium content, as well as information about purchasing the premium content, if desired.

Free Resources The free resources, which are available online, present (1) up-to-date content including current statistics, trends, models, products, programs, apps, etc., (2) content that elaborates on essential material in the book, or (3) content required for those students majoring in the information technology or computer science fields. When free resources are available for a topic in this book, they will be identified in one of two ways:

(a) Free resources icon (📄): These icons precede chapter boxed elements to indicate that additional material is available in the free resources. The chapter boxed elements that may have associated free resources include the following (Figure 1):

- Ethics & Issues
- How To
- Secure IT
- Technology @ Work

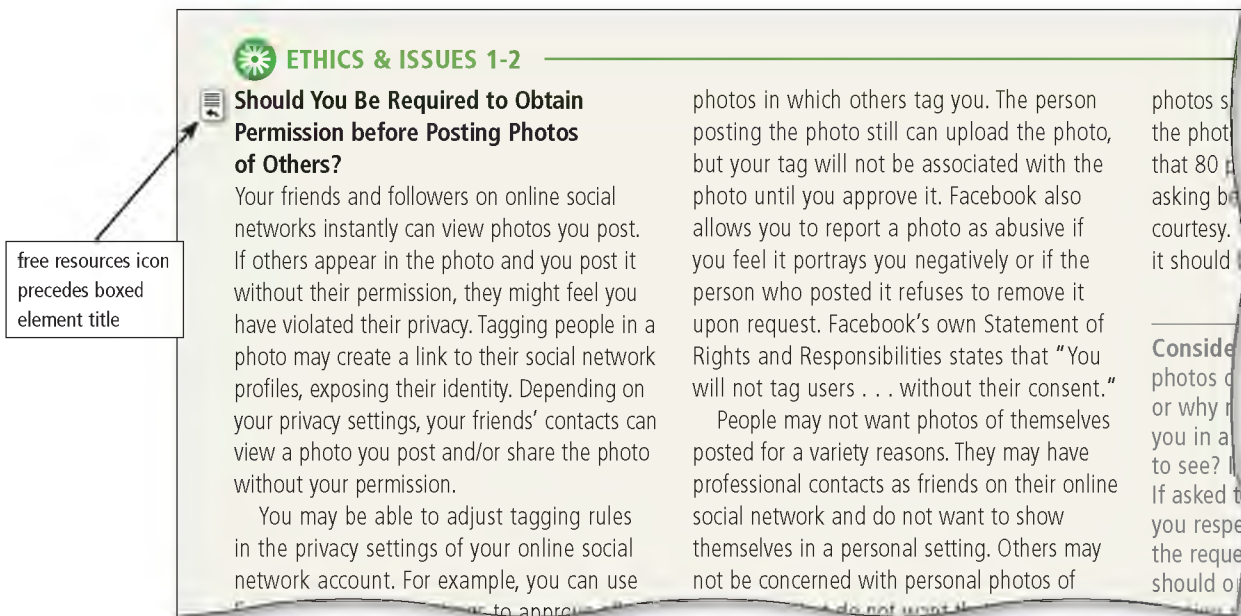


Figure 1 When you see the 📄 icon to the left of a boxed element title or the phrase, it means you can find additional related online material in the free resources.

(b) **Discover More** reference: These references within the text and in the margins briefly identify the type of material you will find in the free resources. The **Discover More** references appear within the paragraphs of text in the chapter (Figure 2). The marginal elements that may have associated free resources include the following:

- High-Tech Talk
- Technology Innovator
- Technology Trend

BTW
Table of Boxed Elements
 For a complete list of every print and online boxed element in this book, see the Table of Boxed Elements in the preface.

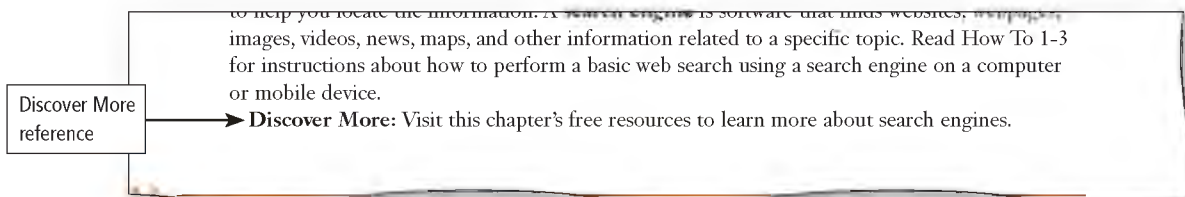


Figure 2 When you see the **Discover More** reference, it means you can find additional, related online content that will direct you either to material in the free resources or premium content.

Premium Content The premium content, which is available online, includes interactive activities, additional exercises, and other resources designed to enhance your learning experience, reinforce and test your knowledge of chapter concepts, or challenge you with additional assignments. When premium content is available for a topic in this book, it will be identified in one of two ways:

- (a) Premium content icon (🔒): These icons precede chapter figures and other elements to indicate that additional resources are available as premium content. The chapter elements with associated premium content include the following (Figure 3):
 - Animation videos: View these animations to better understand some of the more complex figures in the book.
 - Drag-and-drop activities: Practice these interactive activities to test your knowledge of a concept in a table or figure.
 - Study Guide, Flash Cards, and Practice Test resources: Prepare for quizzes and exams by viewing the material from your smartphone, tablet, laptop, or desktop.

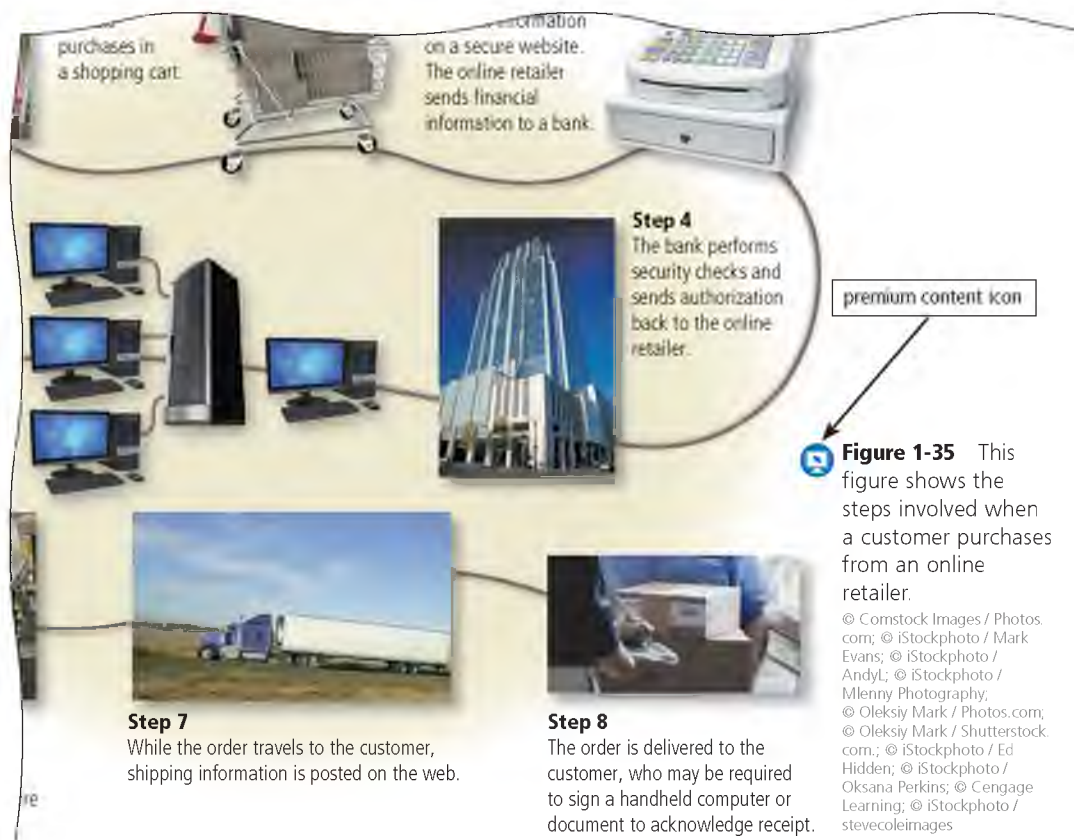


Figure 3 When you see the 🔒 icon, it means you can find additional, related online chapter resources in the premium content.

- (b) **Discover More** reference: These references within the text briefly identify the type of material you will find in the premium content. Resources available as premium content include practice quizzes, study guide questions for material presented in the free resources, Key Terms and Checkpoint activities, additional How To: Your Turn and Internet Research exercises, and more.

Purchasing the Right Computer

As a student in a technology course, you might be thinking of purchasing a desktop, laptop, or tablet to help you with this course and future courses in your academic career. In addition to the information in this section, consider speaking with your instructors, as well as an academic advisor, to see if they have any specific recommendations for computers or mobile devices you might use in the courses you plan to take. If your academic institution has a store that sells computers, it also might have specific computer or mobile device recommendations, as well as a student discount program. Make sure the computer or mobile device you purchase is capable of running the software that you will need for your classes.

Step 1: Choose the Computer Type

Laptops, tablets, and desktops each serve a different purpose. It is important that you choose the type of computer best suited to your needs. This section briefly describes and identifies some of the pros and cons associated with each type of computer. See Chapter 3 for a more thorough discussion of computer types.

Laptops A laptop is a thin, lightweight mobile computer with a screen in its lid and a keyboard in its base (Figure 4). Users who need or want to be able carry a computer from place to place may choose a laptop.



Figure 4 Two different types of laptops.

© Sergey Peterman / Shutterstock.com; © iStockphoto / Skip Odonnel; Source: Microsoft; Apple, Inc.

PROS

- Portable
- Uses less electricity than a desktop
- Contains a battery that can last at least several hours without being plugged in to an external power source
- Often more powerful than a tablet
- Contains several different types of ports
- All required components housed in a single unit (i.e., compact keyboard, touchpad, screen, speakers, etc.)
- Can support more types of external devices than tablets (i.e., full-sized keyboard, mouse, microphone, monitor, printer, scanner, webcam, speakers, etc.)
- Supports programs and apps specifically designed for desktops and laptops
- Can connect to a large monitor

CONS

- Might not be as powerful as high-end desktops
- May not support as much memory and hard drive space as desktops
- Contains fewer ports than desktops
- May support fewer external devices than desktops
- Not as easy for a user to upgrade or repair as desktops
- May not be as portable as tablets

Tablets A tablet is a thin, lightweight mobile computer that has a touch screen (Figure 5). Users who do not need the power of a laptop but require a portable computer for basic tasks may choose a tablet.



Figure 5 One type of tablet.
© iStockphoto / franckreporter

PROS

- More portable than laptops
- Lightweight (most tablets weigh less than two pounds)
- Use less electricity than a desktop
- Battery life often is superior to laptops
- All required components housed in a single unit (touch screen, speakers, etc.)
- Can connect a removable keyboard
- Use thousands of free and fee-based apps
- Often are easier to use than desktops and laptops
- Built-in memory card slots can increase storage capacity

CONS

- Not as powerful as desktops and laptops
- Hardware cannot be upgraded
- Typically do not support the same types of apps as desktops and laptops
- Have limited multitasking capabilities
- More susceptible to damage because they frequently are moved from place to place
- Because a touch screen is the primary form of input, it may be difficult to enter large amounts of text on a tablet (unless an external keyboard is connected)
- Lack surface to rest wrists and arms, so ergonomic problems may develop

Desktops A desktop is a computer designed to be in a stationary location, where all of its components fit on or under a desk or table (Figure 6). Users who may prefer desktops include those with basic home or office computing needs who do not require the portability of a mobile computer or those with high-end computing needs, such as 3-D gaming or HD video editing.



Figure 6 Two different types of desktops.
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PROS

- Often more powerful than laptops and tablets
- Can connect to one or more large monitor(s)
- Contain several different types of ports or multiple duplicate ports
- Can accommodate more types of external devices than laptops and tablets (i.e., keyboard, mouse, microphone, monitor, printer, scanner, webcam, speakers, etc.)
- Often support more memory and hard drive capacity than laptops and tablets
- Support programs and apps specifically designed for desktops and laptops
- Relatively easy for a user to upgrade and repair

CONS

- Require several external, separate components, such as a keyboard, mouse, speakers, and sometimes the monitor
- High-end models can be more expensive than laptops and tablets
- Cannot run apps designed for mobile device operating systems, such as Android and iOS

Most students will find that a laptop or desktop is most suitable for their coursework or for gaming. In addition, they might choose a tablet to carry with them at other times because tablets are ideal for everyday tasks, such as searching the web, checking email messages, participating in video calls, and reading e-books.

Step 2: Choose the Operating System

An operating system is software (a program) that coordinates all the activities among computer components. Multiple operating systems exist for each type of device (Table 1). Deciding which operating system is best for you will be the next step in determining the specific brand of computer that ultimately meets your needs.

Certain courses may require specific applications (apps), and those applications may be available only on a specific operating system. For example, a course that teaches digital media might require an application that is available only for Mac OS. Table 2 illustrates the various categories of programs and apps. This section outlines the more common operating systems for each type of device. See Chapter 4 for a more thorough discussion of an operating system.

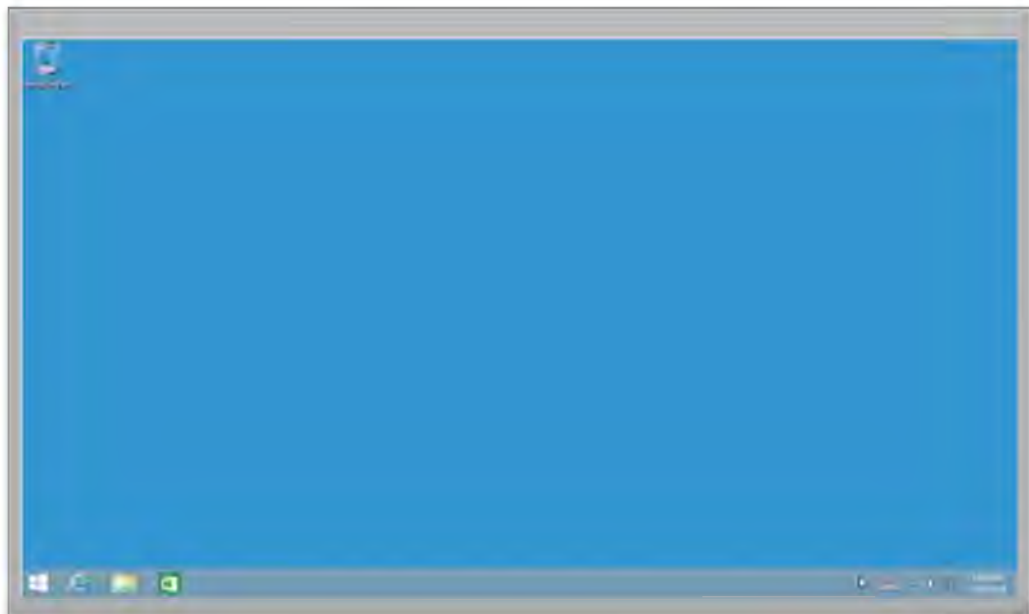
Table 1 Examples of Operating Systems by Category

Category	Name
Desktop	Windows
	OS X
	UNIX
	Linux
	Chrome OS
Mobile	Google Android
	Apple iOS
	Windows Phone

Table 2 Categories of Programs and Apps

Category	Sample Uses for Students
Communications	View course websites. Communicate via email with instructors and other students. Send and receive files. Facilitate and participate in online meetings with instructors and other students.
File, Disk, and System Management	Organize personal and school-related files. Copy and move files. Search for files.
Graphics and Media	Create digital media, such as images and movies. View multimedia course content, such as online lectures.
Personal Interest	Perform research using content from dictionaries, encyclopedias, etc. Learn through tutors and prepare for tests.
Productivity	Create research papers and other documents. Develop presentations to use in classes. Organize your academic and personal schedule.
Security	Protect your computer and schoolwork from viruses and other malicious software.

Laptops and Desktops The two primary operating systems available on laptops and desktops are Windows (shown in Figure 7) and Mac OS (shown in Figure 8). While other operating systems, such as UNIX, Linux, and Chrome OS also are available, Windows and Mac OS are the most common. Some computers can run multiple operating systems. For example, Apple computers can run Windows and Linux in addition to Mac OS. Windows and Mac OS each offer a unique user experience; the best way to determine which one you are most comfortable with is to try using each one. Most stores that sell laptops and desktops will have some working models that you can evaluate. Make sure the operating system you decide to use also is capable of running the programs and apps required for your courses.

**Figure 7** Windows operating system.

Source: Microsoft



Figure 8 Mac OS operating system.
Source: Apple, Inc.

Tablets Tablets often include one of three operating systems: Android (Figure 9), iOS (Figure 10), or Windows (Figure 11). While Android and iOS are the most popular operating systems on tablets, the Windows operating system is increasing in popularity. Determine the types of apps you wish to use on the tablet and then determine which operating systems support those apps.

If you want your tablet to synchronize seamlessly with other computers and devices, such as a laptop, desktop, or smartphone, consider an operating system that is compatible with your other computer or device. For example, if you have an Android phone, you might prefer the Android operating system for your tablet. If you use an iPhone or iPod Touch, you might prefer the iOS operating system for your tablet.



Figure 9 Tablet running Android operating system.
© iStockphoto / PetkoDanov



Figure 10 Tablet running iOS operating system.
© iStockphoto / Hocus Focus Studio



Figure 11 Tablet running Windows operating system.
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Step 3: Choose Configuration Options

The final step in choosing the best laptop, tablet, or desktop to meet your needs is to choose the specific configuration details. For example, you may have to choose the size of the display, amount of memory, storage capacity, and processor speed.

Display Screen Size Display screens for computers are available in a variety of sizes (Figure 12). A laptop's screen typically can range from 11 to 17 inches, and a tablet's screen generally is between 7 and 12 inches. If you purchase a laptop or tablet, a smaller screen size will make the device lighter and more portable. For example, laptops with screens exceeding 15 inches typically are much heavier, which makes them less convenient to transport. Desktops often use a monitor as their display, with the size of screens on these monitors ranging from 13 inches to more than 30 inches.

If you primarily will be sending and receiving email messages, creating and editing documents using a word processing app, and browsing the web, a device with a smaller screen should meet your needs. If you require a larger screen to work with large documents or display multiple windows simultaneously, or if you want to experience less eyestrain with the contents appearing larger on the screen, consider a desktop or laptop display with a larger screen size. If you require touch functionality (and the operating system you plan to use supports it), purchase a screen that supports touch input. In addition, if you decide to purchase a laptop or desktop, you usually can connect a second monitor.



Figure 12 A variety of displays

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© Peter Gaid / Shutterstock.com

Memory The amount of memory (RAM) installed in your laptop, tablet, or desktop will help determine the types of programs and apps that can run on the computer, as well as how many programs and apps can run simultaneously (Figure 13). If you are purchasing a laptop or desktop, review the system requirements for the programs and apps you plan to use, and make sure to purchase a computer with enough memory to meet those system requirements. For example, if the operating system you plan to use requires at least 4 GB (gigabytes) of memory, and you plan to use a word processing app that requires 4 GB of memory, you should purchase a laptop or desktop with at least 8 GB of memory. It is recommended that you purchase a computer with slightly more memory than you need at the present time. This enables you to use multiple programs and apps simultaneously and also accommodates programs and apps you might install and use at a later time.



Figure 13 Memory modules contain memory chips.

© TerryM / Shutterstock.com

Storage Capacity and Media Laptops, tablets, desktops are available with various storage capacities. The higher the storage capacity, the more data and information you can keep on the computer or device. To determine the ideal storage capacity, add together the amount of storage space required for all the programs and apps you want to use. In addition, estimate the amount of space you might need to store the files you create. If you are planning to store digital media, such as audio, photos, and videos, make sure the storage device has sufficient space for those files as well. Try not to purchase a device with exactly the amount of storage space you anticipate needing. Always purchase more than you need so that you do not risk running out of space.

In addition to determining sufficient storage capacity for your needs, two main types of primary storage devices from which you may be able to choose include a hard disk (also called a hard drive) or an SSD (solid-state drive) (Figure 14). Hard disks use magnetic particles to store data, instructions, and information on one or more inflexible, circular platters. SSDs are flash memory storage devices that contain their own processors to manage their storage. Hard disks often are less expensive than SSDs and offer greater storage capacities. SSDs, however, are faster than hard disks and may be less susceptible to failure.

Processor Speed If you are purchasing a laptop or desktop, you probably will have to determine the processor that will best meet your needs. Many different brands and models of processors are available (Figure 15). Review the system requirements for the programs and apps you want to run to determine the processor best suited to your needs. Because a variety of brands and models of processors exist, you may find it difficult to decide which one to purchase. When you are shopping for your laptop, tablet, or desktop, ask a sales associate to explain the differences among the various processors so that you can make an informed decision.

Step 4: Choose the Purchasing Option

You can purchase new computers and mobile devices in physical stores as well as from online retailers. Each purchasing option has advantages and disadvantages, and it is important to consider these before making a purchasing decision. If, after reading this section, you still do not have a strong preference to purchase from a physical store or an online retailer, compare costs from each for a computer with an identical or similar configuration.

Physical Stores A variety of computers and mobile devices are available for sale at physical stores. While physical stores offer the convenience of being able to shop for and bring home a computer or mobile device the same day, they have a limited inventory and available configuration options. Computers and mobile devices in retail stores are prebuilt and often cannot be customized at the store. For example, if you evaluate the various computers at a physical store and see a laptop you are considering, that laptop may be available in only one configuration. If you want to make changes to the hardware configuration (such as adding a larger hard drive), that would need to be done by a third party after you make the purchase. Some computer and mobile device manufacturers may void their warranty if a third party upgrades your computer or mobile device after the purchase has been made, so be sure to purchase a computer that adequately meets your needs.



Figure 14 Two different types of storage devices.

© Andres / Shutterstock.com; © roadk / Shutterstock.com



Figure 15 Processor that might be found in a computer or device.

Courtesy of Intel Corporation

Online Retailers Unlike physical stores, online retailers may offer greater configuration options for a computer or mobile device you are considering purchasing. For example, you may be able to completely customize a computer by choosing the exact processor, memory, and hard drive capacity. Online retailers also may offer prebuilt options, so consider the cost difference between purchasing a prebuilt computer and a customized computer with similar specifications. You may find that purchasing a prebuilt computer with a configuration slightly better than one you customized is less expensive. Prebuilt computers often may be less expensive because they are mass produced. If you purchase a computer from an online retailer, however, you will not be able to see the computer and evaluate it before purchase. In addition, it may take several days to several weeks before computers and mobile devices purchased from online retailers may arrive on your doorstep. If you receive the computer or mobile device and do not like it, returning or exchanging it may not be as easy as if you were to purchase it in a physical store.

How To: Your Turn

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Get the Most out of Your Book

Unlike many traditional textbooks, this book contains a variety of elements to help enrich your understanding of the concepts taught in the text. These elements include steps that teach you how to perform real-world tasks, current issues related to technology, and a variety of information to keep you secure while interacting with computers and mobile devices. The following steps guide you through the process of navigating this book and getting the most out of it.

- Locate and read a How To box in Chapter 1 (or other chapter of your choice). How To boxes appear in shaded boxes with orange borders at the top and bottom. These boxes teach you how to perform real-world tasks that are related to the surrounding chapter content. Answer the question(s) at the bottom of the How To box.
- Locate and read a Consider This box in Chapter 1 (or other chapter of your choice). Consider This boxes are identified by a green border at the top and bottom. These boxes contain common questions and answers that are related to the surrounding chapter content and often promote critical thinking.
- Locate and read a Secure IT box in Chapter 1 (or other chapter of your choice). Secure IT boxes

appear in shaded boxes with orange borders at the top and bottom. These boxes contain information about security concerns and helpful safety and security tips that are related to the surrounding chapter content. Answer the question(s) at the bottom of the Secure IT box.

- Locate and read an Ethics & Issues box in Chapter 1 (or other chapter of your choice). Ethics & Issues boxes appear in shaded boxes with orange borders at the top and bottom. These boxes contain information about current, relative ethical issues and present multiple sides of the issue. Answer the question(s) at the bottom of the Ethics & Issues box.
- Locate and read a Mini Feature in Chapter 1 (or other chapter of your choice). Mini Features are one page in length and present interesting concepts that are related to the surrounding chapter text. Answer the question(s) at the bottom of the Mini Feature.
- Locate and read a BTW element (BTW stands for "by the way"). BTW elements provide extra tidbits of information related to the chapter text and also may reference additional online content.
- Locate and read an Internet Research element. These elements provide suggested search keywords to help you use a search engine to locate current information about the surrounding chapter text.

How To: Your Turn

- h. Locate and read the Technology @ Work box in Chapter 1 (or other chapter of your choice). Technology @ Work boxes are identified by purple borders at the top and bottom and provide information about how technology is used in various industries. Answer the question(s) at the bottom of the Technology @ Work box.

Exercises

1. What type of box or element described above is your favorite? Why? Which one is your least favorite? Why?
2. Describe ways that each type of box and element in the chapter can help enhance your understanding of the chapter contents.
3. Review the topics of the boxes in Chapter 1 (or other chapter of your choice). Which one is of most interest to you? Why?

Access This Book's Free Resources

This book's free resources contain a wealth of information that extends beyond what you learn by reading this book. The free resources also contain additional information about current technology developments and content required for those students majoring in the information technology or computer science fields.

You can access the free resources at the web address of www.cengagebrain.com. Once the book's free resources are displayed, select Chapter 1 to view the resources associated with that chapter. View the resources available with another chapter and notice the similarities between the types of content offered in Chapter 1 and the other chapter you chose.

Exercises

1. What exact steps did you take to access the free resources?
2. List and describe the different types of content present in the Chapter 1 free resources.

3. Do you feel the free resources will be useful to you and further enhance your understanding of computers and other technology? Why or why not?

Sign Up for a Microsoft Account

A Microsoft account provides access to resources to several Microsoft services. These services include access to resources, such as a free email account, cloud storage, a location to store information about your contacts, and an online calendar. You will need a Microsoft account to complete some of the exercises in this book. The following steps guide you through the process of signing up for a Microsoft account.

- a. Run a browser and navigate to www.outlook.com.
- b. Tap or click the link and then follow the on-screen instructions to sign up for a free Microsoft account.
- c. Browse the resources available to you in your Microsoft account.
- d. If assigned by your instructor, compose and send a new email message from your Microsoft account to your instructor stating that you have signed up for a Microsoft account successfully.
- e. Add your instructor's contact information. Next, add contact information for at least three more people.
- f. Add your birthday to the calendar.
- g. Edit your Microsoft account profile to add more contact and work information.

Exercises

1. If necessary, navigate to and view your new outlook .com email account. What are some ways to prevent junk email messages using the mail settings? What is junk email?
2. What is OneDrive? How much space do you have available on OneDrive to post files?
3. How can you see yourself using the various features in your newly created Microsoft account?

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Social Media

You likely have heard and seen the phrases, “Like us on Facebook” and “Follow us on Twitter.” Facebook and Twitter are two websites that advertisers, organizations, celebrities, and many groups use to promote and share their products, causes, events, and interests. Millions of people have accounts on Facebook, Twitter, and many other websites known collectively as online social networks. You will learn about social media throughout this book and, in Chapter 1, will learn how to create Facebook and Twitter accounts. You then will view information on these websites and realize that social media can engage and connect the online social network community members effectively.

Research This: If you are signed in to your Facebook account, sign out. Run a browser and then navigate to www.facebook.com. What information is required to sign up for an account? Why does Facebook require a birthdate? Locate and then tap or click the About link. How many ‘likes’ does Facebook have? What is the content of the first post on this page? How many people ‘liked’ this first post, and how many people replied to it?

If you are signed in to your Twitter account, sign out. Navigate to www.twitter.com. Describe the contents of the cover photos. Tap or click the About link at the bottom of the page and read the information. What is the content of the three most recent Tweets?

Search Skills

Searching in an E-Book

One advantage that e-books have over printed books is that you can search the text to locate specific content easily. To search within an e-book, locate its search box, often identified by a ‘Search inside this book’ (or similar) label. Type the word or phrase for which to search, and tap or click a search button. The search button usually contains the word Search or the word Go, or displays a magnifying glass icon. The reader will highlight or provide a list of occurrences where the search text appears within the e-book. You often can jump directly to the page where the word or phrase appears or tap or click buttons labeled Next or Previous (or displaying forward- and backward-pointing arrow icons) to navigate through the occurrences. Within the text, the key words appear highlighted.

A search box also may include options for narrowing down search results, such as limiting search results to a particular chapter. When you type a page number in a search box, some e-book readers will navigate to the location in the e-book corresponding to that page in the printed book.

Research This: Select any e-book to display on your computer or mobile device. Type a significant word from the title as your search text. Use the e-book reader’s search feature to answer these questions: (1) Where on the screen, and in what format, does the e-book reader display search results? (2) What information do search results include to help you find the result you are seeking? (3) How do you navigate from one occurrence of the search term to the next? (3) How does the e-book display your search text within the book so that you can locate it easily?

If you are reading the *Discovering Computers* e-book, display it on your computer or mobile device. Enter appropriate search text into the search box for the *Discovering Computers* e-book reader to search for answers to each of these questions: (1) How many times does the word, Twitter, appear in Chapter 1? (2) Complete the sentence in Chapter 1 that begins, “Most e-book reader models have...” (3) What sentence contains the first occurrence of the word, laptop, in Chapter 1?

If you read both the *Discovering Computers* e-book and another e-book, compare the experience using both e-book readers. Which features are common to both? What differences did you notice?

Security

The buyer’s guide in this introductory chapter provides information you can use to purchase a laptop, tablet, or desktop. No matter which operating system you choose and how you configure the computer or device, you need to protect your investment from security risks. You will learn about these unwelcome intrusions, called malware, in Chapter 1 and throughout this book, but it is important to obtain malware protection when, or soon after, you purchase the computer or mobile device. You also should install the latest updates.

Research This: Visit a physical electronics store or view online retailers’ websites to learn about software that helps prevent malware from infecting computers. Read the packaging or the product details or talk to employees to determine the names of three programs recommended or rated highly. What protections against Internet threats are offered? For example, do they safeguard your photos, music, and financial data, include updates and backup tasks, and offer parental controls? What is the cost, if any, of these programs and the updates? Do computer or mobile device manufacturers include this software with the original purchase? Which operating system is required? How much memory is required?

INTRODUCING TODAY'S TECHNOLOGIES: Computers, Devices, and the Web

1



"I use computers, mobile devices, and the web to do homework, look up information, check email, play games, post updates, talk to friends, upload photos, sync music, and so much more! I feel comfortable using technology. What more do I need to know?"

While you may be familiar with some of the content in this chapter, do you know how to . . .

- Use a touch screen?
- Configure social media privacy settings to prevent others from posting unauthorized photos of you?
- Ease eyestrain while working on a computer or mobile device?
- Protect your hearing when using earbuds or headphones?
- Back up computers and mobile devices?
- Perform a web search?
- Sync computers and mobile devices?
- Protect your computer from viruses and other malware?
- Shop safely online?
- Create a strong password?
- 'Like' the Discovering Computers page on Facebook and 'follow' it on Twitter?
- Connect to a wireless network?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

Technology provides access to the digital world around you.





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✓ Objectives

After completing this chapter, you will be able to:

- 1 Differentiate among laptops, tablets, desktops, and servers
- 2 Describe the purpose and uses of smartphones, digital cameras, portable and digital media players, e-book readers, wearable devices, and game devices
- 3 Describe the relationship between data and information
- 4 Briefly explain various input options (keyboards, pointing devices, voice and video input, and scanners), output options (printers, displays, and speakers), and storage options (hard disks, solid-state drives, USB flash drives, memory cards, optical discs, and cloud storage)
- 5 Differentiate the web from the Internet, and describe the relationship among the web, webpages, websites, and web servers
- 6 Explain the purpose of a browser, a search engine, and an online social network
- 7 Briefly describe digital security risks associated with viruses and other malware, privacy, your health, and the environment
- 8 Differentiate between an operating system and applications
- 9 Differentiate between wired and wireless network technologies, and identify reasons individuals and businesses use networks
- 10 Discuss how society uses technology in education, government, finance, retail, entertainment, health care, science, travel, publishing, and manufacturing
- 11 Identify technology used by home users, small/home office users, mobile users, power users, and enterprise users

Today's Technology

In the course of a day, you may . . . complete a homework assignment and watch a streaming video using your laptop, flip through news headlines and make dinner reservations using your tablet, search for directions and the local weather forecast while listening to music on your smartphone, edit a video on a desktop computer, and share photos online from your digital camera with family and friends. These and many other technologies are an integral part of everyday life: at school, at home, and at work (Figure 1-1).

Technology can enable you to more efficiently and effectively access and search for information; share personal ideas, photos, and videos with friends, family, and others; communicate with and meet other people; manage finances; shop for goods and services; play games or access other sources of entertainment; keep your life and activities organized; and complete business activities. People who can accomplish these types of tasks using technology often are said to be tech savvy.

Because technology changes, you must keep up with the changes to remain digitally literate. *Digital literacy* involves having a current knowledge and understanding of computers, mobile devices, the web, and related technologies. This book presents the knowledge you need to be digitally literate today.

As you read this first chapter, keep in mind it is an overview. Most of the terms and concepts introduced in this chapter will be discussed in more depth later in the book.



Figure 1-1 People use a variety of computers, mobile devices, and apps everyday.

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Computers

A **computer** is an electronic device, operating under the control of instructions stored in its own memory, that can accept data (*input*), process the data according to specified rules, produce information (*output*), and store the information for future use. Computers contain many electric, electronic, and mechanical components known as *hardware*.

Electronic components in computers process data using instructions, which are the steps that tell the computer how to perform a particular task. A collection of related instructions organized for a common purpose is referred to as software or a program. Using software, you can complete a variety of activities, such as search for information, type a paper, balance a budget, create a presentation, or play a game.

One popular category of computer is the personal computer. A *personal computer* (PC) is a computer that can perform all of its input, processing, output, and storage activities by itself and is intended to be used by one person at a time. Most personal computers today also can communicate with other computers and devices.

Types of personal computers include laptops, tablets, and desktops, with the first two sometimes called mobile computers. A *mobile computer* is a portable personal computer, designed so that a user can carry it from place to place. A *user* is anyone who interacts with a computer or mobile device, or utilizes the information it generates.

Discover More: Visit this chapter's free resources to learn more about electronic components and circuitry of a computer.

Laptops

A **laptop**, also called a *notebook computer*, is a thin, lightweight mobile computer with a screen in its lid and a keyboard in its base (Figure 1-2). Designed to fit on your lap and for easy transport, most laptops weigh up to 7 pounds (varying by manufacturer and specifications). A laptop that is less than one inch thick and weighs about three pounds or less sometimes is referred to as an ultrathin laptop. Most laptops can operate on batteries or a power supply or both.

Tablets

Usually smaller than a laptop but larger than a phone, a **tablet** is a thin, lighter-weight mobile computer that has a touch screen (read How To 1-1 for ways to interact with a touch screen). A popular style of tablet is the slate, which does not contain a physical keyboard (Figure 1-3). Like laptops, tablets run on batteries or a power supply or both; however, batteries in a tablet typically last longer than those in laptops.



Free Resources

For information about how to access this book's free resources (which are indicated by the Discover More text or icons beside titles) and other additional instructor-assigned support material, refer to the Intro chapter and the Preface.



Figure 1-2 A typical laptop has a keyboard in the base and a screen in the lid, with the lid attaching to the base with hinges.

© iStockphoto / Stephen Krow



Figure 1-3 A slate tablet.

© iStockphoto / frankreporter








HOW TO 1-1

Interact with a Touch Screen

You usually can interact with a touch screen using gestures. A *gesture* is a motion you make on a touch screen with the tip of one or more fingers or your hand. Touch screens are convenient because they do not require a separate device for input. Tablets and smartphones typically have touch screens.

The table below presents common ways to interact with a touch screen.

Touch Screen Gestures

Motion	Description	Common Uses
 <p>Tap</p>	Quickly touch and release one finger one time	<ul style="list-style-type: none"> Activate a link (built-in connection) Press a button Run a program or app
 <p>Double-tap</p>	Quickly touch and release one finger two times	<ul style="list-style-type: none"> Run a program or app Zoom in (show a smaller area on the screen, so that contents appear larger) at the location of the double-tap
 <p>Press and hold</p>	Press and hold one finger to cause an action to occur, or until an action occurs	<ul style="list-style-type: none"> Display a shortcut menu (immediate access to allowable actions) Activate a mode enabling you to move an item with one finger to a new location
 <p>Drag, or slide</p>	Press and hold one finger on an object and then move the finger to the new location	<ul style="list-style-type: none"> Move an item around the screen Scroll
 <p>Swipe</p>	Press and hold one finger and then move the finger horizontally or vertically on the screen	<ul style="list-style-type: none"> Scroll Display a bar that contains commands on an edge of the screen
 <p>Stretch</p>	Move two fingers apart	Zoom in (show a smaller area on the screen, so that contents appear larger)
 <p>Pinch</p>	Move two fingers together	Zoom out (show a larger area on the screen, so that contents appear smaller)

Consider This: In addition to the motions listed in the table, what other motions do you think a touch screen should support?

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CONSIDER THIS

If a slate tablet has no keyboard, how do you type on it?

You can use your fingers to press keys on a keyboard that appears on the screen, called an *on-screen keyboard*, or you can purchase a separate physical keyboard that attaches to or wirelessly communicates with the tablet. You also may be able to speak into the tablet, and your spoken words will translate to typed text.



Internet Research

What is a virtual keyboard?

Search for: virtual keyboard



Desktop

The term, desktop, also sometimes is used to refer to an on-screen work area on laptops, tablets, and desktops.

Desktops and All-in-Ones

A **desktop**, or desktop computer, is a personal computer designed to be in a stationary location, where all of its components fit on or under a desk or table. On many desktops, the screen is housed in a display device (or simply display) that is separate from a tower, which is a case that contains the processing circuitry (Figure 1-4a). Another type of desktop called an **all-in-one** does not contain a tower and instead uses the same case to house the display and the processing circuitry (Figure 1-4b). Some desktops and all-in-ones have displays that support touch.

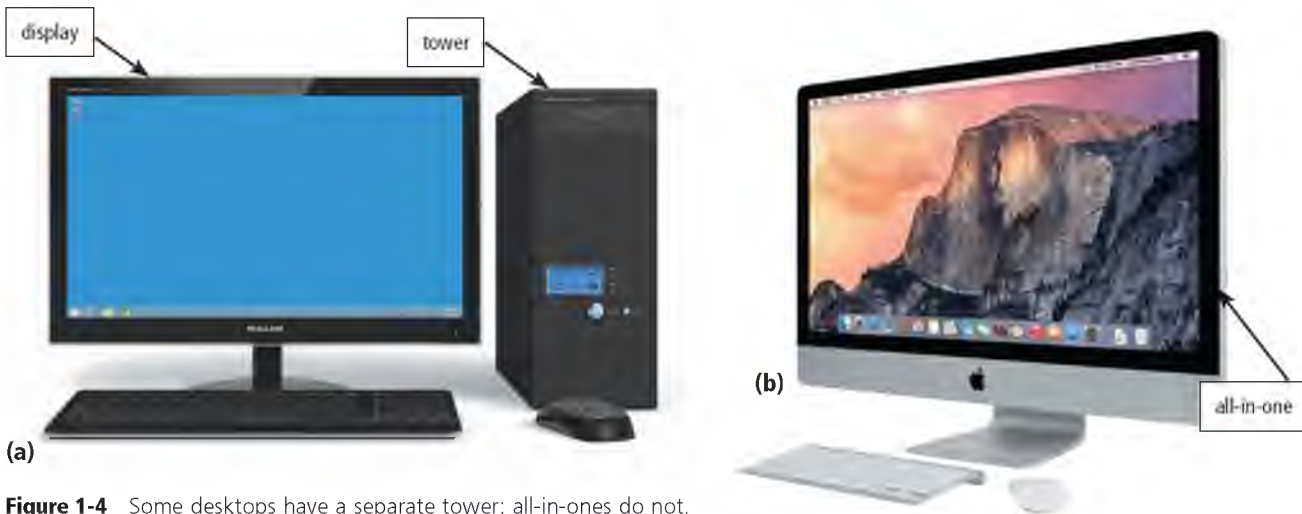


Figure 1-4 Some desktops have a separate tower; all-in-ones do not.

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CONSIDER THIS

Which type of computer — laptop, tablet, or desktop — is best?

It depends on your needs. Because laptops can be as powerful as the average desktop, more people today choose laptops over desktops so that they have the added benefit of portability. Tablets are ideal for those not needing the power of a laptop or for searching for information, communicating with others, and taking notes in lectures, at meetings, conferences, and other forums where a laptop is not practical. Desktops and all-in-ones often have larger displays than laptops or tablets, which make them well suited for developing software, editing large documents, or creating images and videos.



Online

When a computer or device connects to a network, it is said to be online.



Servers

A **server** is a computer dedicated to providing one or more services to other computers or devices on a network. A network is a collection of computers and devices connected together, often wirelessly. Services provided by servers include storing content and controlling access to hardware, software, and other resources on a network.

A server can support from two to several thousand connected computers and devices at the same time. Servers are available in a variety of sizes and types for both small and large business applications (Figure 1-5). Smaller applications, such as at home, sometimes use a high-end desktop as a server. Larger corporate, government, and web applications use powerful, expensive servers to support their daily operations.

Figure 1-5 A server provides services to other computers or devices on a network.

© iStockPhoto / GuidoVrola

Mobile and Game Devices

A *mobile device* is a computing device small enough to hold in your hand. Because of their reduced size, the screens on mobile devices are small — often between 3 and 5 inches.

Some mobile devices are Internet capable, meaning that they can connect to the Internet wirelessly. You often can exchange information between the Internet and a mobile device or between a computer or network and a mobile device. Popular types of mobile devices are smartphones, digital cameras, portable and digital media players, e-book readers, and wearable devices.

CONSIDER THIS

Are mobile devices computers?

The mobile devices discussed in this section can be categorized as computers because they operate under the control of instructions stored in their own memory, can accept data, process the data according to specified rules, produce or display information, and store the information for future use.

Smartphones

A **smartphone** is an Internet-capable phone that usually also includes a calendar, an address book, a calculator, a notepad, games, and several other apps (which are programs on the smartphone). Other apps are available through an app store that typically is associated with the phone.

Smartphones typically communicate wirelessly with other devices or computers. With most smartphone models, you also can listen to music, take photos, and record videos.

Many smartphones have touch screens. Instead of or in addition to a touch screen, some smartphones have a keyboard that slides in and out from behind the phone (Figure 1-6). Others have built-in mini keyboards or keypads that contain both numbers and letters. Some are called a *phablet* because they combine the features of a smartphone with a tablet.



Internet Research

What are some app stores?

Search for: popular app stores

 **Figure 1-6** Smartphones may have a touch screen and/or a slide out keyboard.
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© iStockPhoto / scanrail

Instead of calling someone's phone to talk, you can send messages to others by pressing images on an on-screen keyboard on the phone, keys on the phone's mini keyboard, or buttons on the phone's keypad. Four popular types of messages that you can send with smartphones include voice messages, text messages, picture messages, and video messages.

- A *voice mail message* is a short audio recording sent to or from a smartphone or other mobile device.
- A *text message* is a short note, typically fewer than 300 characters, sent to or from a smartphone or other mobile device.
- A *picture message* is a photo or other image, sometimes along with sound and text, sent to or from a smartphone or other mobile device.
- A *video message* is a short video clip, usually about 30 seconds, sent to or from a smartphone or other mobile device.

BTW

Messaging Services

Mobile service providers may charge additional fees for sending text, picture, or video messages, depending on the messaging plan.

Read Ethics & Issues 1-1 to consider whether it should be legal to use a hands-free device, such as a smartphone, while driving.

ETHICS & ISSUES 1-1

Should It Be Legal to Use a Hands-Free Device while Driving?

Your new vehicle includes a sophisticated hands-free system that enables you to connect a mobile device to the vehicle's sound system. In addition to making phone calls without holding your device, you also can use this technology to read and respond to email messages or to update your Facebook status using speech-to-text, which converts your spoken words to text. Is this technology safe to use?

The debate about hands-free device safety elicits different points of view from vehicle insurance companies, consumer safety groups, and the telecommunications industry. AAA (American Automobile

Association) conducted a study to measure the mental effect of using hands-free devices while driving. The conclusions indicated that drivers using hands-free devices are distracted, miss visual clues, and have slower reaction times. The report also stated that 3000 fatalities occur each year due to the use of hands-free devices.

Critics say that using a hands-free device gives people a false sense of security. Others claim that drivers can be just as easily distracted if they are discussing business or emotional matters with passengers in the vehicle. Some states have outlawed any use of mobile phones while driving; others require drivers to use hands-free devices

while driving. Lawmakers are attempting to regulate "distracted driving" caused by using hands-free devices. One issue that remains unclear is whether law enforcement has a right to look at a user's devices to determine whether they were used illegally.

Consider This: Do you think the government should be able to establish rules about hands-free device usage while driving? Why or why not? Do you believe you are distracted if you use hands-free devices while driving? Why or why not? Do you think auto manufacturers should continue to put hands-free device technology in vehicles? Why or why not?

Digital Cameras

A **digital camera** is a device that allows you to take photos and store the photographed images digitally (Figure 1-7). A smart digital camera also can communicate wirelessly with other



Figure 1-7 With a digital camera, you can view photographed images immediately through a small screen on the camera to see if the photo is worth keeping.

Source: Samsung

Internet Research

What is a digital SLR camera?

Search for: digital slr camera

devices and include apps similar to those on a smartphone. Many mobile computers and devices, such as tablets and smartphones, include at least one integrated digital camera.

Digital cameras typically allow you to review, and sometimes modify, images while they are in the camera. You also can transfer images from a digital camera to a computer or device, so that you can review, modify, share, organize, or print the images. Digital cameras often can connect to or communicate wirelessly with a computer, a Smart TV (discussed later in the chapter), a printer, or the Internet, enabling you to access the photos on the camera without using a cable. Some also can record videos. Many digital cameras also have built-in GPS (discussed later in this chapter), giving them the capability to record the exact location where a photo was taken and store these details with the photo.

Portable and Digital Media Players

A **portable media player** is a mobile device on which you can store, organize, and play or view digital media (Figure 1-8). *Digital media* includes music, photos, and videos. Thus, portable media players enable you to listen to music, view photos, and watch videos, movies, and television shows. With most, you transfer the digital media from a computer or the web, if the device is Internet capable, to the portable media player. Some enable you to play the media while it streams, that is, while it transfers to the player.

Portable media players usually require a set of *earbuds*, which are small speakers that rest inside each ear canal. Some portable media player models have a touch screen, while others have a pad that you operate with a thumb or finger, so that you can navigate through digital media,

adjust volume, and customize settings. Some portable media players also offer a calendar, address book, games, and other apps (discussed later in this chapter).

Portable media players are a mobile type of digital media player. A *digital media player* or *streaming media player* is a device, typically used in a home, that streams digital media from a computer or network to a television, projector, or some other entertainment device.



What are popular digital media players?

Search for: digital media players



Figure 1-8 Portable media players, such as the iPod shown here, typically include a set of earbuds. Digital media players stream media to a home entertainment device.

© iStockphoto / Sebastien Cote; © iStockPhoto / marvinh

E-Book Readers

An **e-book reader** (short for electronic book reader), or *e-reader*, is a mobile device that is used primarily for reading e-books (Figure 1-9). An *e-book*, or digital book, is an electronic version of a printed book, readable on computers and other digital devices. In addition to books, you typically can purchase and read other forms of digital media such as newspapers and magazines.

Most e-book reader models have a touch screen, and some are Internet capable. These devices usually are smaller than tablets but larger than smartphones.



Figure 1-9 An e-book reader.

© iStockPhoto

Wearable Devices

A **wearable device** or *wearable* is a small, mobile computing consumer device designed to be worn (Figure 1-10). These devices often communicate with a mobile device or computer.

Wearable devices include activity trackers, smartwatches, and smartglasses. Activity trackers monitor heart rate, measure pulse, count steps, and track sleep patterns. In addition to keeping time, a smartwatch can communicate with a smartphone to make and answer phone calls, read and send messages, access the web, play music, work with apps, such as fitness trackers and GPS, and more. With smartglasses, a user looks into an eyeglass-type device to view information or take photos and videos that are projected to a miniature screen in the user's field of vision.



Figure 1-10 Activity trackers, smartwatches, and smartglasses are popular types of wearable devices.

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© iStockPhoto / scanrail;
© iStockPhoto / ferrantraite

Game Devices

A **game console** is a mobile computing device designed for single-player or multiplayer video games. Gamers often connect the game console to a television so that they can view their gameplay on the television's screen (Figure 1-11). Many game console models are Internet capable and also allow you to listen to music and watch movies or view photos. Typically weighing between three and eleven pounds, the compact size of game consoles makes them easy to use at home, in the car, in a hotel, or any location that has an electrical outlet and a television screen.

A handheld game device is small enough to fit in one hand, making it more portable than the game console. Because of their reduced size, the screens are small — similar in size to some smartphone screens. Some handheld game device models are Internet capable and also can communicate wirelessly with other similar devices for multiplayer gaming.



Figure 1-11 Game consoles often connect to a television; handheld game devices contain a built-in screen
 © iStockPhoto / pagadesign; © iStockPhoto / AnthonyRosenberg



CONSIDER THIS

Are digital cameras, portable media players, e-book readers, and handheld game devices becoming obsolete because more and more smartphones and tablets include their functionality?

Many smartphones and tablets enable you to take and store photos; store, organize, and play or view your digital media; read e-books; and play games. This trend of computers and devices with technologies that overlap, called **digital device convergence**, means that consumers may need fewer devices for the functionality that they require.

Still, consumers may purchase separate stand-alone devices (i.e., a separate digital camera, portable media player, etc.) for a variety of reasons. The stand-alone device (i.e., a digital camera) may have more features and functionality than the combined device offers (i.e., a smartphone). You might want to be able to use both devices at the same time; for example, you might send text messages on the phone while reading a book on an e-book reader. Or, you might want protection if your combined device (i.e., smartphone) breaks. For example, you still can listen to music on a portable media player if your smartphone becomes nonfunctional.

Mini Feature 1-1: Living Digitally — Gaming and Digital Home

Technology has made homes entertaining, efficient, and safe. Read Mini Feature 1-1 to learn how game devices provide entertainment and education, and home automation offers convenience and significant cost savings.

MINI FEATURE 1-1

Gaming and Digital Home

Academic researchers developed the first video games in the 1950s as part of their studies of artificial intelligence and simulations, and their work was applied and expanded commercially to early home consoles and arcade games. The concept of home automation can be traced back to 1898 when Nikola Tesla invented the first remote control. The following sections describe how these two technologies are used today.

Gaming

Video gamers spend billions of dollars each year making the most of their downtime with game consoles and devices, with an estimated 5 billion people worldwide playing at least 45 hours per week. The popularity is due, in large part, to the social aspect of gathering families and friends to play together as a group or online with each other and those around the world. The wide variety of categories offers a gaming experience for practically everyone in genres such as adventure, education, fitness, puzzles, sports, role-playing, and simulation.

- **Obtaining Games:** Gamers have several options available for locating games. For tablets and smartphones, they can download games from an app store to a mobile computer or device. For game consoles, they can purchase or rent discs or other media that contain games; download or transfer them from online stores; or sign up for cloud services that stream or transfer games on demand.
- **Accessories and Input Techniques:** The more popular game consoles work with a wide variety of accessories and input techniques for directing movements and actions of on-screen players and objects. They include gamepads, voice commands, and fitness accessories, some of which are shown here. Although many games are played using a controller, several systems operate by allowing the player to be the controller.



Home Automation

New home builders and existing homeowners are integrating features that automate a wide variety of tasks, save time and money, and enhance the overall at-home environment.

- **Lighting:** Controlling lighting is one of the more common uses of technology in the home. Remotes turn light fixtures on and off, and motion sensors turn on lights when a car or a visitor approaches the driveway or walkway.
- **Thermostats:** Programmable thermostats adjust to seasonal needs and can be set to control temperatures in individual rooms. Homeowners can use their smartphones to monitor heating and cooling systems, adjust temperatures, and manage energy consumption.
- **Appliances:** Smart appliances, such as dishwashers, can be programmed to run at nonpeak electrical times. Coffeemakers can turn on at set times and shut off if an overheating coffee pot has been left on accidentally. Refrigerators can track expiration dates and create shopping lists.
- **Security:** Security systems can detect break-ins at doors and heat from fires, and they can send text and email messages to alert a homeowner when someone has entered or left the home. Surveillance cameras keep a watchful eye on the premises and interior rooms; homeowners can view the images on televisions and computers within the house or on a webpage when they are away from home, as shown in the figure.
- **Remotes:** Many people are turning to using their smartphones and tablets to control all the devices in the room. Users enjoy the convenience of customizing apps to operate their television, DVR, and security system and to perform other functions anywhere in the home.



Discover More: Visit this chapter's free resources to learn more about game genres, game controllers, remotes, programmable thermostats, smart appliances, security systems, and vacuum systems.

Consider This: How has your life become more efficient, safe, and enjoyable by using home automation and entertainment features? What are the advantages of playing games, and do they outweigh the disadvantages?

Data and Information

Computers process data (input) into information (output) and often store the data and resulting information for future use. *Data* is a collection of unprocessed items, which can include text, numbers, images, audio, and video. *Information* conveys meaning to users. Both business and home users can make well-informed decisions because they have instant access to information from anywhere in the world.

Many daily activities either involve the use of or depend on information from a computer. For example, as shown in Figure 1-12, computers process several data items to print information in the form of a cash register receipt.

Step 1

Cashier scans or enters items purchased and the amount received from the customer. These items are entered into the computer as data.



DATA (input)

2 Medium Sodas	\$1.49 each
1 Small Turkey Sub	\$3.49 each
1 Caesar Salad	\$4.49 each
1 Bag of Chips	\$0.99 each
3 Cookies	\$0.39 each
Amount Received	\$20.00

Step 2

The computer receives the entered data, stores it, processes the data into information (the receipt), and stores the resulting information.

STORAGE and PROCESSES

- Stores entered data.
- Computes each item's total price by multiplying the quantity ordered by the item price (i.e., $2 * 1.49 = 2.98$).
- Organizes data.
- Sums all item total prices to determine order total due from customer (13.12).
- Calculates change due to customer by subtracting the order total from amount received ($20.00 - 13.12 = 6.88$).
- Stores resulting information.

Step 3

The resulting information (the cash register receipt) is printed for the customer.



INFORMATION (output)

Figure 1-12 A computer processes data into information. In this simplified example, the item ordered, item price, quantity ordered, and amount received all represent data (input). The computer processes the data to produce the cash register receipt (information, or output).

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Mobile Computer Input

If you prefer a full-sized keyboard to a laptop's keyboard or a tablet's on-screen keyboard, you can use a full-sized keyboard with your mobile computer. Likewise, if you prefer using a mouse instead of a touchpad, you can use a mouse with your mobile computer.



CONSIDER THIS

Can you give another example of data and its corresponding information?

Your name, address, term, course names, course sections, course grades, and course credits all represent data that is processed to generate your semester grade report. Other information on the grade report includes results of calculations such as total semester hours, grade point average, and total credits.

Input

Users have a variety of input options for entering data into a computer, many of which involve using an input device. An **input device** is any hardware component that allows you to enter data and instructions into a computer or mobile device. The following sections discuss common input methods.

Keyboards A *keyboard* contains keys you press to enter data and instructions into a computer or mobile device (Figure 1-13). All desktop keyboards have a typing area that includes letters of the alphabet, numbers, punctuation marks, and other basic keys. Some users prefer a wireless keyboard because it eliminates the clutter of a cord.

Keyboards for desktops contain more keys than keyboards on mobile computers and devices. To provide the same functionality as a desktop keyboard, many of the keys on mobile computers and devices serve two or three purposes. On a laptop, for example, you often use the same keys to type numbers and to show various areas on a screen, switching a key's purpose by pressing a separate key first.

Instead of a physical keyboard, users also can enter data via an on-screen keyboard or a virtual keyboard, which is a keyboard that projects from a device to a flat surface.



desktop keyboard



laptop keyboard



on-screen keyboard



mini keyboard



virtual keyboard

Figure 1-13 Users have a variety of options for entering typed text.

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© iStockphoto / kycstudio; © iStockphoto / MorePixels; Courtesy of Virtek, Inc.

Pointing Devices A pointing device is an input device that allows a user to control a small symbol on a screen, called the pointer. Desktops typically use a mouse as their pointing device, and laptops use a touchpad (Figure 1-14).

A *mouse* is a pointing device that fits under the palm of your hand comfortably. With the mouse, you control movement of the pointer and send instructions to the computer or mobile device. Table 1-1 identifies some of the common mouse operations. Like keyboards, some users prefer working with a wireless mouse.

A *touchpad* is a small, flat, rectangular pointing device that is sensitive to pressure and motion. To control the pointer with a touchpad, slide your fingertip across the surface of the pad. On most touchpads, you also can tap the pad's surface to imitate mouse operations, such as clicking.



mouse



touchpad

Figure 1-14 A mouse and a touchpad.

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© iStockphoto / Michael Bodmann

Table 1-1 Mouse Operations

Operation	Description	Common Uses
<i>Point</i>	Move the mouse until the pointer is positioned on the item of choice.	Position the pointer on the screen.
<i>Click</i>	Press and release the primary mouse button, which usually is the left mouse button.	Select or deselect items on the screen or start a program or feature.
<i>Right-click</i>	Press and release the secondary mouse button, which usually is the right mouse button.	Display a shortcut menu.
<i>Double-click</i>	Quickly press and release the primary mouse button twice without moving the mouse.	Start a program or program feature.
<i>Drag</i>	Point to an item, hold down the primary mouse button, move the item to the desired location on the screen, and then release the mouse button.	Move an object from one location to another or draw pictures.

Voice and Video Input Some mobile devices and computers enable you to speak data instructions using voice input and to capture live full-motion images using video input. With your smartphone, for example, you may be able to use your voice to send a text message, schedule an appointment, and dial a phone number. Or, you may opt for video calling instead of a voice phone call, so that you and the person you called can see each other as you chat on a computer or mobile device. As in this example, video input usually works in conjunction with voice input. For voice input, you use a microphone, and for video input you use a webcam (Figure 1-15).

A *microphone* is an input device that enables you to speak into a computer or mobile device. Many computers and most mobile devices contain built-in microphones. You also can talk into a *headset*, which contains both a microphone and a speaker. Many headsets can communicate wirelessly with the computer or mobile device. A *webcam* is a digital video (DV) camera that allows you to capture video and usually audio input for your computer or mobile device.



Figure 1-15 You can speak instructions into a microphone or wireless headset and capture live video on a webcam for a video call

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Figure 1-16 A scanner.

© iStockphoto / Edgaras Marozas

Scanners A *scanner* is a light-sensing input device that converts printed text and images into a form the computer can process (Figure 1-16). A popular type of scanner works in a manner similar to a copy machine, except that instead of creating a paper copy of the document or photo, it stores the scanned document or photo electronically.

Output

Users have a variety of output options to convey text, graphics, audio, and video — many of which involve using an output device. An **output device** is any hardware component that conveys information from a computer or mobile device to one or more people. The following sections discuss common output methods.

Printers A **printer** is an output device that produces text and graphics on a physical medium, such as paper or other material (Figure 1-17). Printed content sometimes is referred to as a *hard copy* or *printout*. Most printers today print text and graphics in both black-and-white and color on a variety of paper types with many capable of printing lab-quality photos. A variety of printers support wireless printing, where a computer or other device communicates wirelessly with the printer.

A *3-D printer* can print solid objects, such as clothing, prosthetics, eyewear, implants, toys, parts, prototypes, and more. 3-D printers use a plastic substance that prints in layers to create a 3-D (three-dimensional) model.



Figure 1-17 A printer can produce a variety of printed output including photos and 3-D solid objects.

Courtesy of Epson America, Inc.; © iStockPhoto / Stefano Tint

Displays A display is an output device that visually conveys text, graphics, and video information. Displays consist of a screen and the components that produce the information on the screen. The display for a desktop typically is a monitor, which is a separate, physical device. Mobile computers and devices typically integrate the display in their same physical case (Figure 1-18). Some displays have touch screens.

Home users sometimes use a digital television or a Smart TV as a display. A *Smart TV* is an Internet-enabled high-definition television (HDTV) from which you can use the Internet to watch video, listen to the radio, play games, and communicate with others — all while watching a television show.



Figure 1-18 Displays vary depending on the computer or mobile device.

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CONSIDER THIS

What can you do to ease eyestrain while using a computer or mobile device?

Position the display about 20 degrees below eye level. Clean the screen regularly. Blink your eyes every five seconds. Adjust the room lighting. Face into an open space beyond the screen. Use larger fonts or zoom the display. Take an eye break every 30 minutes. If you wear glasses, ask your doctor about computer glasses.



Figure 1-19 In a crowded environment where speakers are not practical, users can wear headphones to hear music, voice, and other sounds.

© iStockphoto / Photo_Alto

Speakers, Earbuds, and Headphones

Speakers allow you to hear audio, that is, music, voice, and other sounds. Most personal computers and mobile devices have a small internal speaker. Many users attach higher-quality speakers to their computers and mobile devices, including game consoles.


So that only you can hear sound, you can listen through earbuds (shown earlier in this chapter in Figure 1-8) or headphones, which cover or are placed outside of the ear (Figure 1-19). Both earbuds and headphones usually include noise-cancelling technology to reduce the interference of sounds from the surrounding environment. To eliminate the clutter of cords, users can opt for wireless speakers or wireless headphones. Read How To 1-2 to learn how to protect your hearing when using earbuds or headphones.

HOW TO 1-2

Protect Your Hearing when Using Earbuds or Headphones

Using earbuds and headphones improperly can lead to permanent hearing loss. The following tips describe some ways to protect your hearing when using earbuds or headphones:

- If people standing next to you can hear the sound being transmitted through the earbuds or headphones you are wearing, decrease the volume until they no longer can hear it. The quieter the sounds, the less damage you will incur.
- If you intend to listen to music through earbuds or headphones for hours at a time, consider listening at only 30 percent maximum volume. Listening for extended periods of time at a high volume may be unsafe for your ears.
- Consider using a high-quality set of headphones. These headphones reduce your risk of developing hearing loss because the sound quality often is better and does not require you to turn up the volume as loud. Also, their design is better, allowing a closer fit and thus reducing the necessary volume required for optimal listening.
- Consider using a set of earbuds or headphones that reduce outside noise. When the earbuds or headphones eliminate the external noise effectively, they can reduce the volume level needed. The lower the volume levels, the less potential hearing damage.

 **Consider This:** Do you prefer earbuds or headphones? Why? Do you think you turn the volume up too loud while listening to music through earbuds or headphones?

Internet Research

What types of headphones are available?

Search for: headphone reviews

Memory and Storage

Memory consists of electronic components that store instructions waiting to be executed and the data needed by those instructions. Although some forms of memory are permanent, most memory keeps data and instructions temporarily, which means its contents are erased when the computer is shut off.

Storage, by contrast, holds data, instructions, and information for future use. For example, computers can store hundreds or millions of student names and addresses permanently.

A computer keeps data, instructions, and information on **storage media**. Examples of local storage media includes hard disks, solid-state drives, USB (universal serial bus) flash drives, memory cards, and optical discs. The amount of storage for each type of storage media varies, but hard disks, solid-state drives, and optical discs usually hold more than USB flash drives and memory cards. Some storage media are portable, meaning you can remove the medium from one computer and carry it to another computer.

A **storage device** records (writes) and/or retrieves (reads) items to and from storage media. Storage devices often also function as a source of input and output because they transfer items from storage to memory and vice versa. Drives and readers/writers, which are types of storage devices, accept a specific kind of storage media. For example, a DVD drive (storage device) accepts a DVD (storage media).

Discover More: Visit this chapter's free resources to learn more about media storage capacity.

Hard Disks A *hard disk* is a storage device that contains one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information. The entire device is enclosed in an airtight, sealed case to protect it from contamination. Laptops and desktops often contain at least one hard disk that is mounted inside the computer's case (Figure 1-20).



Figure 1-21 A solid-state drive (SSD) is about the same size as a laptop hard disk.
© iStockphoto / Ludovit Repko



Figure 1-20 A hard disk mounted inside a laptop's case.
© iStockphoto / Brian Balster

Solid-State Drives A *solid-state drive (SSD)* is a storage device that typically uses flash memory to store data, instructions, and information. Flash memory contains no moving parts, making it more durable and shock resistant than other types of media. For this reason, some manufacturers are using SSDs instead of hard disks in their laptops, tablets, and desktops (Figure 1-21).

CONSIDER THIS

What is an external hard drive?

An external hard drive is a separate, portable, freestanding hard disk or SSD that usually connect to the computer with a cable (Figure 1-22). As with an internal hard disk or SSD, the entire external hard drive is enclosed in an airtight, sealed case.



Figure 1-22 A external hard drive is a separate, freestanding storage device.
© iStockphoto / Armin Schick

BTW
Hard Drives
The term **hard drive** is used to collectively refer to hard disks and SSDs.



Figure 1-23 You insert a USB flash drive in a USB port on a computer.
© Pakhnyushcha / Shutterstock.com

USB Flash Drives A *USB flash drive* is a portable flash memory storage device that you plug in a USB port, which is a special, easily accessible opening on a computer or mobile device (Figure 1-23). USB flash drives are convenient for mobile users because they are small and lightweight enough to be transported on a keychain or in a pocket.

Memory Cards A *memory card* is removable flash memory, usually no bigger than 1.5 inches in height or width, that you insert in and remove from a slot in a computer, mobile device, or card reader/writer (Figure 1-24). With a card reader/writer, you can transfer the stored items, such as digital photos, from a memory card to a computer or printer that does not have a built-in card slot.

Figure 1-24 Computers and mobile devices use a variety of styles of memory cards to store documents, photos, and other items.

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© Sonar / Fotolia; Courtesy of Mark Frydenberg;
© uwimages / Fotolia



CONSIDER THIS

What is the general use for each type of local storage media?

Hard disks and SSDs store software and all types of user files. A *file* is a named collection of stored data, instructions, or information and can contain text, images, audio, and video. Memory cards and USB flash drives store files you intend to transport from one location to another, such as a homework assignment or photos. Optical discs generally store software, photos, movies, and music.



Figure 1-25 You can insert a DVD in a DVD drive on a computer.
© iStockphoto / Hanquan Chen

Optical Discs An *optical disc* is a type of storage media that consists of a flat, round, portable metal disc made of metal, plastic, and lacquer that is written and read by a laser. CDs (compact discs) and DVDs (digital versatile discs) are two types of optical discs (Figure 1-25).

Cloud Storage Instead of storing data, instructions, and information locally on a hard drive or other media, some users opt for cloud storage. **Cloud storage** is an Internet service that provides remote storage to computer users. For example, Figure 1-26 shows JustCloud, which provides cloud storage solutions to home and business users.

Types of services offered by cloud storage providers vary. Some provide storage for specific types of media, such as photos, whereas others store any content and provide backup services. A **backup** is a duplicate of content on a storage medium that you can use in case the original is lost, damaged, or destroyed. Read Secure IT 1-1 for suggestions for backing up your computers and mobile devices.



Figure 1-26 JustCloud is an example of a website that provides cloud storage solutions to home and business users.

Source: JustCloud.com

SECURE IT 1-1

Backing Up Computers and Mobile Devices

Power outages, hardware failure, theft, and many other factors can cause loss of data, instructions, or information on a computer or mobile device. To protect against loss, you should back up the contents of storage media regularly. Backing up can provide peace of mind and save hours of work attempting to recover important material in the event of a mishap.

A backup plan for laptop and desktop computers could include the following:

- Use a backup program, either included with your computer's operating system or one that you purchased separately, to copy the contents of your entire hard drive to a separate device.
- Regularly copy music, photos, videos, documents, and other important items to an external hard drive, a USB flash drive, or a DVD.
- Subscribe to a cloud storage provider.
- Schedule your files to be backed up regularly.

Backup plans for mobile devices are less specific. Apps for backing up your smartphone or tablet's content are available. You also can back up a mobile device to your computer's hard drive using synchronization software that runs on your computer (synchronization software is discussed later in this chapter). Some mobile device manufacturers, such as Apple, provide cloud storage solutions to

owners of their devices. Other services allow subscribers to use another computer as a backup storage location. Overall, the best advice is to back up often using a variety of methods.

Consider This: Do you back up files regularly? If not, why not? What would you do if you had no backup and then discovered that your computer or mobile device had failed?



NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Today's Technology, Computers, Mobile and Game Devices, and Data and Information, as it relates to the chapter objectives.

Now you should know . . .

- Which type of computer might be suited to your needs (Objective 1)
- Why you would use a smartphone, digital camera, portable or digital media player, e-book reader, or wearable device, and which game software/apps you find interesting (Objective 2)
- How to recognize the difference between data and information (Objective 3)
- When you might use the various methods of input, output, and storage (Objective 4)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

The Web

The World Wide Web (or web, for short) is a global library of information available to anyone connected to the Internet. The **Internet** is a worldwide collection of computer networks that connects millions of businesses, government agencies, educational institutions, and individuals (Figure 1-27).

CONSIDER THIS

How do I access the Internet?

Businesses, called Internet service providers (ISPs), offer users and organizations access to the Internet free or for a fee. By subscribing to an ISP, you can connect to the Internet through your computers and mobile devices.



Figure 1-27 The Internet is the largest computer network, connecting millions of computers and devices around the world.

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CONSIDER THIS

Are the web and Internet the same?

No. The Internet provides more than three billion home and business users around the world access to a variety of services. The World Wide Web is one of the widely used services of the Internet. Other popular services include email, instant messaging, VoIP, and FTP (all discussed later in this chapter).

People around the world access the web to accomplish the following types of online tasks:

- Search for information
- Conduct research
- Communicate with and meet other people
- Share information, photos, and videos with others
- Access news, weather, and sports
- Participate in online training
- Shop for goods and services
- Play games with others
- Download or listen to music
- Watch videos
- Download or read books
- Make reservations

The **web** consists of a worldwide collection of electronic documents. Each electronic document on the web is called a **webpage**, which can contain text, graphics, audio, and video (Figure 1-28). A **website** is a collection of related webpages, which are stored on a web server. A **web server** is a computer that delivers requested webpages to your computer or mobile device.

Webpages often contain links. A *link*, short for *hyperlink*, is a built-in connection to other documents, graphics, audio files, videos, webpages, or websites. To activate an item associated with a link, you tap or click the link. In Figure 1-27, for example, tapping or clicking the audio link connects to a live radio show so that you can hear the broadcast. A text link often changes color after you tap or click it to remind you visually that you previously have visited the webpage or downloaded the content associated with the link.

Links allow you to obtain information in a nonlinear way. That is, instead of accessing topics in a specified order, you move directly to a topic of interest. Some people use the phrase *surfing the web* to refer to the activity of using links to explore the web.

A **browser** is software that enables users with an Internet connection to access and view webpages on a computer or mobile device. Some widely used browsers include Internet Explorer, Firefox, Safari, and Google Chrome. Read How To 1 in the Succeeding in this Course chapter at the beginning of this book for instructions about using a browser to display a webpage on a computer or mobile device.



Downloading

Downloading is the process of transferring content from a server on the Internet to a computer or mobile device.



Figure 1-28 Webpages, such as the one shown here, can display text, graphics, audio, and video on a computer or mobile device. Pointing to a link on the screen typically changes the shape of the pointer to a small hand with a pointing index finger.

Source: WTMJ

Web Searching

A primary reason that people use the web is to search for specific information, including text, photos, music, and videos. The first step in successful searching is to identify the main idea or concept in the topic about which you are seeking information. Determine any synonyms, alternate spellings, or variant word forms for the topic. Then, use a search engine, such as Google, to help you locate the information. A **search engine** is software that finds websites, webpages, images, videos, news, maps, and other information related to a specific topic. Read How To 1-3 for instructions about how to perform a basic web search using a search engine on a computer or mobile device.

Discover More: Visit this chapter's free resources to learn more about search engines.

HOW TO 1-3

Perform a Basic Web Search

The following steps describe how to use a search engine on a computer or mobile device to perform a basic web search:

1. Run a browser. (For instructions on running programs and apps, see How To 1-4 later in this chapter.)
2. Display the search engine's webpage on the screen by entering its web address in the address bar. For example, you could type `google.com` to access the Google search engine, `bing.com` to access the

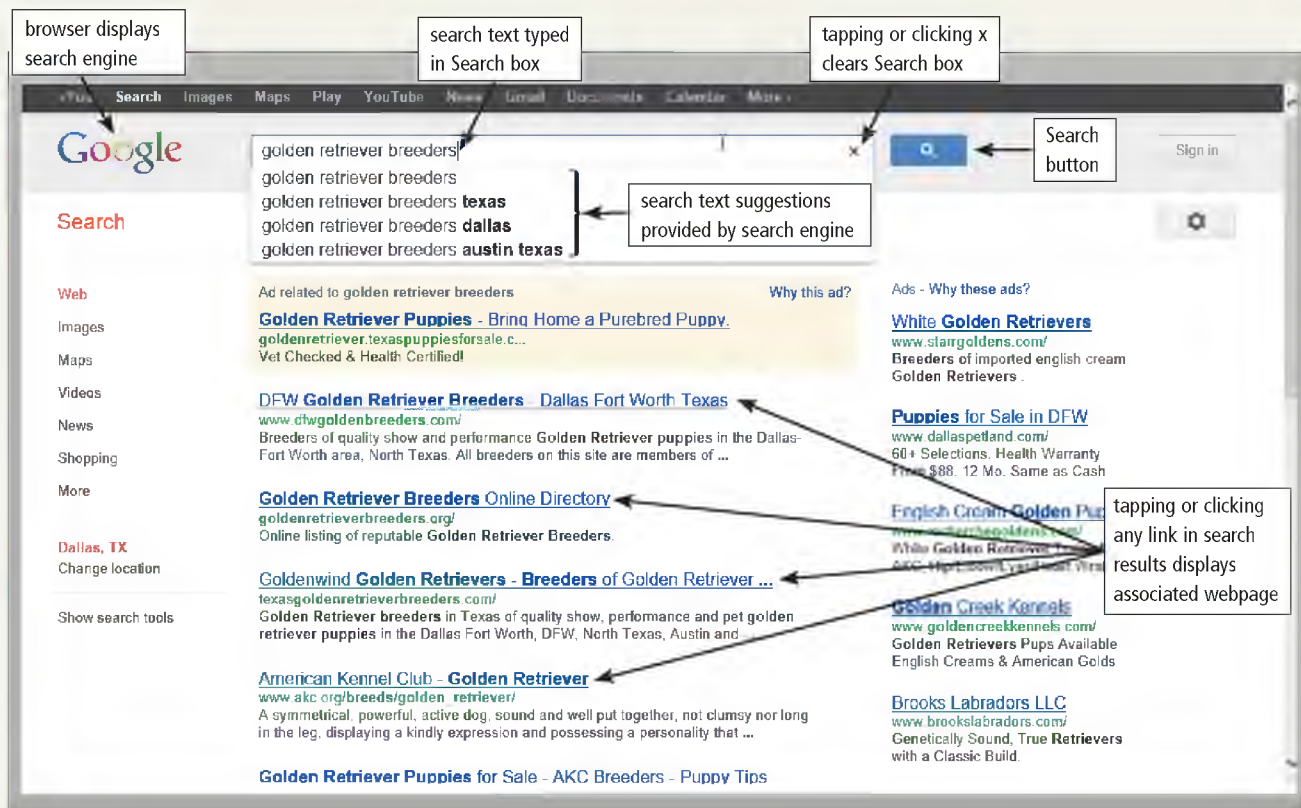
Bing search engine, or `yahoo.com` to access the Yahoo! search engine.

3. Tap or click the Search box and then type the desired search text in the Search box. The more descriptive the search text, the easier it will be to locate the desired search results. As the figure shows, the search engine may provide search text suggestions as you type search text in the Search box.
4. To display search results based on your typed search text, press the ENTER key or tap or click the Search button. To display search results based on one of the suggestions provided

by the search engine, tap or click the desired search text suggestion.

5. Scroll through the search results and then tap or click a search result to display the corresponding webpage.
6. To return to the search results, tap or click the Back button in your browser or on your mobile device, which typically looks like a left-pointing arrow.

Consider This: What search text would you enter to locate the admission criteria for your school?



Source: Google Inc.

Online Social Networks

An **online social network**, also called a *social networking site*, is a website that encourages members in its online community to share their interests, ideas, stories, photos, music, and videos with other registered users (Figure 1-29). Popular online social networks include Facebook, Twitter, and LinkedIn.

Some online social networks have no specialized audience; others are more focused. A photo sharing site, for example, is a specific type of online social network that allows users to create an online photo album and store and share their digital photos. Similarly, a video sharing site is a type of online social network that enables users to store and share their personal videos. Read Ethics & Issues 1-2 to consider whether you should be required to obtain permission before posting photos of others.



Technology Innovators

Discover More: Visit this chapter's free resources to learn more about Facebook and its founder, Mark Zuckerberg, and Twitter.



Figure 1-29 When Facebook users ‘like’ this Discovering Computers Facebook page, posts from the Discovering Computers page will appear on their own personal pages. As a student in this class, you should ‘like’ the Discovering Computers page so that you easily can keep up to date with relevant technology changes and events in the computing industry. If you do not have a Facebook account, use a search engine to search for the text, *discovering computers facebook*, to display the page in a browser.

Source: Facebook

ETHICS & ISSUES 1-2

Should You Be Required to Obtain Permission before Posting Photos of Others?

Your friends and followers on online social networks instantly can view photos you post. If others appear in the photo and you post it without their permission, they might feel you have violated their privacy. Tagging people in a photo may create a link to their social network profiles, exposing their identity. Depending on your privacy settings, your friends’ contacts can view a photo you post and/or share the photo without your permission.

You may be able to adjust tagging rules in the privacy settings of your online social network account. For example, you can use Facebook’s privacy settings to approve all

photos in which others tag you. The person posting the photo still can upload the photo, but your tag will not be associated with the photo until you approve it. Facebook also allows you to report a photo as abusive if you feel it portrays you negatively or if the person who posted it refuses to remove it upon request. Facebook’s own Statement of Rights and Responsibilities states that “You will not tag users . . . without their consent.”

People may not want photos of themselves posted for a variety of reasons. They may have professional contacts as friends on their online social network and do not want to show themselves in a personal setting. Others may not be concerned with personal photos of themselves but do not want their children’s

photos shared online. Or, they simply may find the photo unflattering. A poll by Sophos stated that 80 percent of respondents consider asking before posting a photo to be common courtesy. Eight percent of respondents felt that it should be illegal to do so.

Consider This: Is it ever acceptable to post photos of others without permission? Why or why not? Has someone posted or tagged you in a photo that you did not want others to see? How did you handle the situation? If asked to remove a photo or tag, would you respect the person’s feelings and honor the request? What restrictions and policies should online social networks have about posting photos of others?



Blogs

Posts on Twitter also form a blog, because of its journal format with the most recent entry at the top.



CONSIDER THIS

How do Facebook, Twitter, and LinkedIn differ?

With Facebook, you share messages, interests, activities, events, photos, and other personal information — called posts — with family and friends. You also can 'like' pages of celebrities, companies, products, etc., so that posts from others who like the same items will appear along with your other activities on Facebook. With Twitter, you 'follow' people, companies, and organizations in which you have an interest. Twitter enables you to stay current with the daily activities of those you are following via their Tweets, which are short posts (messages) that Twitter users broadcast for all their followers.

On LinkedIn, you share professional interests, education, and employment history, and add colleagues or coworkers to your list of contacts. You can include recommendations from people who know you professionally. Many employers post jobs using LinkedIn and consider information in your profile as your online resume.

Internet Communications

As mentioned earlier, the web is only one of the services on the Internet. Other services on the Internet facilitate communications among users, including the following:

- Email allows you to send messages to and receive messages and files from other users via a computer network.
- With messaging services, you can have a real-time typed conversation with another connected user (real-time means that both of you are online at the same time).
- VoIP (Voice over Internet Protocol) enables users to speak to other users over the Internet (discussed further in later chapters).
- With FTP (File Transfer Protocol), users can transfer items to and from other computers on the Internet (discussed further in later chapters).

Digital Security and Privacy

People rely on computers to create, store, and manage their information. To safeguard this information, it is important that users protect their computers and mobile devices. Users also should be aware of health risks and environmental issues associated with using computers and mobile devices.



Malware

A leading maker of security software claims its software blocked more than five billion malware attacks in a single year.

Viruses and Other Malware

Malware, short for malicious software, is software that acts without a user's knowledge and deliberately alters the computer's or mobile device's operations. Examples of malware include viruses, worms, trojan horses, rootkits, spyware, adware, and zombies. Each of these types of malware attacks your computer or mobile device differently. Some are harmless pranks that temporarily freeze, play sounds, or display messages on your computer or mobile device. Others destroy or corrupt data, instructions, and information stored on the infected computer or mobile device. If you notice any unusual changes in the performance of your computer or mobile device, it may be infected with malware. Read Secure IT 1-2 for ways to protect computers from viruses and other malware.

Privacy

Nearly every life event is stored in a computer somewhere . . . in medical records, credit reports, tax records, etc. In many instances, where personal and confidential records were not protected properly, individuals have found their privacy violated and identities stolen. Some techniques you can use to protect yourself from identity theft include shredding financial documents before discarding them, never tapping or clicking links in unsolicited email messages, and enrolling in a credit monitoring service.

Adults, teens, and children around the world are using online social networks to share their photos, videos, journals, music, and other personal information publicly. Some of these unsuspecting, innocent computer users have fallen victim to crimes committed by dangerous strangers.

Internet Research

What are other techniques that deter identity theft?

Search for: prevent identity theft

SECURE IT 1-2



Protection from Viruses and Other Malware


It is impossible to ensure a virus or malware never will attack a computer, but you can take steps to protect your computer by following these practices:

- **Use virus protection software.** Install a reputable antivirus program and then scan the entire computer to be certain it is free of viruses and other malware. Update the antivirus program and the virus signatures (known specific patterns of viruses) regularly.
- **Use a firewall.** Set up a hardware firewall or install a software firewall that protects your network's resources from outside intrusions.
- **Be suspicious of all unsolicited email and text messages.** Never open an email message unless you are expecting it, *and* it is from a trusted source. When in doubt, ask the sender to confirm the message is

legitimate before you open it. Be especially cautious when deciding whether to tap or click links in email and text messages or to open attachments.

- **Disconnect your computer from the Internet.** If you do not need Internet access, disconnect the computer from the Internet. Some security experts recommend disconnecting from the computer network before opening email attachments.
- **Download software with caution.** Download programs or apps only from websites you trust, especially those with music and video sharing software.
- **Close spyware windows.** If you suspect a pop-up window (a rectangular area that suddenly appears on your screen) may be spyware, close the window. Never tap or click an Agree or OK button in a suspicious window.

- **Before using any removable media, scan it for malware.** Follow this procedure even for shrink-wrapped software from major developers. Some commercial software has been infected and distributed to unsuspecting users. Never start a computer with removable media inserted in the computer unless you are certain the media are uninfected.
- **Keep current.** Install the latest updates for your computer software. Stay informed about new virus alerts and virus hoaxes.
- **Back up regularly.** In the event your computer becomes unusable due to a virus attack or other malware, you will be able to restore operations if you have a clean (uninfected) backup.

 **Consider This:** What precautions do you take to prevent viruses and other malware from infecting your computer? What new steps will you take to attempt to protect your computer?

Protect yourself and your dependents from these criminals by being cautious in email messages and on websites. For example, do not share information that would allow others to identify or locate you, and do not disclose identification numbers, user names, passwords, or other personal security details. A user name is a unique combination of characters, such as letters of the alphabet or numbers, that identifies one specific user. A password is a private combination of characters associated with a user name. Read Secure IT 1-3 for tips on creating strong passwords.

SECURE IT 1-3



Creating Strong Passwords


A good password is easy for you to remember but difficult for criminals and password-breaking software to guess. Use these guidelines to create effective, strong passwords:

- **Personal information:** Avoid using any part of your first or last name, your family members' or pets' names, phone number, street address, license plate number, Social Security number, or birth date.
- **Length:** Use at least eight characters.
- **Difficulty:** Use a variety of uppercase and lowercase letters, numbers, punctuation marks, and symbols. Select characters located on different parts of the keyboard, not the ones you commonly use or that are adjacent to each other. Criminals often use software that converts common words to symbols, so their program might generate the passwords

GoToSleep and Go2Sleep as possibilities to guess.

- **Modify:** Change your password frequently, at least every three months.
- **Variation:** Do not use the same password for all websites you access. Once criminals have stolen a password, they attempt to use that password for other accounts they find on your computer or mobile device, especially banking websites.
- **Passphrase:** A passphrase, which is similar to a password, consists of several words separated by spaces. Security experts recommend misspelling a few of the words and adding several numerals. For example, the phrase, "Create a strong password," could become the passphrase, "Creaet a strang pasword42."
- **Common sequences:** Avoid numbers or letters in easily recognized patterns, such

as "asdfjkl;," "12345678," "09870987," or "abcdefg." Also, do not spell words backwards, use common abbreviations, or repeat strings of letters or numbers.

- **Manage:** Do not keep your passwords in your wallet, on a sheet of paper near your computer, or in a text file on your computer or mobile device. Memorize all of your passwords, or store them securely using a password management app on your computer or mobile device. Additional information about password management software is provided in Secure IT 5-3 in Chapter 5.
 - **Test:** Use online tools to evaluate password strength.
-  **Consider This:** How strong are your passwords? How will you modify your passwords using some of these guidelines?

Health Concerns

Prolonged or improper computer and mobile device use can lead to injuries or disorders of the hands, wrists, elbows, eyes, neck, and back. Computer and mobile device users can protect themselves from these health risks through proper workplace design, good posture while at the computer, and appropriately spaced work breaks.

With the growing use of earbuds and headphones, some users are experiencing hearing loss. Ways to protect your hearing when using these devices were presented in How To 1-2 earlier in this chapter.

Two behavioral health risks are technology addiction and technology overload. Technology addiction occurs when someone becomes obsessed with using technology. Individuals suffering from technology overload feel distressed when deprived of computers and mobile devices. Once recognized, both technology addiction and technology overload are treatable disorders.

Environmental Issues

Manufacturing processes for computers and mobile devices along with *e-waste*, or discarded computers and mobile devices, are depleting natural resources and polluting the environment. When computers and mobile devices are stored in basements or other locations, disposed of in landfills, or burned in incinerators, they can release toxic materials and potentially dangerous levels of lead, mercury, and flame retardants.

Green computing involves reducing the electricity consumed and environmental waste generated when using a computer. Strategies that support green computing include recycling, using energy efficient hardware and energy saving features, regulating manufacturing processes, extending the life of computers, and immediately donating or properly disposing of replaced computers. When you purchase a new computer, some retailers offer to dispose of your old computer properly.

Discover More: Visit this book's premium content for the Internet Research: Green Computing exercise for each chapter in this book.



BTW

Technology Innovators

Discover More: Visit this chapter's free resources to learn about Microsoft and its founder, Bill Gates, Apple, and its cofounders, Steve Jobs and Steve Wozniak.



CONSIDER THIS

How can you contribute to green computing?

Some habits you can alter that will help reduce the environmental impact of computing include the following:

1. Do not leave a computer or device running overnight.
2. Turn off your monitor, printer, and other devices when you are not using them.
3. Use energy efficient hardware.
4. Use paperless methods to communicate.
5. Recycle paper and buy recycled paper.
6. Recycle toner, computers, mobile devices, printers, and other devices.
7. Telecommute.
8. Use videoconferencing and VoIP for meetings.

Programs and Apps

Software, also called a **program**, consists of a series of related instructions, organized for a common purpose, that tells the computer what tasks to perform and how to perform them.

Two categories of software are system software and application software (or applications). System software consists of the programs that control or maintain the operations of the computer and its devices. Operating systems are a widely recognized example of system software. Other types of system software, sometimes called tools, enable you to perform maintenance-type tasks usually related to managing devices, media, and programs used by computers and mobile devices. The next sections discuss operating systems and applications.

Operating Systems

An *operating system* is a set of programs that coordinates all the activities among computer or mobile device hardware. It provides a means for users to communicate with the computer or mobile device and other software. Many of today's computers and mobile devices use a version of Microsoft's Windows, Apple's Mac OS, Apple's iOS, or Google's Android (Figure 1-30).

To use an application, your computer or mobile device must be running an operating system.

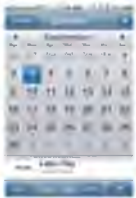

Applications

An **application** (or **app** for short) consists of programs designed to make users more productive and/or assist them with personal tasks. Browsers, discussed in an earlier section, are an example of an application that enables users with an Internet connection to access and view webpages. Table 1-2 identifies the categories of applications with samples of ones commonly used in each category.






Figure 1-30 Shown here are the Mac OS and Windows operating systems for laptops and desktops and the Android and iOS operating systems for smartphones. You interact with these operating system interfaces by tapping or clicking their icons or tiles.
Sources: Apple Inc.; Apple Inc.; Google Inc.; Microsoft

Table 1-2 Categories of Applications

Category	Sample Applications	Sample Uses
Productivity 	Word Processing Presentation Schedule and Contact Management Personal Finance	Create letters, reports, and other documents. Create visual aids for presentations. Organize appointments and contact lists. Balance checkbook, pay bills, and track income and expenses.
Graphics and Media 	Photo Editing Video and Audio Editing Media Player	Modify digital photos, i.e., crop, remove red-eye, etc. Modify recorded movie clips, add music, etc. View images, listen to audio/music, watch videos.
Personal Interest 	Travel, Mapping, and Navigation Reference Educational Entertainment	View maps, obtain route directions, locate points of interest. Look up material in dictionaries, encyclopedias, etc. Learn through tutors and prepare for tests. Receive entertainment news alerts, check movie times and reviews, play games.

(Continued)

Table 1-2 Continued

Category	Sample Applications	Sample Uses
Communications 	Browser Email VoIP FTP	Access and view webpages. Send and receive messages. Speak to other users over the Internet. Transfer items to and from other computers on the Internet.
Security 	Antivirus Personal Firewall Spyware, Adware, and other Malware Removers	Protect a computer against viruses. Detect and protect against unauthorized intrusions. Detect and delete spyware, adware, and other malware.
File, System, and Disk Management 	File Manager Search Image Viewer Screen Saver	Display and organize files on storage media. Locate files and other items on storage media. Display, copy, and print contents of graphics files. Shows moving image or blank screen if no keyboard or mouse activity occurs.

© Cengage Learning, Courtesy of NCH Software, Source: Apple Inc., Source: Google Inc., Courtesy of AVG Technologies, Source: Microsoft

Discover More: Visit this chapter's free resources for an expanded Categories of Applications table.

Applications include programs stored on a computer, as well as those on a mobile device or delivered to your device over the Internet.

- A *desktop app* is an application stored on a computer.
- A *web app* is an application stored on a web server that you access through a browser.
- A *mobile app* is an application you download from a mobile device's app store or other location on the Internet to a smartphone or other mobile device.

Some applications are available as both a web app and a mobile app. In this case, you typically can sync (or match) the data and activity between the web app and the mobile app, which is discussed later in this chapter.

Discover More: Visit this book's premium content for the How To: Your Turn – App Adventure exercise for each chapter in this book.

Installing and Running Programs

Installing a program is the process of setting up the program to work with a computer or mobile device, printer, and/or other hardware. When you buy a computer or mobile device, it usually has some software, such as an operating system, preinstalled on its internal media so that you can use the computer or mobile device the first time you turn it on.

Installed operating systems often include applications such as a browser, media player, and calculator. To use additional desktop apps on a computer, you usually need to install the software. Mobile apps typically install automatically after you transfer the app's files to your mobile device from its website. You usually do not need to install web apps before you can run them.

Once installed, you run a program so that you can interact with it. When you instruct a computer or mobile device to run a program, the computer or mobile device *loads* it, which means the program's instructions are copied from storage to memory. Once in memory, the

computer or mobile device can carry out, or execute, the instructions in the program so that you can use it.

You interact with a program through its user interface. The *user interface* controls how you enter data and instructions and how information is displayed on the screen. Often, you work with icons or tiles (shown in Figure 1-30 earlier in the chapter), which are miniature images that link to programs, media, documents, or other objects. Read How To 1-4 for instructions about locating, installing, and running programs and mobile apps.

HOW TO 1-4

Locate, Install, and Run Programs and Mobile Apps

The following steps describe how to locate, install, and run programs and mobile apps:

Locate the Program or Mobile App

- Locate the program or mobile app to install. Programs are available from retail stores, websites, and from other online services such as Apple's App Store or Google Play. Mobile apps are available from your device's app store.

Download and/or Install the Program or Mobile App

- If you are installing a program on your computer from physical media such as a CD or DVD, insert the media in your computer. If the installation process does not start automatically, locate the


installation program on the media and then double-tap or double-click the installation program.

- If the program or mobile app is available from a website or online store, download the application to your computer or mobile device. Once the download is complete, if the installation process does not start automatically, locate and then double-tap or double-click the downloaded file to begin the installation.

Run the Program or Mobile App

- You have various options for running a program or mobile app:
 - If you are using a computer, tap or click the program's tile or double-tap or double-click the program's icon in the desktop.

- Display a list of all programs and apps on your computer or mobile device and then tap or click the icon representing the program to run (some computers may require you to double-tap or double-click the icon).
- Use the search feature in the operating system to locate the newly installed program or app and then tap or click the search result to run the program or app.

 **Consider This:** After installing a mobile app, where are some locations you might look to find the new app's icon or tile?

CONSIDER THIS

How do you know if a program will run on your computer?

When you buy a computer, you can find a list of the computer's specifications on the box, the manufacturer's website, or the order summary. Similarly, when you buy software, the box or the product's website will list specifications and minimum requirements for memory, speed, and more. Your computer's specifications should be the same as or greater than the software specifications. Ensure the software will run on your computer before making a purchase, because many retailers will not allow you to return software.

Developing Programs and Apps

A *software developer*, sometimes called a developer or programmer, is someone who develops programs and apps or writes the instructions that direct the computer or mobile device to process data into information. When writing instructions, a developer must be sure the program or app works properly so that the computer or mobile device generates the desired results. Complex programs can require thousands to millions of instructions.

Software developers use a programming language or application development tool to create programs and apps. Popular programming languages include C++, Java, JavaScript, Visual C#, and Visual Basic. Figure 1-31 shows some of the Visual Basic instructions a software developer may write to create a simple payroll program.

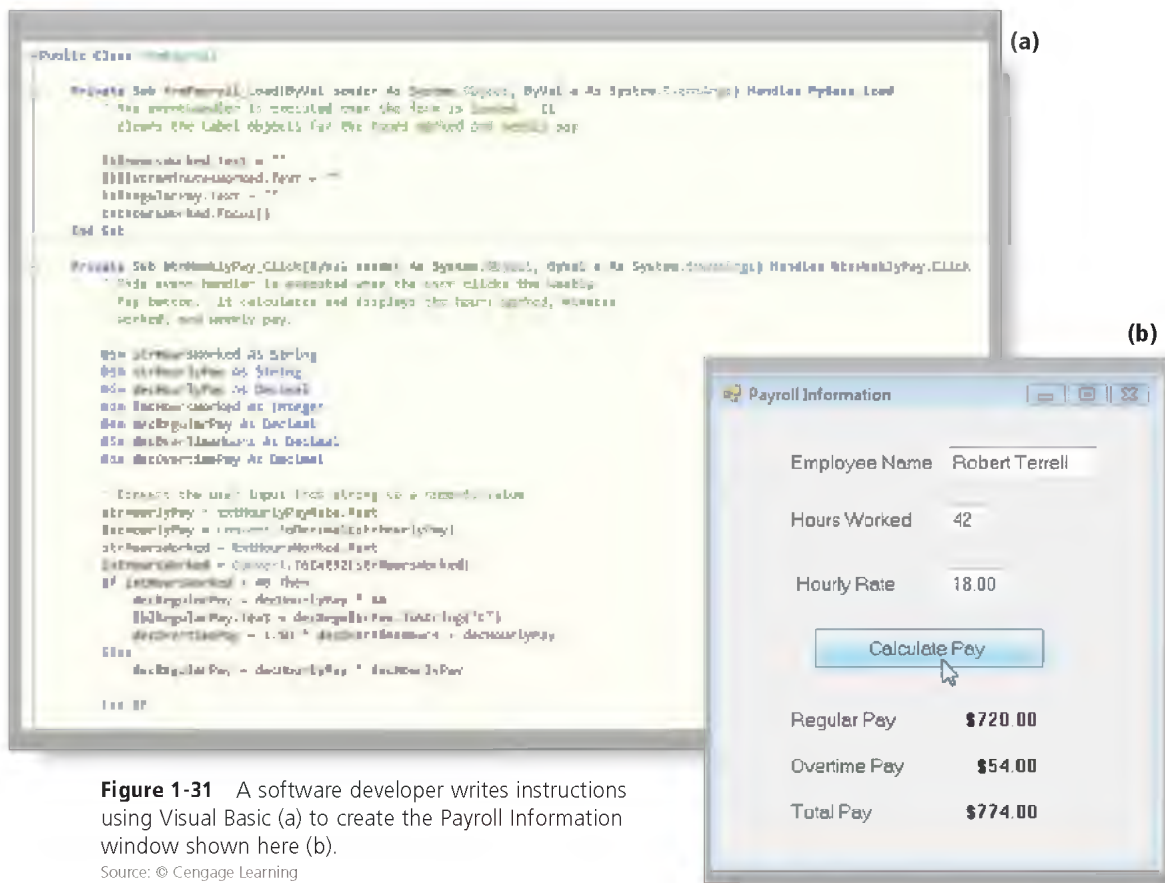


Figure 1-31 A software developer writes instructions using Visual Basic (a) to create the Payroll Information window shown here (b).

Source: © Cengage Learning

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled The Web, Digital Security and Privacy, and Programs and Apps, as it relates to the chapter objectives.

Now you should know . . .

- Why webpages use links (Objective 5)
- How to perform a basic web search (Objective 6)
- What risks you are exposed to as a result of your technology use and how you can minimize those risks (Objective 7)
- How to recognize an operating system and which programs and apps you might find useful (Objective 8)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Communications and Networks

Communications technologies are everywhere. Many require that you subscribe to an Internet service provider. With others, an organization such as a business or school provides communications services to employees, students, or customers.

In the course of a day, it is likely you use, or use information generated by, one or more of the communications technologies in Table 1-3.

Table 1-3 Uses of Communications Technologies

Type	Brief Description
Chat rooms	Real-time typed conversation among two or more people on a computers or mobile devices connected to a network
Email	Transmission of messages and files via a computer network
Fax	Transmission and receipt of documents over telephone lines
FTP	Permits users to transfer files to and from servers on the Internet
GPS	Navigation system that assists users with determining their location, ascertaining directions, and more
Instant messaging	Real-time typed conversation with another connected user where you also can exchange photos, videos, and other content
Internet	Worldwide collection of networks that links millions of businesses, government agencies, educational institutions, and individuals
Newsgroups	Online areas in which users have written discussions about a particular subject
RSS	Specification that enables web content to be distributed to subscribers
Videoconference	Real-time meeting between two or more geographically separated people who use a network to transmit audio and video
Voice mail	Allows users to leave a voice message for one or more people
VoIP	Conversation that takes place over the Internet using a telephone connected to a computer, mobile device, or other device
Wireless Internet access points	Enables users with computers and mobile devices to connect to the Internet wirelessly
Wireless messaging services	Send and receive wireless messages to and from smartphones, mobile phones, handheld game devices, and other mobile devices using text messaging and picture/video messaging

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Wired and Wireless Communications

Computer communications describes a process in which two or more computers or devices transfer (send and receive) data, instructions, and information over transmission media via a communications device(s). A **communications device** is hardware capable of transferring items from computers and devices to transmission media and vice versa. Examples of communications devices are modems, wireless access points, and routers. As shown in Figure 1-32, some communications involve cables and wires; others are sent wirelessly through the air.

Wired communications often use some form of telephone wiring, coaxial cable, or fiber-optic cables to send communications signals. The typically are used within buildings or underground between buildings.

Because it is more convenient than installing wires and cables, many users opt for wireless communications, which sends signals through the air or space. Examples of wireless communications technologies include Wi-Fi, Bluetooth, and cellular radio, which are discussed below:

- **Wi-Fi** uses radio signals to provide high-speed Internet and network connections to computers and devices capable of communicating via Wi-Fi.



Figure 1-32 Modems, wireless access points, and routers are examples of communications devices that enable communications between computers/mobile devices and the Internet. Notice that some computers and devices communicate via wires, and others communicate wirelessly.

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Most computers and many mobile devices, such as smartphones and portable media players, can connect to a Wi-Fi network.

- **Bluetooth** uses short-range radio signals to enable Bluetooth-enabled computers and devices to communicate with each other. For example, Bluetooth headsets allow you to connect a Bluetooth-enabled phone to a headset wirelessly.
- Cellular radio uses the cellular network to enable high-speed Internet connections to devices with built-in compatible technology, such as smartphones. Cellular network providers use the categories 3G, 4G, and 5G to denote cellular transmission speeds, with 5G being the fastest.

Wi-Fi and Bluetooth are both hot spot technologies. A *hot spot* is a wireless network that provides Internet connections to mobile computers and devices. Wi-Fi hot spots provide wireless network connections to users in public locations, such as airports and airplanes, train stations, hotels, convention centers, schools, campgrounds, marinas, shopping malls, bookstores, libraries, restaurants, coffee shops, and more. Bluetooth hot spots provide location-based services, such as sending coupons or menus, to users whose Bluetooth-enabled devices enter the coverage range.

Discover More: Visit this chapter's free resources to learn more about cellular transmissions.



The Internet

The world's largest computer network is the Internet.

Networks

A **network** is a collection of computers and devices connected together, often wirelessly, via communications devices and transmission media. Networks allow computers to share *resources*, such as hardware, software, data, and information. Sharing resources saves time and money. In many networks, one or more computers act as a server. The server controls access to the resources on a network. The other computers on the network, each called a client, request resources from the server (Figure 1-33). The major differences between the server and client computers are that the server typically has more power, more storage space, and expanded communications capabilities.

Many homes and most businesses and schools network their computers and devices. Most allow users to connect their computers wirelessly to the network. Users often are required to sign in to, or log on, a network, which means they enter a user name and password (or other credentials) to access the network and its resources. Read Ethics & Issues 1-3 to consider issues associated with unsecured networks.



Figure 1-33 A server manages the resources on a network, and clients access the resources on the server. This network enables three separate computers to share the same printer, one wirelessly.

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 **ETHICS & ISSUES 1-3**
Would You Connect to an Unsecured Network?

If you turn on your laptop and notice that you can connect to a nearby home or business's wireless network and access the Internet without a password, for free, you may find yourself in an ethical dilemma. Because they do not know how to secure a wireless network, many home and business users leave their networks open for use by anybody in their signal's range. Experts estimate that up to 35 percent of wireless connections are unsecured, leaving them open to hackers. (A hacker is someone who accesses a computer or network illegally.)

Criminals sometimes use unsecured wireless networks to cover up technology-

related crimes. Others may steal connections to avoid the costs of Internet service. In other cases, a user's laptop or mobile device may connect automatically to an open wireless network, without the user's authorization or knowledge. If you are using an unsecured wireless network, hackers may be able to capture your passwords, hijack your accounts, or send spam or a virus.

The Electronic Communications Privacy Act (ECPA) states that it is not illegal "to intercept or access an electronic communication made through an electronic communication system that is configured so that such electronic communication is readily accessible to the general public." It is unclear whether this law refers to an unsecured

home network or whether it pertains only to public hot spots, such as restaurants and libraries. Some lawmakers even support punishing those who leave their networks unsecured.

Consider This: Would you use your neighbor's unsecured wireless home network without permission? Why or why not? What would you do if you found out that someone was using your wireless home network without your permission? How should legal authorities address such abuse? What punishment should violators receive? Should those leaving their networks unsecured receive punishment, too? Why or why not?

Home Networks Home networks save the home user money and provide many conveniences. Each networked computer or mobile device on a home network has the following capabilities:

- Connect to the Internet at the same time
- Share a single high-speed Internet connection
- Access photos, music, videos, and other content on computers and devices throughout the house
- Share devices such as a printer, scanner, or external hard drive
- Play multiplayer games with players on other computers and mobile devices in the house
- Connect game consoles to the Internet
- Subscribe to and use VoIP
- Interact with other devices in a smart home (such as thermostats, lighting controls, etc.)

Home networks usually are small, existing within a single structure, and use wireless technologies such as those shown previously in Figure 1-30. You do not need extensive knowledge of networks to set up a home network. You will need a communications device, such as a router, which usually includes setup instructions. Most operating systems also provide tools enabling you easily to connect all the computers and devices in your house.

Business Networks Business and school networks can be small, such as in a room or building, or widespread, connecting computers and devices across a city, country, or the globe. Some reasons that businesses network their computers and devices together include the following:

- **Facilitate communications.** Using a network, employees and customers communicate efficiently and easily via email, messaging services, blogs, online social networks, video calls, online meetings, videoconferencing, VoIP, and more.
- **Share hardware.** In a networked environment, each computer on the network can access the hardware on the network, instead of providing each user with the same piece of hardware. For example, computer and mobile device users can access the laser printer on the network, as they need it.
- **Share data, information, and software.** In a networked environment, any authorized computer user can access data, information, and software stored on other computers on the network. A large company, for example, might have a database of customer information that any authorized user can access.

Mini Feature 1-2: Staying in Sync

If you use multiple computers and mobile devices throughout the day, keeping track of common files may be difficult. Read Mini Feature 1-2 to learn how to keep your computers and devices in sync with each other.

MINI FEATURE 1-2

Staying in Sync

Assume that each morning you begin the day by checking your appointment calendar on your home or office computer. That same calendar appears on your smartphone, so that you can view your schedule throughout the day. If you add, change, or delete appointments using the smartphone, however, you may need to update the calendar on your computer to reflect these edits. When you **synchronize**, or **sync**, computers and mobile devices, you match the files in two or more locations with each other, as shown in the figure below. Along with appointments, other commonly synced files from a smartphone are photos, email messages, music, apps, contacts, calendars, and ringtones.

Syncing can be a one-way or a two-way process. With a one-way sync, also called mirroring, you add, change, or delete files in a destination location, called the *target*, without altering the same files in the original location, called the *source*. For example, you may have a large collection of music stored on your home computer (the source), and you often copy some of these songs to your mobile device (the target). If you add or delete songs from your computer, you also will want to add or change these songs on your mobile device. If, however, you add or change the songs on your mobile device, you would not want to make these changes on your computer.


In two-way sync, any change made in one location also is made in any other sync location. For example,

you and your friends may be working together to create one document reflecting your combined ideas. This document could be stored on a network or on cloud storage on the Internet. Your collaboration efforts should reflect the latest edits each person has made to the file.

You can use wired or wireless methods to sync. In a wired setup, cables connect one device to another, which allows for reliable data transfer. While wireless syncing offers convenience and automation, possible issues include battery drain and low signal strength when the devices are not close to each other. Strategies for keeping your files in sync include the following:

- **Use a cable and software.** Syncing photos from a camera or a smartphone to a computer frees up memory on the mobile device and creates a backup of these files. You easily can transfer photos using a data sync cable and synchronization software. Be certain not to disconnect the mobile device from the computer until the sync is complete. You also can copy your photos and documents from the computer to a smartphone, an external hard drive, a USB flash drive, or some other portable storage device.
- **Use cloud storage.** Cloud storage can provide a convenient method of syncing files stored on multiple computers and accessing them from most devices with Internet access. Several cloud storage providers offer a small amount of storage space at no cost and additional storage for a nominal fee per month or per year. Each provider has specific features, but most allow users to share files with other users, preview file contents, set passwords, and control who has permission to edit the files.
- **Use web apps.** By using web apps for email, contacts, and calendars, your information is stored online, so that it is accessible anywhere you have an Internet connection and can sync with multiple devices.

Discover More: Visit this chapter's free resources to learn more about wired setups, wireless syncing, and cloud storage providers.

 **Consider This:** Synchronization is an effective method of organizing and sharing common files. What files have you synced, such as photos, music, and email? Which sync method did you use?



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Technology Uses

Technology has changed society today as much as the industrial revolution changed society in the eighteenth and nineteenth centuries. People interact directly with technology in fields such as education, government, finance, retail, entertainment, health care, science, travel, publishing, and manufacturing.

Education/Mini Feature 1-3: Digital School

Educators and teaching institutions use technology to assist with education. Most equip labs and classrooms with laptops or desktops. Some even provide computers or mobile devices to students. Many require students to have a mobile computer or mobile device to access the school's network or Internet wirelessly, or to access digital-only content provided by a textbook publisher. To promote the use of technology in education, vendors often offer substantial student discounts on hardware and software.

Educators may use a course management system, sometimes called a learning management system, which is software that contains tools for class preparation, distribution, and management. For example, through the course management system, students access course materials, grades, assessments, and a variety of collaboration tools.

Many schools offer distance learning classes, where the delivery of education occurs at one place while the learning occurs at other locations. Distance learning courses provide time, distance, and place advantages for students who live far from a campus or work full time. A few schools offer entire degrees online. National and international companies offer distance learning training because it eliminates the costs of airfare, hotels, and meals for centralized training sessions.

Read Mini Feature 1-3 to learn about additional technologies integrated in the classroom.



BTW

Technology @ Work

For more information about how technology is used in a variety of fields, read the Technology @ Work feature at the end of each chapter in this book.



BTW

Technology Trend

Discover More: Visit this chapter's free resources to learn about massive open online courses (MOOCs).



Internet Research

How do educators use iTunes U?

Search for: itunes u

MINI FEATURE 1-3

Digital School

Technology and education intersect in today's classrooms. Students can use a variety of devices, apps, and websites to collaborate and obtain content while teachers can share information in most content areas to engage students and enhance the learning process. Digital technology offers flexibility and a revised classroom setting.

- **Mobile devices and tablets:** Schools are updating their computer labs by eliminating rows of desktops and allowing students to bring their own devices into the room and also into their classrooms, a practice often referred to as *BYOD* (bring your own device). They connect their laptops and mobile devices to power and data; they then they use educational apps, store and share files, read digital books, and create content without leaving their desks.
- **Virtual field trips:** Virtual tours of museums, ancient sites, and galleries allow audiences to see exhibits, examine paintings, and explore historical objects. After viewing 360-degree panoramas of such places as Colonial Williamsburg and Machu Picchu, students can interact with experts via Twitter and videoconferencing.
- **Games and simulations:** Game design theory can help engage students and reinforce key

concepts. When students master one set of objectives in a particular topic, they can progress to more advanced levels. They can receive instant feedback and recognition for their accomplishments, collaborate with teammates, repeat play to achieve higher scores, and document their experiences. Researchers claim that students are more likely to pursue challenging subject matter when it is offered in a gaming setting.

- **Interactive whiteboards:**

Teachers and students can write directly on an interactive display, shown in the figure, which is a touch-sensitive device resembling a dry-erase board. It displays images on a connected computer screen. Touch gestures are used to zoom, erase, and annotate displayed content.

- **Share projects:**

Effective movies can bring the words in a textbook to life. Students can create scripts and then use animation software or a video camera to tell stories that apply the concepts they have learned



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(continued)

and upload them to media sharing websites. They also can write blogs, design graphics, and conduct interviews to apply and share the concepts they have learned in the classroom.

- **3-D printers:** Low-cost 3-D printers created for the classroom and libraries are becoming popular, especially in science and engineering classes. Geology students can create topography models, biology students can examine cross sections of

organs, architecture students can print prototypes of their designs, and history students can create artifacts.

Discover More: Visit this chapter's free resources to learn more about the digital school.

 **Consider This:** Which digital technologies have you used in your classrooms? Did they help you learn and retain information presented? If so, how?

Government

Most government offices have websites to provide citizens with up-to-date information. People in the United States access government websites to view census data, file taxes, apply for permits and licenses, pay parking tickets, buy stamps, report crimes, apply for financial aid, and renew vehicle registrations and driver's licenses.

Employees of government agencies use computers as part of their daily routine. North American 911 call centers use computers to dispatch calls for fire, police, and medical assistance. Military and other agency officials use the U.S. Department of Homeland Security's network of information about domestic security threats to help protect against terrorist attacks. Law enforcement officers have online access to the FBI's National Crime Information Center (NCIC) through in-vehicle laptops, fingerprint readers, and mobile devices (Figure 1-34). The NCIC contains more than 15 million missing persons and criminal records, including names, fingerprints, parole/probation records, mug shots, and other information.



Figure 1-34 Law enforcement officials use computers and mobile devices to access emergency, missing person, and criminal records in computer networks in local, state, and federal agencies.
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Finance

Many people and companies use online banking or finance software to pay bills, track personal income and expenses, manage investments, and evaluate financial plans. The difference between using a financial institutions' website versus finance software on your computer is that all your account information is stored on the bank's computer instead of your computer. The advantage is you can access your financial records from anywhere in the world.

Investors often use online investing to buy and sell stocks and bonds — without using a broker. With online investing, the transaction fee for each trade usually is much less than when trading through a broker.

Discover More: Visit this chapter's free resources to learn more about online investing.

Retail

You can purchase just about any product or service on the web, including groceries, flowers, books, computers and mobile devices, music, movies, airline tickets, and concert tickets. To purchase from an online retailer, a customer visits the business's storefront, which contains product descriptions, images, and a shopping cart. The shopping cart allows the customer to collect purchases. When ready to complete the sale, the customer enters personal data and the method of payment, which should be through a secure Internet connection. Figure 1-35 illustrates the steps involved when a customer purchases from an online retailer.

Many mobile apps make your shopping experience more convenient. Some enable you to manage rewards, use coupons, locate stores, or pay for goods and services directly from your phone or other mobile device. Other mobile apps will check a product's price and availability at stores in your local area or online. Read Secure IT 1-4 for tips about shopping safely online.

Discover More: Visit this chapter's free resources to learn more about mobile payments.

SECURE IT 1-4

Shopping Safely Online


Browsing electronic storefronts and making online purchases can be convenient and economical, but the experience can be a disaster if you encounter unscrupulous vendors. These tips can help you enjoy a safe and productive online shopping trip.

- **Read customer reviews.** Shoppers frequently post comments about merchandise quality, pricing, and shipping. Their evaluations may help you decide whether a company is legitimate. Be aware, however, that the Federal Trade Commission has sued companies for posting false positive reviews and that some companies remove negative comments. Make it a habit to rate merchants as often as possible so that others can learn from your experiences.
- **Look for seals of approval.** Online businesses can display seals if they have

met rigorous standards. Some unscrupulous merchants, however, will place the seals on their websites even if they have not been approved. To check a seal's legitimacy, tap or click the logo and be certain you are directed to the issuing agency's website to verify the seal is valid.

- **Create a strong password and password questions.** If the merchant requires you to create a user name and password, be certain to develop a long, complex password with at least eight characters that include letters, numbers, and special characters. (Refer to Secure IT 1-3 earlier in this chapter for guidance on creating a strong password.) The website also may ask for answers to security questions; if so, do not supply information that hackers could locate easily, such as your high school, place of birth, or family members' or pets' names.

- **Check website details.** Locate the business's privacy policy to learn how your information will be stored. Also, look for phone numbers, physical addresses, and email addresses to contact the vendor if questions arise about damaged goods or billing discrepancies.
- **Beware of requests to supply further information.** After you have placed an order, you may receive an email message asking you to confirm the transaction or to supply additional account information. A reputable business will not solicit these requests, so do not reply to the message.

 **Consider This:** Have you made online purchases? If so, have you followed the precautions listed here? How will you change your activities the next time you shop online?

Purchasing from an Online Retailer

Step 1

The customer displays the online retailer's storefront.



Step 2

The customer collects purchases in a shopping cart.



Step 3

The customer enters payment information on a secure website. The online retailer sends financial information to a bank.



Step 5

The online retailer's web server sends confirmation to the customer, processes the order, and then sends it to the fulfillment center.



Step 4

The bank performs security checks and sends authorization back to the online retailer.



Step 6

The fulfillment center packages the order, prepares it for shipment, and then sends a report to the server where records are updated.




Step 7

While the order travels to the customer, shipping information is posted on the web.



Step 8

The order is delivered to the customer, who may be required to sign a handheld computer or document to acknowledge receipt.

 **Figure 1-35** This figure shows the steps involved when a customer purchases from an online retailer.

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Entertainment

You can use computers and mobile devices to listen to audio clips or live audio; watch video clips, television shows, or live performances and events; read a book, magazine, or newspaper; and play a myriad of games individually or with others. In some cases, you download the media from the web to a computer or mobile device so that you can watch, listen to, view, or play later. Some websites support *streaming*, where you access the media content while it downloads. For example, radio and television broadcasts often use streaming media to broadcast music, interviews, talk shows, sporting events, news, and other segments so that you can listen to the audio or view the video as it downloads to your computer. You also can create videos, take photos, or record audio and upload (transfer) your media content to the web to share with others, such as on an online social network.



CONSIDER THIS

Can I make copies of songs or other media that I have purchased and downloaded from a legitimate website, such as iTunes?

You typically can make a copy as a personal backup, but you cannot share the copy with others in any format unless you have legal permission from the copyright owner to do so. That is, you cannot give someone a CD copy, nor can you share a digital file by posting it on the web or sending it as an email message.



BTW

Technology Trend

Discover More: Visit this chapter's free resources to learn what is meant by a QR code and how QR codes are used in the medical field.

Health Care

Nearly every area of health care today uses computers. Whether you are visiting a family doctor for a regular checkup, having lab work or an outpatient test, filling a prescription, or being rushed in for emergency surgery, the medical staff around you will be using computers for various purposes:

- Hospitals and doctors use computers and mobile devices to maintain and access patient records (Figure 1-36).
- Computers and mobile devices monitor patients' vital signs in hospital rooms and at home; patients use computers to manage health conditions, such as diabetes.
- Robots deliver medication to nurses' stations in hospitals.
- Computers and computerized devices assist doctors, nurses, and technicians with medical tests.
 - Doctors use the web and medical software to assist with researching and diagnosing health conditions.
 - Doctors use email, text messaging, and other communications services to correspond with patients.
 - Patients use computers and mobile devices to refill prescriptions, and pharmacists use computers to file insurance claims and provide customers with vital information about their medications.
 - Surgeons implant computerized devices, such as pacemakers, that allow patients to live longer.
 - Surgeons use computer-controlled devices to provide them with greater precision during operations, such as for laser eye surgery and robot-assisted heart surgery.
 - Medical staff create labels for medicine, hospital ID bracelets, and more, enabling staff to verify dosage and access patient records by scanning the label.



Figure 1-36 Doctors, nurses, technicians, and other medical staff use computers and computerized devices to assist with medical tests.
© iStockPhoto / Neustockimage

Science

All branches of science, from biology to astronomy to meteorology, use computers to assist them with collecting, analyzing, and modeling data. Scientists also use the Internet to communicate with colleagues around the world. Breakthroughs in surgery, medicine, and treatments often result from scientists' use of computers. Tiny computers now imitate functions of the central nervous system, retina of the eye, and cochlea of the ear. A cochlear implant allows a deaf person to distinguish

sounds. Electrodes implanted in the brain stop tremors associated with Parkinson's disease.

A *neural network* is a system that attempts to imitate the behavior of the human brain. Scientists create neural networks by connecting thousands of processors together much like the neurons in the brain are connected. The capability of a personal computer to recognize spoken words is a direct result of scientific experimentation with neural networks.

Travel

Whether traveling by car or plane, your goal is to arrive safely at your destination. As you make the journey, you may interact with a navigation system or GPS, which uses satellite signals to determine a geographic location. GPS technology also assists people with creating maps, determining the best route between two points, locating a lost person or stolen object, monitoring a person's or object's movement, determining altitude, calculating speed, and finding points of interest. Vehicles manufactured today typically include some type of onboard navigation system (Figure 1-37). Many mobile devices, such as smartphones, also have built-in navigation systems.

In preparing for a trip, you may need to reserve a car, hotel, or flight. Many websites offer these services to the public where you can search for and compare flights and prices, order airline tickets, or reserve a rental car. You also can print driving directions and maps from the web.

Publishing

Many publishers of books, magazines, newspapers, music, film, and video make their works available online. Organizations and individuals publish their thoughts and ideas using a blog, podcast, or wiki.

- A *blog* is an informal website consisting of time-stamped articles (posts) in a diary or journal format, usually listed in reverse chronological order. Posts can contain text, photos, links, and more. For example, Figure 1-38 shows the Nutrition Blog Network, in which registered



Figure 1-37 Many vehicles include an onboard navigation system.

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High-Tech Talk

Discover More: Visit this chapter's free resources to learn how navigation systems, mobile phone trackers, and game consoles use triangulation to determine a location.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn more about how neural networks work.

Figure 1-38 Any group or individual can create a blog, so that they can share thoughts and ideas.

Source: Nutrition Blog Network

Internet Research

How can you create a blog?

Search for: create a blog

dietitians post articles about nutrition. As others read articles in your blog, you can enable them to reply with their own thoughts. A blog that contains video is called a video blog.

- Podcasts are a popular way to distribute audio or video on the web. A *podcast* is recorded media that users can download or stream to a computer or portable media player. Examples of podcasts include lectures, political messages, radio shows, and commentaries. Podcasters register their podcasts so that subscribers can select content to automatically download when they are connected.
- A *wiki* is a collaborative website that allows users to create, add to, modify, or delete the content via their browser. Many wikis are open to modification by the general public. The difference between a wiki and a blog is that users cannot modify original posts made by a blogger. Read Ethics & Issues 1-4 for an issue related to using wikis as a source for research.

ETHICS & ISSUES 1-4



Should Wikis Be Allowed as Valid Sources for Academic Research?

As wikis have grown in number, size, and popularity, many educators and librarians have shunned them as valid sources of research. While some wikis are tightly controlled with a limited number of contributors and expert editors, these wikis usually focus on narrowly defined, specialized topics. Most large, multi-topic online wikis, such as Wikipedia, often involve thousands of editors, many of whom remain anonymous.

Critics of wikis cite the lack of certified academic credentials by the editors, as well as potential political or gender bias by contributors. Wikis also are subject to vandalism. Vandals' motives vary; some

enter false information to discredit the wiki, and others for humorous results. On occasion, rival political factions have falsified or embellished wiki entries in an attempt to give their candidate an advantage. Some wiki supporters argue that most wikis provide adequate controls to correct false or misleading content quickly and to punish those who submit it. One popular wiki now requires an experienced editor to verify changes made to certain types of articles. Other wiki protection methods include locking articles from editing, creating a list of recently edited articles, enabling readers to report vandalism, and allowing people to be notified about changes to a wiki page that

they have edited or that is about them. Some proponents propose that people should use wikis as a starting point for researching a fact, but that they should verify the fact using traditional sources.

Consider This: Should instructors allow wikis as valid sources for academic research? Why or why not? Would you submit a paper to your instructor that cites a wiki as a source? Why or why not? What policies might wikis enforce that could garner more confidence from the public? If a wiki provided verification of the credentials of the author, would you trust the wiki more? Why or why not?



Manufacturing

Computer-aided manufacturing (CAM) refers to the use of computers to assist with manufacturing processes, such as fabrication and assembly. Industries use CAM to reduce product development costs, shorten a product's time to market, and stay ahead of the competition. Often, robots carry out processes in a CAM environment. CAM is used by a variety of industries, including oil drilling, power generation, food production, and automobile manufacturing. Automobile plants, for example, have an entire line of industrial robots that assemble a car (Figure 1-39).

Figure 1-39 Automotive factories use industrial robots to weld car bodies.

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Special computers on the shop floor record actual labor, material, machine, and computer time used to manufacture a particular product. The computers process this data and automatically update inventory, production, payroll, and accounting records on the company's network.

Technology Users

Every day, people around the world use various technologies at home, at work, and at school. Depending on the hardware, software, and communications requirements, these users generally can be classified in one of five categories. Keep in mind that a single user may fall into more than one category.

- A *home user* is any person who spends time using technology at home. Parents, children, teenagers, grandparents, singles, couples, etc., are all examples of home users.
- A *small/home office user* includes employees of companies with fewer than 50 employees, as well as the self-employed who work from home. Small offices include local law practices, accounting offices, travel agencies, and florists.
- A *mobile user* includes any person who works with computers or mobile devices while away from a main office, home, or school. Examples of mobile users are sales representatives, real estate agents, insurance agents, meter readers, package delivery people, journalists, consultants, and students.
- A *power user* is a user who requires the capabilities of a powerful computer. Examples of power users include engineers, scientists, architects, desktop publishers, and graphic artists.
- An enterprise has hundreds or thousands of employees or customers who work in or do business with offices across a region, the country, or the world. Each employee or customer who uses computers, mobile devices, and other technology in the enterprise is an *enterprise user*. Read Ethics & Issues 1-5 to consider whether employees should be held accountable for their online social network posts.



ETHICS & ISSUES 1-5



Should Employees Be Held Accountable for Their Online Social Network Posts?

In addition to looking at your resume and scheduling an interview, a potential employer may search the web to find out information about you. A recent Career Builder survey found that 39 percent of employers look at applicants' use of online social networks, and 43 percent of those found information that caused them not to hire the applicant.

Once employed, your manager still may track your online activity. Companies are concerned about damaged reputations, or even lawsuits. Employee actions that worry their employers

include discussing company sales activity, griping about their managers or customers, or posting photos that show them taking part in unethical, illegal, or unsavory activities.

Social network-related firings have raised the question of whether companies should monitor employees' online social network activity. Accessing an employee's or a potential employee's social network profile also could have consequences for the company. If a company realizes that a person is a member of a minority group or has a disability, the company could face discrimination charges if it does not hire or later fires the employee. Privacy experts state that your online social network posts are your

own business. Debate about what falls under free speech is ongoing. Remember that you cannot delete easily what you post online. Whether or not you currently are searching for employment, online posts you make now can damage your future job prospects.

Consider This: What are the results when you search for yourself online? What steps can you take to clean up and protect your online reputation? Would you share social networking accounts or passwords with an employer or potential employer? Why or why not? Should companies monitor employees' accounts? Why or why not?

Table 1-4 illustrates the range of hardware, programs/apps, and communications forms used in each of these categories.



Table 1-4 Categories of Users

User	Sample Hardware	Sample Desktop Apps	Sample Mobile or Web Apps	Forms of Communications
All Users 	<ul style="list-style-type: none"> – Smartphone – Digital camera – Printer 	<ul style="list-style-type: none"> – Word processing – Schedule and contact management – Browser – Security 	<ul style="list-style-type: none"> – Alarm clock – Calculator – News, weather, sports – Reference – Finance 	<ul style="list-style-type: none"> – Email – Online social networks – Blogs
Home User 	<ul style="list-style-type: none"> – Laptop, tablet, or desktop – Portable media player and earbuds or headphones – Game console – E-book reader – Wearable device – Webcam – Headset 	<ul style="list-style-type: none"> – Personal finance – Photo and video editing – Media player – Educational – Entertainment 	<ul style="list-style-type: none"> – Banking – Travel – Mapping – Navigation – Health and fitness – Retail – Media sharing – Educational 	<ul style="list-style-type: none"> – Messaging – VoIP
Small/Home Office User 	<ul style="list-style-type: none"> – Desktop(s) or laptop(s) – Server – Webcam – Scanner 	<ul style="list-style-type: none"> – Spreadsheet – Database – Accounting 	<ul style="list-style-type: none"> – Travel – Mapping 	<ul style="list-style-type: none"> – Messaging – VoIP – FTP
Mobile User 	<ul style="list-style-type: none"> – Laptop or tablet – Video projector – Wireless headset 	<ul style="list-style-type: none"> – Note taking – Presentation – Educational – Entertainment 	<ul style="list-style-type: none"> – Travel – Mapping – Navigation – Retail – Educational 	
Power User 	<ul style="list-style-type: none"> – Desktop – Scanner 	<ul style="list-style-type: none"> – Desktop publishing – Multimedia authoring – Computer-aided design – Photo, audio, video editing 		<ul style="list-style-type: none"> – FTP – Videoconferencing
Enterprise User 	<ul style="list-style-type: none"> – Server – Desktop(s) or laptop(s) – Industry-specific handheld computer – Webcam – Scanner 	<ul style="list-style-type: none"> – Spreadsheet – Database – Accounting 	<ul style="list-style-type: none"> – Travel – Mapping – Navigation 	<ul style="list-style-type: none"> – Messaging – VoIP – FTP – Videoconferencing

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NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Communications and Networks, Technology Uses, and Technology Users, as it relates to the chapter objectives.

Now you should know . . .


- When you might use wired and wireless communications, and why you would use a network (Objective 9)
- How you would use technology in education, government, finance, retail, entertainment, health care, science, travel, publishing, and manufacturing (Objective 10)
- What types of hardware, software, and communications you could use at home, school, and work (Objective 11)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

Chapter 1 introduced you to basic computer concepts. You learned about laptops, tablets, desktops, servers, smartphones, digital cameras, portable media players, e-book readers, and game devices. The chapter introduced various methods for input, output, memory, and storage. It discussed the Internet, browsing and searching the web, and online social networks. Next, the chapter introduced digital security and safety risks and precautions, along with various types of programs, applications, communications, and networks. The many different uses of technology applications in society also were presented, along with types of users. This chapter is an overview. Many of the terms and concepts introduced will be discussed further in later chapters.

Discover More: Visit this book's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Facebook/Mark Zuckerberg, Twitter, Microsoft/Bill Gates, and Apple/Steve Jobs/Steve Wozniak; Technology Trends: MOOCs and QR Codes in the Medical Field; and High-Tech Talks: Triangulation and Neural Networks.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Health Care

You are out running on a beautiful day, tracking your route and distance using a health and fitness app on a smartphone. While running, you accidentally step on uneven pavement and suffer an injury that requires a trip to an emergency room. Upon check-in, the employee at the front desk uses a tablet to record your personal data and symptoms. She also uses the tablet to verify that your insurance coverage is current and informs you of your co-payment amount. After waiting several minutes, a triage nurse takes your temperature and blood pressure and then asks a series of questions about your symptoms. The nurse also records this data in a tablet and asks you to remain in the waiting room until someone from the radiology department is available to perform a CT scan. The radiology department is located in a different area of the hospital, so the technicians watch a computer screen that displays a list of patients who currently are waiting for their services.

About 30 minutes later, a technician calls your name and escorts you to the radiology department for your CT scan. As she is performing the scan, a computer records the images that later will be reviewed by a physician. When the CT scan is complete, you return to the waiting room until a physician reviews the results. Once she receives the results and reviews them, a hospital employee takes you to a consultation room.

The physician informs you that other than a few bumps and bruises, she believes that you have sustained no permanent damage and prescribes medication to help ease the pain. She then returns to a computer at the nurses' station and adds her diagnosis to the database that stores your medical records. She also sends your prescription electronically to the hospital's pharmacy. Once discharged, you visit the cashier to pay the bill. You then use a tablet to sign an electronic version of your discharge paperwork so that the hospital can store it

electronically. The hospital bills your insurance company electronically. If you owe a balance after the insurance company pays its portion, a computer at the hospital will generate a bill that will be mailed to you. After purchasing your medication and leaving the hospital, you realize that despite the hospital being busy, computers decreased the time of your visit by automating processes that otherwise would have been performed manually and reduced possible errors by storing all of your personal information centrally.



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-  **Consider This:** How else might computers and technology be used in the health care industry?

Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to test your knowledge of digital content associated with this chapter and access the Study Guide resource from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

1. Define the term, digital literacy.
2. Define the terms, computer, hardware, and user.
3. Differentiate between a PC and a mobile computer. A laptop also is known as a(n) ___ computer.
4. Describe the characteristics and features of a tablet. List several touch screen gestures.
5. Explain the difference between a desktop and an all-in-one. What additional meaning does the term, desktop, sometimes have?
6. Define the term, server. What services does a server provide?
7. Explain whether or not a mobile device is a computer.
8. List characteristics of a smartphone.
9. Differentiate among voice, text, picture, and video messages.
10. Describe the purpose of these mobile devices: digital cameras, portable and digital media players, e-book readers, wearable devices, and game devices.
11. Describe the trend of digital device convergence and how it applies to mobile devices.
12. Describe uses of technology in home automation.
13. Differentiate between data and information. Give an example of each.
14. Define the terms, input and output. List several types of input devices and output devices.
15. Describe the purpose of a pointing device. Give an example.
16. List the hardware you can use to input and view output for voice and video.
17. Differentiate between memory and storage.
18. A computer keeps data, instructions, and information on ___ media. Give some examples.
19. Define the term, cloud storage. Describe the types of services offered by cloud storage providers.
20. Describe components of a backup plan. How do backup plans for mobile devices and personal computers differ?
21. Describe the Internet. Identify reasons people use the Internet.
22. Differentiate between the web and the Internet.
23. The ___ consists of a worldwide collection of electronic documents. What is each electronic document called?
24. What is a browser? Describe the purpose of a search engine.
25. Explain the purpose of an online social network.
26. Differentiate between the services and uses of Facebook, Twitter, and LinkedIn.
27. List services of the Internet that facilitate communications.
28. Define the term, malware. List ways you can protect yourself from malware.
29. What privacy risks are involved with using technology? List guidelines for creating a strong password.
30. Explain physical and behavioral health risks associated with using computers.
31. Describe strategies that support green computing.
32. Define the term, software. Software also is called a(n) ___.
33. Define the term, operating system. List popular operating systems for computers and mobile devices.
34. Differentiate between desktop, web, and mobile apps.
35. List the steps involved in installing programs.
36. Explain how to locate, install, and run programs. What is the role of a software developer?
37. Define the term, communications device. List examples of wireless communications technologies.
38. Define the term, hot spot. Give two examples and describe how each is used.
39. Describe how homes and businesses use networks.
40. Identify issues surrounding accessing an unsecured network.
41. Explain what occurs when you synchronize computers and mobile devices.
42. List ways that schools use technology to enhance education.
43. Identify how the following industries use technology: government, financial, retail, entertainment, health care, science, travel, publishing, and manufacturing.
44. Describe how you might use blogs, wikis, and podcasts to publish content.
45. Differentiate among the following technology user types: home user, small/home office user, mobile user, power user, and enterprise user.
46. Describe how technology is used in the health care industry.

Key Terms

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

Discover More: Visit this chapter's premium content to view definitions for each term and access the Flash Cards resource from your smartphone, tablet, laptop, or desktop.

Primary Terms (shown in bold-black characters in the chapter)

all-in-one (6)	digital camera (8)	network (32)	storage media (17)
app (27)	digital device	online social network (23)	sync (34)
application (27)	convergence (10)	output device (14)	synchronize (34)
backup (18)	e-book reader (9)	portable media player (8)	tablet (4)
browser (21)	game console (10)	printer (14)	wearable device (9)
Bluetooth (32)	green computing (26)	program (26)	web (21)
cloud storage (18)	hard drive (17)	search engine (22)	web server (21)
communications	input device (12)	server (6)	webpage (21)
device (31)	Internet (20)	smartphone (7)	website (21)
computer (4)	laptop (4)	software (26)	Wi-Fi (31)
desktop (6)	memory (16)	storage device (17)	

Secondary Terms (shown in italic characters in the chapter)

<i>3-D printer (15)</i>	<i>hot spot (32)</i>	<i>point (13)</i>	<i>stretch (5)</i>
<i>blog (39)</i>	<i>hyperlink (21)</i>	<i>power user (41)</i>	<i>surfing the web (21)</i>
<i>BYOD (35)</i>	<i>information (12)</i>	<i>press and hold (5)</i>	<i>swipe (5)</i>
<i>click (13)</i>	<i>input (4)</i>	<i>printout (14)</i>	<i>tap (5)</i>
<i>computer-aided manufacturing (40)</i>	<i>keyboard (13)</i>	<i>resources (32)</i>	<i>target (34)</i>
<i>data (12)</i>	<i>link (21)</i>	<i>right-click (13)</i>	<i>text message (7)</i>
<i>desktop app (28)</i>	<i>loads (28)</i>	<i>scanner (14)</i>	<i>touchpad (13)</i>
<i>digital literacy (2)</i>	<i>malware (24)</i>	<i>slide (5)</i>	<i>USB flash drive (18)</i>
<i>digital media (8)</i>	<i>memory card (18)</i>	<i>small/home office user (41)</i>	<i>user (4)</i>
<i>digital media player (9)</i>	<i>microphone (14)</i>	<i>Smart TV (15)</i>	<i>user interface (29)</i>
<i>double-click (13)</i>	<i>mobile app (28)</i>	<i>social networking site (23)</i>	<i>video message (7)</i>
<i>double-tap (5)</i>	<i>mobile computer (4)</i>	<i>software developer (29)</i>	<i>voice mail message (7)</i>
<i>downloading (21)</i>	<i>mobile device (7)</i>	<i>solid-state drive (17)</i>	<i>wearable (9)</i>
<i>drag (5, 13)</i>	<i>mobile user (41)</i>	<i>source (34)</i>	<i>web app (28)</i>
<i>earbuds (8)</i>	<i>mouse (13)</i>	<i>streaming (38)</i>	<i>webcam (14)</i>
<i>e-book (9)</i>	<i>neural network (39)</i>	<i>streaming media player (9)</i>	<i>wiki (40)</i>
<i>enterprise user (41)</i>	<i>notebook computer (4)</i>		
<i>e-reader (9)</i>	<i>on-screen keyboard (5)</i>		
<i>e-waste (26)</i>	<i>operating system (27)</i>		
<i>file (18)</i>	<i>optical disc (18)</i>		
<i>gesture (5)</i>	<i>output (4)</i>		
<i>hard copy (14)</i>	<i>personal computer (4)</i>		
<i>hard disk (17)</i>	<i>phablet (7)</i>		
<i>hardware (4)</i>	<i>picture message (7)</i>		
<i>headset (14)</i>	<i>pinch (5)</i>		
<i>home user (41)</i>	<i>podcast (40)</i>		



all-in-one (6)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to complete the Checkpoint exercises interactively; complete the self-assessment in the Test Prep resource from your smartphone, tablet, laptop, or desktop; and then take the Practice Test.

True/False

Mark T for True and F for False.

- _____ 1. Electronic components in computers process data using instructions, which are the steps that tell the computer how to perform a particular task. (4)
- _____ 2. An all-in-one contains a separate tower. (6)
- _____ 3. Smartphones typically communicate wirelessly with other devices or computers. (7)
- _____ 4. Data conveys meaning to users, and information is a collection of unprocessed items, which can include text, numbers, images, audio, and video. (12)
- _____ 5. A headset is a type of input device. (14)
- _____ 6. A scanner is a light-sensing output device. (14)
- _____ 7. Although some forms of memory are permanent, most memory keeps data and instructions temporarily, meaning its contents are erased when the computer is turned off. (16)
- _____ 8. A solid-state drive contains one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information. (17)
- _____ 9. The terms, web and Internet, are interchangeable. (21)
- _____ 10. One way to protect your computer from malware is to scan any removable media before using it. (25)
- _____ 11. Operating systems are a widely recognized example of system software. (26)
- _____ 12. You usually do not need to install web apps before you can run them. (28)

Multiple Choice

Select the best answer.

1. A(n) _____ is any hardware component that allows you to enter data and instructions into a computer or mobile device. (12)
 - a. output device
 - b. communications device
 - c. input device
 - d. display
2. Which of the following is *not* an example of an output device? (14)
 - a. scanner
 - b. printer
 - c. display
 - d. speaker
3. _____ consists of electronic components that store instructions waiting to be executed and the data needed by those instructions. (16)
 - a. Storage
 - b. Cloud storage
 - c. Solid-state drives
 - d. Memory
4. _____ is an Internet service that provides remote storage to computer users. (18)
 - a. Smart TV
 - b. Cloud storage
 - c. Solid-state drive (SSD)
 - d. Bluetooth
5. A computer that delivers requested webpages to your computer or mobile device is a(n) _____. (21)
 - a. VoIP computer
 - b. web server
 - c. FTP device
 - d. hard drive
6. A _____ is software that enables users with an Internet connection to access and view webpages on a computer or mobile device. (21)
 - a. search engine
 - b. wiki
 - c. browser
 - d. digital media player
7. _____ uses short-range radio signals to enable computers and devices to communicate with each other. (32)
 - a. Cellular radio
 - b. Bluetooth
 - c. Wi-Fi
 - d. A hot spot
8. A(n) _____ is a collaborative website that allows users to create, add to, modify, or delete the content via their browser. (40)
 - a. podcast
 - b. blog
 - c. online social network
 - d. wiki

Checkpoint

Matching Match the terms with their definitions.

- | | |
|--|--|
| _____ 1. all-in-one (6) | a. term that describes the trend of computers and devices with technologies that overlap |
| _____ 2. server (6) | b. mobile device that combines features of a smartphone and a tablet |
| _____ 3. phablet (7) | c. storage device that typically uses flash memory to store data, instructions, and information |
| _____ 4. digital device convergence (10) | d. small, flat, rectangular pointing device that is sensitive to pressure and motion |
| _____ 5. touchpad (13) | e. set of programs that coordinates all the activities among computer or mobile device hardware |
| _____ 6. storage device (17) | f. named collection of stored data, instructions, or information |
| _____ 7. solid-state drive (17) | g. type of desktop computer that does not contain a tower and instead uses the same case to house the display and the processing circuitry |
| _____ 8. file (18) | h. series of related instructions, organized for a common purpose, that tells the computer what tasks to perform and how to perform them |
| _____ 9. software (26) | i. computer that is dedicated to providing one or more services to other computers or devices on a network |
| _____ 10. operating system (27) | j. component that records and/or retrieves items to and from storage media |

**Consider This**

Answer the following questions in the format specified by your instructor.

- Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (8, 23, 33, 40, 41), How To (5, 16, 22, 29), Mini Features (11, 34, 35), Secure IT (19, 25, 25, 37), and Technology @ Work (43).
- What does it mean to be digitally literate, and why is it important? (2)
- What are the different touch screen gestures and the actions they may cause to occur? (5)
- What types of keyboards are available for smartphones and tablets? (5, 7)
- In addition to books, what other digital media can be read on an e-book reader? (9)
- In addition to keeping time, how might you use a smartwatch? (9)
- Why might a consumer purchase separate stand-alone devices, such as smartphones, digital cameras, portable media players? (10)
- How can you ease eyestrain while using a computer or mobile device? (16)
- What types of files might you choose to store on a memory card or USB flash drive, rather than on a hard drive? (18)
- What steps might you include in a backup plan? (19)
- Why might you choose to use LinkedIn rather than Facebook? (24)
- How might you know if your computer or mobile device is infected with malware? (24)
- What types of software protect a computer from viruses and other malware? (25)
- Why should you use a different password for all websites you access? (25)
- How might you know if you are addicted to computers or suffer from technology overload? (26)
- Why is green computing important? (26)
- What steps can you take to contribute to green computing? (26)
- What is the difference between system and application software? (26)
- What are some examples of popular operating systems? (27)
- How do desktop apps, web apps, and mobile apps differ? (28)
- Where can you obtain programs or apps? (29)
- What does a user interface control? (29)
- What are some popular programming languages? (29)
- Why might you opt for wireless communications? (31)
- In a network, what is the major difference between a server and a client? (32)
- When should you use a one-way sync or a two-way sync? (34)
- What type of industries use computer-aided manufacturing (CAM)? (40)

Problem Solving

The **Problem Solving** exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The **Collaboration** exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Shopping for Software** You are shopping for software that will assist you with your home's interior design. The package for the program you would like to purchase states that it was designed for the most recent version of Windows, but an older version is installed on your computer. How can you determine whether the program will run on your computer?
- 2. Bad Directions** You are driving to your friend's house and are using your smartphone for directions. While approaching your destination, you realize that your smartphone app instructed you to turn the wrong way on your friend's street. How could this have happened?
- 3. Bank Account Postings** While reviewing your checking account balance online, you notice that debit card purchases have not posted to your account for the past several days. Because you use online banking to balance your account, you become concerned about your unknown account balance. What steps will you take to correct this situation?
- 4. Trial Expired** You have been using an app on your mobile device for a 30-day trial period. Now that the 30 days have expired, the app is requesting that you to pay to continue accessing your data. What are your next steps? What steps could you have taken to preserve your data before the trial period expired?
- 5. Problematic Camera** After charging your digital camera battery overnight, you insert the battery and turn on the camera only to find that it is reporting a low battery. Seconds later, the camera shuts off automatically. What might be wrong?



Professional

- 6. Discarding Old Computer Equipment** Your company has given you a new laptop to replace your current, outdated desktop. Because of the negative environmental impact of discarding the old computer in the trash, your supervisor asked you to suggest options for its disposal. How will you respond?
- 7. Dead Battery** While traveling for business, you realize that you forgot to bring the battery charger for your laptop. Knowing that you need to use the laptop to give a presentation tomorrow, what steps will you take tonight to make sure you have enough battery power?
- 8. Cannot Share Photos** You are attempting to send photos of a house for sale in an email message to your real estate partner. Each time you attempt to send the email message, you receive an automatic response stating that the files are too large. What are your next steps?
- 9. Incorrect Sign-In Credentials** Upon returning to the office from a well-deserved two-week vacation, you turn on your computer. When you enter your user name and password, an error message appears stating that your password is incorrect. What are your next steps?
- 10. Synchronization Error** You added appointments to the calendar on your computer, but these appointments are not synchronizing with your smartphone. Your calendar has synchronized with your smartphone in the past, but it has stopped working without explanation. What are your next steps?

Collaboration

- 11. Technology in Health Care** Your primary care physician is moving from a shared office so that he can open his own practice. He mentioned that he would like to use technology in his office that not only will improve the patient experience, but also make his job easier. Form a team of three people to determine the types of technology your doctor can use in his new office. One team member should research ways that technology can help improve patient check-in and billing. Another team member should research the types of technology your doctor can use while he is working with patients, and the third team member should research any additional technology that can be used in the office to improve the patient experience. Compile your findings in a report and submit it to your instructor.

The **How To: Your Turn** exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

How To: Your Turn

Discover More: Visit this chapter's premium content to challenge yourself with additional How To: Your Turn exercises, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

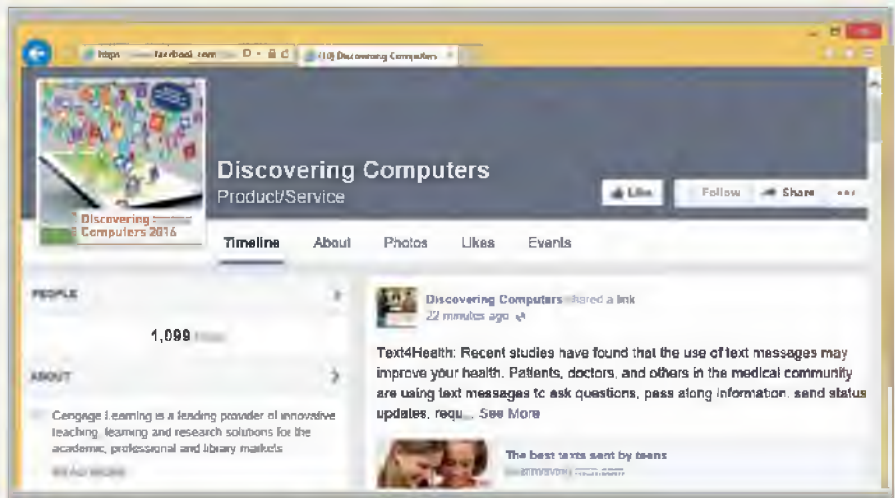
1 Create a Facebook Account, Find the Discovering Computers Facebook Page, and Like It

The Discovering Computers Facebook page contains links to current events and other technology news, as well as relating the links to content in this book. The following steps guide you through the process of signing up for a Facebook account, navigating to the Discovering Computers Facebook page, and liking the page.

- Run a browser and then navigate to www.facebook.com.
- Follow the steps on the Facebook webpage to sign up for a new account. If you already have an account, enter your sign-in information and sign in to your Facebook account.
- Search for the Discovering Computers Facebook page using the search text, Discovering Computers.
- Select the Discovering Computers Product/Service in the search results.
- Tap or click the Like button to like the page.
- If your screen displays a Follow button, tap or click it to see information from the Discovering Computers Facebook page in your news feed.
- View the posts and tap or click links on the page that are of interest to you.
- When you are finished, sign out of Facebook.

Exercises

- Summarize the process you use to sign up for or sign in to your Facebook account.
- Which links on the Discovering Computers Facebook page are of interest to you? Why?
- Browse Facebook and find at least three other Facebook pages that are of interest to you. Which pages have you found, and why do you like them?



2 Create a Twitter Account, Find the Discovering Computers Twitter Account, and Follow It

The Discovering Computers Twitter account contains links to current events and other technology news, as well as how it relates to the content in this textbook. The following steps guide you through the process of signing up for a Twitter account, navigating to the Discovering Computers Twitter account, and following it.

- Run a browser and then navigate to www.twitter.com.
- Follow the steps on the Twitter webpage to sign up for a new account. If you already have an account, enter your sign-in information and sign in to your Twitter account.
- Search for the Discovering Computers Twitter account using the search text, DiscoveringComp.
- Select Shelly Cashman @DiscoveringComp in the search results.
- Tap or click the Follow button to follow the account.
- View the posts and tap or click links on the page that are of interest to you.
- When you are finished, sign out of Twitter.

How To: Your Turn

Exercises

1. Summarize the process you use to sign up for or sign in to your Twitter account.
2. How is the Discovering Computers Twitter account similar to the Discovering Computers Facebook page? How are they different?
3. Browse Twitter and find at least three other Twitter accounts to follow. Which ones have you found, and why do you like them?

Connect to a Wireless Network

Wireless networks are available in many homes and businesses. Connecting to a wireless network can provide you with high-speed access to the Internet and other network resources. The following steps guide you through the process of connecting to a wireless network from a computer or mobile device.

- a. If necessary, turn on your computer or mobile device and make sure wireless functionality is enabled.
- b. Obtain the name of the wireless network to which you want to connect. **Note:** *You should connect only to wireless networks for which you have permission.*
- c. On your computer or mobile device, view the list of available wireless networks.
- d. Select the wireless network to which you want to connect.

- e. If necessary, enter the requested security information, such as an encryption key or a password.
- f. Run a browser to test your connection to the wireless network.

Exercises

1. Why should you not connect to a wireless network unless you have permission?
2. What is the name of the wireless network to which you connected?
3. Why might you connect to a wireless network on your smartphone instead of using your mobile data plan?

Manage Your Calendar

Individuals are choosing to use calendars on computers and mobile devices to keep track of events in their personal and professional lives more easily. In addition, students might use calendars to keep track of their class schedules. The following steps guide you through the process of managing your computer or mobile device's calendar.

- a. Run the calendar app (usually by tapping or clicking its icon or tile on the home screen).
- b. To add a new appointment, tap or click the Add or New Appointment button or icon and then enter the title or subject of the appointment, its date, time, location, and other information. Tap or click the Save button or icon on the New Appointment screen to save the information to your calendar.
- c. Specify repeating information for appointments that occur at the same time over multiple occurrences, such as a class that meets every Tuesday from 10:00 a.m. to 11:00 a.m.
- d. View your appointments on a daily, weekly, or monthly calendar by tapping or clicking the appropriate choice in the calendar app.
- e. To edit an appointment, meeting, or event on your calendar, open the item by tapping or clicking it, make the necessary changes and then save the changes.



How To: Your Turn

- f. To delete an appointment, meeting, or event on your calendar, open the item by tapping or clicking it, and then tap or click the button to delete it. If necessary, confirm the deletion. If you are attempting to delete a recurring item on the calendar, the calendar app may ask whether you want to delete the one occurrence, or the entire series of appointments, meetings, or events.



© iStockphoto / Moncherie

Exercises

1. In addition to your class schedule, what other recurring appointments might you add to your calendar?
2. Many calendar apps have a feature that can remind you of upcoming appointments in advance. How far in advance do you think you should be reminded of upcoming appointments?
3. How can you synchronize the calendar on your mobile device with the calendar on your home computer?

5 Back Up Photos from a Phone or Tablet

Many individuals take photos using mobile devices such as phones and tablets. Many, however, neglect to realize the importance of backing up these memories. A backup of the photos will be useful if you lose your mobile device, upgrade it to a newer model, or the device becomes damaged. While many mobile devices have built-in capabilities to back up photos to the cloud or to a desktop or laptop, it is important to make sure these features are configured properly. The following steps guide you through the process of backing up photos from a phone or tablet.

Backing Up to the Cloud

- a. If necessary, install and sign in to an app on a phone or tablet that can back up photos to the cloud. Make sure the service you use gives you enough storage space for the photos you intend to upload.
- b. Follow the instructions in the app and configure it to back up the photos at an interval of your choosing. Some options might include:
 - Back up all photos at certain intervals (such as one time per day or one time per week)
 - Back up photos as you take them
 - Back up photos stored in specific folders
- c. If you are using a mobile device with a data plan, consider specifying whether you want the backup to occur only when you are connected to

Wi-Fi. Backing up using your phone or tablet's data plan may result in additional charges if you inadvertently exceed your quota.

- d. Verify all photos have been backed up to the cloud service.

Backing Up to a Computer

- a. Use the USB cable that came with your phone or tablet to connect it to the computer to which you want to back up the photos.
- b. After the computer has recognized that a phone or tablet is connected, navigate to the drive on the computer representing the phone or tablet and then navigate to the folder containing the photos. If your phone or tablet stores pictures on both internal storage and a memory card, remember to back up your photos from both locations.
- c. Drag the photos from the location on your phone or tablet to a folder on your computer that will store the backed up files.
- d. When the files have finished backing up to the computer, close all open folder windows on the computer and then safely disconnect the phone or tablet from the computer.



© Dmitry Rukhlenko / Photos.com

Exercises

1. How often do you think you should back up your photos? Why?
2. When backing up photos, why might it be better to connect your phone or tablet to the computer using a cable instead of inserting the memory card from the phone or tablet into the computer?
3. Compare and contrast three apps or services that can back up photos from your phone or tablet to the cloud. Which one would you choose, and why?

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to challenge yourself with additional Internet Research exercises, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Informational and Research

Informational and research websites contain factual information and include reference works such as libraries, encyclopedias, dictionaries, directories, and guides. More than 2.4 billion people worldwide use the Internet, and Google is one of the websites they visit most often. Google reports that people perform more than 100 billion searches every month using its Google Search. In How To 1 in the Succeeding in this Course chapter at the beginning of this book and How To 1-3 in this chapter, you learned how to use a browser to display a webpage on a computer or mobile device and to perform a basic web search using a search engine.

Research This: Using a browser and search engine, find the answers to the following questions. (1) Search for the top five informational websites and top five research websites. What types of information or research does each present? What search text did you use? (2) Visit Google's website and locate the company's early philosophy: "Ten things we know to be true." What are five of these values? What is the goal of the "Made with Code" initiative? (3) Visit the Engadget website and read at least three reviews of tablets. Create a table listing the product name, price, battery life, pros, and cons. (4) Locate articles about using hands-free devices for conversations while driving. Which states have passed legislation to restrict drivers' use of hands-free devices while driving? Describe the features found in the sophisticated hands-free system of one of this year's vehicles.



Source: Google Inc.

2 Social Media

Online social networks are a central communications tool and the primary source of news and information for many people. Historians place the birth of online social networking with the BBS (Bulletin Board System), where users communicated with a central computer and sent messages to other BBS members and also downloaded files and games. The next phase of online social networks evolved when CompuServe, AOL (America Online), and Prodigy were among the services linking people with similar interests. Today's online social networks share many of the same basic principles by allowing members to communicate common interests, play games, and share photos, videos, and music. Some of these online social networks are for personal use, while others are for entrepreneurs, business owners, and professionals to share job-related topics.

Research This: Compare the features of the top personal online social networks, and create a table listing the number of active members in the United States and worldwide, the number of years the sites have existed, the more popular features, and the amount of content, such as photos, news stories, and links, that is shared each month. What types of advertisements are featured in each of these sites? Which sites are marketed toward younger and older users? Then, research the online social networks used for business. How does their content differ from that found on the personal online social networks? How many companies use these sites as a recruiting tool? How many native languages are supported? How are professionals using these websites to find potential clients and business partners?

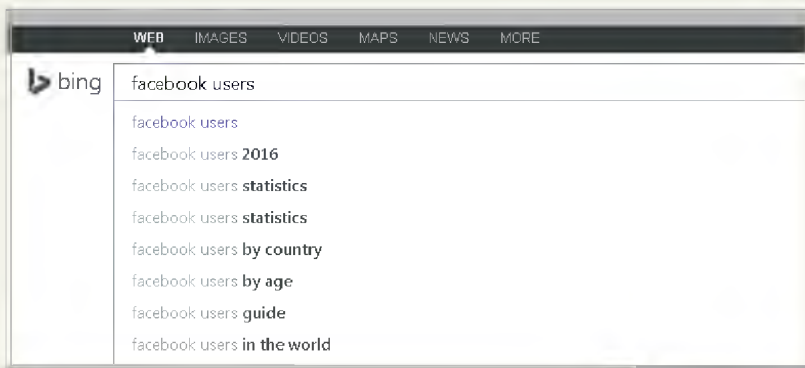
3 Search Skills Selecting Search Terms

Search text that you send to a search engine, such as Google, Bing, or Yahoo!, impacts the quality of your search results. Rather than typing a long question in the search box, you may improve your results if you select the question's most important words as your search text. For example, instead of typing the

Internet Research

entire question “How many users currently are on Facebook?” as your search text, type the following as your search text: facebook users current. Many search engines consider common words — such as how, are, and on — as stop words, or words that a search engine ignores when performing a search.

Place the most specific or important word (facebook) first in your search text and then follow it with additional words to narrow the results. To see if rearranging the order of the words yields different results, type current users facebook. Some search results from both queries likely will overlap. Many search engines assist you by automatically completing terms as you type them and will display a list of popular alternatives from which you can select. Sometimes, replacing a search term with a synonym will improve your results. For example, try using the search text, facebook users, followed by the current year instead of the using the word, current. Most search engines are not case sensitive. (They do not distinguish between uppercase and lowercase characters.)



Source: Microsoft

Research This: Create search text using the techniques described above, and type it into a search engine to find answers to these questions. (1) What English words are stop words for Google? (2) What is the largest solid-state drive available? (3) How many hours per day on average do teens spend playing video games? (4) When is the next update to the Android mobile operating system expected to be released?

Security

Secure IT 1-3 in this chapter offers advice about creating secure passwords when registering for websites. Despite suggestions and constant reminders from security experts to develop and then periodically change passwords, users continue to create weak passwords.

These common passwords are broken easily and, therefore, never should be used. For many years, the most common passwords have been the word, password, and the number sequences 123456 and 12345678.

Research This: Use a search engine to locate at least 2 different companies' lists of the 10 or 20 more common passwords in the past two years. Which passwords appear on both lists? Find a password-strength checking website and type three passwords to determine how easy or difficult they are to crack. Why do consumers continue to use these passwords despite repeated warnings to avoid them? Do you have accounts using one or more of these passwords? What advice is given for developing strong passwords, such as using the lyrics to the first line of a favorite song? How do the companies gather data to determine common passwords?

Cloud Services

Cloud Storage (IaaS)

Cloud storage providers offer online access to hardware for storing files, and web and mobile apps to access, back up, and manage files. Cloud storage is an example of IaaS (infrastructure as a service), a service of cloud computing that allows individuals and businesses to use a vendor's hardware to manage their computing needs.

Cloud storage providers offer both free and paid service plans based on the amount of free storage, and some allow users to earn additional storage by recommending friends to use their services or by participating in promotional campaigns. Many cloud storage providers enable users to synchronize files across multiple devices, access files via mobile or web apps, share files with team members, and maintain previous versions of files. Some provide built-in access to web-based productivity software or integrate with third-party web and mobile apps.

Research This: (1) Use a search engine to find three popular cloud storage providers. Create accounts and try each for a period specified by your instructor. In a table, summarize their features, including amount of free storage available (offered or earned), restrictions on file sizes you can upload, ease of use of web and mobile apps, operating systems or devices supported, cost of paid plans, and additional services provided for a fee. (2) Many cloud storage providers offer several gigabytes of free storage to their users. What is the largest amount of free storage you can find? Who is the provider? Can you identify any drawbacks to using this service?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Reactions to Software Problems

People who use computers and mobile devices sometimes experience problems with software, including operating systems, desktop apps, web apps, and mobile apps. Problems range from not being able to install or download the program or app to a computer or mobile device, to a program or an app producing unanticipated results. Depending on the situation, these problems can result in user stress. Many people believe reactions to software problems tend to be more extreme than reactions to problems with other tools.

Do This: Evaluate situations in which you have seen people react to program and app problems on their computers and mobile devices. Discuss how these users can reduce their frustration when dealing with such problems. Have you ever been frustrated by problems with a program or an app? How did you react? What did you do to solve the problem?

2. Energy Efficiency

Increases in energy prices lead many individuals to look at purchasing energy-efficient computers and devices. Energy-efficient models often look and perform similarly to equivalent computers or devices that use more energy.

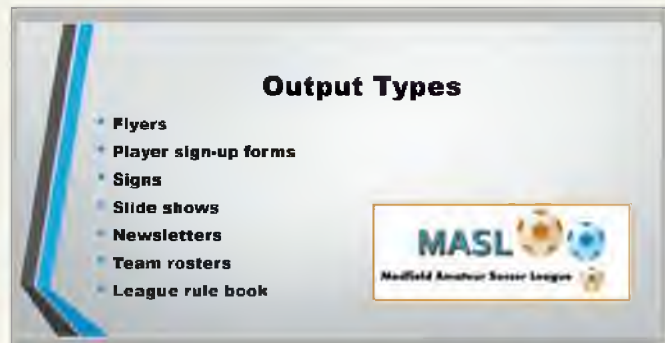
Do This: Find two computers or devices of identical configuration, where the only difference is energy consumption. How much energy does the energy-efficient model save? Are energy-efficient computers and devices more or less expensive? Will the difference in cost (if any) affect your purchasing decision? How else might you be able to change your settings on your

existing computer or device to save energy? Use the web to locate articles that recommend energy-efficient products and that provide tips about additional ways to save energy.

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The previous manager tracked all of the data on paper. You realize that using technology will increase your efficiency and enable you to communicate better with the board of directors, coaches, and players. At the board's next meeting, you will share ideas of how you will use technology.

Do This: To prepare for the meeting, you compile the following: differences between input and output, a list of the types of data you can use as input, and a list of the types of information you can produce as output. You include the types of computers, mobile devices, and other technologies you will use to enter data and produce the information. Incorporate your own experiences and user reviews of the devices. Compile your findings.



Source: © Cengage Learning

Collaboration

4. Recommending Technology Solutions People use computers and mobile devices in a variety of fields, including travel, manufacturing, and more. Although the way people use computers and mobile devices varies, each use involves hardware, programs and apps, and some type of communications method, such as the Internet or cellular network.

Do This: Form a three-member team and choose a field in which you all are interested. Assign one member to investigate hardware, another to investigate programs and apps, and the third member to investigate communications methods used in the field. Locate user reviews and articles by industry experts. Each team member should develop a list of related items that may be used. After the investigation, create a hypothetical business or organization in the field. Recommend specific hardware, programs or apps, and communications capabilities that would be best for the network or organization. Include comparisons of specific items, as well as costs. Be sure to summarize your investigations, describe the hypothetical business or organization, and outline and support your recommendations.

CONNECTING AND COMMUNICATING ONLINE: The Internet, Websites, and Media

2



The Internet provides a variety of ways to communicate online.


"I use the Internet and web to shop for bargains, browse Google for all sorts of information, manage my fantasy sports teams, download music, check email on my phone, and so much more! What more could I gain from using the Internet?"

While you may be familiar with some of the content in this chapter, do you know how to . . .

- Use a public Wi-Fi hot spot safely?
- Register a domain name?
- Identify a cybersquatter?
- Browse the web safely?
- Tag digital content?
- Protect yourself from identity theft?
- Improve search results?
- Publish a website?
- Download digital media from online services?
- Set up a personal VoIP service?
- Combat cyberbullying?
- Determine your IP address?
- Search for a job online?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.



 Objectives

After completing this chapter, you will be able to:

- 1 Discuss the evolution of the Internet
- 2 Briefly describe various broadband Internet connections
- 3 Describe the purpose of an IP address and its relationship to a domain name
- 4 Describe features of browsers and identify the components of a web address
- 5 Describe ways to compose effective search text
- 6 Explain benefits and risks of using online social networks
- 7 Describe uses of various types of websites: search engines; online social networks; informational and research; media sharing; bookmarking; news, weather, sports, and other mass media; educational; business, governmental, and organizational; blogs; wikis and collaboration; health and fitness; science; entertainment; banking and finance; travel and tourism; mapping; retail and auctions; careers and employment; e-commerce; portals; content aggregation; and website creation and management
- 8 Explain how the web uses graphics, animation, audio, video, and virtual reality
- 9 Explain how email, email lists, Internet messaging, chat rooms, online discussions, VoIP, and FTP work
- 10 Identify the rules of netiquette

The Internet

One of the major reasons business, home, and other users purchase computers and mobile devices is for Internet access. The **Internet** is a worldwide collection of networks that connects millions of businesses, government agencies, educational institutions, and individuals. Each of the networks on the Internet provides resources that add to the abundance of goods, services, and information accessible via the Internet.

Today, billions of home and business users around the world access a variety of services on the Internet using computers and mobile devices. The web, messaging, and video communications are some of the more widely used Internet services (Figure 2-1). Other Internet services include chat rooms, discussion forums, and file transfer. To enhance your understanding of Internet services, the chapter begins by discussing the history of the Internet and how the Internet works and then explains each of these services.

Evolution of the Internet

The Internet has its roots in a networking project started by the Pentagon's Advanced Research Projects Agency (ARPA), an agency of the U.S. Department of Defense. ARPA's goal was to build a network that (1) allowed scientists at different physical locations to share information and work together on military and scientific projects and (2) could function even if part of the network were disabled or destroyed by a disaster such as a nuclear attack. That network, called *ARPANET*, became functional in September 1969, linking scientific and academic researchers across the United States.

The original ARPANET consisted of four main computers, one each located at the University of California at Los Angeles, the University of California at Santa Barbara, the Stanford Research Institute, and the University of Utah. Each of these computers served as a host on the network. A *host*, more commonly known today as a server, is any computer that provides services and connections to other computers on a network. Hosts often use high-speed communications to transfer data and messages over a network. By 1984, ARPANET had more than 1,000 individual computers linked as hosts. Today, millions of hosts connect to this network, which now is known as the Internet.



Figure 2-1 People around the world use the Internet in daily activities, such as accessing information, sending or posting messages, and conversing with others from their computers and mobile devices.

Source: Library of Congress; © artjazz / Shutterstock; © iStockphoto / Chesky_W; © iStockPhoto / pictafolio; © iStockphoto / Blend_Images; © Andrey_Popov / Shutterstock; © Bloomua / Shutterstock

The Internet consists of many local, regional, national, and international networks. Both public and private organizations own networks on the Internet. These networks, along with phone companies, cable and satellite companies, and the government, all contribute toward the internal structure of the Internet.

Discover More: Visit this chapter's free resources to learn about Internet2.

CONSIDER THIS

Who owns the Internet?

No single person, company, institution, or government agency owns the Internet. Each organization on the Internet is responsible only for maintaining its own network.

The World Wide Web Consortium (W3C), however, oversees research and sets standards and guidelines for many areas of the Internet. The mission of the W3C is to ensure the continued growth of the web. Nearly 400 organizations from around the world are members of the W3C, advising, defining standards, and addressing other issues.

Internet Research

Which organizations are members of the World Wide Web Consortium?

Search for: w3c members

Connecting to the Internet

Users can connect their computers and mobile devices to the Internet through wired or wireless technology and then access its services free or for a fee. With wired connections, a computer or device physically attaches via a cable or wire to a communications device, such as a modem, that transmits data and other items over transmission media to the Internet. For wireless connections, many mobile computers and devices include the necessary built-in technology so that they can transmit data and other items wirelessly. Computers without this capability can use a wireless modem or other communications device that enables wireless connectivity. A *wireless modem*, for example, uses a wireless communications technology (such as cellular radio, satellite, or Wi-Fi) to connect to the Internet. Figure 2-2 shows examples of modems. The wireless modem shown in the figure is known as a *dongle*, which is a small device that connects to a computer and enables additional functions when attached.

Today, users often connect to the Internet via *broadband* Internet service because of its fast data transfer speeds and its always-on connection. Through broadband Internet service, users can download webpages quickly, play online games, communicate in real time with others, and more. Table 2-1 shows examples of popular wired and wireless broadband Internet service technologies for home and small business users.



Figure 2-2 Using a modem is one way to connect computers and mobile devices to the Internet.

Courtesy of Zoom Telephonics Inc.; © Oleksiy Mark / Shutterstock.com; Source: Microsoft; © Kristina Postnikova / Shutterstock.com; Kristina Postnikova / Shutterstock.com; © Cengage Learning; © DR / Fotolia

Table 2-1 Popular Broadband Internet Service Technologies

	Technology	Description
Wired	<i>Cable Internet service</i>	Provides high-speed Internet access through the cable television network via a cable modem
	<i>DSL (digital subscriber line)</i>	Provides high-speed Internet connections through the telephone network via a DSL modem
	<i>Fiber to the Premises (FTTP)</i>	Uses fiber-optic cable to provide high-speed Internet access via a modem
Wireless	Wi-Fi (wireless fidelity)	Uses radio signals to provide high-speed Internet connections to computers and devices with built-in Wi-Fi capability or a communications device that enables Wi-Fi connectivity
	<i>Mobile broadband</i>	Offers high-speed Internet connections over the cellular radio network to computers and devices with built-in compatible technology (such as 3G, 4G, or 5G) or a wireless modem or other communications device
	<i>Fixed wireless</i>	Provides high-speed Internet connections using a dish-shaped antenna on a building, such as a house or business, to communicate with a tower location via radio signals
	<i>Satellite Internet service</i>	Provides high-speed Internet connections via satellite to a satellite dish that communicates with a satellite modem

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Many public locations, such as shopping malls, coffee shops, restaurants, schools, airports, hotels, and city parks have Wi-Fi hot spots. Recall that a **hot spot** is a wireless network that provides Internet connections to mobile computers and devices. Although most hot spots enable unrestricted or open access, some require that users agree to terms of service, obtain a password (for example, from the hotel's front desk), or perform some other action in order to connect to the Internet. Read Secure IT 2-1 for ways to use a public Wi-Fi hot spot safely.

SECURE IT 2-1



Using Public Wi-Fi Hot Spots Safely

Connecting wirelessly to a public hot spot at your local coffee shop or at the airport can be convenient and practical. Using this free service can be risky, however, because cybercriminals may lurk in public Wi-Fi hot spots, hoping to gain access to confidential information on your computer or mobile device. Follow these guidelines for a safer browsing experience:

- **Avoid typing passwords and financial information.** Identity thieves are on the lookout for people who sign in to accounts, enter their credit card account numbers in shopping websites, or conduct online banking transactions. If you must type this personal information, be certain the website's web address begins with "https," signifying a secure connection. If the website's web address changes to "http," indicating an unsecure connection,

sign out to end your Internet session immediately.

- **Sign out of websites.** When finished using an account, sign out of it and close the window.
- **Disable your wireless connection.** If you have finished working online but still need to use the computer, disconnect from the wireless connection.
- **Do not leave your computer or mobile device unattended.** It may seem obvious, but always stay with your computer or mobile device. Turning your back to talk with a friend or to refill your coffee gives thieves a few seconds to steal sensitive information that may be displayed on the screen.
- **Beware of over-the-shoulder snoopers.** The person sitting behind you may be watching or using a camera

phone to record your keystrokes, read your email messages and online social network posts, and view your photos and videos.

- **Consider This:** How will you apply these precautions the next time you use a public Wi-Fi hot spot? Should businesses post signs alerting customers about Wi-Fi security issues?



Home and small business users can share and provide wireless Internet connections by creating their own Wi-Fi hot spot through a communications device in the home or business that is connected to broadband Internet service. Instead of a stationary Wi-Fi hot spot, some users opt to create mobile hot spots through mobile broadband Internet service via a separate communications device or a tethered Internet-capable device (Figure 2-3). *Tethering* transforms a smartphone or Internet-capable tablet into a portable communications device that shares its Internet access with other computers and devices wirelessly. Users may pay additional fees for mobile hot spot and tethering services.

Internet Research

What is a MiFi device?

Search for: mifi



Figure 2-3 You can create a mobile hot spot using a communications device or by tethering a smartphone.

Courtesy of Verizon Wireless; © figarro / Can Stock Photo; © iStockphoto / Dane Wirtzfeld; © amfoto / Shutterstock.com; © Alex Staroseltsev / Shutterstock.com; Source: Microsoft; © Cengage Learning

Employees and students typically connect their computers and mobile devices to the Internet wirelessly through a business or school network, which, in turn, usually connects to a high-speed Internet service. When away from the office, home, or school, mobile users often access the Internet using Wi-Fi, mobile hot spots, or tethering services. Hotels and airports often provide wireless Internet connections as a free service to travelers. Many hotels have computers in their lobbies for customers to check email, browse the web, or print travel documents. Customers often bring their laptops or tablets to coffee shops, restaurants, libraries, hotels, and malls that offer free Wi-Fi as a service to their patrons.



CONSIDER THIS

Does everyone use broadband Internet?

No. Some home users connect computers and devices to the Internet via slower-speed dial-up access because of its lower cost or because broadband access is not available where they live. Dial-up access takes place when a modem in a computer connects to the Internet via a standard telephone line that transmits data and information using an *analog* (continuous wave pattern) signal.

Internet Service Providers

An **Internet service provider (ISP)**, sometimes called an Internet access provider, is a business that provides individuals and organizations access to the Internet free or for a fee. ISPs often charge a fixed amount for an Internet connection, offering customers a variety of plans based on desired speeds, bandwidth, and services. In addition to Internet access, ISPs may include additional services, such as email and online storage.

Bandwidth represents the amount of data that travels over a network. A higher bandwidth means more data transmits. Data sizes typically are stated in terms of megabytes and gigabytes. A *megabyte (MB)* is equal to approximately one million characters, and a *gigabyte (GB)* is equal to approximately one billion characters. Table 2-2 shows approximate data usage for various Internet activities.

Table 2-2 Data Usage Examples

Activity	Quantity	Approximate Data Usage
Send and receive email messages (with no attachments)	100 messages	3–6 MB
Post on online social networks (text only)	100 posts	25–50 MB
Upload or download photos	50 photos	50 MB
Send and receive email messages (with attachments)	100 messages	0.75–1 GB
Visit webpages	200 visits	1 GB
Talk with others using VoIP (without video)	1 hour	1.25 GB
Listen to streaming music	1 hour	1–2 GB
Play online games	1 hour	1.75 GB
Watch smaller, standard-quality streaming video	1 hour	2–5 GB
Download apps, games, music, e-books	25 downloads	3 GB
Talk with others using VoIP (with video)	1 hour	5–7.5 GB
Watch HD streaming video	1 hour	5–20 GB

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CONSIDER THIS

Does the term data have multiple meanings?

In the technology field, as discussed in Chapter 1, data can refer to unprocessed items that computers often process into information. Data also refers to the content that is stored on media or transmitted over a network. For example, when you select a data plan for your smartphone, the mobile service provider typically limits the amount of data (number of bytes) you can transfer each month depending on the plan you selected.

Wi-Fi networks often provide free Internet access, while some charge a daily or per use fee. Instead of locating a hot spot, some users prefer to subscribe to a mobile service provider, such as Verizon Wireless, so that they can access the Internet wherever they have mobile phone access. A **mobile service provider**, sometimes called a wireless data provider, is an ISP that offers wireless Internet access to computers and mobile devices with the necessary built-in wireless capability (such as Wi-Fi), wireless modems, or other communications devices that enable wireless connectivity. An antenna on or built into the computer or device, wireless modem, or communications device typically sends signals through the airwaves to communicate with a mobile service provider.

Discover More: Visit this chapter's free resources to learn more about Internet service providers.



Byte

A byte is the basic storage unit on a computer or mobile device and represents a single character.



Internet Research

Can I check the speed of my Internet connection?

Search for: internet speed test

How Data Travels the Internet

Computers and devices connected to the Internet work together to transfer data around the world using servers and clients and various wired and wireless transmission media. On the Internet, your computer or device is a client that can access data and services on a variety of servers. Wired transmission media includes phone line, coaxial cable, and fiber-optic cable. Wireless transmission media includes radio waves and satellite signals.

The inner structure of the Internet works much like a transportation system. Just as interstate highways connect major cities and carry the bulk of the automotive traffic across the country, several main transmission media carry the heaviest amount of **traffic**, or communications activity, on the Internet. These major carriers of network traffic are known collectively as the *Internet backbone*.

In the United States, the transmission media that make up the Internet backbone exchange data at several different major cities across the country. That is, they transfer data from one network to another until reaching the final destination (Figure 2-4).

How a Home User's Request for a Webpage Might Travel the Internet Using Cable Internet Service

Step 1

You send a request to the Internet. For example, you enter the web address of a webpage you want to visit in the address bar of your browser.



Step 2

A cable modem transfers the computer's digital signals to the cable television line in your house.



Step 3

Your request (digital signals) travels through cable television lines to a central cable system, which is shared by up to 500 homes in a neighborhood.



Step 4

The central cable system sends your request over high-speed fiber-optic lines to the cable operator, who often also is the ISP.



Step 6

The server retrieves the requested webpage and sends it back through the Internet backbone to your computer.



Step 5

The ISP routes your request through the Internet backbone to the destination server (in this example, the server that contains the requested webpage).



Figure 2-4 This figure shows how a home user's request for eBay's webpage might travel the Internet using cable Internet service.

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IP Addresses and Domain Names

The Internet relies on an addressing system much like the postal service to send data to a computer or device at a specific destination. An **IP address**, short for Internet Protocol address, is a sequence of numbers that uniquely identifies the location of each computer or device connected to the Internet.

The Internet uses two IP addressing schemes: IPv4 and IPv6. Due to the growth of the Internet, the original IPv4 addresses began dwindling in availability. The IPv6 scheme increased the available number of IP addresses exponentially. Because lengthy IP addresses can be difficult to remember, the Internet supports domain names. A **domain name** is a text-based name that corresponds to the IP address of a server that hosts a website (Figure 2-5). A domain name is part of the web address that you type in a browser's address bar to access a website.



Figure 2-5 The IPv4 and IPv6 addresses, along with the domain name for Google's website.

© Cengage Learning

The suffix of the domain name, called the *top-level domain (TLD)*, identifies the type of organization associated with the domain. In Figure 2-5, for example, the .com is the TLD. Table 2-3 lists some of the original TLDs. New TLDs are being introduced to give individuals and businesses flexibility and creativity when purchasing domain names. For example, .museum, .technology, .name, and .biz have been introduced as TLDs within recent years.

The organization that approves and controls TLDs is called *ICANN* (pronounced *EYE-can*), which stands for Internet Corporation for Assigned Names and Numbers. For websites outside the United States, the suffix of the domain name may include a country code TLD (*ccTLD*), which is a two-letter country code, such as au for Australia. For example, www.philips.com.au is the domain name for Philips Australia. Read How To 2-1 to learn how to register a domain name.

Table 2-3 Original TLDs

TLD	Intended Purpose
.com	Commercial organizations, businesses, and companies
.edu	Educational institutions
.gov	Government agencies
.mil	Military organizations
.net	Network providers or commercial companies
.org	Nonprofit organizations

Discover More: Visit this chapter's free resources for an expanded table of popular TLDs.

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HOW TO 2-1

Register a Domain Name

Individuals and companies register domain names so that people can find their websites easily using a browser. You register a domain name through a *registrar*, which is an organization that sells and manages domain names. When creating a website to post online, register a domain name that is easy to remember so that visitors can navigate to your website quickly. The following steps describe how to register a domain name.

1. Run a browser.
2. Use a search engine to locate a domain name registrar and then navigate to the

website. You may want to evaluate several domain name registrars before deciding which one to use. Domain name registrars often offer various pricing models for registering domain names.

3. Perform a search on the domain name registrar's website for the domain name you wish to register. If the domain name is not available or costs too much, continue searching for a domain name that is available and within your price range, or explore various TLDs. For example, if the domain name you wish to register is not available or too expensive with the

".com" TLD, consider using another TLD such as ".net" or ".org."

4. Follow the steps on the domain name registrar's website to select and complete the purchase and registration of the desired domain name.

Consider This: What domain name based on your name would you register for your personal website? If your preferred domain name is not available, what are three alternative domain names you would consider?

BTW
High-Tech Talk

Discover More: Visit this chapter's free resources to learn more about DNS servers.

The *domain name system (DNS)* is the method that the Internet uses to store domain names and their corresponding IP addresses. When you enter a domain name (i.e., google.com) in a browser, a DNS server translates the domain name to its associated IP address so that the request can be routed to the correct computer (Figure 2-6). A *DNS server* is a server on the Internet that usually is associated with an ISP. Read Ethics & Issues 2-1 to consider issues related those who purchase unused or lapsed domain names for nefarious purposes.

How a Browser Displays a Requested Webpage

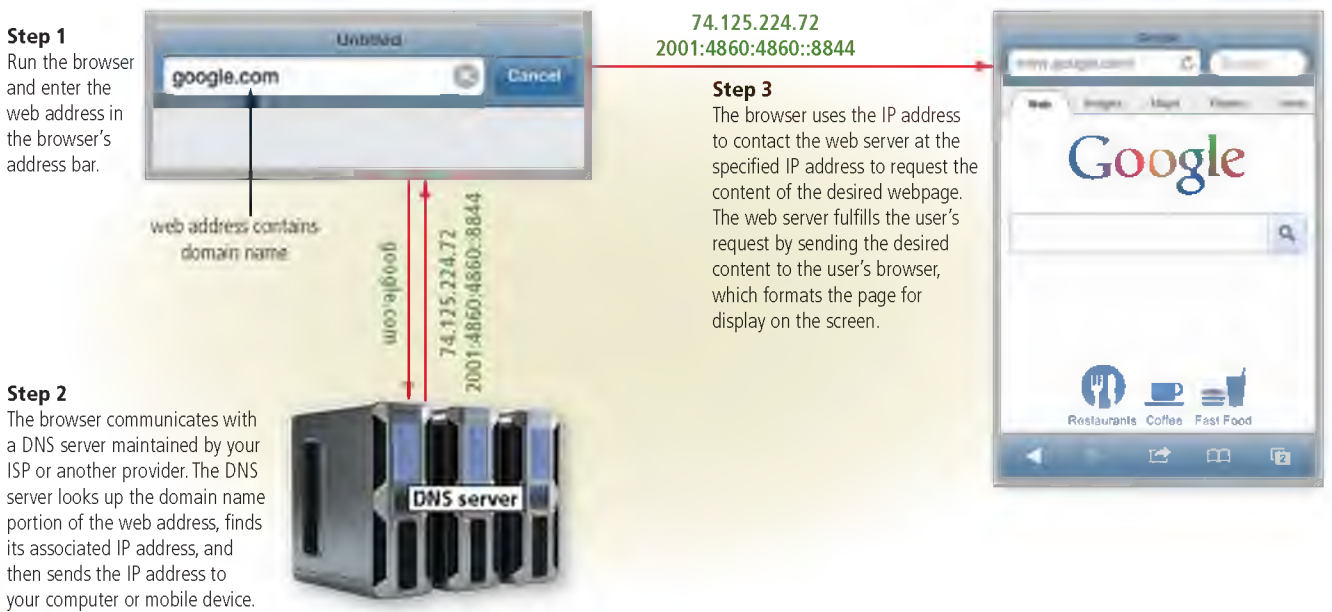


Figure 2-6 This figure shows how a user's entered domain name (google.com) uses a DNS server to display a webpage (Google, in this case).

Apple Inc.; © Cengage Learning; © Cengage Learning; © Sashkin / Shutterstock.com; Source: Google Inc.

ETHICS & ISSUES 2-1

Should Cybersquatters Be Prosecuted?

You learn from a registrar that a domain name containing your company name is not available. When you enter the web address in a browser, a webpage appears that contains ads, false content, or a notice that the domain is available for purchase, likely by a cybersquatter. Cybersquatters purchase unused or lapsed domain names so that they can profit from selling them. Cybersquatters sometimes will sell you the domain name, but some take advantage of people trying to reach a more popular website to promote their own business or needs. One example is when a politician registered several domain names that included his opponent's names and redirected them to his own campaign website.

Website owners periodically must renew domain names. Cybersquatters look for out-of-date registrations and buy them so that the original website owner must buy them back. Cybersquatters often purchase domain names with common words, alternate spellings of trademarked terms, or celebrity names. With the constant increase of new TLDs, cybersquatting cases are on the rise. Experts recommend purchasing your domain name with as many TLDs as you can afford, as well as to register your own name and that of your children.

More than 15 years ago, lawmakers enacted the *Anticybersquatting Consumer Protection Act (ACPA)*. The ACPA's goal is to protect trademark owners from having

to pay a cybersquatter for a domain name that includes their trademark. To win a case against a cybersquatter, the owners must prove that the cybersquatters acted in bad faith, meaning they tried knowingly to profit from purchasing a domain name with a trademarked term, or a common misspelling or nickname of a trademarked term. Critics say that the ACPA prohibits free speech and free market.

Consider This: Should cybersquatting be illegal? Why or why not? Is it ethical to profit from cybersquatting? Why or why not? How should companies protect their brands when registering for domain names?

The World Wide Web

While the Internet was developed in the late 1960s, the World Wide Web emerged in the early 1990s as an easier way to access online information using a browser. Since then, it has grown phenomenally to become one of the more widely used services on the Internet.

As discussed in Chapter 1, the **World Wide Web (WWW)**, or **web**, consists of a worldwide collection of electronic documents. Each electronic document on the web is called a **webpage**, which can contain text, graphics, animation, audio, and video. Some webpages are static (fixed); others are dynamic (changing). Visitors to a *static webpage* all see the same content each time they view the webpage. With a *dynamic webpage*, by contrast, the content of the webpage generates each time a user displays it. Dynamic webpages may contain customized content, such as the current date and time of day, desired stock quotes, weather for a region, or ticket availability for flights. The time required to download a webpage varies depending on the speed of your Internet connection and the amount of graphics and other media involved.

A **website** is a collection of related webpages and associated items, such as documents and photos, stored on a web server. A **web server** is a computer that delivers requested webpages to your computer or mobile device. The same web server can store multiple websites.

As web technologies matured in the mid-2000s, industry experts introduced the term *Web 2.0* to refer to websites that provide a means for users to share personal information (such as online social networks), allow users to modify website content (such as wikis), and provide applications through a browser (such as web apps).

Navigating the Web

Recall from Chapter 1 that a **browser** is an application that enables users with an Internet connection to access and view webpages on a computer or mobile device. Internet-capable mobile devices such as smartphones use a special type of browser, called a *mobile browser*, which is designed for their smaller screens and limited computing power. Many websites can detect if you are accessing their content on a mobile device (Figure 2-7).



Figure 2-7 Many websites, such as the Centers for Disease Control and Prevention shown here, provide a mobile version that is designed specifically for display on a mobile browser.

Source: Centers for Disease Control and Prevention



Web vs. Internet

Recall that the terms web and Internet should not be used interchangeably. The World Wide Web is a service of the Internet.



Technology Innovator

Discover More: Visit this chapter's free resources to learn about Tim Berners-Lee (creator of the World Wide Web).

Internet Research

How do I change my browser's home page?

Search for: change browser home page

When you run a browser, it may retrieve and display a starting webpage, sometimes called a home page. The initial home page that is displayed is specified in the browser. You can change your browser's home page at any time through its settings, options, or similar commands.

Another use of the term, **home page**, refers to the first page that is displayed on a website. Similar to a book cover or a table of contents, a website's home page provides information about its purpose and content. Many websites allow you to personalize the home page so that it contains areas of interest to you.

Current browsers typically support **tabbed browsing**, where the top of the browser shows a tab (similar to a file folder tab) for each webpage you display (shown in Figure 2-7). To move from one displayed webpage to another, you tap or click the tab in the browser. Tabbed browsing allows users to have multiple home pages that automatically are displayed when the browser runs. You also can organize tabs in a group, called a tab group, and save the group as a favorite, so that at any time you can display all tabs at once.

Because some websites attempt to track your browsing habits or gather personal information, current browsers usually include a feature that allows you to disable and/or more tightly control the dissemination of your browsing habits and personal information. Read Secure IT 2-2 for safe browsing tips.

SECURE IT 2-2

Safe Browsing Techniques


Browsing the web is similar to crossing a busy street: you need to exercise caution and look carefully for unexpected traffic. Cybercriminals are on the lookout to prey upon unsuspecting users, so you should follow these guidelines when browsing:

- **Verify the website is safe.** Type the website address of your email, banking, online social network, and other personal accounts directly in a browser; never visit these websites merely by tapping or clicking links found in email messages. Before you sign in, double-check the web address to verify it is correct. Most browsers change the color of the address bar to verify the website is legitimate. Also, check that the web address begins with https instead of the less secure http, and look for a closed padlock symbol beside it.
- **Turn off location sharing.** At times, you may want allow *location sharing*, which gives websites access to your current location. This feature is handy when you want to obtain current weather conditions or use a navigation app. This information could be misused

by dishonest individuals, however, so it is recommended you turn off location sharing.

- **Clear your browsing history.** A copy of every website you visit is stored in the browser's *cache* (pronounced cash) folder. If you perform online banking or view your credit card transactions, the cache could contain personal information, such as passwords and account numbers. You can specify to clear cache automatically each time you close a browser.
- **Never store passwords.** Many browsers can store your passwords so that you do not need to type them each time you visit the same websites. Although you may consider this feature a convenience, keep in mind that anyone who accesses your computer can view these secure websites easily using your account information.
- **Use a phishing filter.** *Phishing* is a scam in which a perpetrator attempts to obtain your personal and/or financial information. Many browsers include a *phishing filter*, which is a program that warns or blocks you from potentially fraudulent or suspicious websites.
- **Enable a pop-up or pop-under blocker.** Malicious software creators can develop a

pop-up ad or pop-under ad, which are Internet advertisements that suddenly appear in a new window on top of or behind a webpage displayed in a browser. A **pop-up blocker** is a filtering program that stops pop-up ads from displaying on webpages; similarly a **pop-under blocker** stops pop-under ads. Many browsers include these blockers. You also can download them from the web at no cost.

- **Use private browsing.** Prevent people using your computer or mobile device from seeing the websites you viewed or searches you conducted by using *private browsing*. The browser discards passwords, temporary Internet files, data entered into forms, and other information when you exit the browser.
 - **Use a proxy server.** To protect your online identity, use a *proxy server*, which is another computer that screens all your incoming and outgoing messages. The proxy server will prevent your browsing history, passwords, user names, and other personal information from being revealed.
-  **Consider This:** Which pop-ups have you encountered while browsing? What new techniques will you use to browse the web safely?

Internet Research

Does the browser war have a winner?

Search for: browser wars

Mini Feature 2-1: Browsers

The decision of which browser to use is a topic of discussion among computer experts and novices alike. Read Mini Feature 2-1 to learn about features of specific browsers.

MINI FEATURE 2-1

Browsers

All browsers can retrieve and display webpages, but their features and ease of use vary. Many factors can affect the decision to choose the browser that best fits your needs.

Configuring Options

Users can customize some settings to improve their browsing experience, such as those listed below.

- **Favorites**, also called *bookmarks*, are links to preferred websites. When you add a website to the list of favorites, you can visit that website simply by tapping or clicking its name in a list instead of typing its web address. Favorites can be organized into folders, alphabetized, and sorted by date or how frequently you view the websites.
- Security features, such as filters and secure connections, help protect you from fraudulent and malicious websites that might attempt to steal your identity and personal information. These features also can block websites you do not want to be displayed and can instruct the browser to save passwords.
- Privacy features help prevent thieves from accessing information about your browsing history, such as websites you have visited, data about your browsing session, and content you have seen on specific webpages.

Obtaining Browsers

A browser often is included in the operating system of a computer or mobile device. For example, many computer manufacturers include Internet Explorer when they install Windows and include Safari when they install Mac OS. Use a search engine to locate the browser you want to install, and visit its website to download the most recent version. Most browsers are available for download at no cost. Keep your browser up to date to prevent security holes. You can set your browser to perform updates automatically.

Making a Decision

Selecting the best browser for your needs involves some careful thought. You may decide to install several and then use each one for specific needs. Perform some research to compare browsers and then consider the following factors:

- How old is your computer or mobile device? A newer browser may not work properly on older hardware.
- How much memory is in your computer or mobile device? Some browsers work best with a lot of memory.
- Which operating system are you using? Some browsers are available for specific operating systems. For example, Internet Explorer is available only for Windows operating systems.
- What do you want the browser to do? Some browsers are best suited for performing simple searches, while others excel when running websites containing media.

Specific Browsers

- **Chrome:** Google's Chrome is one of the newer browser offerings, first released in 2008. This free browser is available for Windows and Mac OS and must be downloaded and installed. It includes a large number of security features. Chrome has independent tabbed browsing; if one tab develops a problem, the other tabs continue to function.
- **Firefox:** Developed by the Mozilla Corporation for computers running Windows, Mac OS, and Linux, Firefox is recognized for its extensive array of plug-ins (discussed later in the chapter). This free general-purpose browser was first released in 2004 and must be downloaded and installed. It has enhanced privacy and security features, a spelling checker, tabbed browsing, and a password manager.
- **Internet Explorer:** Microsoft's free browser, Internet Explorer, is available primarily for Microsoft Windows and comes preinstalled. First released in 1995, the browser features the capability to rearrange tabs, protection against phishing and malware, and settings to delete information about searches performed and webpages visited.
- **Opera:** This second-oldest browser is free, fast, and small. Used on both computers and mobile devices, Opera must be downloaded and installed. It began as a research project in Norway in 1994 and introduced several features found on most of today's browsers.
- **Safari:** Preinstalled on Apple computers and mobile devices, Safari has been the default browser for Mac OS since 2003 and is relatively new to Windows. The browser is recognized for its sleek design, built-in sharing with online social networks, fast performance, parental controls, and ease of use.

Mobile Browsers

Many browsers are included by default with some mobile devices and smartphones. Their features vary greatly. Some allow users to zoom and use keyboard shortcuts with most websites, while others display only websites optimized for mobile devices. The more popular mobile browsers are Chrome, Firefox, Internet Explorer, Safari, and Opera Mini.

Discover More: Visit this chapter's free resources to learn more about filters and secure connections, shareware websites, research to compare browsers, and specific browsers.

Consider This: Which browser or browsers have you used? Why did you use that browser? Would you consider using another browser? Why or why not? When browsers were first invented, their only function was to browse the web. What other capabilities do current browsers provide? Can you recommend a more descriptive name for today's browsers?



Chrome



Firefox



Internet Explorer



Opera



Safari

Google Inc; Mozilla Foundation; Microsoft; Opera Software; Apple Inc



Internet Research

What is the Silk browser?

Search for: silk browser

Web Addresses

A webpage has a unique address, called a **web address** or *URL* (Uniform Resource Locator). For example, the web address of `http://www.nps.gov` identifies the U.S. Department of the Interior National Park Service home page. A browser retrieves a webpage using its web address.

If you know the web address of a webpage, you can type it in the address bar of the browser. For example, if you type the address `http://www.nps.gov/history/places.htm` in the address bar and then press the **ENTER** key or tap or click the Search, Go, or similar button, the browser downloads and displays the associated webpage (Figure 2-8). The path, `history/places.htm`, in this web address identifies a webpage that is specified in a file named `places.htm`, which is located in a folder named `history` on the server that hosts the `nps.gov` website. When you enter this web address, after obtaining the IP address for the `nps.gov` domain name, the browser sends a request to the web server to retrieve the webpage named `places.htm`, and delivers it to your browser to be displayed.



CONSIDER THIS

Although you entered the web address correctly, your screen does not match Figure 2-8. Why?

Organizations may update or redesign their websites, which may cause your screens to look different from those shown in this book.

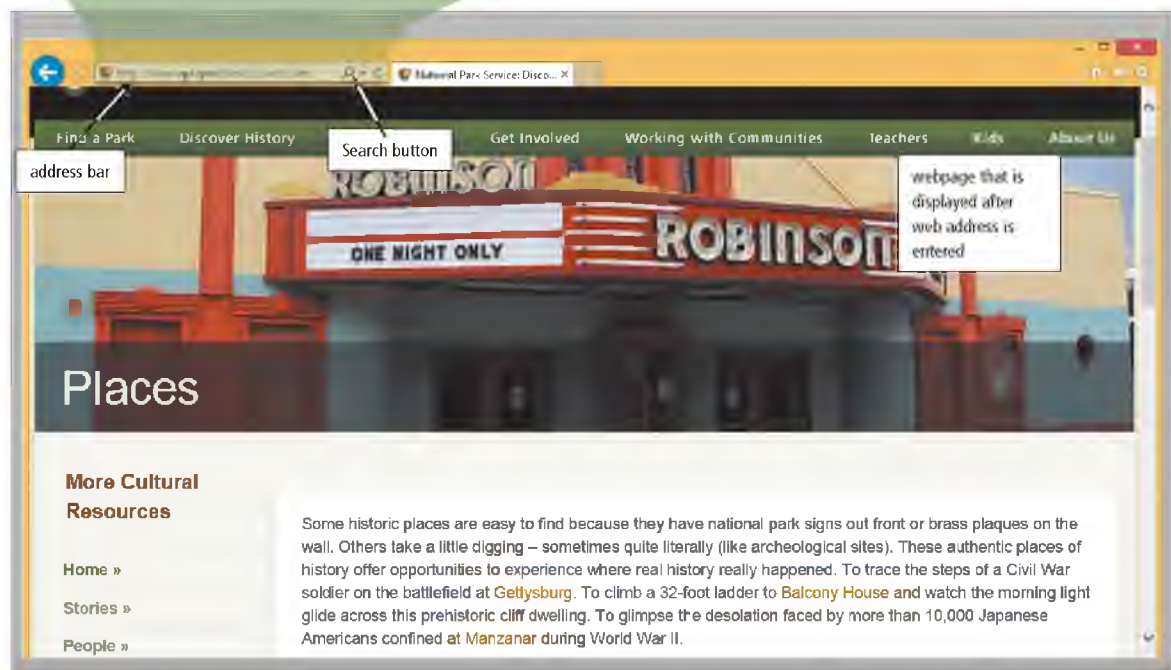
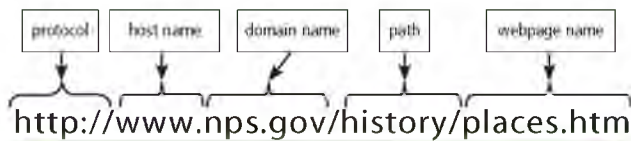


Figure 2-8 After entering `http://www.nps.gov/history/places.htm` in the address bar and then pressing the **ENTER** key or tapping or clicking the Search, Go, or similar button in a browser, the U.S. Department of the Interior National Park Service home page is displayed.

Source: National Park Service U.S. Department of the Interior

A web address consists of a protocol, domain name, and sometimes the host name, path to a specific webpage, or file name of the webpage. The *http*, which stands for Hypertext Transfer Protocol, is a set of rules that defines how webpages transfer on the Internet. Many web addresses begin with `http://` as the protocol. The text between the protocol and the domain name, called the host name, identifies the type of Internet server or the name of the web server. The `www`, for example, indicates a web server.

CONSIDER THIS

Do you need to type the protocol and host name in a web address?

Many browsers and websites do not require that you enter the `http://` or the host name `www` in the web address. For example, you could enter `nps.gov` instead of `http://www.nps.gov`. As you begin typing a web address or if you enter an incorrect web address, browsers often display a list of similar addresses or related websites from which you can select. If, however, the host name is not `www`, you will need to type the host name as part of the web address. For example, the web address of `schools.nyc.gov` for the New York City schools website does not contain a `www` and thus requires entry of the entire web address.

When you enter a web address in a browser, you request, or pull, information from a web server. Another way users can pull content is by subscribing to a *web feed*, which contains content that has changed on a website. Mass media, blogs, and online social networks often provide web feeds, saving users the time spent checking the websites for updated content. Most browsers contain the capability to read web feeds.

Discover More: Visit this chapter's free resources to learn about Internet protocols.

Internet Research

How do I read web feeds?

Search for: rss reader

Web Apps and Mobile Apps

Recall from Chapter 1 that a *web app* is an application stored on a web server that you access through a browser. Users typically interact with web apps directly on a website, sometimes referred to as the host. Web app hosts usually provide storage for users' data and information on their servers, known as *cloud storage*.

Many web app hosts provide free access to their software. Others offer part of their web app free and charge for access to a more comprehensive program. Many include advertisements in the free version and charge for an advertisement-free version. Some allow you to use the web app free and pay a fee when a certain action occurs. For example, you can prepare your tax return for free, but if you elect to print it or file it electronically, you pay a minimal fee.

A *mobile app* is an application you download from a mobile device's app store or other location on the Internet to a smartphone or other mobile device. Mobile apps often take advantage of features of the device, such as touch screens, digital cameras, microphones, and embedded GPS receivers, to enable you to enter and capture data.

CONSIDER THIS

What are GPS receivers?

GPS (global positioning system) is a navigation system that consists of one or more earth-based receivers that accept and analyze signals sent by satellites in order to determine the receiver's geographic location. A **GPS receiver** is a handheld, mountable, or embedded device that contains an antenna, a radio receiver, and a processor. Most smartphones include embedded GPS receivers so that users can determine their location, obtain directions, and locate points of interest. Read Ethics & Issues 2-2 to consider issues related to apps that track your location.

GPS receivers determine their location on Earth by analyzing at least 3 separate satellite signals from 24 satellites in orbit.

Discover More: Visit the High-Tech Talk in Chapter 1's free resources to learn about how GPS receivers use triangulation.

ETHICS & ISSUES 2-2

Should Apps Be Allowed to Track Your Location?

When you install an app on your smartphone, you unintentionally may be allowing the app to send personal data. Apps can transmit your location, as well as the time you spend using the app. Apps also can collect personal information, including gender and birth year, if you access the app through an online social network profile. Although apps often present an option to review their security policies, some track user data without permission, or require you to enable tracking before you can use the app. You may see the results of tracking in the ads you see when browsing the web or using an app. Other

apps may track your location without your knowledge, such as apps that parents use to pinpoint a child's whereabouts.

If you search for driving directions, coupons, or restaurant tips based on your current location or past activities, you might be using apps that openly use this type of tracking. For example, a check-in app posts your location to online social networks, and another app enables you to locate friends by tracking their Bluetooth signals. Even when you opt to share data, use of these types of apps is not without risk. When people use location-tracking apps, for instance, they run the risk of someone stalking or robbing them. One positive use of location-tracking apps is with emergency

services. Lawmakers have struggled with whether law enforcement officials can use location-tracking without a user's knowledge. The U.S. Supreme Court recently ruled that police must get a warrant before searching a user's phone or reading text messages.

Consider This: Should app makers be able to require you to enable tracking or track your activity without your knowledge? Why or why not? Should the police be able to track GPS data without warrants? Why or why not? Would you use apps that post your location to your online social network profile or otherwise alert others of your whereabouts? Why or why not?

Internet Research

What are popular mobile apps?

Search for: top mobile apps

Web apps and mobile apps often work together (Figure 2-9). You might access your cloud storage website from a laptop or desktop. The cloud storage website hosts web apps to upload, download, browse, organize, and view files. The website also may provide a mobile app that you install on a smartphone so that you can access the same information or perform the same tasks from a mobile device. Because the data and information for each app is stored on cloud storage, all data is synchronized and accessible from anywhere you have an Internet connection, regardless of the computer or device used. The functionality of the app across computers and devices generally is the same, although the mobile app sometimes has fewer features. Some tasks may be easier to accomplish on one device or the other. For example, if a lot of typing is required, you may opt to use the web app on a laptop so that you can use a standard keyboard.

Discover More: Visit this chapter's free resources to learn more about mobile device app stores.



Figure 2-9 Web and mobile apps often work together, enabling you to access your content from a variety of computers and devices.

Courtesy of Microsoft Corporation

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled The Internet, Connecting to the Internet, and The World Wide Web, as it relates to the chapter objectives.

Now you should know...

- Why you interact with hosts and networks on the Internet (Objective 1)
- Which broadband Internet service and ISP is best suited to your needs (Objective 2)
- How a browser works with domain names and IP addresses when you enter a web address (Objectives 3 and 4)
- Which browser(s) you would use and why (Objective 4)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Types of Websites

The web contains several types of websites: search engines; online social networks; informational and research; media sharing; bookmarking; news, weather, sports, and other mass media; educational; business, governmental, and organizational; blogs; wikis and collaboration; health and fitness; science; entertainment; banking and finance; travel and tourism; mapping; retail and auctions; careers and employment; e-commerce; portals; content aggregation; and website creation and management. Many websites fall into more than one of these types. All of these websites can be accessed from computers or mobile devices but often are formatted differently and may have fewer features on mobile devices.

Search Engines

A web **search engine** is software that finds websites, webpages, images, videos, news, maps, and other information related to a specific topic. You also can use a search engine to solve mathematical equations, define words, and more.

Thousands of search engines are available. Some search engines, such as Bing, Google, and Yahoo!, are helpful in locating information on the web for which you do not know an exact web address or are not seeking a specific website. Those that work with GPS devices or services are location based, meaning they display results related to the device's current geographical position. For example, your smartphone may be able to display all gas stations within a certain distance of your current location. Some search engines restrict searches to a specific type of information, such as jobs or recipes.

Search engines typically allow you to search for one or more of the following items:

- Images: photos, diagrams, and drawings
- Videos: home videos, music videos, television programs, and movie clips
- Maps: maps of a business or address, or driving directions to a destination
- Audio: music, songs, recordings, and sounds
- Publications: news articles, journals, and books
- People or Businesses: addresses and phone numbers
- Blogs: specific opinions and ideas of others

Search engines require that you enter a word or phrase, called *search text*, to describe the item you want to find. Search text can be broad, such as spring break destinations, or more specific, such as Walt Disney World. If you misspell search text, search engines typically correct the misspelling or identify alternative search text. Some also provide suggested search text, links, and/or images as you type your search text.

Depending on your search text, search engines may respond with thousands to billions of search results, sometimes called *hits*. The content of the search results varies depending on the type of information you are seeking and your search text. Some search results contain links to webpages or articles; others are media, such as images or videos. Most search engines sequence the search results based on how close the words in the search text are to one another in the titles and descriptions of the results. Thus, the first few links probably contain more relevant information.

If you enter a phrase with spaces between the words in search text, most search engines display results that include all of the keywords. Because keywords describe content, search



Technology Innovators
Discover More: Visit this chapter's free resources to learn about Yahoo! and Google.



Internet Research

What is a natural language search engine?

Search for: natural language search



Internet Research

What is a search engine spider?

Search for: search engine spider

results exclude articles, conjunctions, and other similar words (e.g., to, the, and). Table 2-4 lists some operators you can use in search text to refine searches. Instead of working with operators to refine search text, many search engines provide an advanced search feature or search tools that assist with limiting search results based on items such as date, TLD, language, etc.

 **Table 2-4 Search Engine Operators**

Operator	Description	Examples	Explanation
Space or +	Display search results that include specific words.	art + music art music	Results have both words, art and music, in any order.
OR	Display search results that include only one word from a list.	dog OR puppy dog OR puppy OR canine	Results have either the word, dog, or the word, puppy. Results have the word, dog, or the word, puppy, or the word, canine.
()	Combine search results that include specific words with those that include only one word from a list.	Kalamazoo Michigan (pizza OR subs)	Results include both words, Kalamazoo Michigan, and either the word, pizza, or the word, subs.
–	Exclude a word from search results.	automobile-convertible	Results include the word, automobile, but do not include the word, convertible.
" "	Search for an exact phrase in a certain order.	"19th century literature"	Results include the exact phrase, 19th century literature.
*	Substitute characters in place of the asterisk.	writer*	Results include any word that begins with the text, writer (e.g., writer, writers, writer's)

© Cengage Learning



CONSIDER THIS

How can you improve search results?

You may find that many items listed in the search results have little or no bearing on the item you are seeking. You can eliminate superfluous items in search results by carefully crafting search text and use search operators to limit search results. Other techniques you can use to improve your searches include the following:

- Use specific nouns.
- Put the most important terms first in the search text.
- List all possible spellings, for example, email, e-mail.
- Before using a search engine, read its Help information.
- If the search is unsuccessful with one search engine, try another.
- Practice search techniques by performing the Internet Research: Search Skills exercise in each chapter of this book.

Subject Directories A *subject directory* classifies webpages in an organized set of categories, such as sports or shopping, and related subcategories. A subject directory provides categorized lists of links arranged by subject. Using a subject directory, you locate a particular topic by tapping or clicking links through different levels, moving from the general to the specific. A disadvantage with a subject directory is that users sometimes have difficulty deciding which categories to choose as they work through the menus of links presented.

Discover More: Visit this chapter's free resources to learn more about search engines and subject directories.

Mini-Feature 2-2: Online Social Networks

Recall from Chapter 1 that an **online social network**, or *social networking site*, is a website that encourages members in its online community to share their interests, ideas, stories, photos, music, and videos with other registered users. Some online social networks also enable users to communicate through text, voice, and video chat, and play games together online. You interact with an online social network through a browser or mobile app on your computer or mobile device. Read Mini Feature 2-2 for features and uses of popular online social networks.

MINI FEATURE 2-2

Online Social Networks

People you know through personal and professional circles form your social networks. You share common interests, work or spend leisure time together, and know many of one another's friends. Online social networks allow you to manage your social networks online.

Your account on an online social network includes profile information, such as your name, location, photos, and personal and professional interests. You might create accounts on several online social networks to separate your personal and professional activities. Online social networks allow you to view the profiles of other users and designate them as your *friends* or *contacts*. Some sites, such as Facebook and LinkedIn, require friends to confirm a friendship, while others, such as Twitter and Google+, allow users to follow one another without confirmation.



© iStockphoto / temizyurek

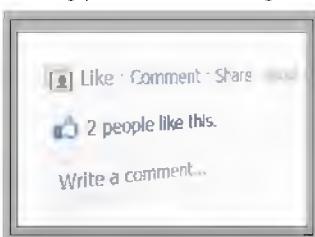
You can expand your online social network by viewing your friends' friends and then, in turn, designating some of them as your friends. Friends of your friends and their friends form your *extended contacts*.

- Extended contacts on a personal online social network such as Facebook can introduce you to others at your college or from your hometown, connect you with long-distance friends or relatives, or enable you to stay in touch with those who have interests similar to yours.
- Extended contacts on a professional online social network such as LinkedIn can introduce you to people who work at companies where you might be seeking employment. You can share employment history and skills in your profile, enabling potential employers who look at your profile to learn about your specific skills.

Read Secure IT 2-3 for tips about securing your privacy when using online social networks.

Personal Uses

Personal uses of online social networks include sharing photos and videos, greetings, or status updates.



© iStockphoto / Lentz Photography

A *status update* informs friends about what you are doing. You can *like*, or show appreciation for, online content such as photos or videos

on online social networks such as Facebook and Google+. When you do, people who see the same content will know that you liked it, and the person who posted it is notified. All of your updates, likes, posts, and events appear in the activity stream associated with your account. Activity updates from friends may appear on a separate page associated with your account, often called a *news feed*.

On many online social networks, updates can include hashtags to identify their topics. A *hashtag* is a word(s) preceded by a # symbol that describes or categorizes a post. Users can search for posts on a topic by searching for a hashtag. Some online social networks list trending topics based on popular hashtags. Many television broadcasts, advertisements, and businesses post hashtags to encourage viewers and customers to share comments on Twitter or Facebook.

When accessing an online social network with a GPS-enabled mobile device, the location where you check in may be revealed as part of a status update. An online social network's mobile app can share your location with friends, find others nearby, and alert you to promotional deals from local businesses.



© iStockphoto / hocus-focus

Business Uses

Businesses use online social networks to connect with their customers, provide promotional offers, and offer targeted advertising. For example, users who recommend online content about travel services may see travel-related advertising on their online social network's webpage.

Businesses also use data from online social networks to better connect with and understand customers. They can review comments from customers about their experiences using companies' products or services. Monitoring these feeds continuously gives companies immediate feedback from customers.

Nonprofit organizations use online social networks to promote activities and causes, accept donations, and allow volunteers to contact one another online.

Discover More: Visit this book's chapter's free resources to learn more about specific online social network websites and mobile apps.

Consider This: How can businesses and individuals use online social networks to bring people together in support of a common goal? What benefits and risks are involved when using online social networks?

SECURE IT 2-3

Privacy and Security Risks with Online Social Networks

Online social networks can be excellent places to share messages, photos, and videos. They can, however, be risky places to divulge personal information. Follow these tips to help protect against thieves who are following the network traffic and attempting to invade private facets of your life.

- **Register with caution.** During the registration process, provide only necessary information. Do not disclose your birthdate, age, place of birth, or the city where you currently are living. If an email address is required, consider using a new address so that the online social network cannot access your email address book. Online social networks occasionally ask users to enter their email address and password to determine if their friends also are members of the network. In turn, the network obtains access to contacts in your address book and can send spam (unsolicited email messages) to your friends.
- **Manage your profile.** Check for privacy settings, usually found on the Settings or Options tabs, to set permissions so that you

can control who can review your profile and photos, determine how people can search for you and make comments, and if desired, block certain people from viewing your page. Be aware that online social networks may change privacy settings. Periodically check your settings to ensure you have the most up-to-date settings.

- **Choose friends carefully.** You may receive a friend request that appears to be from someone you know. In reality, this message may originate from an identity thief who created a fake profile in an attempt to obtain your personal information. Confirm with the sender that the request is legitimate.
- **Limit friends.** While many online social networks encourage the practice, do not try to gather too many friends in your social network. Some experts believe that a functional online social network should not exceed 150 people. Occasionally review what your friends are posting about you.
- **Divulge only relevant information.** Write details about yourself that are relevant to the reasons you are participating in an online social network. When posting

information, be aware that the message may be accessible publicly and associated with your identity permanently. Do not post anything you would not want to be made public.

- **Be leery of urgent requests for help.** Avoid responding to emergency pleas for financial assistance from alleged family members. In addition, do not reply to messages concerning lotteries you did not enter and fabulous deals that sound too good to be true.
- **Read the privacy policy.** Evaluate the website's privacy policy, which describes how it uses your personal information. For example, if you watch a video while signed in to your account, an external website or app may have access to this information and post this activity as an entry in both your activity stream and your friends' news feeds.

Consider This: Should online social networks do a better job of telling their users what information is safe or unsafe to share? What role should parents play in overseeing their child's involvement in online social networks?

Informational and Research

An informational and research website contains factual information. Examples include libraries, encyclopedias, dictionaries, directories, guides (Figure 2-10), and other types of reference. You can find guides on numerous topics, such as health and medicine, research paper documentation styles, and grammar rules. Many of the other types of websites identified in this section also are used to research information.



Figure 2-10 You can research health conditions from your symptoms on a medical website, such as WebMD.

Source: WebMD, LLC

Media Sharing

A *media sharing site* is a website that enables members to manage and share media such as photos, videos, and music. These websites are sometimes called photo sharing sites, video sharing sites (Figure 2-11), and music sharing sites, respectively. Media sharing sites, which may be free or charge a fee, provide a quick and efficient way to upload, organize, store, share, and download media.

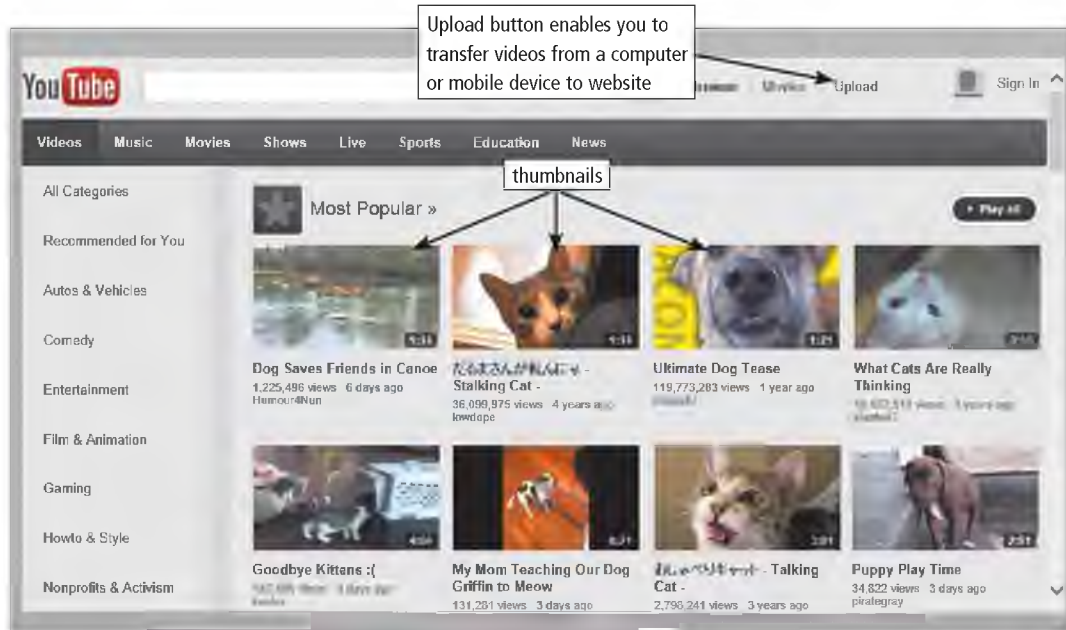


Figure 2-11 YouTube is an example of a video sharing site. You tap or click the thumbnail to view the video.

Source: YouTube, Inc.

CONSIDER THIS

Why would you use a media sharing site instead of an online social network?

Although the lines between media sharing sites and online social networks are becoming blurred, some users chose a traditional media sharing site if they simply want to post photos, videos, or music to share with others and do not require the full functionality of an online social network. Before you allow someone to take your photo or record video of you, however, remember that the photo or video may be posted on a media sharing site. These photos or videos may be accessible publicly and associated with your identity for a long time. Also, once posted, you may be giving up certain rights to the media. Further, do not post photos or videos that are protected by copyright.



Technology Trend

Discover More: Visit this chapter's free resources to learn more about uses of bookmarking sites.

Bookmarking

A *bookmarking site* is a website that enables members to organize, tag, and share links to media and other online content (Figure 2-12). A **tag** is a short descriptive label that you assign to webpages, photos, videos, blog posts, email messages, and other digital content so that it is easier locate at a later time. Many websites and web apps support tagging, which enables users to organize their online content. Read How To 2-2 to learn how to tag digital content.



Figure 2-12 Pinterest is an example of a bookmarking site.

HOW TO 2-2

Tag Digital Content

When you post digital content online, it is a good idea to tag the content so that it is easy for you and others to locate and organize. After you have uploaded digital content to a media sharing site, follow the instructions on the website to apply tags to the digital content you uploaded. Consider the following suggestions when tagging digital content:

- Apply tags to all digital media, such as photos, music, and videos.
- If you are using multiple tags to identify one file, separate each tag with a separator. The website to which you are posting will inform you how to separate multiple tags (such as a space, comma, or semicolon).
- Choose tags that are descriptive of the content you are posting. For example, if you are posting a photo from a recent family vacation to Hammonasset Beach State Park, you might choose “Hammonasset” and “vacation” as two of your tags for this photo.

After you have tagged the digital content, perform a search on the media sharing site for your content, using the tags as your search criteria, to verify your content is displayed as intended.

Consider This: Why else is it important to tag digital content? What tags might you assign to your favorite song in your music library?

Discover More: Visit this chapter’s free resources to learn more about websites that support tagging.



CONSIDER THIS

What are the various kinds of social media?

Social media consists of content that users create and share online, such as photos, videos, music, links, blog posts, Tweets, wiki entries, podcasts, and status updates. Social media websites facilitate the creation or publishing of social media online and include media sharing sites (for photo, video, and audio files), bookmarking sites, blogs and microblogs, wikis, podcasts, online social networks, and online gaming sites.



Technology Innovator

Discover More: Visit this chapter’s free resources to learn about Arianna Huffington (founder of *The Huffington Post* news website).

News, Weather, Sports, and Other Mass Media

News, weather, sports, and other mass media websites contain newsworthy material, including stories and articles relating to current events, life, money, politics, weather (Figure 2-13), and sports. You often can customize these websites so that you can receive local news or news about specific topics. Some provide a means to send you alerts, such as weather updates or sporting event scores, via text or email messages.



Figure 2-13 Forecasts, radar, and other weather conditions are available on the WEATHER webpage on USA TODAY’s website.

Source: Gannett

News on the web is not replacing the newspaper but enhancing it and reaching different populations. Although some exist solely online, many magazines and newspapers sponsor websites that provide summaries of printed articles, as well as articles not included in the printed versions. Newspapers, magazines, and television and radio stations often have corresponding news, weather, or sports websites and mobile apps. Read Ethics & Issues 2-3 to consider the issues related to using fake names on websites.

ETHICS & ISSUES 2-3

Is It Ethical to Use a Fake Name or ID on a Website?

You are signing up for an account on an online social network, an online dating website, or a news website that enables you to post comments. Should you use your real name?

Many argue that it is harmless to protect your anonymity by using a fake name but believe that it is not right to create a fake profile to mislead others or leave malicious comments on a website. The latter has become so prevalent that terms have emerged to describe this behavior. For example, *catfishing* is when someone creates a fake online social network or online dating profile and forms relationships with unsuspecting users. A *troll* is a user who

posts negative, inflammatory comments on a blog post or article with the intent of inciting other users.

One website creates very thorough, but completely fake, personas, which include email addresses, Social Security numbers, phone numbers, and more. Although law enforcement has raised concerns over the potential misuses of fake profiles, it technically is legal, even though the names and personas are not real. Legitimate uses for fake name generators include testers of large databases, such as ones for hospitals.

Facebook currently requires members to use their real names. Twitter's policy is that anyone can create a fake account, but it has a verification process to identify the official account of a celebrity or public

figure. Most fake Twitter accounts are harmless, and often are flattering. Although some argue that creating a fake account constitutes identity theft, unless the intent is to harm or embarrass the real person, it is not unethical or illegal. When a journalist created a fake account for a politician and posted discriminatory quotes and Tweets in the politician's name, many considered it an ethics violation, because journalists are supposed to report the truth.

Consider This: Is it ever acceptable to use a fake name online? Why or why not? Is it unethical to create fake personas for others to use? Why or why not? Should websites require you to use a real name, or have a verification process? Why or why not?

Educational

An educational website offers exciting, challenging avenues for formal and informal teaching and learning. The web contains thousands of tutorials from learning how to fly airplanes to learning how to cook a meal. For a more structured learning experience, companies provide online training to employees, and colleges offer online classes and degrees. Instructors often use the web to enhance classroom teaching by publishing course materials, grades, and other pertinent class information.

Business, Governmental, and Organizational

A business website contains content that increases brand awareness, provides company background or other information, and/or promotes or sells products or services. Nearly every enterprise has a business website. Examples include Allstate Insurance Company, Apple Inc., General Motors Corporation, Kraft Foods Inc., and Walt Disney Company.

Most United States government agencies have websites providing citizens with information, such as census data, or assistance, such as filing taxes (Figure 2-14). Many other types of organizations use the web for a variety of reasons. For example, nonprofit organizations raise funds for a cause and advocacy groups present their views or opinions.

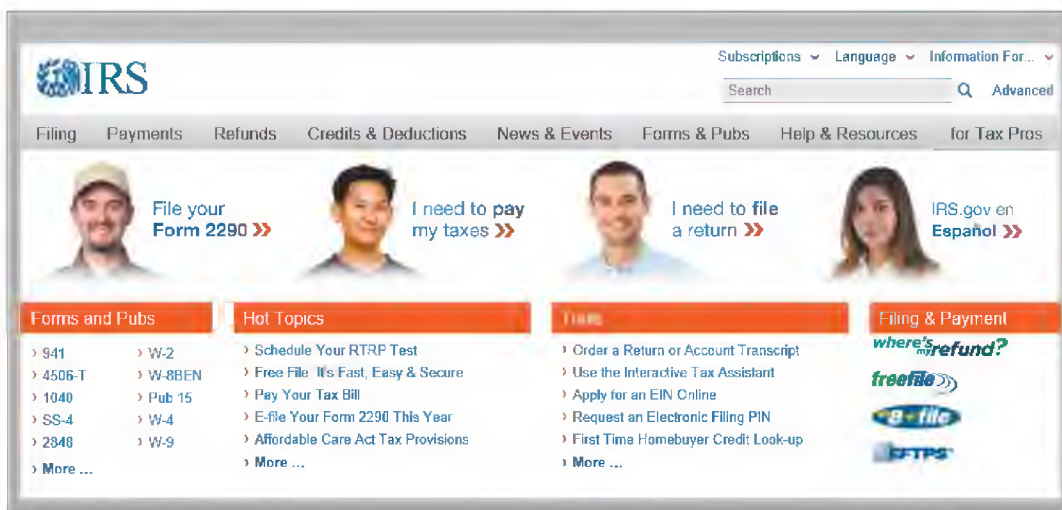


Figure 2-14

Government agencies, such as the IRS webpage shown here, have websites providing assistance and information to citizens.

Source: IRS

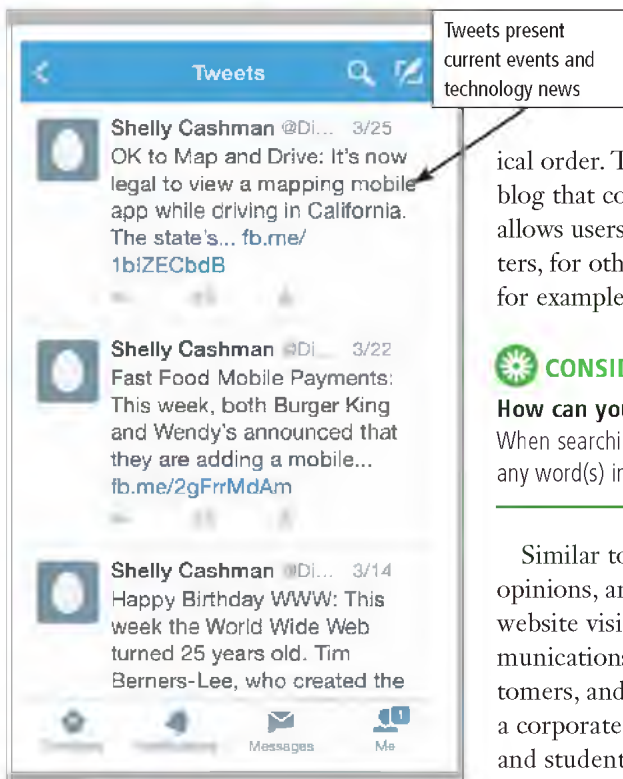


Figure 2-15 When you ‘follow’ @DiscoveringComp on Twitter, you will see Tweets such as those shown here posted by the Discovering Computers user “Shelly Cashman”, in your account’s timeline, along with Tweets from others whom you are following. As a student in this class, you should ‘follow’ @DiscoveringComp so that you easily can keep current with relevant technology changes and events in the computing industry.
Source: Twitter

Blogs

As described in Chapter 1, a **blog** (short for weblog) is an informal website consisting of time-stamped articles, or posts, in a diary or journal format, usually listed in reverse chronological order. The term *blogosphere* refers to the worldwide collection of blogs. A blog that contains video sometimes is called a video blog, or vlog. A *microblog* allows users to publish short messages usually between 100 and 200 characters, for others to read. The collection of a user’s Tweets, or posts on Twitter, for example, forms a microblog (Figure 2-15).



CONSIDER THIS

How can you locate Tweets about certain topics?

When searching Twitter, you can use hashtags to find related posts. Similarly, you can tag any word(s) in your Tweets by typing it as a hashtag, such as #election.

Similar to an editorial section in a newspaper, blogs reflect the interests, opinions, and personalities of the author, called the **blogger**, and sometimes website visitors. Blogs have become an important means of worldwide communications. Businesses create blogs to communicate with employees, customers, and vendors. They may post announcements of new information on a corporate blog. Teachers create blogs to collaborate with other teachers and students. Home users create blogs to share aspects of their personal lives with family, friends, and others.

Wikis and Collaboration

Whereas blogs are a tool for publishing and sharing messages, wikis enable users to organize, edit, and share information. A **wiki** is a type of collaborative website that allows users to create, add, modify, or delete the website content via a browser. Wikis can include articles, documents, photos, or videos. Some wikis are public, accessible to everyone (Figure 2-16). Others are private so that content is accessible only to certain individuals or groups. Many companies, for example, set up wikis as an intranet for employees to collaborate on projects or access information, procedures, and documents. (An *intranet* is an internal network that uses Internet technologies.)



Figure 2-16 Wikipedia is a popular public wiki.
Source: Wikimedia Foundation

Contributors to a wiki typically must register before they can edit content or add comments. Wikis usually hold edits on a webpage until an editor or website manager can review them for accuracy. Unregistered users typically can review the content but cannot edit it or add comments.

Other types of collaboration sites enable users to share and edit any type of project — including documents, photos, videos, designs, prototypes, schedules, and more, often at the same time. On these websites, comments or edits are seen by other connected users. Most of these websites also enable users to communicate via chat windows, and some provide a whiteboard.

Discover More: Visit this chapter's free resources to learn more about public wikis and other collaboration websites.

Health and Fitness

Many websites provide up-to-date medical, fitness, nutrition, or exercise information for public access. Some offer users the capability of listening to health-related seminars and discussions. Consumers, however, should verify the online information they read with a personal physician. Health service organizations store your personal health history, including prescriptions, lab test results, doctor visits, allergies, and immunizations. Doctors use the web to assist with researching and diagnosing health conditions.

Science

Several websites contain information about space exploration, astronomy, physics, earth sciences, microgravity, robotics, and other branches of science. Scientists use online social networks to collaborate on the web. Nonprofit science organizations use the web to seek public donations to support research.

Entertainment

An entertainment website offers music, videos, shows, performances, events, sports, games, and more in an interactive and engaging environment. Many entertainment websites support streaming media. **Streaming** is the process of transferring data in a continuous and even flow, which allows users to access and use a file while it is transmitting. You can listen to streaming audio or watch streaming video, such as a live performance or broadcast, as it downloads to your computer, mobile device, or an Internet-connected television.

Sophisticated entertainment websites often partner with other technologies. For example, you can cast your vote on a television show via your phone or online social network account.

Banking and Finance

Online banking and online trading enable users to access their financial records from anywhere in the world, as long as they have an Internet connection. Using online banking, users can access accounts, pay bills, transfer funds, calculate mortgage payments, and manage other financial activities from their computer or mobile device (Figure 2-17). With online trading, users can invest in stocks, options, bonds, treasuries, certificates of deposit, money market accounts, annuities, mutual funds, and so on, without using a broker. Read Secure IT 2-4 for tips about protecting your bank accounts and other personal information from identity theft.

Internet Research

Have errors been found in Wikipedia?

Search for: wikipedia factual errors

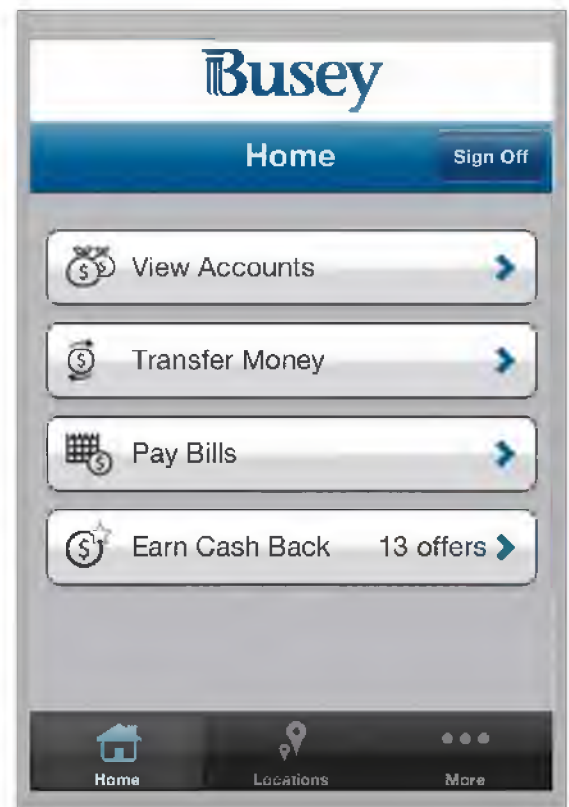


Figure 2-17 Many banks, such as Busey shown here, provide mobile versions of their online banking website so that users can manage financial accounts from their smartphones.


Source: First Busey Corporation

 **SECURE IT 2-4**
**Protecting Yourself from Identity Theft**

The fastest growing crime in the United States is identity theft. More than nine million people fall victim each year, with the unauthorized use of an existing credit card accounting for much of the problem. The National Crime Victimization Survey reports that household identity theft losses amount to more than \$13 billion each year, and that figure does not account for the aggravation and time required to repair the accounts. Practice these techniques to thwart attempts to steal your personal data:

- Do not tap or click links in or reply to spam for any reason.
- Install a personal firewall (software that protects network resources from outside intrusions).
- Clear or disable web cookies (small text files that web servers store on a computer) in your browser. This action might prevent some cookie-based websites from functioning, but you will be able to decide which cookies to accept or reject.
- Turn off file and printer sharing on your Internet connection.
- Set up a free email account. Use this email address for merchant forms.
- Sign up for email filtering through your ISP or use an anti-spam program.
- Shred financial documents before you discard them.
- Provide only the required information on website forms.
- Avoid checking your email or performing banking activities on public computers. These computers are notorious for running *keyloggers*, which record keystrokes in a hidden file, and other tracking software. If you must use a public computer for critical activities, be certain to sign out of any password-protected website and to clear the browser's cache.
- Request a free copy of your medical records each year from the Medical Information Bureau.
- Obtain your credit report once a year from each of the three major credit reporting agencies and correct any errors. Enroll in a credit monitoring service.
- Request, in writing, to be removed from mailing lists.
- Place your phone number on the National Do Not Call Registry.
- Avoid shopping club and buyer cards.
- Do not write your phone number on charge or credit receipts. Ask merchants not to write this number or any other personal information, especially your Social Security number and driver's license number, on the back of your personal checks.
- Do not preprint your phone number or Social Security number on personal checks.
- Fill in only the required information on rebate, warranty, and registration forms.
- Learn how to block your phone number from displaying on the receiver's system.

If your identity has been stolen, immediately change any passwords that may have been compromised. If you have disclosed your debit or credit card numbers, contact your financial institutions. You also should visit the Federal Trade Commission website or call the FTC help line.

 **Consider This:** Do you know anyone who has been a victim of identity theft? What steps will you take to protect your identity using some of these guidelines?

Travel and Tourism

Travel and tourism websites enable users to research travel options and make travel arrangements. On these websites, you typically can read travel reviews, search for and compare flights and prices, order airline tickets, book a room, or reserve a rental car.

Discover More: Visit this chapter's free resources to learn more about travel websites.

Mapping

Several mapping website and web apps exist that enable you to display up-to-date maps by searching for an address, postal code, phone number, or point of interest (such as an airport, lodging, or historical site). The maps can be displayed in a variety of views, including terrain, aerial, maps, streets, buildings, traffic, and weather. These websites also provide directions when a user enters a starting and destination point (Figure 2-18). Many work with GPS to determine where a user is located, eliminating the need for a user to enter the starting point and enabling the website to recommend nearby points of interest.

Discover More: Visit this chapter's free resources to learn more about mapping web apps.

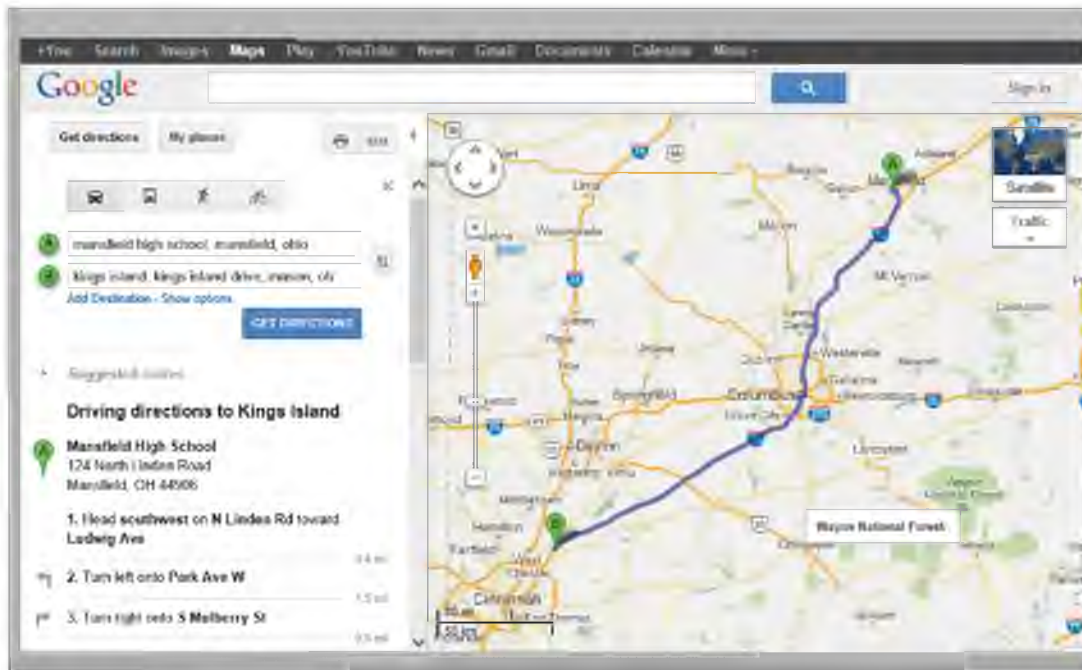


Figure 2-18 Using mapping web apps, such as Google Maps shown here, you can obtain driving directions from one destination to another.

Source: Google Inc.

Retail and Auctions

You can purchase just about any product or service on the web, a process that sometimes is called *e-retail* (short for electronic retail). To purchase online, the customer visits the business's *electronic storefront*, which contains product descriptions, images, and a shopping cart (Figure 2-19). The *shopping cart* allows the customer to collect purchases. When ready to complete the sale, the customer enters personal data and the method of payment, which should be through a secure Internet connection.

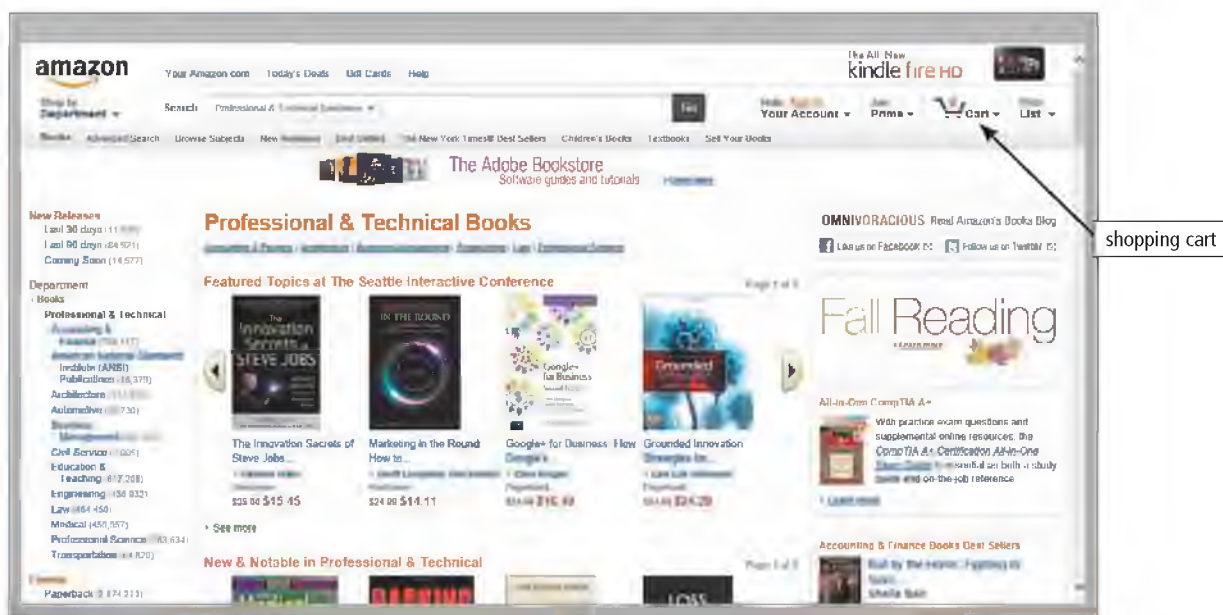


Figure 2-19 Shown here is Amazon's storefront for Professional and Technical Books.

Source: Amazon.com, Inc.

With an **online auction**, users bid on an item being sold by someone else. The highest bidder at the end of the bidding period purchases the item. eBay is one of the more popular online auction websites.

CONSIDER THIS

Is it safe to enter financial information online?

As an alternative to entering credit card, bank account, or other financial information online, some shopping and auction websites allow consumers to use an online payment service such as PayPal. To use an online payment service, you create an account that is linked to your credit card or funds at a financial institution. When you make a purchase, you use your online payment service account, which transfers money for you without revealing your financial information.

Careers and Employment

You can search the web for career information and job openings. Job search websites list thousands of openings in hundreds of fields, companies, and locations. This information may include required training and education, salary data, working conditions, job descriptions, and more. In addition, many organizations advertise careers on their websites.

When a company contacts you for an interview, learn as much about the company and the industry as possible before the interview. Many have websites with detailed company profiles.

Discover More: Visit this chapter's free resources to learn more about job search websites.

E-Commerce

E-commerce, short for electronic commerce, is a business transaction that occurs over an electronic network, such as the Internet. Anyone with access to a computer or mobile device, an Internet connection, and a means to pay for purchased goods or services can participate in e-commerce. Some people use the term *m-commerce* (mobile commerce) to identify e-commerce that takes place using mobile devices. Popular uses of e-commerce by consumers include shopping and auctions, finance, travel, entertainment, and health.

Three types of e-commerce websites are business-to-consumer, consumer-to-consumer, and business-to-business.

- *Business-to-consumer (B2C) e-commerce* consists of the sale of goods and services to the general public, such as at a shopping website.
- *Consumer-to-consumer (C2C) e-commerce* occurs when one consumer sells directly to another, such as in an online auction.
- *Business-to-business (B2B) e-commerce* occurs when businesses provide goods and services to other businesses, such as online advertising, recruiting, credit, sales, market research, technical support, and training.

Portals

A **portal** is a website that offers a variety of Internet services from a single, convenient location (Figure 2-20). A wireless portal is a portal designed for Internet-capable mobile devices. Most portals offer these free services: search engine; news, sports, and weather; web publishing; yellow pages; stock quotes; maps; shopping; and email and other communications services.

Discover More: Visit this chapter's free resources to learn more about portals.



Technology Innovator

Discover More: Visit this chapter's free resources to learn about LinkedIn (a business-oriented online social network).



Figure 2-20 Portals, such as MSN, offer a variety of Internet services from a single location.

Courtesy of Microsoft Corporation

Content Aggregation

A **content aggregation** website or web app, sometimes called a *curation website*, allows users to collect and compile content from a variety of websites about a particular topic or theme (Figure 2-21). Types of content that may be compiled includes news, reviews, images, videos, podcasts (discussed later in this chapter), and blogs. Content aggregation websites save users time because they need to visit only one website (the content aggregation website) instead of visiting multiple websites to obtain information.

Discover More: Visit this chapter's free resources to learn more about content aggregation websites.

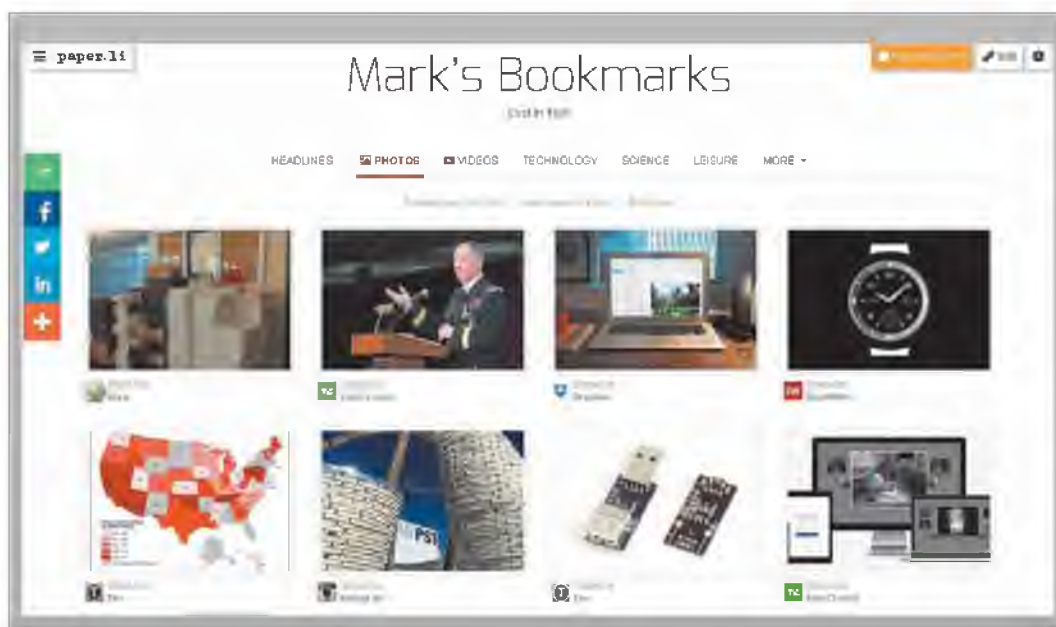


Figure 2-21 A content aggregation web app that compiles news from a variety of online sources.

Source: SmallRivers

Website Creation and Management

By creating their own websites, businesses and individuals can convey information to billions of people. The content of the webpages ranges from news stories to product information to blogs to surveys. Web creation and management sites provide tools that support the steps in **web publishing**, which is the creation and maintenance of websites. To create a website, you do not have to be a computer programmer. For the small business or home user, web publishing is fairly easy as long as you have the proper tools. Table 2-5 outlines the five main steps in web publishing.



Table 2-5 Steps in Web Publishing

Step	Description
1. Plan the website.	<p>Identify the purpose of the website and the characteristics of the people you want to visit the website.</p> <p>Determine ways to differentiate your website from other similar ones.</p> <p>Decide how visitors will navigate the website.</p> <p>Register the desired domain name.</p>
2. Design the website.	<p>Design the appearance and layout of elements on the website.</p> <p>Decide colors and formats.</p> <p>Determine content for links, text, graphics, animation, audio, video, virtual reality, and blogs.</p> <p>You may need specific hardware, such as a digital camera, webcam, video camera, scanner, and/or audio recorder.</p> <p>You also may need software that enables you to create images or edit photos, audio, and video.</p>
3. Create the website.	<p>To create a website, you have several options:</p> <ol style="list-style-type: none"> Use the features of a word processing program that enable you to create basic webpages from documents containing text and graphics. Use a <i>content management system</i>, which is a tool that assists users with creating, editing, and hosting content on a website. Use website authoring software to create more sophisticated websites that include text, graphics, animation, audio, video, special effects, and links. More advanced users create sophisticated websites by using a special type of software, called a text editor, to enter codes that instruct the browser how to display the text, images, and links on a webpage. For advanced features, such as managing users, passwords, chat rooms, and email, you may need to purchase specialized website management software.
4. Host the website.	<p>Options for transferring the webpages from your computer to a web server include the following:</p> <ol style="list-style-type: none"> A <i>web hosting service</i> provides storage space on a web server for a reasonable monthly fee. Many ISPs offer web hosting services to their customers for free or for a monthly fee. Online content management systems usually include hosting services for free or for a fee, depending on features and amount of storage used.
5. Maintain the website.	<p>Visit the website regularly to ensure its contents are current and all links work properly.</p> <p>Create surveys on the website to test user satisfaction and solicit feedback.</p> <p>Run analytics to track visitors to the website and measure statistics about its usage.</p>



Technology Trend

Discover More: Visit this chapter's free resources to learn more about responsive web design.

Some websites are dedicated to one portion of web publishing; others provide a variety of web publishing tools, including website design, content management, web hosting, website marketing, website analytics, survey development, and more. Because users view websites on a variety of computers and devices, many website developers use an approach called **responsive web design (RWD)** that adapts the layout of the website to fit the screen on which it is being displayed.

Discover More: Visit this chapter's free resources to learn more about website creation and management.

CONSIDER THIS

Can you assume that content on a website is correct and accurate?

No. Any person, company, or organization can publish a webpage on the Internet. No one oversees the content of these webpages.

Use the criteria below to evaluate a website or webpage before relying on its content.

- Affiliation: A reputable institution should support the website without bias in the information.
- Audience: The website should be written at an appropriate level.
- Authority: The website should list the author and the appropriate credentials.
- Content: The website should be well organized and the links should work.
- Currency: The information on the webpage should be current.
- Design: The pages at the website should download quickly, be visually pleasing, and be easy to navigate.
- Objectivity: The website should contain little advertising and be free of bias.

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the section titled Types of Websites as it relates to the chapter objectives. *Now you should know ...*

- How to enter search text and improve your search results (Objective 5)
- How you can benefit from online social networks (Objective 6)
- When you would use specific types of websites (Objective 7)
- How you can publish your own website (Objective 7)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Digital Media on the Web

Most webpages include *multimedia*, which refers to any application that combines text with media. Media includes graphics, animation, audio, video, and/or virtual reality. The sections that follow discuss how the web uses these types of media.

Graphics

A **graphic** is a visual representation of nontext information, such as a drawing, chart, or photo. Many webpages use colorful graphics to convey messages (Figure 2-22). As shown in the figure, some websites use thumbnails on their pages because larger graphics can be time-consuming to display. A *thumbnail* is a small version of a larger image. You usually can tap or click a thumbnail to display the image in full size.

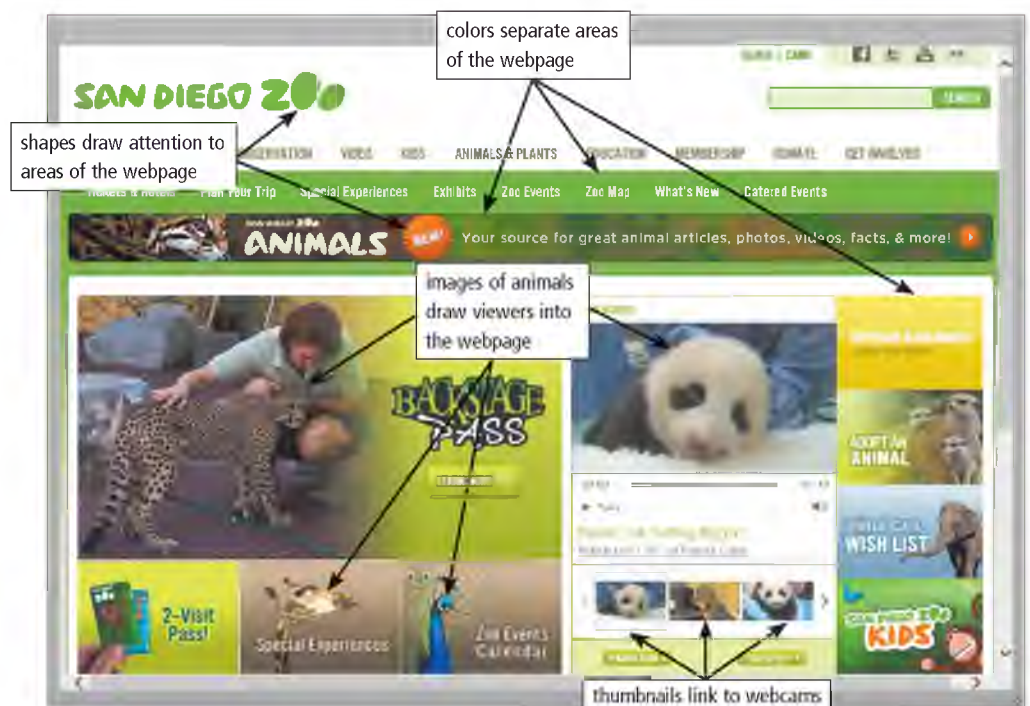


Figure 2-22 Many webpages use colorful graphics to convey messages. For example, the variety of colors, images, shapes, and thumbnails on the San Diego Zoo webpage visually separate and draw attention to areas of the webpage, making the webpage more dynamic and enticing.

Source: Zoological Society of San Diego

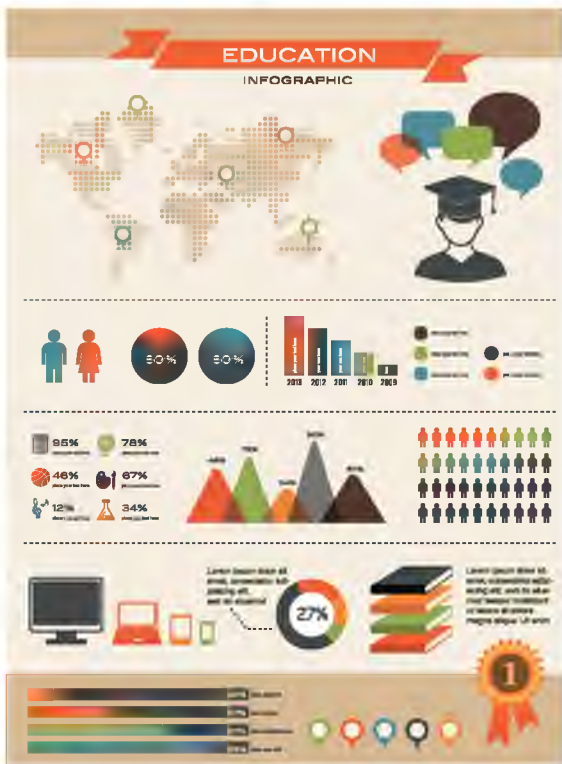


Figure 2-23 An infographic presents complex concepts at a glance.

© Marish / Shutterstock

Internet Research

What other formats for images and graphics are used on the web?

Search for: web image formats

BTW

Compressed Files

Compressed files take up less storage space. Smaller file sizes result in faster downloading of webpages because small files transmit faster than large files.

Internet Research

How do you subscribe to an iTunes podcast?

Search for: subscribe itunes podcast

The web often uses infographics to present concepts, products, and news. An *infographic* (short for information graphic) is a visual representation of data or information, designed to communicate quickly, simplify complex concepts, or present patterns or trends (Figure 2-23). Many forms of infographics exist: maps, signs, charts, and diagrams.

Of the graphics formats for displaying images on the web (Table 2-6), the JPEG and PNG formats are more common. *JPEG* (pronounced JAY-peg) is a compressed graphics format that attempts to reach a balance between image quality and file size. With JPG files, the more compressed the file, the smaller the image and the lower the quality. *PNG* (pronounced ping) is a patent-free compressed graphics format that restores all image details when the file is viewed. That is, the PNG format does not lose image quality during compression.

Table 2-6 Graphics Formats Used on the Web

Abbreviation	Name	Uses
BMP	Bitmap	Desktop backgrounds Scanned images
GIF	Graphics Interchange Format	Images with few colors Simple diagrams Shapes
JPEG	Joint Photographic Experts Group	Digital camera photos Game screenshots Movie still shots
PNG	Portable Network Graphics	Comic-style drawings Line art Web graphics
TIFF	Tagged Image File Format	Photos used in printing industry

© Cengage Learning

CONSIDER THIS

What is a PDF file?

PDF, which stands for Portable Document Format, is an electronic image format by Adobe Systems that mirrors the appearance of an original document. Users can view a PDF without needing the software that originally created the document.

Animation Many webpages use *animation*, which is the appearance of motion created by displaying a series of still images in sequence. For example, text that animates by scrolling across the screen can serve as a ticker to display stock updates, news, sports scores, weather, or other information. Web-based games often use animation.

Audio

On the web, you can listen to audio clips and live audio. *Audio* includes music, speech, or any other sound. Simple applications consist of individual audio files available for download to a computer or device. Once downloaded, you can play (listen to) the content of these files. Read How To 2-3 for instructions about downloading digital media from online services. Other applications use streaming audio so that you can listen to the audio while it downloads.



HOW TO 2-3

Download Digital Media from Online Services

Online services make various forms of digital media available, such as books, music, movies, and apps. You typically can use a program, such as iTunes, or an app, such as the Google Play Store, to access digital media. Digital media also may be available from these services' websites. The following steps describe how to download digital media from online services when you know the name or keyword(s) for the digital media you want to find.

1. On a computer or mobile device, run the program or app from which the digital media is available. If a program or app is not accessible easily, navigate to the online service using a browser.

2. Enter the name or keyword(s) in the Search box.
3. Tap or click the Search button to perform the search.
4. Navigate through the search results and then tap or click the search result for the item you want to download.
5. Locate and then tap or click the Download button or link to download the digital media to your computer or mobile device.

The following steps describe how to browse for and download digital media.

1. On your computer or mobile device, run the program or app from which the digital media is available. If a program or app is not accessible easily, navigate to the online service using a browser.

2. Tap or click the category corresponding to the type of digital media you want to browse. Common categories include music, movies, books, and apps.
3. Browse the items in the category.
4. When you find an item you want to download, tap or click the item to display additional information.
5. Look for and then tap or click the Download button or link to download the digital media to your computer or mobile device.

Consider This: In addition to the online services listed in this box, what are three additional resources from which you can download digital media?

Audio files are compressed to reduce their file sizes. For example, the *MP3* format reduces an audio file to about one-tenth its original size, while preserving much of the original quality of the sound.

To listen to an audio file on your computer, you need special software called a *media player*. Most current operating systems contain a media player; for example, the Windows operating system includes Windows Media Player (Figure 2-24). Some audio files, however, might require you to download a media player. Media players available for download include iTunes and RealPlayer. You can download media players free from the web.

Discover More: Visit this chapter's free resources to learn more about audio file formats.

Video

On the web, you can view video clips or watch live video. *Video* consists of images displayed in motion. Most video also has accompanying audio. You also can upload, share, or view video clips at a video sharing site. Educators, politicians, and businesses use video blogs and video podcasts to engage students, voters, and consumers.

Simple video applications on the web consist of individual video files, such as movie or television clips, that you must download completely before you can play them on a computer or mobile device. Video files often are compressed because they are quite large in size. Videos posted to the web often are short in length, usually less than 10 minutes, because they can take a long time to download. As with streaming audio files, streaming video files allows you to view longer or live videos by playing them as they download to your computer.

Discover More: Visit this chapter's free resources to learn more about video file formats.

Virtual Reality **Virtual reality (VR)** is the use of computers to simulate a real or imagined environment that appears as a three-dimensional (3-D) space. VR involves the display of 3-D images that users explore and manipulate interactively. Using special VR software, a developer



Figure 2-24 Windows Media Player is a popular media player, through which you can listen to music and watch video.

Source: Microsoft Corporation



Internet Research

What is a Smart TV?

Search for: smart tv



Figure 2-25 Users can explore a VR world using a touch screen or their input device. For example, users can explore the inside of the Gemini 7 space capsule, located at the Smithsonian Air and Space Museum in Washington, D.C., from their computer or mobile device
Source: World VR

Internet Research

What is HTML5?

Search for: html5

view and print PDF files. You typically can download plug-ins at no cost from various websites. Some plug-ins run on all sizes of computers and mobile devices; others have special versions for mobile devices.

Some mobile devices and browsers, however, do not support plug-ins. For this reason, web designers are using newer technologies to create websites that display correctly in both desktop and mobile browsers; these technologies generally do not require the use of plug-ins to display media.

Discover More: Visit this chapter's free resources to learn more about plug-ins.

Other Internet Services

As previously mentioned, the web is only one of the many services on the Internet. Other Internet services include the following: email, email lists, Internet messaging, chat rooms, online discussions, VoIP (Voice over IP), and FTP (File Transfer Protocol).

Email

Email (short for electronic mail) is the transmission of messages and files via a computer network. Email was one of the original services on the Internet, enabling scientists and researchers working on government-sponsored projects to communicate with colleagues at other locations.

You use an **email program** to create, send, receive, forward, store, print, and delete email messages. Email programs are available as desktop apps, web apps, and mobile apps. An email message can be simple text or can include an attachment such as a document, a graphic, an audio clip, or a video clip.

Just as you address a letter when using the postal system, you address an email message with the email address of your intended recipient. Likewise, when someone sends you a message, he or she must have your email address.

An *email address* is a combination of a user name and a domain name that identifies a user so that he or she can receive Internet email. A **user name** is a unique combination of characters, such as letters of the alphabet and/or numbers, that identifies a specific user. Your user name must be different from the other user names in the same domain. For example, a user named Rick Claremont whose server has a domain name of esite.com might want to select rclaremont

creates an entire 3-D environment that contains infinite space and depth, called a VR world (Figure 2-25). A VR world on the web, for example, might show a house for sale where potential buyers walk through rooms in the VR house by sliding their finger on a touch screen or moving an input device forward, backward, or to the side.

In addition to games and simulations, many practical applications of VR also exist. Science educators create VR models of molecules, organisms, and other structures for students to examine. Companies use VR to showcase products or create advertisements. Architects create VR models of buildings and rooms so that clients can see how a completed construction project will look before it is built.

Plug-Ins

Most browsers have the capability of displaying basic multimedia elements on a webpage. Sometimes, however, a browser requires an additional program, called a plug-in, to display multimedia. A *plug-in*, or add-on, is a program that extends the capability of a browser. For example, your browser may require Adobe Reader to

as his user name. If `esite.com` already has an `rclaremont` (for Rita Claremont) user name, then Rick will have to select a different user name, such as `rick.claremont` or `rclaremont2`.

Sometimes, organizations decide the format of user names for new users so that the user names are consistent across the company. In many cases, however, users select their own user names, often selecting a nickname or any other combination of characters for their user name. Many users select a combination of their first and last names so that others can remember it easily.

In an Internet email address, an `@` (pronounced at) symbol separates the user name from the domain name. Your service provider supplies the domain name. A possible email address for Rick Claremont would be `rclaremont@esite.com`, which would be read as follows: R Claremont at e site dot com. Most email programs allow you to create a *contacts folder*, which contains a list of names, addresses, phone numbers, email addresses, and other details about people with whom you communicate.

Figure 2-26 illustrates how an email message may travel from a sender to a receiver. When you send an email message, an outgoing mail server determines how to route the message through the Internet and then sends the message. As you receive email messages, an incoming mail server holds the messages in your mailbox until you use your email program to retrieve them. Most email programs have a mail notification alert that informs you via a message and/or sound when you receive a new email message(s).

Discover More: Visit this chapter's free resources to learn more about email programs.

CONSIDER THIS

What are good practices to follow when using email?

1. Keep messages brief.
2. Respond to messages promptly.
3. Use proper grammar, spelling, and punctuation.
4. Never respond to unsolicited messages.
5. Use meaningful subject lines.
6. Read the message before you send it.
7. Use email when you want a permanent record of a communication.

How an Email Message May Travel from a Sender to a Receiver

Step 1

Using an email program, you create and send a message on a computer or mobile device.



Step 2

Your email program contacts software on the outgoing mail server.



Step 3

Software on the outgoing mail server determines the best route for the data and sends the message, which travels along Internet routers to the recipient's incoming mail server.



Internet router

Step 4

When the recipient uses an email program to check for email messages, the message transfers from the incoming mail server to the recipient's computer or mobile device.



incoming mail server



Internet router



Figure 2-26 This figure shows how an email message may travel from a sender to a receiver.

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Email Lists

An **email list**, or electronic mailing list, is a group of email addresses used for mass distribution of a message. When a message is sent to an email list, each person on the list receives a copy of the message in his or her mailbox. You *subscribe* to an email list by adding your email address to the mailing list, which is stored on a list server. To remove your name, you *unsubscribe* from the mailing list.

The original use of email lists, such as *LISTSERV*, allowed any subscriber to send a message, which created a discussion-type forum among all subscribers via email. Many mailing lists today, such as in Figure 2-27, however, are one-way communications and do not allow subscribers to send messages.

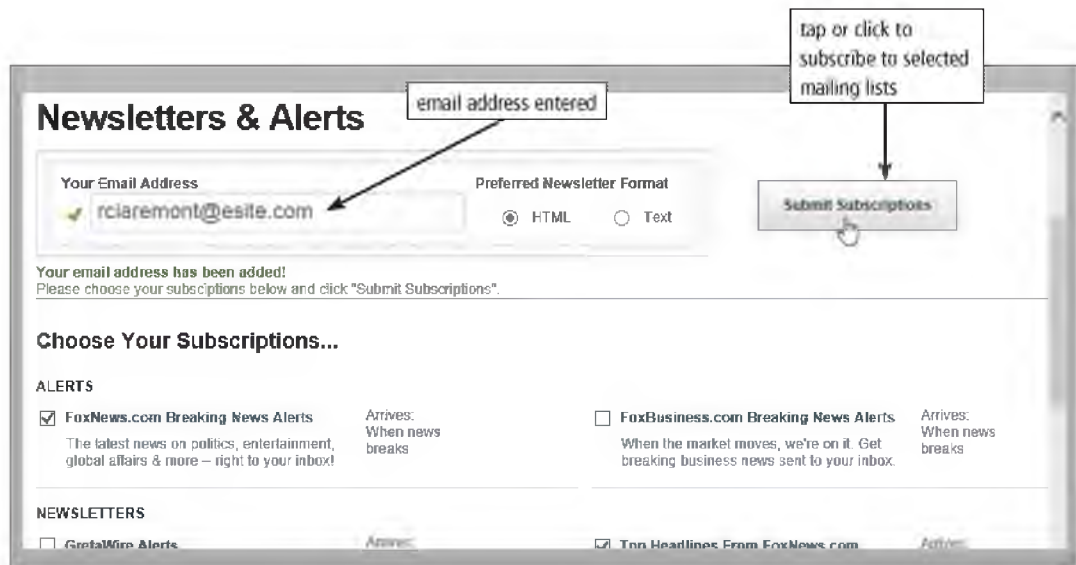


Figure 2-27 When you subscribe to a mailing list, you and all others in the list receive messages from the website. Shown here is a user who receives newsletters and alerts from FoxNews.com.

Source: FOX News Network, LLC

Internet Messaging

Internet messaging services, which often occur in real-time, are communications services that notify you when one or more of your established contacts are online and then allows you to exchange messages or files or join a private chat room with them (Figure 2-28). *Real time* means that you and the people with whom you are conversing are online at the same time. Some Internet messaging services support voice and video conversations, allow you to send photos or other documents to a recipient, listen to streaming music, and play games with another online contact.

For real-time Internet messaging to work, both parties must be online at the same time. Also, the receiver of a message must be willing to accept messages. To use an Internet messaging service, you may have to install messenger software or an app on the computer or mobile device, such as a smartphone, you plan to use.

Many online social networks include a messaging feature. To ensure successful communications, all individuals on the friend list need to use the same or a compatible messenger.



Figure 2-28 With Internet messaging services, you and the person(s) with whom you are conversing are online at the same time. The conversation appears on all parties' screens at the same time. Shown here is Facebook messenger.

© iStockphoto / Petar Chernaev; © Cengage Learning; © iStockphoto / Oleksiy Mark; © Cengage Learning

Discover More: Visit this chapter's free resources to learn more about Internet messaging services.

Chat Rooms

A **chat** is a real-time typed conversation that takes place on a computer or mobile device with many other online users. A **chat room** is a website or application that permits users to chat with others who are online at the same time. A server echoes the user's message to everyone in the chat room. Anyone in the chat room can participate in the conversation, which usually is specific to a particular topic. Businesses sometimes use chat rooms to communicate with customers.

As you type on your keyboard, others connected to the same chat room server also see what you have typed (Figure 2-29). Some chat rooms support voice chats and video chats, in which people hear or see each other as they chat. Most browsers today include the capability to connect to a chat server.



Figure 2-29 As you type, others in the same chat room see what you have typed.

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Online Discussions

An **online discussion**, or *discussion forum*, is an online area in which users have written discussions about a particular subject (Figure 2-30). To participate in a discussion, a user posts a message, called an article, and other users read and reply to the message. A **thread**, or threaded discussion, consists of the original article and all subsequent related replies.

Some discussion forums require that you enter a user name and password to participate in the discussion. For example, an online discussion for students taking a college course may require a user name and password to access the discussion. This ensures that only students in the course

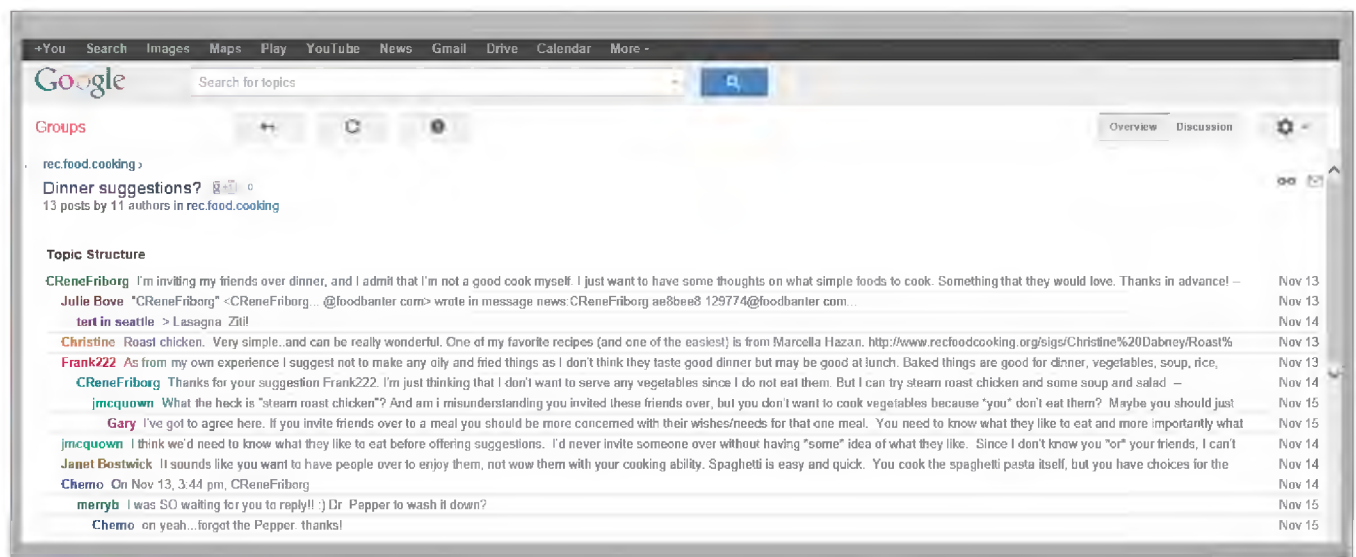


Figure 2-30 Users in an online discussion read and reply to other users' messages.

Source: Google Inc.

participate in the discussion. Posts in an online discussion usually are stored for a certain amount of time, such as a semester, in this example.

VoIP

VoIP, short for Voice over IP (Internet Protocol), enables users to speak to other users via their Internet connection. That is, VoIP uses the Internet (instead of the public switched telephone network) to connect a calling party to one or more local or long-distance called parties.

To place an Internet phone call, you need a broadband Internet connection, a microphone and speaker, both of which are included with a standard computer or mobile device, and VoIP software, such as Skype. Some VoIP services require that you purchase a separate phone and VoIP router, and subscribe to their service. Others offer certain services free and require a subscription for additional services. Read *How To 2-4* for instructions about how to set up a personal VoIP service and make a call.



VoIP Microphone

You also can use a headset connected to or that communicates with your computer or mobile device.

HOW TO 2-4

Set Up a Personal VoIP Service and Make a Call

VoIP services enable you to make free video or voice calls to others around the world. In many cases, the person you are calling also must use the same VoIP service. The following steps describe how to set up a VoIP service and make a call.

1. If you do not know the VoIP service you want to use, search for a program or app that enables you to place and receive VoIP calls.
2. If necessary, download the program or app for the VoIP service you will use.
3. Most VoIP services require you to have an account with their service before you can place or receive a call. When you start the VoIP program or app, search for the button or link to create a new account.
4. Once the account has been created, if necessary, sign in to the VoIP service with your user name and password.
5. Make sure the person you are calling also has an account with the same VoIP service. You should know at least one person using this service to successfully place a call. VoIP services typically allow you to locate and call someone by entering their user name or adding them to your list of contacts. If necessary, add the person you want to call to your list of contacts.
6. On the list of contacts, select the person you want to call and then tap or click the appropriate button to place the call.
7. When the other person answers, you can start your voice or video call.
8. When you are ready to end the call, tap or click the button to end the call.
9. When you are finished using the VoIP service, you should sign out of and exit the VoIP program or app.

Consider This: Survey your friends and family to see if they use a VoIP service. If so, which service is the most popular among them?



Source: Microsoft

FTP

FTP (File Transfer Protocol) is an Internet standard that permits file uploading and downloading to and from other computers on the Internet. *Uploading* is the process of transferring files from your computer or mobile device to a server on the Internet. Recall that downloading is the process of transferring files from a server on the Internet to your computer or mobile device. Webpage developers, for example, often use FTP to upload their webpages to a web server.

Many operating systems include FTP capabilities. If yours does not, you can download FTP programs from the web, usually for a small fee.

An *FTP server* is a computer that allows users to upload and/or download files using FTP. An FTP site is a collection of files that reside on an FTP server. Many FTP sites have *anonymous FTP*, whereby anyone can transfer some, if not all, available files. Some FTP sites restrict file transfers to those who have authorized accounts (user names and passwords) on the FTP server.

Discover More: Visit this chapter's free resources to learn more about FTP programs.

Mini Feature 2-3: Digital Communications


Home users, small/home office users, mobile users, power users, and enterprise users interact with technology for many reasons, including communication, productivity, and information. Read Mini Feature 2-3 for examples of how a home user might interact with digital communications.

MINI FEATURE 2-3


Digital Communications

This scenario, which assumes you are a home user with a busy family, presents situations and questions regarding technology use during a single day.


7:30 a.m. You notice a leaky pipe under the kitchen sink. Your regular plumber recently has retired. On your smartphone, you run an app that enables you to use search criteria, GPS, and user reviews. You find a local plumber who has many positive reviews and tap the phone number on the smartphone touch screen to place the call. You leave a message explaining the problem and asking the plumber to call you back.

 How can you evaluate reviews for authenticity and bias? How might an app provider use your location information in ways you have not authorized?

8:45 a.m. The plumber calls you back to schedule an appointment time. You open your laptop and use the electronic calendar web app your entire family uses to keep track of appointments. You find a time that works for both of you and update the electronic calendar.

 What features enable multiple people, such as a family or small business, to use an electronic calendar? What issues may occur from using a shared calendar?


10:00 a.m. You have a freelance job blogging for a local florist. You are required to post twice weekly to the florist's blog about agreed-upon topics. You use a wiki to confirm the symbolic meaning of different types of roses so that you can include that in your next blog post. You sign in to the blog's content management system and submit your post to the blog.

 What responsibility do bloggers have to post accurate, verified information? Should users rely on wikis to verify content?




11:00 a.m. While you are driving to a doctor's appointment, you receive several text messages on your smartphone. You use your Bluetooth headset and your smartphone's speech-to-text feature to respond to

the text messages without taking your eyes off of the road.

 Is it legal in your state to use hands-free devices while driving? What, if any, are the consequences of noncompliance?

1:00 p.m. Back at home, you flip through today's mail. You received a bill for your monthly mortgage payment. Using your laptop, you navigate to your bank's website

and schedule a recurring payment for the mortgage to ensure you never will be late on a payment.


 What precautions should you take when accessing financial information and authorizing payments on the web?

5:30 p.m. Unsure of what to make for dinner, you use your tablet to view recipes you bookmarked on a bookmarking site. You verify that you have the ingredients on hand and follow the recipe on your tablet as you prepare dinner.



 Who owns the content posted to social networking or bookmarking sites? What risks are involved with using these types of websites?

8:30 p.m. While helping your daughter with her math homework, you discover a website that includes the answers to questions asked in her textbook. You have a discussion with your daughter about ethical issues surrounding posting and using that type of content.


 Should students receive punishment for using answers they find on a website?

9:00 p.m.


You sit down to watch your favorite vocal competition



reality show, streaming live through your Smart TV. The show enables you to send a text message to vote for your favorite contestant. You debate between two popular singers, then finally send your vote via text message.

 How else do TV, movie, and other entertainment websites use the Internet to interact with viewers or listeners?

10:30 p.m. You use the calendar app on your smartphone to confirm your schedule for tomorrow and then head to bed.

 How does technology enhance the daily life of a home user?

Discover More: Visit this chapter's free resources for additional scenarios for small/home office users, mobile users, power users, and enterprise users.

Netiquette

Netiquette, which is short for Internet etiquette, is the code of acceptable behaviors users should follow while on the Internet; that is, it is the conduct expected of individuals while online. Netiquette includes rules for all aspects of the Internet, including the web, social media, Internet messaging, chat rooms, online discussions, and FTP. Figure 2-31 outlines some of the rules of netiquette, with respect to online communications. Read Ethics & Issues 2-4 to consider issues related to an extreme misuse of online communications — online bullying.

Discover More: Visit this chapter's free resources to learn more about emoticons.

Netiquette Guidelines for Online Communications

Golden Rule: Treat others as you would like them to treat you.

Be polite. Avoid offensive language.

Avoid sending or posting *flames*, which are abusive or insulting messages. Do not participate in *flame wars*, which are exchanges of flames.

Be careful when using sarcasm and humor, as it might be misinterpreted.

Do not use all capital letters, which is the equivalent of SHOUTING!

Use **emoticons** to express emotion. Popular emoticons include:

:) Smile :| Indifference :o Surprised :(Frown :\ Undecided ;) Wink

Use abbreviations and acronyms for phrases:

BTW	by the way	IMHO	in my humble opinion	FWIW	for what it's worth
FYI	for your information	TTFN	ta ta for now	TYVM	thank you very much

Clearly identify a *spoiler*, which is a message that reveals an outcome to a game or ending to a movie or program.

Be forgiving of other's mistakes.

Read the *FAQ* (frequently asked questions), if one exists.

Figure 2-31 Some of the rules of netiquette, with respect to online communications.

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ETHICS & ISSUES 2-4

Who Is Responsible for Monitoring Cyberbullying?

Sending or forwarding threatening text messages, posting embarrassing or altered pictures of someone without his or her permission, or setting up a fake online social network page where others make cruel comments and spread rumors about someone all are examples of cyberbullying. *Cyberbullying* is harassment using technology, often involving teens and preteens. Unlike verbal bullying, the perpetrators can hide behind the anonymity of the Internet and can reach a wide audience quickly. Victims cannot just walk away or ignore bullying that comes in the form of text messages, email, or online social network posts.

Cyberbullying often takes place outside of school hours on personal devices or computers not owned or monitored by a school. Yet the ramifications affect the victim at school. Schools struggle to come up with policies. Many schools are adopting policies that include consequences for any form of student-to-student bullying, even using nonschool resources, if it contributes to a hostile environment for any student or group of students. Some schools specify that students who retaliate against anyone who reports instances of bullying or cyberbullying will receive punishment.

Anti-bullying laws vary from state to state and often do not include specific language about cyberbullying. One argument against

criminalizing cyberbullying is the protection of free speech. Awareness campaigns, school policies, and parent monitoring of technology use are some ways to attempt to prevent cyberbullying. These methods are not always effective. The impact on the victim can lead to poor grades, health issues, mental health concerns, and even suicide.

Consider This: Should schools be responsible for punishing students who cyberbully other students outside of school? Why or why not? What role can parents play in reducing cyberbullying? What are the positive and negative aspects of the freedom to be anonymous on the Internet?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Digital Media on the Web, Other Internet Services, and Netiquette as it relates to the chapter objectives.

Now you should know ...


- Why you use media on the web (Objective 8)
- How you can benefit from using email, email lists, Internet messaging, chat rooms, discussion forums, VoIP, and FTP (Objective 9)
- What rules you should follow in online communications (Objective 10)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter presented the evolution of the Internet, along with various ways to connect to the Internet, how data travels the Internet, and how the Internet works with domain names and IP addresses. It discussed the web at length, including topics such as browsing, navigating, web addresses, web apps and mobile apps, searching, and online social networks. It presented various types of websites and media on the web. It also introduced other services available on the Internet, such as email, email lists, Internet messaging, chat rooms, online discussions, VoIP, and FTP. Finally, the chapter listed rules of netiquette.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Tim Berners-Lee, Yahoo! and Google, Arianna Huffington, and LinkedIn; Technology Trends: Uses of Bookmarking Sites and Responsive Web Design; and High-Tech Talks: IP Addresses and DNS Servers.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Transportation

What is transportation like without computers and mobile devices? Delivery drivers use clipboards to hold their records. Human navigators use paper maps to track routes for pilots. Ship captains rely solely on experience to navigate through shallow waters. Today, the transportation industry relies heavily on computer and mobile device usage.

Many vehicles include onboard navigation systems to help you navigate from one location to another. Some of these systems provide other services, such as dispatching roadside assistance, unlocking the driver's side door if you lock the keys in your vehicle, and tracking the vehicle if it is stolen.

The shipping and travel industries identify items during transport using bar codes, which are identification codes that consist of lines and spaces of different lengths. When you ship a package, the shipping company, such as UPS or FedEx, places a bar code on the package to indicate its destination to a computer. Because a package might travel to its destination by way of several trucks, trains, and airplanes,


computers automatically route the package as efficiently as possible. You are able to visit a website or sign up for text message notifications to track a package's progress during shipment.

When you travel by airplane, baggage handling systems ensure that your luggage reaches its destination on time. When you check in your baggage at the airport, a bar code identifies the airplane on which the bags should be placed. If you change planes, automated baggage handling systems route your bags to connecting flights with very little, if any, human intervention. When the bags reach their destination, they are routed automatically to the baggage carousel in the airport's terminal building.

Pilots of high-technology commercial, military, and space aircraft today work in a glass cockpit, which features computerized instrumentation, navigation, communications, weather reports, and an autopilot. The electronic flight information shown on high-resolution displays is designed to reduce pilot workload, decrease fatigue, and enable pilots to concentrate on flying safely.

Boats and ships also are equipped with computers that include detailed electronic maps, which help the captain navigate, as well as calculate the water depth and provide a layout of the underwater surface so that the captain can avoid obstructions.

As you travel the roadways, airways, and waterways, bear in mind that computers often are responsible for helping you to reach your destination as quickly and safely as possible.

 **Consider This:** In what other ways do computers and technology play a role in the transportation industry?



Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to test your knowledge of digital content associated with this chapter and access the Study Guide resource from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

1. Explain how ARPANET contributed to the growth of the Internet.
2. Describe the role of a host on a network.
3. Identify the role of the W3C.
4. Define the terms, dongle and broadband. List popular wired and wireless broadband Internet services.
5. State the purpose of a hot spot, and list tips for using hot spots safely.
6. ISP stands for _____.
7. Briefly describe how data and information travel the Internet.
8. Describe the purpose and composition of an IP address. Differentiate between IPv4 and IPv6.
9. Define the term, domain name. List general steps to register for a domain name.
10. Identify the purpose of several generic TLDs. Identify ICANN's role with TLDs.
11. Describe how and why cybersquatters register domain names.
12. State the purpose of a DNS server.
13. Differentiate between static and dynamic webpages.
14. Distinguish among the web, a webpage, a website, and a web server.
15. Explain the purpose of a browser. Describe the function of tabbed browsing.
16. List ways you can browse safely.
17. Name examples of popular browsers for personal computers and mobile devices.
18. Define the term, web address. Name a synonym.
19. Name and give examples of the components of a web address.
20. Describe the purpose of a web feed.
21. Explain the relationship between web and mobile apps.
22. Describe the purpose of GPS receivers, and why manufacturers embed them in smartphones.
23. Explain the risks and concerns involved in letting apps track your location. List any benefits.
24. Describe how to use a search engine. What are some ways you can refine a search?
25. Besides webpages, identify other items a search engine can find.
26. Differentiate between a search engine and a subject directory.
27. Explain how to use an online social network for personal or business use.
28. List ways to use online social networks securely.
29. Describe the purpose of these types of websites: informational and research; media sharing; bookmarking; news, weather, sports, and other mass media; educational; business, governmental, and organizational; blogs; wikis and collaboration; health and fitness; science; entertainment; banking and finance; travel and tourism; mapping; retail and auctions; careers and employment; e-commerce; portals; content aggregation; and website creation and management.
30. Is it ethical to use a fake name online? Why or why not? List techniques to protect yourself from identity theft.
31. Describe the uses of tags. List steps to tag digital content.
32. Define the term, e-commerce. Differentiate among B2C, C2C, and B2B e-commerce.
33. List uses and benefits of content aggregation websites and apps.
34. Identify and briefly describe the steps in web publishing.
35. The _____ web design approach adapts the layout of the website to fit the screen on which it is displayed.
36. List the seven criteria for evaluating a website's content.
37. _____ refers to any application that combines text with media.
38. Explain how webpages use graphics, animation, audio, video, virtual reality, and plug-ins.
39. Define the terms, thumbnail and infographic.
40. Name the types of graphics formats used on the web and how they use compression.
41. List general steps to download digital media.
42. Describe the purpose of these Internet services and explain how each works: email, email lists, messaging, chat rooms, online discussions, VoIP, and FTP.
43. Describe the components of an email address.
44. _____ refers to Internet communications in which both parties communicate at the same time.
45. List steps to set up a personal VoIP service and make a call.
46. Describe how a home user interacts with digital communications.
47. Define the term, netiquette.
48. Describe cyberbullying, and explain why it is difficult to catch the perpetrators.
49. Describe how the transportation industry uses technology.

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

Discover More: Visit this chapter's premium content to view definitions for each term and to access the **Flash Cards** resource from your smartphone, tablet, laptop, or desktop.

Key Terms

Primary Terms (shown in bold-black characters in the chapter)

blog (78)	FTP (92)	netiquette (94)	traffic (62)
blogger (78)	GB (61)	online auction (82)	user name (88)
browser (65)	GPS (70)	online discussion (91)	virtual reality (87)
chat (91)	GPS receiver (70)	online social network (72)	VoIP (92)
chat room (91)	graphic (85)	Opera (67)	web (65)
Chrome (67)	home page (66)	PDF (86)	web address (68)
content	hot spot (59)	pop-up blocker (66)	web publishing (84)
aggregation (83)	Internet (56)	pop-under blocker (66)	web server (65)
domain name (63)	Internet Explorer (67)	portal (82)	webpage (65)
e-commerce (82)	Internet messaging (90)	responsive web design (84)	website (65)
email (88)	Internet service provider	Safari (67)	wiki (78)
email list (90)	(ISP) (61)	search engine (71)	World Wide Web
email program (88)	IP address (62)	social media (76)	(WWW) (65)
emoticons (94)	MB (61)	streaming (79)	
favorites (67)	mobile service	tabbed browsing (66)	
Firefox (67)	provider (61)	tag (75)	

Secondary Terms (shown in *italic* characters in the chapter)

<i>analog (60)</i>	<i>DSL (59)</i>	<i>microblog (78)</i>	<i>spoiler (94)</i>
<i>animation (86)</i>	<i>dynamic webpage (65)</i>	<i>mobile app (69)</i>	<i>static webpage (65)</i>
<i>anonymous FTP (92)</i>	<i>electronic storefront (81)</i>	<i>mobile broadband (59)</i>	<i>status update (73)</i>
<i>Anticybersquatting Consumer</i>	<i>e-retail (81)</i>	<i>mobile browser (65)</i>	<i>subscribe (90)</i>
<i>Protection Act (64)</i>	<i>email address (88)</i>	<i>MP3 (87)</i>	<i>subject directory (72)</i>
<i>ARPANET (56)</i>	<i>extended contacts (73)</i>	<i>multimedia (85)</i>	<i>tethering (60)</i>
<i>audio (86)</i>	<i>FAQ (94)</i>	<i>news feed (73)</i>	<i>tthread (91)</i>
<i>bandwidth (61)</i>	<i>Fiber to the Premises (FTTP) (59)</i>	<i>phishing (66)</i>	<i>tthumbnail (85)</i>
<i>blogosphere (78)</i>	<i>fixed wireless (59)</i>	<i>phishing filter (66)</i>	<i>top-level domain (TLD) (63)</i>
<i>bookmarks (67)</i>	<i>flames (94)</i>	<i>plug-in (88)</i>	<i>troll (77)</i>
<i>bookmarking site (75)</i>	<i>flame wars (94)</i>	<i>PNG (86)</i>	<i>unsubscribe (90)</i>
<i>broadband (58)</i>	<i>friends (73)</i>	<i>pop-up ad (66)</i>	<i>uploading (93)</i>
<i>business-to-business (B2B)</i>	<i>FTP server (92)</i>	<i>pop-under ad (66)</i>	<i>URL (68)</i>
<i>e-commerce (82)</i>	<i>gigabyte (61)</i>	<i>private browsing (66)</i>	<i>video (87)</i>
<i>business-to-consumer (B2C)</i>	<i>hashtag (73)</i>	<i>proxy server (66)</i>	<i>W3C (58)</i>
<i>e-commerce (82)</i>	<i>bits (71)</i>	<i>real time (90)</i>	<i>Web 2.0 (65)</i>
<i>cable Internet service (59)</i>	<i>host (56)</i>	<i>registrar (63)</i>	<i>web app (69)</i>
<i>cache (66)</i>	<i>http (69)</i>	<i>satellite Internet service (59)</i>	<i>web feed (69)</i>
<i>catfishing (77)</i>	<i>ICANN (63)</i>	<i>search text (71)</i>	<i>web hosting service (64)</i>
<i>ccTLD (63)</i>	<i>infographic (86)</i>	<i>shopping cart (81)</i>	<i>Wi-Fi (59)</i>
<i>cloud storage (69)</i>	<i>Internet backbone (62)</i>	<i>social networking site (72)</i>	<i>wireless modem (58)</i>
<i>consumer-to-consumer (C2C)</i>	<i>intranet (78)</i>		
<i>e-commerce (82)</i>	<i>JPEG (86)</i>		
<i>contacts folder (89)</i>	<i>keyloggers (80)</i>		
<i>content management system (84)</i>	<i>like (73)</i>		
<i>curation website (83)</i>	<i>LISTSERV (90)</i>		
<i>cyberbullying (94)</i>	<i>location sharing (66)</i>		
<i>discussion forum (91)</i>	<i>m-commerce (82)</i>		
<i>DNS server (64)</i>	<i>media player (87)</i>		
<i>domain name system (DNS) (64)</i>	<i>media sharing site (75)</i>		
<i>dongle (58)</i>	<i>megabyte (61)</i>		



wiki (78)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. No single person or government agency controls or owns the Internet. (58)
- _____ 2. The W3C is responsible for maintaining all networks and content on the Internet. (58)
- _____ 3. Users typically pay additional fees for mobile hot spot and tethering services. (60)
- _____ 4. A gigabyte (GB) is the basic storage unit on a computer or mobile device and represents a single character. (61)
- _____ 5. A dynamic webpage's contents generate each time a user displays the page. (65)
- _____ 6. Most browsers are available for download at no cost. (67)
- _____ 7. Mobile apps sometimes have fewer features than a web app. (69)
- _____ 8. A subject directory is software that finds websites, webpages, images, videos, maps, and other information related to a specific topic. (71)
- _____ 9. When you post digital content online, it is a good idea to tag it so that it is easy to locate and organize. (76)
- _____ 10. The term, blogosphere, refers to the worldwide collection of blogs. (78)
- _____ 11. Tethering is the process of transferring data in a continuous and even flow, which allows users to access and use a file while it is transmitting. (79)
- _____ 12. One way to protect yourself from identity theft online is to retain all your cookies in your browser. (80)

Multiple Choice

Select the best answer.

1. A(n) _____ is any computer that provides services and connections to other computers on a network. (56)
 - a. host
 - b. client
 - c. FTP site
 - d. subject directory
2. A(n) _____ is a sequence of numbers that uniquely identifies the location of each computer or device connected to the Internet. (62)
 - a. Internet backbone
 - b. domain name
 - c. IP address
 - d. ccTLD
3. You register a domain name through _____, which is an organization that sells and manages domain names. (63)
 - a. a cybersquatter
 - b. a registrar
 - c. ICANN
 - d. an ISP
4. The _____ is the method the Internet uses to store domain names and their corresponding IP addresses. (64)
 - a. domain name system (DNS)
 - b. top-level domain (TLD)
 - c. File Transfer Protocol (FTP)
 - d. W3C
5. One way to protect your identity while browsing is to use a(n) _____, which is another computer that screens all your incoming and outgoing messages. (66)
 - a. password
 - b. anonymous FTP
 - c. phishing filter
 - d. proxy server
6. _____ is a set of rules that defines how webpages transfer on the Internet. (69)
 - a. Top-level domain
 - b. Hypertext Transfer Protocol
 - c. IPv4
 - d. Web 2.0
7. A(n) _____ website contains factual material, such as libraries, encyclopedias, dictionaries, directories, guides, and other types of reference. (74)
 - a. wikis and collaboration
 - b. media sharing
 - c. business and research
 - d. informational
8. A _____ is a website that offers a variety of Internet services from a single, convenient location. (82)
 - a. LISTSERV
 - b. microblog
 - c. portal
 - d. cache

Checkpoint

Matching Match the terms with their definitions.

- | | |
|---------------------------------|--|
| _____ 1. tethering (60) | a. text-based name that corresponds to the IP address of a server that hosts a website |
| _____ 2. Internet backbone (62) | b. website or web app that allows users to collect and compile content from a variety of websites about a particular topic or theme |
| _____ 3. domain name (63) | c. harassment, often involving teens and preteens, using technology |
| _____ 4. web server (65) | d. collaborative website that allows users to create, add, modify, or delete website content via a browser |
| _____ 5. tag (75) | e. technique that transforms a smartphone or Internet-capable tablet into a portable communications device that shares its Internet access with other computers and devices wirelessly |
| _____ 6. catfishing (77) | f. real-time typed conversation that takes place on a computer or mobile device with many other online users |
| _____ 7. wiki (78) | g. computer that delivers requested webpages to your computer or mobile device |
| _____ 8. curation website (83) | h. online practice of creating a fake profile to form relationships with unsuspecting users |
| _____ 9. chat (91) | i. term used to refer to the major carriers of network traffic |
| _____ 10. cyberbullying (94) | j. short descriptive label that you assign to digital content so that it is easier to locate at a later time |

Consider This Answer the following questions in the format specified by your instructor.

- Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (64, 70, 77, 94), How To (63, 76, 87, 92), Mini Features (67, 73, 93), Secure IT (59, 66, 74, 80), and Technology @ Work (95).
- What were ARPANET's original goals? (56)
- What are the advantages of using a broadband Internet service? (58)
- What is the relationship between domain names and IP addresses? (62)
- Is cybersquatting ethical? Why or why not? (64)
- What is a cybersquatter? (64) What is the goal of the Anticybersquatting Consumer Protection Act (ACPA)? (64)
- How does a static webpage differ from a dynamic webpage? (65)
- How does using a proxy server help protect your online identity? (66)
- What are some safe browsing techniques? (66)
- What are some popular mobile browsers? (67)
- How do GPS receivers track their location on earth? (70)
- What are the advantages and risks associated with allowing an app to track your location? (70)
- What techniques can you use to improve search results? (72)
- What precautions can you take to minimize privacy and security risks associated with online social networks? (74)
- Would you use a public computer to check email or do online banking? Why or why not? What are the risks? (80)
- How do e-commerce and m-commerce differ? (82)
- What should you determine during the planning stage of a website? (84)
- What steps are involved in web publishing? (84)
- What are some criteria you can use to evaluate a website or webpage before relying on its content? (85)
- How do JPEG and PNG formats differ? (86)
- What are some practical applications of virtual reality? (88)
- Where can you obtain plug-ins? (88)
- Besides the web, what other Internet services are available? (88)
- What are some good practices to follow when using email? (89)
- What elements do you need to place an Internet phone call? (92)
- What is anonymous FTP? (92)
- What activities might be considered cyberbullying? (94)

Problem Solving

The **Problem Solving** exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, work, or with nonprofit organizations. The **Collaboration** exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Cyberbullying Message** While reviewing the email messages in your email account, you notice one that you interpret as cyberbullying. You do not recognize the sender of the email message, but still take it seriously. What are your next steps?
- 2. Unsolicited Friend Requests** You recently signed up for an account on the Facebook online social network. When you log in periodically, you find that people you do not know are requesting to be your friend. How should you respond?
- 3. Unexpected Search Engine** A class project requires that you conduct research on the web. After typing the web address for Google's home page and pressing the **ENTER** key, your browser redirects you to a different search engine. What could be wrong?
- 4. Images Do Not Appear** When you navigate to a webpage, you notice that no images are appearing. You successfully have viewed webpages with images in the past and are not sure why images suddenly are not appearing. What steps will you take to show the images?
- 5. Social Media Password** Your social media password has been saved on your computer for quite some time and the browser has been signing you in automatically. After deleting your browsing history and saved information from your browser, the online social network began prompting you again for your password, which you have forgotten. What are your next steps?



Source: Twitter

Professional

- 6. Suspicious Website Visits** The director of your company's information technology department sent you an email message stating that you have been spending an excessive amount of time viewing websites not related to your job. You periodically visit websites not related to work, but only on breaks, which the company allows. How does he know your web browsing habits? How will you respond to this claim?
- 7. Automatic Response** When you return from vacation, a colleague informs you that when she sent email messages to your email address, she would not always receive your automatic response stating that you were out of the office. Why might your email program not respond automatically to every email message received?
- 8. Email Message Formatting** A friend sent an email message containing a photo to your email account at work. Upon receiving the email message, the photo does not appear. You also notice that email messages never show any formatting, such as different fonts, font sizes, and font colors. What might be causing this?
- 9. Mobile Hot Spot Not Found** Your supervisor gave you a mobile hot spot to use while you are traveling to a conference in another state. When you attempt to connect to the hot spot with your computer, tablet, and phone, none of the devices is able to find any wireless networks. What might be the problem, and what are your next steps?
- 10. Sporadic Email Message Delivery** The email program on your computer has been displaying new messages only every hour, on the hour. Historically, new email messages would arrive and be displayed immediately upon being sent by the sender. Furthermore, your coworkers claim that they sometimes do not receive your email messages until hours after you send them. What might be the problem?

Collaboration

- 11. Technology in Transportation** Your project team has been assigned to present a business proposal to a group of potential investors. Because the presentation will take place in Kansas City, Missouri, you will need to transport people and ship some materials to that location. Form a team of three people and determine how to use technology to ship materials and how to make travel arrangements. One team member should research the steps required to use a website to make flight reservations, one team member should determine the steps necessary to print a package shipping label from his or her computer and track the package while it is en route, and another team member should find directions from Kansas City International Airport to a nearby hotel.

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

How To: Your Turn

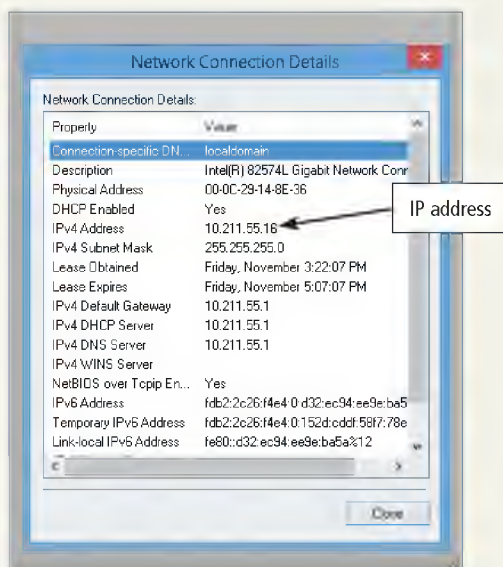
Discover More: Visit this chapter's premium content to **challenge yourself with this additional How To: Your Turn exercises**, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Determine Your IP (Internet Protocol) Address

Knowing a computer or mobile device's IP address can help you identify it on a network and can help you troubleshoot any problems you may experience connecting to the Internet or other computers and devices on your network. The following steps guide you through the process of determining your IP address.

- Run a browser and then navigate to a search engine of your choice.
- Search for a website that can determine your IP address and then navigate to one of these websites.
- Your IP address should be displayed upon navigating to the website. If it does not, return to the search results and navigate to a different site.
or
- Run a browser and then navigate to a search engine of your choice.
- Search for a website that explains how to determine the IP address for your specific operating system and version.
- View the search results and then navigate to the website that provides you with the best guidance.
- Follow the instructions on your computer or mobile device to determine the IP address.



Source: Microsoft Corporation

Exercises

- Summarize the process you used to determine your IP address.
- What is your IP address?
- Is it possible for a computer to have more than one IP address at the same time? Why or why not?

2 Participate in an Online Auction

Online auctions allow consumers to bid on products that other people are selling. If you are the highest bidder at the end of the bidding period, you often can arrange payment through the online auction. The following steps guide you through the process of participating in an online auction.

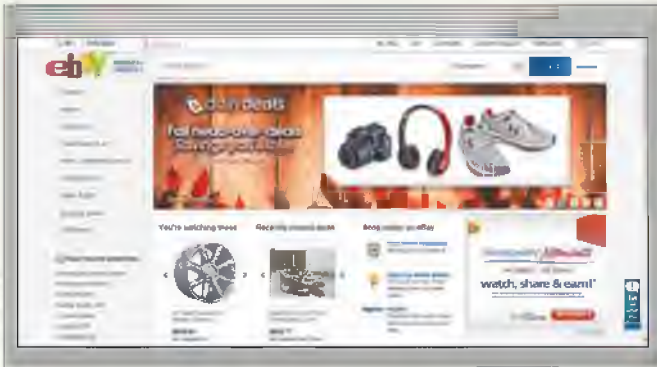
WARNING: Do not purchase or bid on an item if you do not intend to purchase it. If you win the auction, you legally may be obligated to provide payment for the item.

- Run a browser and then navigate to www.ebay.com.
- Tap or click the link to register for a new account.
- Enter the requested information to create the account.
- Search for an item on which you would like to bid. If you want to browse items in a specific category instead, tap or click the link to browse for items by category.
- When the search results appear, tap or click an item that interests you to see more details about the item.
- Review the item details to determine whether you would like to bid on this item. If the item does not interest you, return to the search results and select another item.
- The seller may have a "Buy It Now" option that allows you to purchase the item immediately at a predetermined price. Alternatively, you can bid on the item by making an offer. The highest bidder at the end of the auction will win the item.
Remember: If you bid on and win an item, you are obligated to provide payment.
- You will be notified if you are the winning bidder when the auction closes. At that time, follow the instructions to arrange to pay the seller.
- When you are finished, sign out of eBay.

How To: Your Turn

Exercises

1. What item(s) did you view? If the buyer had the “Buy It Now” option available, do you think the asking price was fair?
2. Would you purchase an item from an online auction? Why or why not?
3. What items might you post for sale on an online auction?



3 View and Manage Data Usage

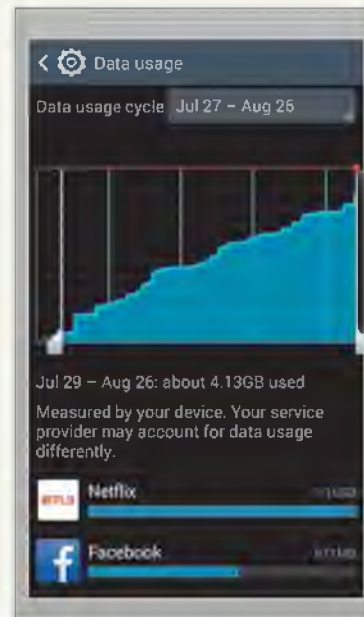
Many people have limited data plans, so it is important to know how to view the amount of data you have used on your phone or tablet when you are not connected to the Internet using a Wi-Fi connection. If you are using a phone or tablet where Wi-Fi is available, you should strongly consider using the Wi-Fi connection not only to limit data plan usage, but also to experience faster speed. If you find that your data usage is high each month, you may be able to see which apps are using the most data and adjust usage of those apps accordingly. The following steps guide you through the process of viewing and managing data usage.

- a. Display the settings on your mobile device.
- b. Select the option to view data usage.
- c. If necessary, tap the option to display a list of apps and how much data each app uses. If necessary, select the time period for which you want to see the data usage.
- d. If you notice an app using a large amount of data, tap the app to see details for that app. If necessary, disable background data transfer for the app. Background data transfer is data the app downloads and uploads even while you are not actively using the app.
- e. If you want your mobile device to notify you when you are approaching your monthly data limit, set the necessary notification option and select a value under your monthly data limit in the appropriate area.

- f. If you want your mobile device to turn off data (this does not include Wi-Fi) when you reach a certain limit, set the necessary option and then select a value that is just less than your monthly data limit to ensure you never reach or exceed the limit.
- g. Save all changes.

Exercises

1. Do you have a data limit on your mobile data plan? If so, what is it?
2. When you enter an area with Wi-Fi, do you configure your mobile device to connect to the Wi-Fi? Why or why not?
3. Review the mobile data usage on your mobile device. Which app uses the most data? Which app uses the least data?



4 Search for a Job Online

If you know the company for which you would like to work, you may be able to visit that company's website and search for a webpage with current job postings. If you would like to search for openings in multiple companies, consider using a job search website. The following steps guide you through the process of searching for a job online.

- a. Run a browser.
- b. Use a search engine to locate a job search website and then navigate to the website.
- c. Many job search websites allow you to search for jobs by criteria, such as keyword, category or location. If

How To: Your Turn

- you are searching for a job in a specific field, enter relevant keyword(s) (i.e., software developer) or select an appropriate category (i.e., technology). To limit your search results to a specific geographical area, specify a location (i.e., Atlanta).
- Some websites allow you to search for jobs based on additional criteria, such as company, salary, job type, education, and experience. Specify these additional criteria by performing an advanced search.
 - After entering the job search criteria, start the search.
 - When the search results appear, scroll through the results. To find out more about a particular job, tap or click the job listing.
 - If desired, follow the instructions in the job listing to apply for the job.

Exercises

- Review three job search websites. Which one did you like the best? Why?
- Which keywords would you use on a job search website to search for a job in your desired field?
- Before completing this exercise, have you ever searched for a job online? Do you think it is better to search for a job using a job search website, or by visiting company websites directly and viewing their job postings? Justify your answer.

5 Send Email Messages Using Various Email Programs and Web Apps

The process required to send an email message using a computer or mobile device from various email programs and web apps is very similar. The following steps guide you through the process of sending email messages using various email programs and web apps.

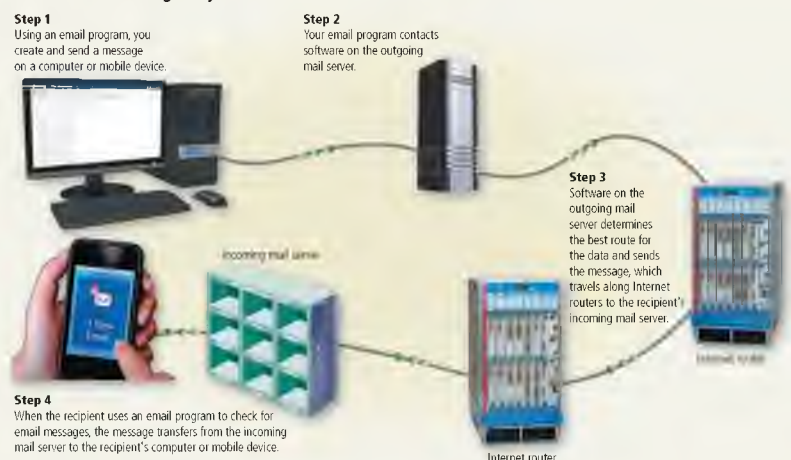
- Run the email program or navigate to the email web app on your computer or mobile device.
- Locate and then tap or click the button to compose a new email message.
- Type the recipient's email address in the To text box. If you are sending the email message to multiple recipients, separate each email address with a semicolon (;).
- If you would like to send a carbon copy of the email message to one or

- more people, type their email address(es) in the Cc text box (which stands for carbon copy).
- To send a copy of the email message to someone while hiding his or her email address from the other recipients, enter his or her email address in the Bcc text box (which stands for blind carbon copy). The email recipients listed in the To or Cc text boxes will not be able to see the recipients you specified in the Bcc text box.
 - Enter a descriptive subject in the Subject text box. It is not good practice to leave the subject blank when you send an email message because the recipient's email server may place messages without a subject in a spam or junk mail folder.
 - Type the body of the email message in the appropriate area.
 - If your email program supports it, check the spelling of your email message and correct any errors found.
 - Tap or click the Send button, which sends the email message to everyone listed in the To, Cc, and Bcc text boxes.

Exercises

- Under what circumstances might you want to send a blind carbon copy of an email message to one or more people?
- Send an email message to your instructor and put your email address in the Cc text box. Use an appropriate subject and tell your instructor you have successfully completed this exercise.
- Search for and evaluate three web apps that can send and receive email. Which one is your favorite, and why?

How an Email Message May Travel from a Sender to a Receiver



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Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to **challenge yourself with additional Internet Research exercises**, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web

Online Social Networks and Media Sharing

Every second, an average of 5,700 Tweets and 41,000 Facebook posts are created. With these impressive numbers, it is no wonder that online social media have become ubiquitous throughout the world. Twitter, Facebook, and other online social networks, especially those featured in Mini Feature 2-2 in this chapter, are popular among users of all ages. Likewise, media sharing sites, such as YouTube, which is shown in Figure 2-11 in this chapter, are popular means of managing and sharing photos, videos, and music.

Research This: Visit two of the websites discussed in Mini Feature 2-2 or other online social networks and create a profile if you do not currently have one. What personal information is required to join? Does either website ask for personal information that you are uncomfortable sharing? How does the content of these two websites differ? Which features are beneficial for casual users, and which are targeted toward business or professional users? Then, visit two social media sites. What personal information is required to join? Are these websites supported by advertisements? Locate the instructions for posting media. Are these instructions straightforward? Do these websites impose a limit on the number and/or size of media files a user can post?

newspapers, advertisements generally are not used to fund the majority of operating costs, nor are users required to pay monthly or annual fees for basic services that they receive at no cost. One method that social media sites use to generate start-up and ongoing subsidies is through venture capitalists' funding. These investors scrutinize business plans and market trends in an effort to locate Internet start-up companies with the potential to generate substantial returns. Once the businesses are running, additional monies are needed to maintain and improve the websites. At this point, some websites display advertisements. The charge for companies to place an advertisement generally increases as the number of subscribers grows. Another method of generating income is to charge users for accessing premium content. Online dating services use this tactic successfully, for they allow people to browse online profiles free of charge but require them to pay to contact a potential dating match.

Research This: Locate venture capitalists who are seeking Internet start-up companies. Which criteria do they use to make investment decisions? Who are the successful venture capitalists, and which companies have they funded? Which types of advertisements are displayed on specific social media and online social networks? How does the content of these ads pertain to the demographics and interests of users?



Source: Facebook

2 Social Media

Most social media companies have invested millions of dollars to develop and maintain their websites. Unlike other commercial media, such as television, radio, and

3 Search Skills

Understand Search Results

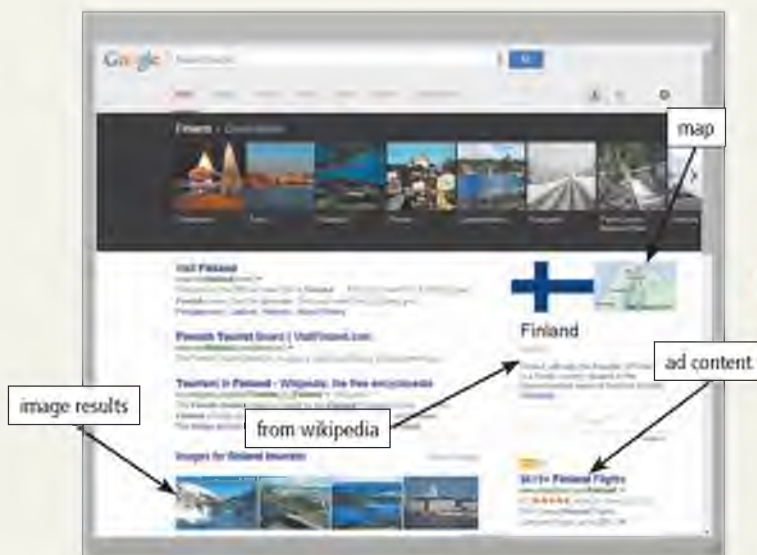
Search results display the most relevant results first. Search results may include links to websites, news stories, images, videos, maps, and information from Wikipedia and other online databases. Results also may show links to similar searches, related people, or posts from online social networks or social media sites.

Because many search engines rely on advertising for revenue, some search results are paid advertisements. Companies and organizations may pay search providers to display links to their websites prominently in the

Internet Research

search results when search text contains words relevant to their products and services. Paid ads often appear at the top or along the side of a search results page. A search results page may display an icon or use shading to specify that the search result is an advertisement.

When evaluating the reliability of search results, consider the sources of the information provided. Specialized information such as medical advice or stock performance should come from recognizable sources in those areas, while you might rely on reviews from customers when selecting a restaurant or purchasing a smartphone.



Source: Google.

Research This: Type each search text phrase listed in the paragraph below into the search boxes in Bing, Google, and Yahoo! and then take a screenshot of the first page of search results from each. Compare them, identifying ads, news, images, videos, social media results, information from online databases, search tools, and common links that both search engines returned. Which search engine's results do you find more useful in each case? Why?

Type the following search text: (1) internet service providers, (2) google corporate headquarters, (3) flights from boston to los angeles, and (4) identity theft.

4 Security

Cybercriminals may lurk in public Wi-Fi hot spots, as you learned in Secure IT 2-1 in this chapter. These thieves also may be on the lookout for customers entering their PIN at keypads near cash registers

or at ATMs. Body heat from fingers touching the keys remains for a short time, and a device with infrared-scanning capabilities can detect which keys are warmer than others. This device, which is readily available for purchase at cell phone accessories stores, snaps on the back of cell phones. It captures the thermal heat signatures, with the most recently touched keys glowing red and the cooler keys glowing light green. The thief, therefore, knows which keys comprise the PIN and the sequence of numbers by looking at the intensity of colors on the infrared scan.

Research This: How much does a thermal imaging cell phone case cost? Which brand of phone is more commonly used to capture thermal imaging? What steps can consumers take to thwart thieves using infrared scanning? Which key materials are less apt to retain the thermal signatures: metal, rubber, or plastic? Researchers from which university published a paper discussing thermal camera-based attacks?

5 Cloud Services

Collaboration and Productivity (SaaS)

Microsoft's Office Online and Google Docs are online productivity suites for creating documents, presentations, spreadsheets, and other projects. Microsoft and Google offer these apps as part of their respective cloud storage services. Because documents are stored on the cloud, you can access them from any computer or device connected to the Internet.

These are examples of SaaS (software as a service), a service of cloud computing that allows access to software using a browser, without the need to install software on a computer or device. As providers update their software, users receive the latest version upon signing in. SaaS apps often allow users to collaborate and share their work with other users. Many providers offer SaaS titles at no cost; others require users to purchase a subscription or pay a fee for the features they use.

Research This: (1) Sign up for accounts on Microsoft OneDrive and Google Drive to create and store documents with Office Online and Google Docs. With each app, create a document, share it with another user, and edit it simultaneously. What is an advantage of sharing documents over sending the files by email to collaborators? (2) How do Microsoft Office Online and Google Docs compare with Microsoft Office installed on your computer? What features are available on the cloud that are not possible on a desktop version?

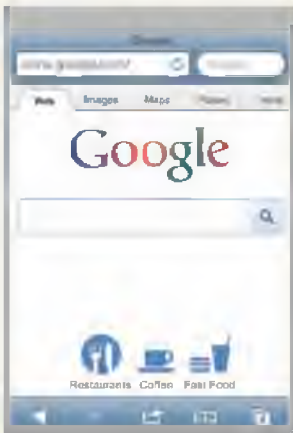
Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Mobile Browser Comparison

Although most mobile devices include a mobile browser, users have the option of downloading and installing other browsers.



Source: Google, Inc.

Do This: Evaluate and compare reviews of at least four mobile browsers, such as Android, Firefox, Opera, Safari, or Silk. Discuss the major differences among the browsers you researched, including number and types of features, which devices are compatible, how they display webpages, security features, and the speed at which they perform. Discuss any experiences you or your classmates have had with various

browsers. Include in your discussion which mobile browser you would recommend and why.

2. Acceptable Use Policy

Most businesses provide Wi-Fi and Internet access, as well as compatible computers or devices, to employees while they are at work. While the intention is for employees to use the Internet for work-related purposes, employees often find it easy to become distracted with other activities on the Internet, such as social media, checking personal email messages, playing games, or visiting websites for entertainment. These activities can degrade Internet access for others or lead to poor performance, as

well as expose the company to malware or other risks. Many businesses create an acceptable use policy (AUP) that outlines how employees should use the Internet. It also may outline consequences for unauthorized Internet use.

Do This: Locate two AUPs published online. Compare the two policies and then create a policy you believe would be fair to employees of a small business. Include guidelines for Internet use during breaks, use of smartphones, and restrictions for using social media.

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The league needs a website. You prepare information about the website to present to the board of directors.

Do This: First, you plan the website by determining its purpose and audience. Use a search engine to locate two sports league websites, and print their home pages. Identify what you like and do not like about each. Think about the design of your website, and select the colors you would recommend. Describe the types of media you would include on the webpage and give specific examples, such as a logo, photos or a slide show, or links to videos. Make a sketch of the home page layout, including navigation, media, and text. Research content management systems. Evaluate whether you could use a preformatted template to meet your needs, and find what types of customization options are available. Determine whether you need a separate ISP for hosting the website, and calculate the costs. List ways you will maintain and update the site content. Compile your findings.

Collaboration

4. Website Evaluation You and three teammates want to open a new chain of fast food sandwich shops. You envision a website that includes a menu, nutritional options, and allergy information, and that has regular promotions and special offers.

Do This: With your teammates, evaluate existing fast food and sandwich websites by comparing the advantages and disadvantages of each. Assign each member the task of evaluating one chain. Team members should print the home page of the assigned website and evaluate each restaurant's website. Pay particular attention to the following areas: (1) design, (2) ease of use, (3) menu, (4) nutritional information, (5) allergy information, (6) special offers, (7) location information and directions, and (8) hours and contact information. Summarize your evaluations and rank the websites in terms of their effectiveness. Be sure to include brief explanations supporting your rankings.

COMPUTERS AND MOBILE DEVICES: Evaluating Options for Home and Work

3



People use or interact with a variety of computers or mobile devices every day.

"I use my laptop at home and school and an all-in-one at work. I send messages and access the Internet on my smartphone, take photos with my digital camera, and read books on my e-book reader. What more do I need to know about computers and mobile devices?"


While you may be familiar with some of the content in this chapter, do you know how to ...

- Protect computers and devices from malware infections?
- Determine which mobile computer, desktop, or mobile device to purchase?
- Safely use an ATM?
- Rent a movie using a DVD kiosk?
- Help eliminate e-waste?
- Use a mobile device safely in a public area?
- Identify a DisplayPort or an HDMI port?
- Pair Bluetooth devices?
- Connect your phone to a Wi-Fi network to save data charges?
- Protect your hardware from theft, vandalism, and failure?
- Prevent technology-related tendonitis or CTS?
- Tell if you are addicted to technology?
- Manage power for your computers and mobile devices

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

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 Objectives

After completing this chapter, you will be able to:

- 1 Describe the characteristics and uses of laptops, tablets, desktops, and all-in-ones
- 2 Describe the characteristics and types of servers
- 3 Differentiate among POS terminals, ATMs, and self-service kiosks
- 4 Describe cloud computing and identify its uses
- 5 Describe the characteristics and uses of smartphones, digital cameras, portable and digital media players, e-book readers, and wearable devices
- 6 Describe the characteristics of and ways to interact with game devices, including gamepads, joysticks and wheels, dance pads, and motion-sensing controllers
- 7 Identify uses of embedded computers
- 8 Differentiate a port from a connector, identify various ports and connectors, and differentiate among Bluetooth, Wi-Fi, and NFC wireless device connections
- 9 Identify safeguards against hardware theft and vandalism and hardware failure
- 10 Discuss ways to prevent health-related injuries and disorders caused from technology use, and describe ways to design a workplace ergonomically

Computers and Mobile Devices



Peripheral Devices

A *peripheral device* is a device you connect to a computer or mobile device to expand its capabilities. Examples include a keyboard, mouse, microphone, monitor, printer, scanner, external hard drive, webcam, and speakers.

As Chapter 1 discussed, a **computer** is an electronic device, operating under the control of instructions stored in its own memory, that can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use. A **mobile device** is a computing device small enough to hold in your hand. Types of computers and mobile devices include laptops, tablets, and desktops; servers and terminals; smartphones, digital cameras, e-book readers, portable and digital media players, and wearable devices; game devices; and embedded computers. Figure 3-1 shows a variety of computers and mobile devices.

In addition to discussing features, functions, and purchasing guidelines of computers and mobile devices, this chapter also presents ways to connect peripheral devices, protect computers and mobile devices from theft and failure, and minimize your health risks while using computers and mobile devices.

Mobile Computers and Desktops

A **mobile computer** is a portable personal computer, such as a laptop or tablet, designed so that a user easily can carry it from place to place, whereas a desktop is designed to be in a stationary location. A *personal computer* (PC) is a mobile computer or desktop that can perform all of its input, processing, output, and storage activities by itself and is intended to be used by one person at a time. Personal computers often are differentiated by the type of operating system they use, with Windows and Mac operating systems leading the market share. Companies such as Acer, Dell, Lenovo, HP (Hewlett-Packard), and Samsung sell personal computers that use the Windows operating system, and Apple sells personal computers that use the Mac operating system. Other operating systems for personal computers include Linux and Chrome OS.

Read Secure IT 3-1 for suggestions about how to avoid malware infections on your computers and mobile devices.



The term PC sometimes is used to describe a computer that runs a Windows operating system.



Figure 3-1 Computers and mobile devices are available in a variety of shapes and sizes.

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SECURE IT 3-1

Avoid Malware Infections

Some websites contain tempting offers to download free games and music, install toolbars that offer convenience, enter contests, and receive coupons on your computers or mobile devices. Danger, however, may lurk in those files, for they secretly could install malware with effects ranging from a mild annoyance to a severe problem such as identity theft. Recall that malware is malicious software that acts without your knowledge and deliberately alters operations of your computer or mobile device. As a general rule, do not install or download unfamiliar software. Follow these guidelines to minimize the chance of your computer or mobile device becoming infected with malware:

- **Social media:** Malware authors often focus on social media, with the goal of stealing personal information, such as passwords, profiles, contact lists, and credit card account details. Their websites urge unsuspecting users to take surveys, tap or click links to obtain free merchandise and games, and download antivirus programs. Ignore these deceitful tactics.
- **Email:** Spam (unsolicited email messages) can be loaded with malware, but even email messages from friends can be a

culprit. If the message does not contain a subject line or contains links or an attachment, exercise caution. One option is to save the attachment to your computer so that antivirus software can scan the file for possible malware before you open it. Your best practice is to avoid opening suspicious messages at all costs.

- **Flash memory storage:** Colleagues and friends may hand you a USB flash drive or memory card with software, photos, and other files. Scan these media with security software before opening any files.
- **Pop-up windows:** At times, a window may open suddenly (called a pop-up window), with a warning that your computer is infected with a virus or that a security breach has occurred, and then make an urgent request to download free software to scan your computer or mobile device and correct the alleged problem. Beware. Many of these offers actually are rogue security software that will infect a computer.
- **Websites:** Websites you visit or pop-up windows may present instructions to download new software or update current programs installed on a computer or mobile device. If you are uncertain of their legitimacy, exit and research the software

by reading reviews online before you decide to install it.

- **Software:** Occasionally, some seemingly safe software attempts to install malware. Even worse, some software touted as offering malware protection actually installs more malware. Always obtain software from reputable sources and, if possible, update software directly from manufacturers' websites. Consider using the custom installation option to ensure that only the desired software is installed. Read the permissions dialog boxes that are displayed on your screen before tapping or clicking the OK or Agree buttons. If you are uncertain about the messages you are viewing, cancel the installation.
- **Smartphones:** Malware creators are targeting smartphones, particularly those using the Android operating system. While an estimated 80 percent of all smartphones are unprotected now, savvy users are obtaining protection from malware attacks. Read reviews before downloading antimalware apps from trusted sources.

Consider This: What online activities might cause malware to be installed on your computer? Which specific websites provide reputable antimalware apps for mobile devices? What new techniques will you use to avoid malware?

CONSIDER THIS

What is inside a personal computer?

The electronic components and circuitry of a personal computer usually are part of or are connected to a motherboard (Figure 3-2). A *motherboard*, sometimes called a system board, is the main circuit board of the personal computer. Many electronic components attach to the motherboard; others are built into it. Two main components on the motherboard are the processor and memory. Many motherboards also integrate sound, video, and networking capabilities. A *processor*, also called a *CPU* (central processing unit), is the electronic component that interprets and carries out the basic instructions that operate a computer. Memory consists of electronic components that store instructions waiting to be executed and data needed by those instructions.

Internet Research

What is a computer chip?

Search for: computer chip



Figure 3-2 Shown here is a partial motherboard in a laptop.

© rawgroup / Fotolia

Laptops, Tablets, and Other Mobile Computers

A **laptop**, also called a *notebook computer*, is a thin, lightweight mobile computer with a screen in its lid and a keyboard in its base (Figure 3-3). Designed to fit on your lap and for easy transport, most laptops weigh up to 7 pounds (varying by manufacturer and specifications) and can be as powerful as the average desktop.

Laptops have input devices, such as a keyboard, touchpad, and webcam; output devices, such as a screen and speakers; a storage device(s), such as a hard drive and maybe an optical disc drive; and usually built-in wireless communications capability. Some laptops have touch screens. Most can operate on batteries or a power supply or both. Read Ethics & Issues 3-1 to consider issues related to laptops and other devices with cameras.



Technology Innovator
Discover More: Visit this chapter's free resources to learn about Samsung (multinational technology company).



Figure 3-3 Traditional laptops weigh more than ultrathin laptops.

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ETHICS & ISSUES 3-1



What Punishment for Webcam Spying Is Appropriate?

Microphones, digital cameras, and webcams have many practical and harmless uses. These technologies also can leave you open to spying. For example, one school district used software, which was supposed to track the school-distributed laptops in case of theft, to take photos and screen captures of students. In another instance, a person noticed that when she gave a customer service rep access to her computer, he turned on her webcam without asking for her permission.

Cybercriminals can use spy tools that take photos, or record video or audio, without turning on a light or other notification that

indicates your camera or microphone is in use. The Flame virus is one way for spy tools to infect your computer. Security experts recommend using a sticker to cover your webcam, and inserting a dummy plug in the microphone port when you are not using it. These technologies also allow people to take photos or videos in a public setting and share them without your knowledge. A director at the American Civil Liberties Union stated that when you are in a public place, people have the right to photograph you. Privacy advocates criticize *Google Street View*, however, which takes images captured using moving vehicles equipped with GPS and cameras and then creates a

panoramic view of an area, including people entering and exiting buildings or relaxing on a beach.

Many states' laws do not cover these types of acts. Massachusetts, however, recently passed a law that made secretly taking photos or videos that focused on people's private body parts a criminal offense. Lawmakers continue to debate and expand current laws, as well as pass new ones.

Consider This: Should webcam spying punishments be comparable to other types of spying? Why or why not? What kind of privacy should you expect when you are in a public place?

Ultrathin laptops weigh less than traditional laptops, usually have a longer battery life, and generally run the Windows operating system. In order to minimize their thickness, many ultrathin laptops have fewer ports than traditional laptops, do not include an optical disc drive, and often require the use of special dongles to attach cables that connect to external displays or a network. (Recall that a dongle is a small device that connects to a computer and enables additional functions when attached.)



Ultrabooks
An ultrathin laptop that uses a low-power Intel processor often is called an *ultrabook*.

Tablets Usually smaller than a laptop but larger than a phone, a **tablet** is a thin, lighter-weight mobile computer that has a touch screen.

Two popular form factors (shapes and sizes) of tablets are the slate and convertible (Figure 3-4). Resembling a letter-sized pad, a *slate tablet* is a type of tablet that does not contain a physical keyboard. A *convertible tablet* is a tablet that has a screen in its lid and a keyboard in its base, with the lid and base connected by a swivel-type hinge. You can use a convertible tablet like a traditional laptop, or you can rotate the display and fold it down over the keyboard so that it looks like a slate tablet. As with laptops, tablets run on batteries or a power supply or both; however, batteries in a tablet typically last longer than those in laptops.

Some tablets include a *stylus*, which looks like a small ink pen, that you can use instead of a fingertip to enter data, make selections, or draw on a touch screen. A stylus may include buttons you can press to simulate clicking a mouse. As an alternative to interacting with the touch screen, some users prefer to purchase a separate physical keyboard that attaches to or wirelessly communicates with the tablet (shown with the slate tablet in Figure 3-4).

Tablets are useful especially for taking notes in class, at meetings, at conferences, and in other forums where the standard laptop is not practical. Because slate tablets can have a more durable construction, they often are used in the medical field and other areas where exposure to germs, heat, humidity, dust, and other contaminants is greater.



BTW

Pens

Some tablet manufacturers refer to a stylus as a pen.



Figure 3-4 Examples of slate and convertible tablets.

Courtesy of Microsoft; © iStockPhoto / rasslava



CONSIDER THIS

What is a phablet?

Some manufacturers use the term, *phablet*, to refer to a device that combines features of a smartphone with a tablet (Figure 3-5). These devices are larger than smartphones but smaller than full-sized tablets. The screen on a phablet usually measures five to seven inches diagonally. Some include a stylus.



Figure 3-5 A phablet combines features of a smartphone and a tablet.

© iStockPhoto / Krystian Nawrocki

Handheld Computers

A *handheld computer* is a computer small enough to fit in one hand. Many handheld computers communicate wirelessly with other devices or computers. Some handheld computers have miniature or specialized keyboards. Others have a touch screen and also include a stylus for input.

Many handheld computers are industry-specific and serve the needs of mobile employees, such as parcel delivery people or warehouse employees (Figure 3-6), whose jobs require them to move from place to place. Handheld computers often send data wirelessly to central office computers.



Figure 3-6 This handheld computer is a lightweight computer that enables warehouse employees to take inventory and check supplies.

© iStockphoto / Ermin Gutenberger

Mini Feature 3-1: Mobile Computer Buyer's Guide


If you need computing capability while traveling and during lectures or meetings, you may find a laptop or tablet to be an appropriate choice. Read Mini Feature 3-1 for tips to consider when purchasing a mobile computer.

MINI FEATURE 3-1

Mobile Computer Buyer's Guide

With the abundance of mobile computer manufacturers, research each before making a purchase. The following are purchasing considerations unique to mobile computers.



- Determine which mobile computer form factor fits your needs.** Consider a tablet or ultrathin laptop if you require a lightweight device and the most mobility. If you require additional ports or want the computer's capabilities to be more comparable to a desktop, consider purchasing a traditional laptop.
 - Consider a mobile computer with a sufficiently large screen.** Laptops and tablets are available with various screen sizes. For example, most traditional and ultrathin laptop screens range in size from 11 to 18 inches, while most tablet screens range in size from 7 to 12 inches.
 - Experiment with different keyboards and pointing devices.** Mobile computers often vary in size, and for that reason have different keyboard layouts. Familiarize yourself with the keyboard layout of the computer you want to purchase, and make sure it is right for you. If you have large fingers, for example, you should not purchase a computer with a small, condensed keyboard. Laptops typically include a touchpad to control the pointer. Tablets have a touch screen and an on-screen keyboard.
 - Consider processor, memory, and storage upgrades at the time of purchase.** As with a desktop, upgrading a mobile computer's memory and internal storage may be less expensive at the time of initial purchase. Some internal storage is custom designed for mobile computer manufacturers, meaning an upgrade might not be available in the future.
 - The availability of built-in ports and slots is important.** Determine which ports and slots (discussed later in this chapter) you require on the mobile computer. If you plan to transfer photos from a digital camera using a memory card, consider a mobile computer with a built-in card slot compatible with your digital camera's memory card. If you plan to connect devices such as a printer or USB flash drive to your mobile computer, consider purchasing one with a sufficient number of USB ports. In addition, evaluate mobile computers with ports enabling you to connect an external monitor.
 - If you plan to use your mobile computer for a long time without access to an electrical outlet, or if the battery life for the mobile computer you want to purchase is not sufficient, consider purchasing a second battery.** Some mobile computers, such as most tablets and ultrathin laptops, have built-in batteries that can be replaced only by a qualified technician. In that case, you might look into options for external battery packs or power sources.
 - Purchase a well-padded and well-designed carrying case that is comfortable and ergonomic.** An amply padded carrying case will protect your mobile computer from the bumps it may receive while traveling. A well-designed carrying case will have room for accessories such as USB flash drives, pens, and paperwork. Although a mobile computer may be small enough to fit in a handbag, make sure that the bag has sufficient padding to protect the computer. Test the carrying case with the laptop inside to ensure it is comfortable and ergonomic.
 - If you plan to connect your mobile computer to a video projector, make sure the mobile computer is compatible with the video projector.** You should check, for example, to be sure that your mobile computer will allow you to display an image on the screen and projection device at the same time. Also, ensure that the mobile computer has the ports required or that you have the necessary dongle and cables to connect to the video projector.
Discover More: Visit this chapter's free resources to learn more about mobile computer manufacturers, form factors, screens, keyboards, pointing devices, upgrades, batteries, carrying cases, and video projectors.
-  **Consider This:** Based on your current computing needs, should you purchase a traditional laptop, ultrathin laptop, or tablet? What are the specifications of the mobile computer you would purchase?



BTW

Monitor Speakers

Many monitors have integrated speakers.



BTW

Technology Innovators

Discover More: Visit this chapter's free resources to learn about Dell and its founder, Michael Dell

Desktops and All-in-Ones

A **desktop**, or desktop computer, is a personal computer designed to be in a stationary location, where all of its components fit on or under a desk or table (Figure 3-7). Components that typically occupy space outside of a desktop include peripheral devices such as a keyboard, mouse, and webcam (input devices); speakers and printer (output devices); external hard drive (storage device); and possibly a router and/or modem (communications devices). Depending on the form factor of the desktop, it may also require an external monitor.

Some people use the term, *system unit*, to refer to the case that contains and protects the motherboard, internal hard drive, memory, and other electronic components of the computer from damage. A desktop may have a system unit tower that is a separate device from a monitor. A *tower*, which is made of metal or plastic, is a frame that houses the system unit on a desktop. Towers are available in a variety of form factors. Although they can range in height from 12 inches to 30 inches or more, the trend is toward smaller desktop tower form factors. An **all-in-one** (AIO) or *all-in-one desktop*, by contrast, does not have a tower and instead houses the display, system unit, and possibly an optical drive, in the same case.



Figure 3-7 The desktop with a tower shown in this figure is a Windows computer, and the all-in-one is a Mac computer.

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CONSIDER THIS

Who uses desktops?

Home and business users who do not require the portability of a mobile computer may work with desktops for their everyday computing needs. Gaming enthusiasts often choose a *gaming desktop*, which offers high-quality audio, video, and graphics with optimal performance for sophisticated single-user and networked or Internet multiplayer games. Power users may work with a high-end desktop, sometimes called a *workstation*, that is designed to handle intense calculations and sophisticated graphics. For example, architects use powerful desktops to design buildings and homes, and graphic artists use them to create computer-animated special effects for full-length motion pictures and video games. Some users configure a desktop to function as a server on a network (servers are discussed later in this chapter).

Internet Research

Which movies use computer animation?

Search for: movies using computer animation

Mini Feature 3-2: Desktop Buyer's Guide

Desktops are a suitable option if you work mostly in one place and have plenty of space in a work area. Read Mini Feature 3-2 for tips to consider when purchasing a desktop.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn how touch screens use capacitive, resistive, surface wave, and other technologies to sense touch.

MINI FEATURE 3-2

Desktop Buyer's Guide

Today, desktop manufacturers emphasize desktop style by offering bright colors, trendy displays, and theme-based towers so that the computer looks attractive if it is in an area of high visibility. If you have decided that a desktop is most suited to your technology needs, the next step is to determine specific software, hardware, peripheral devices, and services to purchase, as well as where to buy the computer. The following considerations will help you determine the appropriate desktop to purchase.



- 1. Determine the specific software to use on the desktop.** Decide which software contains the features necessary for the tasks you want to perform. Your hardware requirements depend on the minimum requirements of the software you plan to use on the desktop.
- 2. Know the system requirements of the operating system.** Determine the operating system you want to use because this also dictates hardware requirements. If, however, you purchase a new desktop, chances are it will include the latest version of your preferred operating system (Windows, Mac OS, or Linux).
- 3. Look for bundled software.** Purchasing software at the same time you purchase a desktop may be less expensive than purchasing the software at a later date.
- 4. Avoid purchasing the least powerful desktop available.** Technology changes rapidly, which means a desktop that seems powerful enough today may not serve your computing needs in the future. Purchasing a desktop with the most memory, largest hard drive capacity, and fastest processor you can afford will help delay obsolescence.
- 5. Consider upgrades to the keyboard, mouse, monitor, printer, microphone, and speakers.** You use these peripheral devices to interact with the desktop, so make sure they meet your standards.
- 6. Consider a touch screen monitor.** A touch screen monitor will enable you to interact with the latest operating systems and apps using touch input.
- 7. Evaluate all-in-ones, which may be less expensive than purchasing a tower and monitor separately.** In addition, all-in-ones take up less space and often look more attractive than desktops with separate towers.
- 8. If you are buying a new desktop, you have several purchasing options:** buy directly from a school bookstore, a local computer dealer, or a large retail store, or order from a vendor by mail, phone, or the web. Each purchasing option has its advantages. Explore each option to find the best combination of price and service.
- 9. Be aware of additional costs.** Along with the desktop itself, you also may need to make extra purchases. For example, you might purchase computer furniture, an uninterruptible power supply (UPS) or surge protector (discussed later in the chapter), an external hard drive, a printer, a router, or a USB flash drive.
- 10. If you use your computer for business or require fast resolution of major computer problems, consider purchasing an extended warranty or a service plan through a local dealer or third-party company.** Most extended warranties cover the repair and replacement of computer components beyond the standard warranty.

Discover More: Visit this chapter's free resources to learn more about desktop manufacturers, software, upgrades, touch screen monitor options, all-in-ones, hidden costs, and warranties.

Consider This: Shop around for a desktop that meets your current needs. Which desktop would you purchase? Why?

**Table 3-1 Dedicated Servers**

Type	Main Service Provided
Application server	Stores and runs apps
Backup server	Backs up and restores files, folders, and media
Database server	Stores and provides access to a database
Domain name server	Stores domain names and their corresponding IP addresses
File server (or storage server)	Stores and manages files
FTP server	Stores files for user upload or download via FTP
Game server	Provides a central location for online gaming
Home server	Provides storage, Internet connections, or other services to computers and devices in a household
List server	Stores and manages email lists
Mail server	Stores and delivers email messages
Network server	Manages network traffic
Print server	Manages printers and documents being printed
Web server	Stores and delivers requested webpages to a computer via a browser

© Cengage Learning

storage, and network connections. Depending on its function, a server may or may not require a monitor or an input device. Some servers are controlled from remote computers. Form factors for servers include rack server, blade server, and tower server, which are shown in Figure 3-8 and briefly described below.

**Figure 3-8** Shown here are a rack server, blade server, and tower server.

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Servers

A **server** is a computer dedicated to providing one or more services to other computers or devices on a network. Services provided by servers include storing content and controlling access to hardware, software, and other resources on a network. In many cases, a server accesses data, information, and programs on another server. In other cases, personal computers, devices, or terminals (discussed in the next section) access data, information, and programs on a server. Servers can support from two to several thousand connected computers or devices at the same time.

Some servers, called dedicated servers, perform a specific service and can be placed with other dedicated servers to perform multiple services (Table 3-1). Each type of dedicated server uses software designed specifically to manage its service. Dedicated servers typically require a faster processor, more memory, and additional storage.

Servers typically include a processor, memory,

- A *rack server*, sometimes called a rack-mounted server, is a server that is housed in a slot (bay) on a metal frame (rack). A rack can contain multiple servers, each in a different bay. The rack is fastened in place to a flat surface.
- A *blade server* is a server in the form of a single circuit board, or blade. The individual blades insert in a blade server chassis that can hold many blades. Like a rack server, the chassis is fastened in place to a flat surface.
- A *tower server* is a server built into an upright cabinet (tower) that stands alone. The tower can be similar in size and shape to a desktop tower or larger.

CONSIDER THIS

Which server should you use?

Home or small business users and organizations with ample floor space often choose tower servers. (Some home users even use a desktop tower or powerful laptop to act as a home server.) Data centers and other organizations looking to conserve floor space often choose rack servers or blade servers. Organizations that require a large quantity of servers usually opt for blade servers.

Some organizations use virtualization to improve utilization of technology. *Virtualization* is the practice of sharing or pooling computing resources, such as servers and storage devices. *Server virtualization* uses software to enable a physical server to emulate the hardware and computing capabilities of one or more servers, known as virtual servers. Users can use software to configure the storage, processing power, memory, operating system, and other characteristics of virtual servers. From the end user's point of view, a virtual server behaves just like a physical server. The advantages are that a virtual server can be created and configured quickly, does not require a new physical server, and is easier to manage. Cloud computing, discussed later in this chapter, uses server virtualization.

Major corporations use server farms, mainframes, or other types of servers for business activities to process everyday transactions (Figure 3-9). A *server farm* is a network of several servers together in a single location. Server farms make it possible to combine the power of multiple servers. A *mainframe* is a large, expensive, powerful server that can handle hundreds or thousands of connected users simultaneously. Enterprises use server farms, mainframes, or other large servers to bill millions of customers, prepare payroll for thousands of employees, and manage millions of items in inventory.



Figure 3-9 Server farms and mainframes can handle thousands of connected computers and process millions of instructions per second.

© Sashkin / Shutterstock.com

Terminals

A *terminal* is a computer, usually with limited processing power, that enables users to send data to and/or receive information from a server, or host computer. The host computer processes the data and then, if necessary, sends information (output) back to the terminal. Terminals may include a monitor and/or touch screen, keyboard, and memory.

A *thin client* is a terminal that looks like a desktop but has limited capabilities and components. Because thin clients typically do not contain a hard drive, they run programs and access data on a network or the Internet. Public locations, such as libraries and schools, and enterprises sometimes use thin clients because they cost less, are easier to maintain, last longer, use less power, and are less susceptible to malware attacks than desktops.

Special-purpose terminals perform specific tasks and contain features uniquely designed for use in a particular industry. Three widely used special-purpose terminals are point-of-sale (POS) terminals, ATMs, and self-service kiosks.

Point-of-Sale Terminals

The location in a retail or grocery store where a consumer pays for goods or services is the point of sale (POS). Most retail stores use a *POS terminal* to record purchases, process credit or debit cards, and update inventory.



Figure 3-10 Many grocery stores offer self-service checkouts, where consumers use POS terminals to scan purchases, scan their store or saver card and coupons, and then pay for the goods.

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Technology Trend

Discover More: Visit this chapter's free resources to learn about Bitcoin (digital currency).



Figure 3-11 An ATM is a self-service banking terminal that allows customers to access their bank accounts.

© bankerwin / Fotolia

In a grocery store, the POS terminal is a combination of an electronic cash register, bar code reader, and printer (Figure 3-10). A *bar code reader* is an input device that uses laser beams to read bar codes on products. When the checkout clerk or customer scans the bar code on the grocery item, the computer uses the manufacturer name and item numbers to look up the price of the item and the complete product name. Then, the price of the item shows on the display device, the name of the item and its price print on a receipt, and the item being sold is recorded so that the inventory can be updated. Thus, the output from a POS terminal serves as input to other computers to maintain sales records, update inventory, verify credit, and perform other activities associated with the sales transactions that are critical to running the business. Some POS terminals are Internet capable, which allows updates to inventory at geographically separate locations.

Many POS terminals handle credit card or debit card payments. After swiping your card through the reader, the POS terminal connects to a system that authenticates the purchase. Once the transaction is approved, the terminal prints a receipt for the customer.

ATMs

An *ATM* (automated teller machine) is a self-service banking terminal that connects to a host computer through a network (Figure 3-11). Banks place ATMs in public locations, including grocery stores, convenience stores, retail outlets, shopping malls, sports and concert venues, and gas stations, so that customers can access their bank accounts conveniently.

Using an ATM, people withdraw and deposit money, transfer funds, or inquire about an account balance. Some ATMs have a touch screen; others have special buttons or keypads for entering data. To access a bank account, you insert a plastic bank card in the ATM's card reader. The ATM asks you to enter a numeric password, called a *PIN* (personal identification number), which verifies that you are the holder of the bank card. When your transaction is complete, the ATM prints a receipt for your records. Read Secure IT 3-2 for ATM safety tips.

SECURE IT 3-2

ATM Safety

Visiting an ATM to withdraw or deposit money is convenient, but it also is ripe with potential for criminal activity. Avoid being a victim by exercising common sense and following these guidelines.

- **Location:** Choose an ATM in a well-lit public area away from bushes and dividers and near the entrance of a building. If using a drive-up ATM, keep the engine running and doors locked, roll windows up while waiting for the ATM to process your request, and leave adequate room to maneuver between your vehicle and the one in the lane in front of you. Observe your surroundings and be suspicious of people sitting in vehicles or loitering nearby.
- **ATM card and PIN:** Handle the ATM card like cash by keeping it in a safe location and storing it in a protective sleeve. Do not write the PIN on the back of the card or store it in a text file on your smartphone; instead, memorize the numbers. (For information about password manager apps, read Secure IT 5-3 in Chapter 5.) Report a lost or stolen card immediately.
- **Transaction:** Minimize time by having the ATM card ready as you approach the machine. Do not allow people to watch your activity. Cover the keypad or screen with one hand as you enter the PIN, and use your body to block as much of the area as possible. If the ATM screen appears different, behaves unusually, or offers options with which you are unfamiliar or uncomfortable, cancel the transaction and leave the area.
- **Be suspicious of skimmers:** Thieves can capture a credit card number and PIN by placing a *skimmer* on an ATM (shown in the figure) or on other self-service stations, such as gas pumps, where users swipe their credit cards for payment. Sophisticated skimmers are Bluetooth enabled or are entire panels placed directly on top of the ATM faces and are virtually undetectable. Less-technical devices are false card readers secured to the card slot with double-sided tape and a hidden camera or an overlay on the keypad. Many ATMs have security stickers informing customers to notify attendants if the seal is broken.
- **Valuables:** Expensive clothes and jewelry can be incentives to potential assailants. Dress modestly and leave jewels at home.
- **Exiting:** Do not count cash in public; immediately put it in your pocket or fold it in your hand. If you receive a receipt, take



it with you and do not discard it in a trash can near the area. As you leave, be certain you are not being followed. If you suspect someone is tracking you, immediately walk to a populated area or business, or drive to a police or fire station.

- **Statements:** Review your balances and bank statements frequently. Be certain all deposits and withdrawals are listed, and look for unusual or unfamiliar activity.
- **Consider This:** Which of these tips do you follow, and how will you change your behavior the next time you visit an ATM or other self-service stations? Which ATMs in your neighborhood appear to be in safe locations?

Self-Service Kiosks

A self-service *kiosk* is a freestanding terminal that usually has a touch screen for user interaction. Table 3-2 identifies several widely used self-service kiosks. Because users interact with self-service kiosks independently, without a salesperson nearby, it is important the kiosk is simple and easy to use. In many cases, a web app or mobile app can extend or enhance the capability of the kiosk. For example, you can reserve an item via the app on a computer or mobile device and then use the kiosk to finalize the transaction.

Internet Research

What is a mobile boarding pass?
Search for: mobile boarding pass

Table 3-2 Self-Service Kiosks

Type	Typical Services Provided
Financial kiosk	Pay bills, add minutes to phone plans, add money to prepaid cards, and perform other financial activities.
Photo kiosk	Print photos from digital images. Some allow editing of digital photos. Users may print directly at the kiosk or may send an order to a photo lab to be printed.
Ticket kiosk	Print tickets. Located in airports, amusement parks, movie theaters, rental companies, and train stations.
Vending kiosk	Dispense item after payment is received. Examples include DVD rentals and license plate renewals.
Visitor kiosk	Manage and track visitors upon check-in. Located in businesses, schools, hospitals, and other areas where access is controlled or registration is required.



Figure 3-12 A DVD kiosk is a self-service DVD rental terminal.

Courtesy of Redbox

A *DVD kiosk*, for example, is a self-service DVD rental machine that connects to a host computer through a network (Figure 3-12). DVD kiosks are associated with a particular vendor. To rent a movie online, for example, a customer establishes an account or connects to an existing account on the vendor's website, selects the desired movie, and then chooses a nearby DVD kiosk where the movie will be picked up. Customers also usually can select movies directly at the DVD kiosk via a touch screen or some other input device on the kiosk. After presenting identifying information and swiping a credit card through the reader, the DVD kiosk dispenses the rented movie to the customer. The customer returns it to any of the vendor's nationwide DVD kiosks, at which time the customer's account is charged a fee based on the time elapsed.

Supercomputers

A *supercomputer* is the fastest, most powerful computer — and the most expensive (Figure 3-13). Supercomputers are capable of processing many trillions of instructions in a single second. With weights that exceed 100 tons, these computers can store more than 20,000 times the data and information of an average desktop.

Applications requiring complex, sophisticated mathematical calculations use supercomputers. For example, large-scale simulations and applications in medicine, aerospace, automotive design, online banking, weather forecasting, nuclear energy research, and petroleum exploration use a supercomputer.

Internet Research

How is the fastest supercomputer used?

Search for: fastest supercomputer



Figure 3-13 Supercomputers can process more than one quadrillion instructions in a single second

Los Alamos National Laboratory

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Computers and Mobile Devices, Mobile Computers and Desktops, Servers, Terminals, and Supercomputers, as it relates to the chapter objectives.

Now you should know . . .

- What you should consider when purchasing a desktop or mobile computer (Objective 1)
- When you would use specific types of servers (Objective 2)
- How you use a POS terminal, ATM, and self-service kiosk (Objective 3)

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Cloud Computing

Cloud computing refers to an environment that provides resources and services accessed via the Internet (Figure 3-14). Resources include email messages, schedules, music, photos, videos, games, websites, programs, web apps, servers, storage, and more. Services include accessing software, storing files online, and configuring an environment of servers for optimal performance. That is, instead of accessing these resources and services locally, you access them on the cloud. For example, you use cloud computing capabilities when you store or access documents, photos, videos, and other media online; use programs and apps online (i.e., email, productivity, games, etc.); and share ideas, opinions, and content with others online (i.e., online social networks).



The Cloud

The cloud-shaped symbol, which today universally represents cloud computing, stems from early diagrams that visually portrayed the Internet as a cloud, intangible and widespread.

Figure 3-14 Users access resources on the cloud through their Internet connections.

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Businesses use cloud computing to more efficiently manage resources, such as servers and programs, by shifting usage and consumption of these resources from a local environment to the Internet. For example, an employee working during the day in California could use computing resources located in an office in Paris that is closed for the evening. When the company uses the computing resources, it pays a fee that is based on the amount of computing time and other resources it consumes, much in the way that consumers pay utility companies for the amount of electricity used.

Cloud computing allows a company to diversify its network and server infrastructure. Some cloud computing services automatically add more network and server capacity to a company's website as demand for services of the website increases. The network and server capacity may be duplicated around the world so that, for example, an outage of a single server does not affect the company's operations.

Internet Research

How secure is the cloud?

Search for: cloud privacy issues



CONSIDER THIS

Are all cloud services available to everyone?

Some cloud services are public and others are private. A public cloud is made available free or for a fee to the general public or a large group, usually by a cloud service provider. A private cloud is dedicated to a single organization. Some cloud services are hybrid, combining two or more cloud types.

Discover More: Visit this chapter's free resources to learn more about business uses of cloud computing and cloud service providers.

Mobile Devices

A mobile device is a computing device small enough to hold in your hand. Because of their reduced size, the screens on mobile devices are small — often between 3 and 5 inches. Popular types of mobile devices are smartphones, digital cameras, portable and digital media players, e-book readers, and wearable devices. Read Ethics & Issues 3-2 to consider issues related to recycling computers and mobile devices.

ETHICS & ISSUES 3-2



Should Recycling of Electronics Be Made Easier?

As technology advances and prices fall, many people think of computers and mobile devices as disposable. Worldwide, consumers generate an estimated 20 to 50 million tons of e-waste annually. (Recall that e-waste consists of discarded computers and mobile devices.) E-waste releases lead, mercury, barium, and other elements into soil and water.

Electronics recycling is known as eCycling. Only about 12 percent of e-waste is eCycled. Electronics recycling can take several forms: reusing parts; creating new products from old products; or melting down or reducing parts to basic elements or materials.

Many not-for-profit organizations, retail websites, mobile service providers, and big box retailers offer reselling and eCycling options. Several electronics companies allow you to trade your device for a gift certificate. The Sustainable Materials Management (SMM) Electronics Challenge promotes eCycling by certifying recycling businesses that meet or pass qualification guidelines. Other companies focus exclusively on eCycling. One business has developed automated kiosks that tell you what your device is worth, connect you to a buyer, take your device, and dispense cash back on the spot. The U.S. Environmental Protection Agency (EPA) lists eCycling, reselling, and donation resources on its website.

A large amount of e-waste pollutes developing countries that may accept the materials for profit. A proposed federal bill, supported by many electronics manufacturers and resellers, makes it illegal for companies to export e-waste to developing countries. Currently, several states have laws that mandate eCycling.

Consider This: Should the government, manufacturers, or users be responsible for recycling of obsolete equipment? Why? What impact does exporting toxic waste have on developing nations? Should the state or federal government mandate an eCycling program for electronics? Why or why not?

Smartphones

A **smartphone** is an Internet-capable phone that usually also includes a calendar, an address book, a calculator, a notepad, games, browser, and numerous other apps. In addition to basic phone capabilities, many smartphones include these features:

- Send and receive email messages and access the web — via Wi-Fi or a mobile data plan
- Communicate wirelessly with other devices or computers
- Function as a portable media player
- Include a built-in digital camera
- Talk directly into the smartphone’s microphone or into a Bluetooth headset that wirelessly communicates with the phone
- Conduct live video calls, where the parties can see each other as they speak
- Receive GPS signals to determine a user’s current location
- Synchronize data and information with a computer or another mobile device
- Support voice control so that you can speak instructions to the phone and it speaks responses back to you
- Connect to external devices wirelessly, such as via BlueTooth
- Serve as a wireless access point

Many smartphones have touch screens. Instead of or in addition to an on-screen keyboard, some have a built-in mini keyboard on the front of the phone or a keyboard that slides in and out from behind the phone. Others have keypads that contain both numbers and letters. Some also include a stylus.


CONSIDER THIS

How do you type text messages on a phone that has only a numeric keypad and no touch screen?

Each key on the keypad represents multiple characters, which are identified on the key. For example, the 2 key on the phone’s keypad displays the letters a, b, and c on the key’s face. On many phones, you cycle through the number, letters, and other symbols associated with a particular key by pressing a key on the keypad multiple times. To type the word, hi, for instance, you would press the 4 key (labeled with the letters g, h, and i) twice to display the letter h, pause momentarily to advance the cursor, and then press the 4 key three times to display the letter i.

A variety of options are available for typing on a smartphone (Figure 3-15). Many can display an *on-screen keyboard*, where you press keys on the screen using your fingertip or a stylus. Some phones support a *swipe keyboard app*, on which users enter words by tracing a path on an on-screen keyboard with their fingertip or stylus from one letter to the next in a continuous motion. With other phones, you press letters on the phone’s keyboard or keypad. Some phones use *predictive text*, where you press one key on the keyboard or keypad for each letter in a word, and software on the phone predicts the word you want. Swipe keyboard apps and predictive text save users time when entering text on the phone.



 **Figure 3-15** A variety of options for typing on a smartphone.

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Instead of typing on a phone's keyboard or keypad, users can enter text via a *portable keyboard*, which is a full-sized keyboard that communicates with a smartphone via a dock, cables, or wirelessly. Some portable keyboards physically attach to and remove from the device; others are wireless. Another option is a *virtual keyboard* that projects an image of a keyboard on a flat surface. Finally, some phones work with apps that convert your spoken word to text.

Messaging Services With messaging services, users can send and receive messages to and from smartphones, mobile phones, handheld game devices, other mobile devices, and computers. The type of messages you send depends primarily on the services offered by the mobile service provider that works with the phone or other mobile device you select. Many users have unlimited wireless messaging plans, while others pay a fee per message sent or received. Messaging services include text and picture/video.

With text messaging service, or *SMS (short message service)*, users can send and receive short text messages, typically fewer than 300 characters, on a phone or other mobile device or computer. Text message services typically provide users with several options for sending and receiving messages, including:

- **Mobile to mobile:** Send a message from your mobile device to another mobile device.
- **Mobile to email:** Send a message from your mobile device to any email address.
- **Mobile to provider:** Send a message by entering a *common short code (CSC)*, which is a four- or five-digit number assigned to a specific content or mobile service provider, sometimes followed by the message, for example, to a vote for a television program contestant or donate to a charity.
- **Web to mobile:** Send a message from a website to a mobile device or notification from a website to a mobile device with messages of breaking news and other updates, such as sports scores, stock prices, weather forecasts, incoming email messages, game notifications, and more.



CONSIDER THIS

What is the difference between push and pull notifications?

A *push notification*, sometimes called a server push, is a message that initiates from the sending location (such as a server) without a request from the receiver. With a *pull notification*, by contrast, receiver requests information from the sending location.

With picture messaging service, users can send photos and audio files, as well as short text messages, to a phone or other mobile device or computer. With video messaging services, users can send short video clips, usually about 30 seconds in length, in addition to all picture messaging services. Smartphones and other mobile devices with picture/video messaging services, also called *MMS (multimedia message service)*, typically have a digital camera built into the device. Users who expect to receive numerous picture/video messages should verify the phone has sufficient memory. Picture/video message services typically provide users these options for sending and receiving messages:

- **Mobile to mobile:** Send the picture/video from your mobile device to another mobile device.
- **Mobile to email:** Send the picture/video from your mobile device to any email address.

If you send a picture message to a phone that does not have picture/video messaging capability, the phone usually displays a text message directing the user to a webpage that contains the picture/video message. Some online social networks allow you to send a picture/video message directly to your online profile.



CONSIDER THIS

Do you need a messaging service to send a text or picture/video message?

Instead of using a messaging plan from your mobile service provider, you can use a mobile messaging app to send and receive text, picture, and other message from users. Many messaging apps also provide group chat capabilities. Most messaging apps can be downloaded to your mobile device at no cost.

Internet Research

What messaging apps are recommended?

Search for: best messaging apps

Voice mail, which functions much like an answering machine, allows someone to leave a voice message for one or more people. Unlike answering machines, however, a computer in the voice mail system converts an analog voice message into digital form. Once digitized, the message is stored in a voice mailbox. A voice mailbox is a storage location on a hard drive in the voice mail system. To help users manage voice mail messages, some systems offer visual voice mail. With *visual voice mail*, users can view message details, such as the length of calls and, in some cases, read message contents instead of listening to them. Some voice mail systems can convert a voice mail message to a text message for display on a computer or mobile device, such as a smartphone, which you then can manage like any other text message.

Messaging services and voice mail systems also may be able to send messages to groups of phone numbers or email addresses. Read Secure IT 3-3 for tips about safely using smartphones and other mobile devices in public.

Discover More: Visit this chapter's free resources to learn more about speech to text.



Analog vs. Digital
Human speech is analog because it uses continuous (wave form) signals that vary in strength and quality. Most computers and electronic devices are digital, which use only two discrete states: on and off.

SECURE IT 3-3



Safe Mobile Device Use in Public Areas

Sending a text message, updating a Facebook status, posting a Tweet, selecting a new playlist, and checking email messages are tasks you may perform using a mobile device many times each day. They all require some concentration as you focus on the device, usually while looking downward, and they distract you from events occurring around you. Using technology responsibly and safely can prevent theft and injuries.

One common method of thwarting a smartphone thief is to avoid using the phone to check the time. Potential thieves randomly ask people for the correct time. If a person stops and takes a phone out of a pocket or purse, the thief glances at the make and model and decides if it is worth snatching.

Bus stops and train stations are common places for mobile device theft. People in these locations tend to use their smartphones to check schedules, send text messages, and make phone calls. Headphones and earbuds are giveaways that you are using a mobile device and may not be focused on your surroundings. Recent studies show that more than 100 mobile phones are stolen every minute in the United States. Thieves are likely to snatch the devices while the doors are closing just before the train or bus departs from a station so that the victim is unable to pursue the thief. To decrease the chance of theft or pickpocketing, keep your mobile device(s) in a front pocket or in a zippered backpack. Keep your head up and stay aware of your surroundings. If possible, when in public, avoid using accessories that

indicate the type of device to which they are connected.

Cognitive psychologists have studied the effects of inattention blindness, which occurs when a person's attention is diverted while performing a natural activity, such as walking. The researchers have determined that diverted attention is particularly pronounced when people are talking on a mobile phone and, to a lesser extent, using a portable media player. Emergency room reports indicate that distracted walking accidents are on the rise, especially when people trip over cracks in sidewalks or run into fixed objects, such as parked cars and telephone poles.

Consider This: Do you know anyone who has had a mobile device stolen? If so, how did the theft occur? Have you ever experienced inattention blindness or distracted walking?

Digital Cameras

A **digital camera** is a mobile device that allows users to take photos and store the photographed images digitally. A *smart digital camera* also can communicate wirelessly with other devices and can include apps similar to those on a smartphone. Mobile computers and devices, such as smartphones and tablets, often include at least one integrated digital camera.

CONSIDER THIS

Do you need a digital camera if you have a camera built into your mobile phone?

If you use a camera only for posts on social media sites, then you may choose to use your mobile phone's built-in camera. If, however, you want increased zoom capabilities, more powerful flash, image stabilization, manual control of settings, and to reduce the drain on your phone's battery, then you may want to opt for a separate digital camera.

In addition to cameras built into phones and other devices, types of digital cameras include point-and-shoot cameras and SLR cameras (Figure 3-16). A *point-and-shoot camera* is an affordable and lightweight digital camera with lenses built into it and a screen that displays an approximation of the image to be photographed. Point-and-shoot cameras, which range in size and features, provide acceptable quality photographic images for the home or small office user. An *SLR camera* (single-lens reflex camera), by contrast, is a high-end digital camera that has interchangeable lenses and uses a mirror to display on its screen an exact replica of the image to be photographed. SLR cameras are much heavier and larger than point-and-shoot cameras. They also can be quite expensive, with a variety of available lens sizes and other attachments.



Figure 3-16 SLR digital cameras have lenses and other attachments, whereas the lenses on point-and-shoot cameras are built into the device. Many smartphones also have built-in digital cameras.

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 Courtesy of Samsung

Most point-and-shoot cameras include zoom and autofocus capability, use a built-in flash, store images on memory cards, and enable you to view and sometimes edit images directly on the camera. Many can take video in addition to still photos. Some are equipped with GPS, giving them the capability to record the exact location where a photo was taken and then store these details with the photo. Others are waterproof. Figure 3-17 illustrates how a point-and-shoot digital camera might work.

Internet Research

What is an SD card?
 Search for: sd card information

How a Digital Camera Might Work

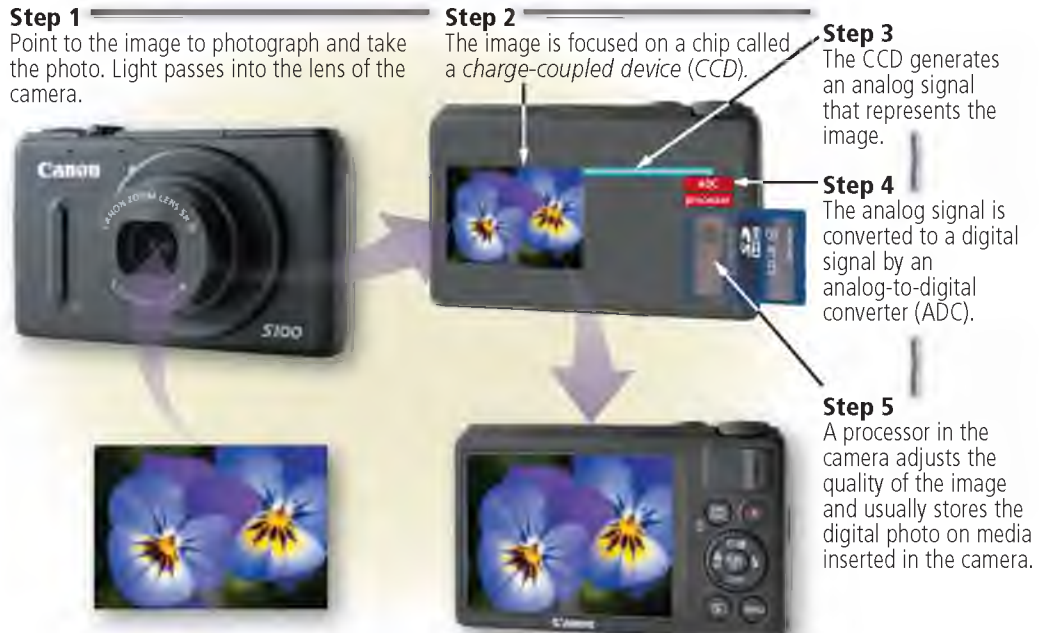


Figure 3-17 This figure shows how a point-and-shoot digital camera might work.

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 Courtesy of Kingston Technology Company, Inc

Smart digital cameras include all the features of point-and-shoot cameras and also enable you to connect wirelessly via Wi-Fi. Using the wireless capability, you instantly can save captured photos or videos on a networked computer or the cloud, share them on your online social network, upload them to a video sharing site, send them via email, and more. With a smart digital camera, you typically can download apps (just like on a smartphone) from an app store.

Digital cameras store captured images on storage media in the camera or on some type of memory card. Although most cameras enable you to review, edit, print, and share photos directly from the camera, some users prefer to transfer photos from a digital camera or the memory card to a computer's hard drive to perform these tasks.

Photo Quality Resolution affects the quality of digital camera photos. **Resolution** is the number of horizontal and vertical pixels in a display. A *pixel* (short for picture element) is the smallest element in an electronic image (Figure 3-18). Digital camera resolution typically is stated in *megapixels (MP)*, or millions of pixels. For example, a 16 MP resolution means 16 million pixels. The greater the number of pixels the camera uses to capture a picture, the better the quality of the picture but the larger the file size and the more expensive the camera. Most digital cameras provide a means to adjust the resolution. At a lower resolution, you can capture and store more images in the camera.

The actual photographed resolution is known as the *optical resolution*. Some manufacturers state enhanced resolution, instead of, or in addition to, optical resolution. The *enhanced resolution* usually is higher because it uses a special formula to add pixels between those generated by the optical resolution. Be aware that some manufacturers compute a digital camera's megapixels from the enhanced resolution, instead of optical resolution.

Discover More: Visit this chapter's free resources to learn more about resolution.



Technology Innovator
Discover More: Visit this chapter's free resources to learn about Sony (multinational technology corporation).



Figure 3-18 A pixel is the smallest element in an electronic image.

© Lingong / Dreamstime.com

Portable and Digital Media Players

A **portable media player** is a mobile device on which you can store, organize, and play or view digital media (Figure 3-19). Smartphones and other mobile devices often can function as a portable media player. Portable media players enable you to listen to music; view photos; watch videos, movies, and television shows; and even record audio and video. Some include a digital camera and also offer a calendar, address book, games, and other apps. Others communicate wirelessly with other devices or computers and enable you to synchronize your digital media with a computer, another mobile device, or cloud storage.



Figure 3-19 Some portable media players have touch screens; others have touch-sensitive pads or buttons that enable you to access your media library.

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EarPods

Apple uses the term, *EarPods*, to refer to earbuds they designed to match the shape of the human ear.

Portable media players usually require a set of *earbuds*, which are small speakers that rest inside each ear canal. Available in a variety of sizes and colors, some portable media player models have a touch screen. Others have a *touch-sensitive pad*, which is an input device that contains buttons and/or wheels you operate with a thumb or finger. Using the touch-sensitive pad, you can scroll through and play music; view pictures; watch videos or movies; navigate through song, picture, or movie lists; display a menu; adjust volume; customize settings; and perform other actions. Some portable media players have only button controls.



Figure 3-20 A digital media player streams media to a home entertainment device.

Courtesy of Apple, Inc.

Portable media players are a mobile type of digital media player. A **digital media player** or *streaming media player* is a device, typically used in a home, that streams digital media from a computer or network to a television, projector, or some other entertainment device (Figure 3-20). Some can stream from the Internet, enabling users to access video on websites. Some users opt for a digital media player instead of subscribing to cable or satellite subscription services to watch television programs.

Your collection of stored digital media is called a *media library*. Portable media players and some digital media players house your media library on a storage device in the player and/or on some type of memory card. With most, you transfer the digital media from a computer or the Internet, if the device is Internet capable, to the player's media library. Read How To 2-3 in Chapter 2 for instructions about how to download digital media from online services.

Mini Feature 3-3: Mobile Device Buyer's Guide

When purchasing a smartphone, digital camera, or portable or digital media player, you should consider several factors. Read Mini Feature 3-3 for tips to consider when purchasing these mobile devices.



MINI FEATURE 3-3

Mobile Device Buyer's Guide

Mobile devices such as smartphones, digital cameras, and portable and digital media players are extremely popular. Research the manufacturers and then consider the following guidelines before purchasing a mobile device.

Smartphone Purchase Guidelines

1. Choose a mobile service provider and plan that satisfies your needs and budget. Choose a sufficient voice, text, and data plan that is appropriate.
2. Decide on the size, style, and weight of the smartphone that will work best for you.
3. Determine whether you prefer an on-screen keyboard, keypad, or mini keyboard.
4. Select a smartphone that is compatible with the program you want to use for synchronizing your email messages, contacts, calendar, and other data.

5. Choose a smartphone with sufficient battery life that meets your lifestyle.
6. Make sure your smartphone has enough memory and storage for contacts, email messages, photos, videos, and apps.
7. Consider purchasing accessories such as extra batteries, earbuds, screen protectors, and carrying cases.



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Digital Camera Purchase Guidelines

1. Determine the type of digital camera that meets your needs, such as a point-and-shoot camera or SLR camera.
2. Choose a camera with an appropriate resolution.
3. Evaluate memory cards, because different cameras require different memory cards...



4. Consider a camera with built-in photo editing features.
5. Make sure that you can see the screen easily.
6. If the photos you plan to take will require you to zoom, choose a camera with an appropriate optical zoom.
7. Purchase accessories such as extra batteries and battery chargers, extra memory cards, lenses, and carrying cases.



Portable or Digital Media Player Purchase Guidelines

1. Choose a device with sufficient storage capacity for your media library and apps.
2. Consider how the portable or digital media player will connect to the Internet. Some devices

connect using a wired and/or wireless connection. Choose a player that is compatible with the type of connection you can provide.

3. Read reviews about sound quality. If you are purchasing a portable device, consider higher-quality earbuds, headphones, or external speakers.



4. Select a player that is compatible with other devices you already own.
5. Consider additional memory cards to increase the storage capacity of your portable or digital media player.
6. Consider the accessories. If your portable or digital media player connects to a television or other display, consider purchasing a keyboard so that you can type easily. If the device is portable, consider additional batteries or a protective case.

Discover More: Visit this chapter's free resources to learn more about smartphone, digital camera, and portable and digital media player manufacturers and specifications.

Consider This: Although most smartphones also can function as digital media players and digital cameras, would you have a separate digital media player and digital camera? Why?

E-Book Readers

An **e-book reader** (short for electronic book reader), or *e-reader*, is a mobile device that is used primarily for reading e-books and other digital publications (Figure 3-21). An *e-book*, or digital book, is an electronic version of a printed book, readable on computers and other mobile devices. Digital publications include books, newspapers, and magazines. Mobile computers and devices that display text also can function as e-book readers.

E-book readers usually are smaller than tablets but larger than smartphones. Most e-book reader models can store thousands of books, have a touch screen, and are Internet capable with built-in wireless technology. You use an on-screen keyboard to navigate, search, make selections, take notes, and highlight. Some have a *text-to-speech feature*, where the device speaks the contents of the printed page. E-book readers are available with an electronic paper black-and-white screen or with a color screen. Most have settings to adjust text size and



Figure 3-21 E-book readers enable you to read e-books and other digital publications such as newspapers and magazines.

© iStockPhoto / Petar Chernaeu

**Electronic Paper Screen**

Some users of e-books prefer the electronic paper black-and-white screen over the models with color screens because the electronic paper resembles a paper page from a book.

for various lighting conditions, such as bright sunlight or dim lighting. Batteries usually have a long life, providing more than 75 hours of use before needing to be recharged.

Similar to how a portable media player stores digital media, e-book readers store digital publications in a library on a storage device in the e-book reader and/or on memory cards. You typically transfer the digital publication from a computer or the Internet, if the device is Internet capable, to the e-book reader. Read How To 2-3 in Chapter 2 for instructions about how to download digital media from online services.

Discover More: Visit this chapter's free resources to learn more about e-book readers.

**CONSIDER THIS****Do you need a separate e-book reader if you have a tablet or other device that can function as an e-book reader?**

If you want the flexibility of reading on one device while using a tablet or other device for separate tasks, you will want to purchase a separate e-book reader. Also, e-book readers have a design suited for optimal readability of on-screen text and a longer battery life.

Internet Research

Which activity trackers are the most widely used?

Search for: popular activity trackers

Wearable Devices

A **wearable device** or *wearable* is a small, mobile computing device designed to be worn by a consumer (Figure 3-22). These devices often communicate with a mobile device or computer using Bluetooth. Three popular types of wearable devices are activity trackers, smartwatches, and smartglasses.



activity tracker communicates with health fitness app on smartphone



smartwatch wirelessly communicates with compatible smartphone



smartglasses, such as Google Glass shown here, respond to voice instruction to access note taking and other apps



An *activity tracker* is a wearable device that monitors fitness-related activities such as distance walked, heart rate, pulse, calories consumed, and sleep patterns. These devices typically sync, usually wirelessly, with a web or mobile app on your computer or mobile device to extend the capability of the wearable device.

A *smartwatch* is a wearable device that, in addition to keeping time, can communicate wirelessly with a smartphone to make and answer phone calls, read and send messages, access the web, play music, work with apps such as fitness trackers and GPS, and more. Most include a touch screen.

Smartglasses, also called *smart eyewear*, are wearable head-mounted eyeglass-type devices that enable the user to view information or take photos and videos that are projected to a miniature screen in the user's field of vision. For example, the device wearer could run an app while wearing smartglasses that display flight status information when he or she walks into an airport. Users control the device

through voice commands or by touching controls on its frame. Some smartglasses also include mobile apps, such as fitness trackers and GPS.

Discover More: Visit this chapter's free resources to learn more about wearable devices.

Internet Research

How does augmented reality apply to smartglasses?

Search for: augmented reality

Figure 3-22 Three popular wearable devices include activity trackers, smartwatches, and smartglasses.

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Game Devices

A **game console** is a mobile computing device designed for single-player or multiplayer video games. Gamers often connect the game console to a television or a monitor so that they can view gameplay on the screen. Some models also allow you to listen to music and watch movies or view photos. Typically weighing between 3 and 11 pounds, many game console models include storage for games and other media. Optical disc drives in the game consoles provide access to games and movies on optical disc. Some use memory cards and accept USB flash drives. Game consoles that are Internet capable enable gamers to download games, stream games or movies, and play with others online. Some gamers connect keyboards or webcams so that they more easily can send text messages or conduct video chats with other gamers.

A **handheld game device** is a small mobile device that contains a screen, speakers, controls, and game console all in one unit. Some include a stylus. Some handheld game device models have touch screens and built-in digital cameras. Some are Internet capable for downloading games and apps. Most handheld game devices can communicate wirelessly with other similar devices for multiplayer gaming.

With a game console or computer video game, players direct movements and actions of on-screen objects via a controller, voice, or air gestures. Game controllers include gamepads, joysticks and wheels, dance pads, and a variety of motion-sensing controllers (Figure 3-23). The following list describes each of these types of game controllers. Most communicate via wired or wireless technology.

- A **gamepad**, which is held with both hands, controls the movement and actions of players or objects in video games or computer games. On the gamepad, users press buttons with their thumbs or move sticks in various directions to trigger events. Several gamepads can communicate with the game console simultaneously for multiplayer gaming.
- Users running flight and driving simulation software often use a joystick or wheel. A **joystick** is a handheld vertical lever, mounted on a base, that you move in different directions to control the actions of the simulated vehicle or player. The lever usually includes buttons, called triggers, that you press to initiate certain events. A **wheel** is a steering-wheel-type input device that users turn to simulate driving a car, truck, or other vehicle. Most wheels also include foot pedals for acceleration and braking actions.
- A **dance pad** is a flat, electronic device divided into panels that users press with their feet in response to instructions from a music video game. These games test the user's ability to step on the correct panel at the correct time, following a pattern that is synchronized with the rhythm or beat of a song.



Figure 3-23 Game players have a variety of ways to direct movements and actions of on-screen objects.

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Technology Innovator
Discover More: Visit this chapter's free resources to learn about Nintendo (multinational consumer electronics company).

Internet Research

Which video games are the most widely used?

Search for: popular video games

- *Motion-sensing game controllers* allow users to guide on-screen elements with air gestures, that is, by moving their body or a handheld input device through the air. Some motion-sensing game controllers are sold with a particular type of game; others are general purpose. Sports games, for example, use motion-sensing game controllers, such as baseball bats and golf clubs. With general-purpose motion-sensing game controllers, you simulate batting, golfing, and other actions with a universal handheld device or no device at all.
- Other controllers include those used for music and fitness games. Controllers that resemble musical instruments, such as guitars, drums, keyboards, and microphones work with music video games that enable game players to create sounds and music by playing the instrument. Fitness games often communicate with a *balance board*, which is shaped like a weight scale and contains sensors that measure a game player's balance and weight. Read Ethics & Issues 3-3 to consider whether games and apps are qualified to provide medical advice.

Discover More: Visit this chapter's free resources to learn more about game devices.

ETHICS & ISSUES 3-3



Are Fitness Video Games and Apps Qualified to Provide Medical Advice?

Most video games and smartphone apps provide a workout only for your fingers. A host of games and apps, however, attempt to track calories, suggest workout routines, and more. Because you can take your smartphone anywhere, one advantage is that apps can provide tips for eating healthfully at a restaurant, act as a pedometer to track your steps, and send reminders to exercise. Wearable fitness devices can track your steps or use GPS to trace your route when running or biking. Another advantage is you can receive instant feedback and support from fitness apps and games that

allow you to post workouts, calorie counts, and even weight loss to online social networks. Some apps even reward you for working out.

Some critics find fault with these apps, claiming that medical personnel have not evaluated either the game or app developers, or the games and apps themselves. Because they do not take into account the amount of lean muscle mass and body fat, health and weight loss goals can be miscalculated. Experts say that games that simulate sports, such as tennis, burn half the calories you would burn if you participated in the actual sport. Some medical professionals also note that apps do not consider a participant's

medical history when recommending activities. Proponents of fitness-related games and apps say that the games encourage people to be more active and can provide positive feedback, especially the elderly and children who might otherwise not get much physical activity.

Consider This: Should game and app developers provide medical advice? Why or why not? Can fitness-related games provide a quality workout? Can an app give accurate calorie recommendations? Why or why not? As long as the games make people more active, should you ignore a games' shortcomings? Why or why not?

Embedded Computers

An **embedded computer** is a special-purpose computer that functions as a component in a larger product. Embedded computers are everywhere — at home, in your car, and at work. The following list identifies a variety of everyday products that contain embedded computers.

- **Consumer electronics:** Mobile phones, digital phones, digital televisions, cameras, video recorders, DVD players and recorders, answering machines
- **Home automation devices:** Thermostats, sprinkling systems, security systems, vacuum systems, appliances, lights
- **Automobiles:** Antilock brakes, engine control modules, electronic stability control, airbag control unit, cruise control, navigation systems and GPS receivers
- **Process controllers and robotics:** Remote monitoring systems, power monitors, machine controllers, medical devices
- **Computer devices and office machines:** Keyboards, printers, fax and copy machines

Because embedded computers are components in larger products, they usually are small and have limited hardware. These computers perform various functions, depending on the requirements of the product in which they reside. Embedded computers in printers, for example, monitor the amount of paper in the tray, check the ink or toner level, signal if a paper jam has occurred, and so on. Figure 3-24 shows some of the many embedded computers in vehicles. Read Ethics & Issues 3-4 to consider whether in-vehicle technology fosters a false sense of security.



Figure 3-24 Some of the embedded computers designed to improve your safety, security, and performance in today's vehicles.

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ETHICS & ISSUES 3-4



Does In-Vehicle Technology Foster a False Sense of Security?

Embedded computers in vehicles can guide you when backing out of a driveway, warn you if a vehicle or object is in your blind spot, or alert you to unsafe road conditions. Apps can track gas mileage or notify you when your car needs an oil change or other services. Recently, all new cars were required to include electronic stability control, which can assist with steering the car in case of skidding, and backup cameras. Other technologies adjust vehicle speed or headlight usage, and can even activate the brakes.

All of this technology is intended to make driving safer.

Critics of in-vehicle technology claim that it can provide drivers with a false sense of security. If you rely on a sensor for assistance while backing up, parking, or changing lanes, for example, you may miss other obstructions that could cause a crash. Reliance on electronic stability control or other crash-avoidance technologies may cause you to drive faster than conditions allow or to pay less attention to the distance between your vehicle and others.

The effect on new, teen drivers is especially of concern. If teens learn to drive using vehicles

equipped with features such as video rearview mirrors, they may be unable to drive older, less-equipped vehicles safely. Many apps and devices help parents protect their teens while driving. Apps can program mobile devices to block incoming calls or text messages while the vehicle is moving. GPS can track a vehicle's location and speed. Sensors can monitor seatbelt usage and number of passengers in the vehicle.

Consider This: Does in-vehicle technology make driving safer? Why or why not? What basic skills should all drivers have, regardless of their vehicle's technology?

CONSIDER THIS

Can embedded computers use the Internet to communicate with other computers and devices?

Many already do, on a small scale. For example, a Smart TV enables you to browse the web, stream video from online media services, listen to Internet radio, communicate with others on social media sites, play online games, and more — all while watching a television show.

A trend, called the *Internet of Things*, describes an environment where processors are embedded in every product imaginable (things), and those "things" communicate with one another via the Internet (i.e., alarm clocks, coffeemakers, apps, vehicles, refrigerators, phones, washing machines, doorbells, streetlights, thermostats, navigation systems, etc.). For example, when your refrigerator detects the milk is low, it sends your phone a text message that you need milk and adds a "buy milk" task to your scheduling app. On the drive home, your phone determines the closest grocery store that has the lowest milk price and sends the address of that grocery store to your vehicle's navigation system, which, in turn, gives you directions to the store. In the store, your phone directs you to the dairy aisle, where it receives an electronic coupon from the store for the milk. Because this type of environment provides an efficient means to track or monitor status, inventory, behavior, and more — without human intervention — it sometimes is referred to as machine-to-machine (M2M) communications. For additional information about the Internet of Things, read Mini Feature 6-1 in Chapter 6.

Putting It All Together



Technology Trend

Discover More: Visit this chapter's free resources to learn about volunteer computing, where you can donate your computer's resources to promote scientific research projects.

Industry experts typically classify computers and mobile devices in six categories: personal computers (desktop), mobile computers and mobile devices, game consoles, servers, supercomputers, and embedded computers. A computer's size, speed, processing power, and price determine the category it best fits. Due to rapidly changing technology, however, the distinction among categories is not always clear-cut. Table 3-3 summarizes the categories of computers discussed on the previous pages.



Table 3-3 Categories of Computers and Mobile Devices

Category	Physical Size	Number of Simultaneously Connected Users	General Price Range
Personal computers (desktop)	Fits on a desk	Usually one (can be more if networked)	Several hundred to several thousand dollars
Mobile computers and mobile devices	Fits on your lap or in your hand	Usually one	Less than a hundred dollars to several thousand dollars
Game consoles	Small box or handheld device	One to several	Several hundred dollars or less
Servers	Small cabinet to room full of equipment	Two to thousands	Several hundred to several million dollars
Supercomputers	Full room of equipment	Hundreds to thousands	Half a million to several billion dollars
Embedded computers	Miniature	Usually one	Embedded in the price of the product

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NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Cloud Computing, Mobile Devices, Game Devices, Embedded Computers, and Putting It All Together, as it relates to the chapter objectives.

Now you should know . . .

- When you are using cloud computing (Objective 4)
- What you should consider when purchasing a mobile device (Objective 5)
- What types of controllers you might use with game consoles (Objective 6)
- When you are using an embedded computer (Objective 7)

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Instead of the term, port, the term, *jack*, sometimes is used to identify audio and video ports (i.e., audio jack or video jack).

Ports and Connections

Computers and mobile devices connect to peripheral devices through ports or by using wireless technologies. A **port** is the point at which a peripheral device (i.e., keyboard, printer, monitor, etc.) attaches to or communicates with a computer or mobile device so that the peripheral device can send data to or receive information from the computer or mobile device. Most computers

and mobile devices have ports (Figure 3-25). Some ports have a micro or mini version for mobile devices because of the smaller sizes of these devices.

A **connector** joins a cable to a port. A connector at one end of a cable attaches to a port on the computer or mobile device, and a connector at the other end of the cable attaches to a port on the peripheral device. Table 3-4 shows a variety of ports you may find on a computer or mobile device. USB and Thunderbolt are more general-purpose ports that allow connections to a wide variety of devices; other ports are more specific and connect a single type of device.



Figure 3-25 Most computers and mobile devices have ports so that you can connect the computer or device to peripherals.

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Table 3-4 Popular Ports and Connectors

Port Type	Connector Photo	Port Photo	Port Type	Connector Photo	Port Photo
DisplayPort (audio/video)			Mini USB		
DVI (digital video interface)			Mini HDMI (audio/video)		
HDMI (audio/video)			Network (Ethernet)		
Headphones			Speaker		
Lightning			Thunderbolt		
Microphone			USB (Type A)		
Micro USB			USB (Type B)		
Mini DisplayPort			VGA		

Discover More: Visit this chapter’s free resources for an expanded list of ports and connectors.

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USB Ports

A **USB port**, short for universal serial bus port, can connect up to 127 different peripheral devices together with a single connector. Devices that connect to a USB port include the following: card reader, digital camera, external hard drive, game console, joystick, modem, mouse, optical disc drive, portable media player, printer, scanner, smartphone, digital camera, speakers, USB flash drive, and webcam. In addition to computers and mobile devices, you find USB ports in vehicles, airplane seats, and other public locations.

Several USB versions have been released, with newer versions (i.e., USB 3.0) transferring data and information faster than earlier ones (i.e., USB 2.0). Newer versions are *backward compatible*, which means they support older USB devices as well as newer ones. Keep in mind, though, that older USB devices do not run any faster in a newer USB port. In addition to transferring data, cables plugged into USB ports also may be able to transfer power to recharge many smartphones and tablets. Newer versions of USB can charge connected mobile devices even when the computer is not in use.

To attach multiple peripheral devices using a single USB port, you can use a USB hub. A *USB hub* is a device that plugs in a USB port on the computer or mobile device and contains multiple USB ports, into which you plug cables from USB devices. Some USB hubs are wireless. That is, a receiver plugs into a USB port on the computer and the USB hub communicates wirelessly with the receiver. Read Secure IT 3-4 for tips when using USB charging stations.

SECURE IT 3-4

Public USB Charging Stations — Safe or Not?

Although you might be tempted to recharge your smartphone or mobile device at a public charging station, think twice before plugging your USB cable into the charging kiosk's port. The station may be *juice jacking*, which occurs when a hacker steals data from or transfers malware to the device via a USB cable at a charging station. (A hacker is someone who accesses a computer or network illegally.)


This process is possible because the USB cable is used for two purposes: supplying power and syncing data. It can occur within one minute after plugging into the charger.

Anything on the device is susceptible, including photos, contacts, and music, and some malware can create a full backup of your data, leaving you prone to identity theft. Once the phone or mobile device is infected, it can continue to transmit data via Wi-Fi. Security experts claim that the only method of erasing this malware is to restore the device to its factory settings.

Charging stations are common in airports, business centers, and conference rooms. While most are safe, you can reduce the possibility of juice jacking by taking these precautions:

- Use a travel charger, also called a power bank, which can recharge a device several times before needing recharging itself.

- Keep the phone or mobile device locked so that it requires a password to sync data with another device. Turning off the device while charging may not provide sufficient protection against accessing the storage media.
- Use a power-only USB cable that does not allow data transmission.

 **Consider This:** Should warning signs be posted by public charging stations? Would you use a public charging kiosk if your smartphone or mobile device was running low on battery power?

Discover More: Visit this chapter's free resources to learn more about USB versions.

Port Replicators and Docking Stations

Instead of connecting peripheral devices directly to ports on a mobile computer, some mobile users prefer the flexibility of port replicators and docking stations. A *port replicator* is an external device that provides connections to peripheral devices through ports built into the device. The mobile user accesses peripheral devices by connecting the port replicator to a USB port or a special port on the mobile computer. Port replicators sometimes disable ports on the mobile computer to prevent conflicts among the devices on the computer and port replicator.

A docking station is similar to a port replicator, but it has more functionality. A *docking station*, which is an external device that attaches to a mobile computer or device, contains a power connection and provides connections to peripheral devices (Figure 3-26). Docking stations also

may include slots for memory cards, optical disc drives, and other devices. With the mobile computer or device in the docking station, users can work with a full-sized keyboard, a mouse, and other desktop peripheral devices from their laptop or tablet.

Wireless Device Connections

Instead of connecting computers and mobile devices to peripheral devices with a cable, some peripheral devices use wireless communications technologies, such as Bluetooth, Wi-Fi, and NFC.

Bluetooth Bluetooth technology uses short-range radio signals to transmit data between two Bluetooth-enabled computers or devices. In addition to computers, mobile devices

and many peripheral devices, such as a mouse, keyboard, printer, or headset, and many vehicles and consumer electronics are Bluetooth enabled. Bluetooth devices have to be within about 33 feet of each other, but the range can be extended with additional equipment. If you have a computer that is not Bluetooth enabled, you can purchase a Bluetooth wireless port adapter that will convert an existing USB port into a Bluetooth port. Read How To 3-1 for instructions about setting up two Bluetooth devices to communicate with each other.



Figure 3-26 Docking stations often are used with tablets and other mobile computers, providing connections to peripheral devices.
Courtesy of Fujitsu Technology Solutions; © Cengage Learning

HOW TO 3-1

Pair Bluetooth Devices

Before two Bluetooth devices will communicate with each other, they might need to be paired. *Pairing* is the process of initiating contact between two Bluetooth devices and allowing them to communicate with each other. It is important to have the documentation for the Bluetooth devices you are pairing readily available. The following steps will help you pair two Bluetooth devices.

1. Make sure the devices you intend to pair are charged completely or plugged into an external power source.
2. Turn on the devices to pair, ensuring they are within your immediate reach.
3. If necessary, enable Bluetooth on the devices you are pairing.
4. Place one device in *discoverable mode*, which means it is waiting for another Bluetooth device to locate its signal. If you are connecting a smartphone to a Bluetooth headset, for example,

the smartphone would need to be in discoverable mode.

5. Refer to the other device's documentation and follow the necessary steps to locate the discoverable device from the other device you are pairing.
6. After no more than about 30 seconds, the devices should initiate communications.
7. You may be required to enter a passkey (similar to a PIN) on one device for the other device with which you are pairing. For example, if you are pairing a smartphone with a Bluetooth headset, you may be required to enter the Bluetooth headset's passkey on the smartphone. In this case, you would refer to the Bluetooth headset's documentation to obtain the passkey. Common passkeys are 0000 and 1234.
8. After entering the correct passkey, the two devices should be paired successfully.

Consider This: Why is a passkey required when pairing two Bluetooth devices? Do you need to pair Bluetooth devices before each use?



Wi-Fi Short for wireless fidelity, **Wi-Fi** uses radio signals that conform to 802.11 standards, which were developed by the Institute of Electrical and Electronics Engineers (IEEE).


Computers and devices that have the appropriate Wi-Fi capability can communicate via radio waves with other Wi-Fi computers or devices. Most mobile computers and devices are Wi-Fi enabled, along with routers and other communications devices. For successful Wi-Fi communications in open or outdoor areas free from interference, the Wi-Fi computers or devices should be within 300 feet of each other. In closed areas, the wireless range is about 100 feet. To obtain communications at the maximum distances, you may need to install extra hardware. Read How To 3-2 for instructions about connecting a phone to a Wi-Fi network.

HOW TO 3-2

Connect Your Phone to a Wi-Fi Network to Save Data Charges

Many of today's data plans limit the amount of data you can transfer each month on your mobile service provider's network. Connecting a smartphone to a Wi-Fi network enables you to transfer data without using your phone's data plan and risking costly overages. The following steps describe how to connect your phone to a Wi-Fi network.

1. Make sure you are in a location where a Wi-Fi network is available. Obtain any necessary information you need to connect to the Wi-Fi network.
2. Navigate to the settings on your phone.
3. Locate and enable Wi-Fi in your phone's settings.
4. When your phone displays a list of available wireless networks, choose the network to which you want to connect.
5. If necessary, enter any additional information, such as a password, required to connect to the network.
6. Your phone should indicate when it successfully is connected to the network.
7. When you are finished using the Wi-Fi connection or are not within range of the Wi-Fi network, disable Wi-Fi on your phone to help conserve battery life.

 **Consider This:** If you have a data plan allowing unlimited data and you are within range of a Wi-Fi network, is it better to use your mobile service provider's network or the Wi-Fi network? Why?



Google Inc.

NFC NFC (near field communications) uses close-range radio signals to transmit data between two NFC-enabled devices. Examples of NFC-enabled devices include smartphones, digital cameras, computers, televisions, and terminals. Other objects, such as credit cards and tickets, also use NFC technology. For successful communications, the devices either touch or are within an inch or two of each other.

Discover More: Visit this chapter's free resources to learn more about transfer rates of wireless communications technologies and 802.11 standards.

CONSIDER THIS

What are some uses of NFC devices?

- Pay for goods and services (i.e., smartphone to terminal)
- Share contacts, photos, and other files (i.e., smartphone to smartphone or digital camera to television)
- Download apps (i.e., computer to smartphone)
- Gain access or admittance (i.e., smartphone to terminal)

Protecting Hardware

Users rely on computers and mobile devices to create, store, and manage important information. Thus, you should take measures to protect computers and devices from theft, vandalism, and failure.

Hardware Theft and Vandalism

Companies, schools, and other organizations that house many computers are at risk of hardware theft and vandalism, especially those with smaller computers that easily can fit in a backpack or briefcase. Mobile users are susceptible to hardware theft because the size and weight of their computers and devices make them easy to steal. Thieves may target laptops of company executives so that they can use the stolen computer to access confidential company information illegally.

To help reduce the chances of theft, companies and schools use a variety of security measures. Physical access controls, such as locked doors and windows, usually are adequate to protect the equipment. Many businesses, schools, and some homeowners install alarm systems for additional security. School computer labs and other facilities with a large number of semifrequent users often attach additional physical security devices, such as cables that lock the equipment to a desk, cabinet, or floor. Mobile users sometimes lock their mobile computers temporarily to a stationary object, for example, a table in a hotel room. Small locking devices also exist that require a key to access a hard drive or optical disc drive.

Users also can install a security or device-tracking app on their mobile computers and devices. Some security apps shut down the computer and sound an alarm if the computer moves beyond a specified distance. Others can be configured to photograph the thieves when they use the computer. Device-tracking apps use GPS, Wi-Fi, IP addresses, and other means to determine the location of a lost or stolen computer or device.

Users can configure computers and mobile devices to require identification before allowing access. For example, you can require entry of a user name and password to use the computer or device. Some computers and mobile devices have built-in or attached fingerprint readers (Figure 3-27), which can be used to verify a user's identity before allowing access. A *fingerprint reader* captures curves and indentations of a fingerprint. This type of security does not prevent theft, but it renders the computer or device useless if it is stolen.

Discover More: Visit this chapter's free resources to learn more about device-tracking apps.

Hardware Failure

Hardware can fail for a variety of reasons: aging hardware; random events, such as electrical power problems; and even errors in programs or apps. Not only could hardware failure require you to replace or repair a computer or mobile device, but it also can cause loss of software, data, and information.

One of the more common causes of system failure is an electrical power variation, which can cause loss of data and loss of equipment. If computers and mobile devices are connected to a network, a single power disturbance can damage multiple devices at once. Electrical disturbances that can cause damage include undervoltages and overvoltages.

Internet Research

How prevalent is theft of mobile devices?

Search for: mobile device theft

BTW

Lost Computers or Devices

You usually can instruct the password screen to display your name and phone number, so that a Good Samaritan can return a lost computer or device to you.



Figure 3-27 Some mobile computers and devices include fingerprint readers, which can be used to verify a user's identity.

- An **undervoltage** occurs when the electrical supply or voltage drops, often defined as more than five percent, below the normal volts. A *brownout* is a prolonged (more than a minute) undervoltage. A *blackout* is a complete power failure. Undervoltages can cause data loss but generally do not cause equipment damage.
- An **overvoltage**, or **power surge**, occurs when the incoming electrical supply or voltage increases, often defined as more than five percent, above the normal volts. A momentary overvoltage, called a *spike*, occurs when the increase in power lasts for less than one millisecond (thousandth of a second). Uncontrollable disturbances such as lightning bolts can cause spikes. Overvoltages can cause immediate and permanent damage to hardware.

To protect against electrical power variations, use a surge protector. A **surge protector**, also called a *surge suppressor*, uses electrical components to provide a stable current flow and minimize the chances of an overvoltage reaching the computer and other electronic equipment (Figure 3-28). Sometimes resembling a power strip, the computer and other devices plug in the surge protector, which plugs in the power source.



Figure 3-28 Circuits inside a surge protector safeguard against electrical power variations.

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The surge protector absorbs small overvoltages — generally without damage to the computer and equipment. To protect the computer and other equipment from large overvoltages, such as those caused by a lightning strike, some surge protectors stop working completely when an overvoltage reaches a certain level. Surge protectors also usually protect the computer from undervoltages. No surge protectors are 100 percent effective. Large power surges can bypass the protector. Repeated small overvoltages can weaken a surge protector permanently. Some experts recommend replacing a surge protector every two to three years.

For additional electrical protection, some users connect an uninterruptible power supply to the computer. An **uninterruptible power supply (UPS)** is a device that contains surge protection circuits and one or more batteries that can provide power during a temporary or permanent loss of power (Figure 3-29). A UPS connects your computer and a power source. Read How To 3-3 for purchasing suggestions regarding surge protectors and UPSs.



Figure 3-29 If power fails, a UPS uses batteries to provide electricity for a limited amount of time.

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HOW TO 3-3



Evaluate Surge Protectors and UPSs


Electrical power surges are a part of everyday life, and they are especially prevalent during thunderstorms and peak energy consumption periods. These unavoidable occurrences can damage or ruin sensitive electronic equipment. The processor in a computer is particularly sensitive to fluctuations in current. Two devices can help protect electronic components: a surge protector and an uninterruptible power supply (UPS).

Purchase the best surge protector you can afford. Typically, the amount of protection offered by a surge protector is proportional to its cost. That is, the more expensive the

surge protector, the more protection it offers. When evaluating surge protectors and UPSs, they should meet or exceed these specifications:

- Sufficient outlets to accommodate each device needing protection
- Individual on/off switch for each device
- Built-in fuse
- UL 1449 rating that ensures quality control and testing
- Joule rating of at least 600
- Indicator light showing the device is functioning properly

- Warranty for damages to any connected equipment
- Low clamping voltage
- High energy-absorption rating
- Low response time, preferably less than ten nanoseconds
- Protection for a modem, communications lines, and cables

 **Consider This:** What other factors might you consider while evaluating surge protectors? Why?

CONSIDER THIS

What other measures can organizations implement if their computers must remain operational at all times?

Some companies use duplicate components or duplicate computers to protect against hardware failure.

A *fault-tolerant computer* has duplicate components so that it can continue to operate when one of its main components fail. Airline reservation systems, communications networks, ATMs, and other systems that must be operational at all times use duplicate components, duplicate computers, or fault-tolerant computers.

Health Concerns of Using Technology

The widespread use of technology has led to some important user health concerns. You should be proactive and minimize your chance of risk.

Repetitive Strain Injuries

A *repetitive strain injury (RSI)* is an injury or disorder of the muscles, nerves, tendons, ligaments, and joints. Technology-related RSIs include tendonitis and carpal tunnel syndrome.

- Tendonitis is inflammation of a tendon due to repeated motion or stress on that tendon.
- Carpal tunnel syndrome (CTS) is inflammation of the nerve that connects the forearm to the palm of the hand.

Repeated or forceful bending of the wrist can cause tendonitis of the wrist or CTS. Symptoms of tendonitis of the wrist include extreme pain that extends from the forearm to the hand, along with tingling in the fingers. Symptoms of CTS include burning pain when the nerve is compressed, along with numbness and tingling in the thumb and first two fingers.

Long-term computer work can lead to tendonitis or CTS. Factors that cause these disorders include prolonged typing, prolonged mouse usage, or continual shifting between the mouse and the keyboard. If untreated, these disorders can lead to permanent physical damage.

CONSIDER THIS

What can you do to prevent technology-related tendonitis or CTS?

Follow these precautions:

- Take frequent breaks to exercise your hands and arms (Figure 3-30).
- Do not rest your wrists on the edge of a desk. Instead, place a wrist rest between the keyboard and the edge of your desk.
- Place the mouse at least six inches from the edge of the desk. In this position, your wrist is flat on the desk.
- Minimize the number of times you switch between the mouse and the keyboard.
- Keep your forearms and wrists level so that your wrists do not bend.
- Avoid using the heel of your hand as a pivot point while typing or using the mouse.
- Keep your shoulders, arms, hands, and wrists relaxed while you work.
- Maintain good posture.
- Stop working if you experience pain or fatigue.

Hand Exercises

- Spread fingers apart for several seconds while keeping wrists straight.
- Gently push back fingers and then thumb.
- Dangle arms loosely at sides and then shake arms and hands.



Figure 3-30 To reduce the chance of developing tendonitis or carpal tunnel syndrome, take frequent breaks during computer sessions to exercise your hands and arms.

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Other Physical Risks

With the growing use of earbuds and headphones in computers and mobile devices, some users are experiencing hearing loss. Read How To 3-4 for guidelines for evaluating earbuds and headphones.

Computer vision syndrome (CVS) is a technology-related health condition that affects eyesight. You may have CVS if you have sore, tired, burning, itching, or dry eyes; blurred or double vision after prolonged staring at a display device; headache or sore neck; difficulty shifting focus between a display device and documents; difficulty focusing on the screen image; color fringes or after-images when you look away from the display device; and increased sensitivity to light. Eyestrain associated with CVS is not thought to have serious or long-term consequences. Figure 3-31 outlines some techniques you can follow to ease eyestrain.

People who spend their workday using the computer sometimes complain of lower back pain, muscle fatigue, and emotional fatigue. Lower back pain sometimes is caused from poor posture. Always sit properly in the chair while you work. To alleviate back pain, muscle fatigue, and emotional fatigue, take a 15- to 30-minute break every 2 hours — stand up, walk around, stretch, and relax.

Techniques to Ease Eyestrain

- Every 10 to 15 minutes, take an eye break.
 - Look into the distance and focus on an object for 20 to 30 seconds.
 - Roll your eyes in a complete circle.
 - Close your eyes and rest them for at least one minute.
- Blink your eyes every five seconds.
- Place your display about an arm's length away from your eyes with the top of the screen at or below eye level.
- Use large fonts.
- If you wear glasses, ask your doctor about computer glasses.
- Adjust the lighting.



Figure 3-31 Following these tips may help reduce eyestrain while using technology.

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HOW TO 3-4

Evaluate Earbuds and Headphones

Earbuds and headphones are used to listen to music and other audio files on computers and mobile devices. Selecting the proper product not only depends on the style you prefer, but also the type of audio you will be playing. Prices for earbuds and headphones can range from only a few dollars to several hundred dollars, so it is important to know what you are purchasing. The following guidelines describe what to look for when evaluating earbuds and headphones.

- Determine which style you prefer. Earbuds rest inside your ear, while headphones rest over your ear. Experiment with both types

and determine which is more comfortable for you.

- Determine the quality you desire. If you listen to music casually and typically do not notice variations in sound quality, a higher-end product might not be necessary. Alternatively, if sound quality is important, you may consider a more expensive set. Note that a higher price does not always indicate better quality; read online product reviews for information about the sound quality of various products.
- Decide whether you would like a noise cancelling feature. *Noise cancelling* helps block external noise while you are

listening to the audio on your device. Noise cancelling headphones sometimes require batteries, and you are able to turn the noise cancelling feature on and off. If you will be listening to audio in locations where you also need to hear what is going on around you, consider purchasing a product without this feature.

- ✪ **Consider This:** Based on your preferences and needs, which type of product (earbuds or headphones) is best for you? Locate a product online that meets your specifications. What brand is it? How much does it cost? Where is this product available?

Internet Research

What is a text neck?

Search for: text neck

Another way to help prevent these injuries is to be sure your workplace is designed ergonomically. **Ergonomics** is an applied science devoted to incorporating comfort, efficiency, and safety into the design of items in the workplace. Ergonomic studies have shown that using the correct type and configuration of chair, keyboard, display, and work surface helps users work comfortably and efficiently and helps protect their health (Figure 3-32). You can hire an ergonomic consultant to evaluate your workplace and recommend changes.



Figure 3-32 A well designed work area should be flexible to allow adjustments to the height and build of different individuals.

© Science Photo Library / Alamy

Behavioral Health Risks

Some technology users become obsessed with computers, mobile devices, and the Internet. **Technology addiction** occurs when technology use consumes someone's entire social life. Technology addiction is a growing health problem, but it can be treated through therapy and support groups.

People suffering from *technology overload* feel distressed when deprived of technology, even for a short length of time, or feel overwhelmed with the amount of technology they are required to manage. To cope with the feelings of distraction and to control the impact that technology can have on work and relationships, set aside technology-free time.

CONSIDER THIS

How can you tell if you are addicted to technology?

Symptoms of a user with technology addiction include the following:

- Craves computer time
- Overjoyed when using a computer or mobile device
- Unable to stop using technology
- Irritable when not using technology
- Neglects family and friends
- Problems at work or school

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Ports and Connections, Protecting Hardware, and Health Concerns of Using Technology as it relates to the chapter objectives.

Now you should know...


- How you can connect a peripheral device to a computer or mobile device (Objective 8)
- How you can protect your hardware from theft, vandalism, and failure (Objective 9)
- How you can minimize your risk of health-related injuries and disorders that can result from using technology (Objective 10)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter presented characteristics of and purchasing guidelines for laptops, tablets, desktops, smartphones, digital cameras, and portable and digital media players. It also discussed servers, supercomputers, point-of-sale terminals, ATMs, self-service kiosks, e-book readers, wearable devices, game devices, embedded computers, and cloud computing. It presented a variety of ports and connections, ways to protect hardware, and health concerns of using technology use along with preventive measures.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Samsung, Dell/Michael Dell, Sony, and Nintendo; Technology Trends: Bitcoin and Volunteer Computing; and High-Tech Talks: Touch Screen Technology and Voice Recognition Technology.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Energy Management


When you walk into your office at the start of a new day, you give little thought to the fact that the lights are on and the temperature is comfortable. For all you know, the air conditioner and lighting were on all night; however, energy management systems are hard at work conserving energy and reducing energy costs. When you return home, you also might take for granted the fact that your dryer automatically stops when it senses that your clothes are dry, or that your dishwasher or washing machine uses only enough water to sufficiently clean its contents. Individuals in the energy management field always are looking for ways to use technology to manage energy use.

Building automation systems are devices that can control various building components, such as complex air conditioning systems and lighting systems. Building automation systems adjust these components to provide a comfortable, safe working environment without wasting energy. For example, in an office building where employees all work weekdays from 8:00 a.m. until 5:00 p.m., the

building automation system might prompt the air conditioner to turn on one or two hours before the first employees arrive. After the employees leave for the day, the air conditioner either may turn off for the evening or maintain a higher temperature to conserve energy. Some systems used in hotel rooms may include motion sensors that turn off the air conditioner if they sense no motion or noise in the room. Cruise ship cabins and hotel rooms with doors to a balcony may automatically shut down the air conditioner if the door is left open. Air conditioning systems often are one of the largest consumers of energy, and money spent toward automating one of these systems often can be recovered in smaller electricity bills. In addition to controlling the air conditioning system, building automation systems also can control and monitor lighting. Many newer buildings include motion and sound sensors in each room and automatically turn off lights when the rooms are unoccupied. Lighting in common areas of these buildings might turn off after hours when the building is unoccupied. Alternatively, if the building

has plenty of natural light coming in, sensors automatically can turn off lights when sufficient sunlight is available, or turn on the lights when the sunlight decreases.

The energy management field has made significant advancements because of computer technologies. Businesses not only are able to reduce their energy costs, but they also are conserving energy at the same time.

 **Consider This:** In what other ways do computers and technology play a role in the energy management field?



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Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to **test your knowledge of digital content** associated with this chapter and **access the Study Guide resource** from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- List types of computers and mobile devices.
- Describe how personal computers often are differentiated.
- Explain how to avoid malware infections.
- Define the term, motherboard.
- Describe the roles of the processor and memory.
- Differentiate among traditional and ultrathin laptops, tablets, phablets, and handheld computers.
- To interact with a tablet, you may use a touch screen or a(n) _____.
- List steps to protect yourself from webcam spying.
- List considerations when purchasing a mobile computer. Explain the importance of built-in ports and slots.
- A(n) _____ desktop may be less expensive and take up less space.
- Identify types of desktop users and explain how each user's computer needs may differ.
- Identify how you can purchase the appropriate desktop computer for your needs.
- Describe the purpose and functions of a server. Differentiate among rack, blade, and tower servers.
- Define virtualization as it relates to servers. Define the terms, server farm and mainframe.
- Define the terms, terminal and thin client. List the advantages of a thin client.
- Identify situations where POS terminals, ATMs, and self-service kiosks might be used. List ATM safety guidelines.
- A(n) _____ is used to solve complex, sophisticated mathematical calculations, such as those used in petroleum exploration.
- List cloud computing resources. Describe how businesses use cloud computing to manage resources.
- List types of mobile devices. Describe features of a smartphone.
- Explain the issues surrounding the recycling of e-waste.
- Identify methods for typing on a smartphone.
- List options provided by text, picture/video message, and voicemail services.
- Distinguish between push and pull notifications.
- _____ occurs when a person's attention is diverted, such as by talking on a mobile phone.
- Describe the types of digital cameras, how they store captured images, and how to transfer photos to a computer.
- Explain how resolution affects digital picture quality.
- Identify the features of portable media and digital media players.
- List considerations when purchasing different types of mobile devices.
- List features of e-book readers and wearable devices.
- Identify types of game controllers.
- Explain whether fitness video games are an effective form of exercise.
- List products that contain embedded computers. List the disadvantages of in-vehicle technology.
- Describe the trend, the Internet of Things.
- Describe categories of computers and mobile devices, and identify general characteristics of size, user type, and price.
- Explain how a computer uses ports and connectors.
- List devices that connect to a USB port. Explain risks of using public USB charging stations.
- Define the term, backward compatible.
- Distinguish between a port replicator and a docking station.
- Describe the following technologies: Bluetooth, Wi-Fi, and NFC.
- _____ is the process of initiating contact between two Bluetooth devices.
- List steps to connect your phone to a Wi-Fi network.
- List methods for securing against hardware theft and vandalism.
- Define the terms, undervoltage and overvoltage, and explain how each can damage a computer or data.
- Describe the purposes of surge protectors and UPS devices. Explain the purpose a fault-tolerant computer.
- Identify causes and types of repetitive strain injuries. List symptoms of CVS.
- List guidelines for evaluating earbuds and headphones.
- Describe the role of ergonomics in a workplace.
- List symptoms of technology addiction. Define the term, technology overload.
- Describe how technology is used in the energy management industry.

Key Terms

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

Discover More: Visit this chapter's premium content to **view definitions** for each term and to **access the Flash Cards resource** from your smartphone, tablet, laptop, or desktop.

Primary Terms (shown in bold-black characters in the chapter)

all-in-one (114)	e-book reader (129)	NFC (138)	tablet (112)
Bluetooth (137)	embedded computer (132)	overvoltage (140)	technology addiction (144)
cloud computing (121)	ergonomics (144)	port (134)	undervoltage (140)
computer (108)	game console (131)	portable media player (127)	uninterruptible power supply (UPS) (140)
computer vision syndrome (143)	handheld game device (131)	power surge (140)	USB port (136)
connector (135)	laptop (111)	resolution (127)	wearable device (130)
desktop (114)	mobile computer (108)	server (116)	Wi-Fi (138)
digital camera (125)	mobile device (108)	smartphone (123)	
digital media player (128)		surge protector (140)	

Secondary Terms (shown in italic characters in the chapter)

<i>all-in-one desktop (114)</i>	<i>handheld computer (112)</i>	<i>rack server (116)</i>	<i>telematics (133)</i>
<i>activity tracker (130)</i>	<i>home server (116)</i>	<i>repetitive strain injury (RSI) (142)</i>	<i>terminal (117)</i>
<i>application server (116)</i>	<i>Internet of Things (133)</i>	<i>server farm (117)</i>	<i>text-to-speech feature (129)</i>
<i>ATM (118)</i>	<i>jack (134)</i>	<i>server virtualization (117)</i>	<i>thin client (117)</i>
<i>backup server (116)</i>	<i>joystick (131)</i>	<i>slate tablet (112)</i>	<i>touch-sensitive pad (128)</i>
<i>backward compatible (136)</i>	<i>juice jacking (136)</i>	<i>SLR camera (125)</i>	<i>tower (114)</i>
<i>balance board (132)</i>	<i>kiosk (119)</i>	<i>smart digital camera (125)</i>	<i>tower server (116)</i>
<i>bar code reader (118)</i>	<i>list server (116)</i>	<i>smart eyewear (130)</i>	<i>ultrabook (111)</i>
<i>blackout (140)</i>	<i>mail server (116)</i>	<i>smartglasses (130)</i>	<i>USB hub (136)</i>
<i>blade server (116)</i>	<i>mainframe (117)</i>	<i>smartwatch (130)</i>	<i>virtual keyboard (124)</i>
<i>brownout (140)</i>	<i>media library (128)</i>	<i>SMS (short message service) (124)</i>	<i>virtualization (117)</i>
<i>building automation systems (145)</i>	<i>megapixel (MP) (127)</i>	<i>spike (140)</i>	<i>visual voice mail (125)</i>
<i>charge-coupled device (CCD) (126)</i>	<i>MMS (multimedia message service) (124)</i>	<i>storage server (116)</i>	<i>voice mail (125)</i>
<i>common short code (CSC) (124)</i>	<i>motherboard (110)</i>	<i>streaming media player (128)</i>	<i>wearable (130)</i>
<i>convertible tablet (112)</i>	<i>motion-sensing game controller (132)</i>	<i>stylus (112)</i>	<i>web server (116)</i>
<i>CPU (110)</i>	<i>network server (116)</i>	<i>supercomputer (120)</i>	<i>wheel (131)</i>
<i>CVS (143)</i>	<i>noise cancelling (143)</i>	<i>surge suppressor (140)</i>	<i>workstation (114)</i>
<i>dance pad (131)</i>	<i>notebook computer (111)</i>	<i>swipe keyboard app (123)</i>	
<i>database server (116)</i>	<i>on-screen keyboard (123)</i>	<i>system unit (114)</i>	
<i>discoverable mode (137)</i>	<i>optical resolution (127)</i>	<i>technology overload (144)</i>	
<i>docking station (136)</i>	<i>pairing (137)</i>		
<i>domain name server (116)</i>	<i>peripheral device (108)</i>		
<i>DVD kiosk (120)</i>	<i>personal computer (108)</i>		
<i>earbuds (128)</i>	<i>phablet (112)</i>		
<i>EarPods (128)</i>	<i>PIN (118)</i>		
<i>e-book (129)</i>	<i>pixel (127)</i>		
<i>enhanced resolution (127)</i>	<i>point-and-shoot camera (125)</i>		
<i>e-reader (129)</i>	<i>port replicator (136)</i>		
<i>fault-tolerant computer (141)</i>	<i>portable keyboard (124)</i>		
<i>file server (116)</i>	<i>POS terminal (118)</i>		
<i>fingerprint reader (139)</i>	<i>predictive text (123)</i>		
<i>FTP server (116)</i>	<i>print server (116)</i>		
<i>game server (116)</i>	<i>processor (111)</i>		
<i>gamepad (131)</i>	<i>pull notification (124)</i>		
<i>gaming desktop (114)</i>	<i>push notification (124)</i>		
<i>Google Street View (111)</i>			



phablet (112)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. Malware authors often focus on social media, with the goal of stealing personal information. (110)
- _____ 2. The disadvantages of a virtual server are that it is difficult to manage and takes a long time to create and configure. (117)
- _____ 3. A mainframe is a small terminal that looks like a desktop, but has limited capabilities and components. (117)
- _____ 4. Thin clients contain powerful hard drives. (117)
- _____ 5. Applications requiring complex, sophisticated mathematical calculations use mainframes. (120)
- _____ 6. Most computers and electronic devices are analog, which use only two discrete states: on and off. (125)
- _____ 7. SLR cameras are much heavier and larger than point-and-shoot cameras. (125)
- _____ 8. Because embedded computers are components in larger products, they usually are small and have limited hardware. (132)
- _____ 9. Instead of the term, port, the term, connector, sometimes is used to identify audio and video ports. (134)
- _____ 10. Newer versions of USB are backward compatible, which means they support only new USB devices, not older ones. (136)
- _____ 11. A port replicator is an external device that provides connections to peripheral devices through ports built into the device. (136)
- _____ 12. Because the processor in a computer is particularly sensitive to fluctuations in current, you always should use a surge protector. (141)

Multiple Choice

Select the best answer.

- 1. Which of the following is *not* true of ultrathin laptops? (111)
 - a. They weigh less than traditional laptops.
 - b. They have a shorter battery life.
 - c. Many have fewer ports than traditional laptops.
 - d. They do not include an optical disc drive.
- 2. Some people use the term _____ to refer to the case that contains and protects the motherboard, internal hard drive, memory, and other electronic components of the computer from damage. (114)
 - a. system unit
 - b. phablet
 - c. thin client
 - d. USB hub
- 3. Power users may work with a high-end desktop, sometimes called a(n) _____, that is designed to handle intense calculations and powerful graphics. (114)
 - a. laptop
 - b. gaming desktop
 - c. server farm
 - d. workstation
- 4. Services provided by _____ include storing content and controlling access to hardware, software, and other resources on a network. (116)
 - a. jacks
 - b. servers
 - c. fault-tolerant computers
 - d. mainframes
- 5. A dedicated server that backs up and restores files, folders, and media is referred to as a _____. (116)
 - a. web server
 - b. file server
 - c. storage server
 - d. backup server
- 6. A four- or five-digit number assigned to a specific content or mobile service provider is referred to as a(n) _____. (124)
 - a. CSC
 - b. MMS
 - c. SMS
 - d. SLR
- 7. A(n) _____ is a special-purpose computer that functions as a component in a larger product. (132)
 - a. server
 - b. embedded computer
 - c. thin client
 - d. ultrabook
- 8. A(n) _____ can connect up to 127 different peripheral devices together with a single connector. (136)
 - a. SLR device
 - b. USB port
 - c. port replicator
 - d. docking station

Checkpoint

Matching Match the terms with their definitions.

- | | |
|---|--|
| _____ 1. peripheral device (108) | a. term used to refer to a device that combines the features of a smartphone with a tablet |
| _____ 2. motherboard (110) | b. computer with duplicate components so that it can continue to operate when one of its main components fail |
| _____ 3. CPU (110) | c. tablet that does not contain a physical keyboard |
| _____ 4. slate tablet (112) | d. component you connect to a computer or mobile device to expand its capabilities |
| _____ 5. phablet (112) | e. terminal that looks like a desktop but has limited capabilities and components |
| _____ 6. server virtualization (117) | f. the use of software to enable a physical server to emulate the hardware and computing capabilities of one or more servers |
| _____ 7. thin client (117) | g. electronic component that interprets and carries out the basic instructions that operate a computer |
| _____ 8. kiosk (119) | h. freestanding terminal that usually has a touchscreen for user input |
| _____ 9. push notification (124) | i. message that initiates from a sending location without a request from the receiver |
| _____ 10. fault-tolerant computer (141) | j. the main circuit board of a personal computer |

**Consider This**

Answer the following questions in the format specified by your instructor.


- Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (111, 122, 132, 133), How To (137, 138, 141, 143), Mini Features (113, 115, 128), Secure IT (110, 119, 125, 136), and Technology @ Work (145).
- How do malware authors use social media to spread infection? (110)
- What are the two main components of the motherboard? (110)
- How do ultrathin laptops differ from traditional laptops? (111)
- What privacy issues have arisen with webcams in mobile devices? (111)
- What are the two types of tablets? (112)
- What is a stylus? (112)
- What is in the system unit? (114)
- What are the features of a gaming desktop? (114)
- Who might use a workstation? (114)
- What additional requirements are associated with a dedicated server? (116)
- What are the three form factors for servers? (116)
- What are the advantages of virtual servers? (117)
- How does a POS terminal serve as input? (118)
- What are some examples of self-serve kiosks? (119)
- How does cloud computing allow businesses to more efficiently manage resources? (122)
- What are three types of cloud computing? (122)
- What information might you receive from a web to mobile text message? (124)
- For what purpose is a common short code (CSC) used? (124)
- How do push notifications differ from pull notifications? (124)
- How do SLR cameras differ from point-and-shoot cameras? (125)
- What is the difference between enhanced and optical resolution? (127)
- What are three popular wearable devices? (130)
- Why are embedded computers usually small with limited hardware? (132)
- What are some types of ports you might find on a computer or mobile device? (135)
- What is the purpose of a docking station? (137)
- What is necessary before two Bluetooth devices can communicate? (138)
- Why might you want to connect your phone to a Wi-Fi network? (138)
- How does a surge protector work? What is the purpose of an uninterruptible power supply? (140)
- How can you prevent RSIs and CTS? (142)

Problem Solving

The **Problem Solving** exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The **Collaboration** exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Slow Computer Performance** Your computer is running exceptionally slow. Not only does it take the operating system a long time to start, but programs also are not performing as well as they used to perform. How might you resolve this?
- 2. Faulty ATM** When using an ATM to deposit a check, the ATM misreads the amount of the check and credits your account the incorrect amount. What can you do to resolve this?
- 3. Wearable Device Not Syncing**  Your wearable device synchronized with your smartphone this morning when you turned it on, but the two devices no longer are synchronized. What might be wrong, and what are your next steps?
- 4. Battery Draining Quickly** Although the battery on your smartphone is fully charged, it drains quickly. In some instances when the phone shows that the battery has 30% remaining, it shuts down immediately. What might be wrong?
- 5. Potential Virus Infection** While using your laptop, a message is displayed stating that your computer is infected with a virus and you should tap or click a link to download a program designed to remove the virus. How will you respond?

Professional

- 6. Excessive Phone Heat** While using your smartphone, you notice that throughout the day it gets extremely hot, making it difficult to hold up to your ear. What steps can you take to correct this problem?
- 7. Server Not Connecting** While traveling on a business trip, your phone suddenly stops synchronizing your email messages, calendar information, and contacts. Upon further investigation, you notice an error message stating that your phone is unable to connect to the server. What are your next steps?
- 8. Mobile Device Synchronization** When you plug your smartphone into your computer to synchronize the data, the computer does not recognize that the smartphone is connected. What might be the problem?
- 9. Cloud Service Provider** Your company uses a cloud service provider to back up the data on each employee's computer. Your computer recently crashed, and you need to obtain the backup data to restore to your computer; however, you are unable to connect to the cloud service provider's website. What are your next steps?
- 10. Connecting to a Projector** Your boss asked you to give a presentation to your company's board of directors. When you enter the boardroom and attempt to connect your laptop to the projector, you realize that the cable to connect your laptop to the projector does not fit in any of the ports on your laptop. What are your next steps?

Collaboration

- 11. Technology in Energy Management** Your science instructor is teaching a lesson about how technology has advanced the energy management field. Form a team of three people to prepare a brief report about how technology and energy management are connected. One team member should research how computers play a role in conserving energy. Another team member should research other types of technology present in today's homes and buildings that can conserve energy, and the third team member should research other benefits (such as cost savings) resulting from proper energy management.

The **How To: Your Turn** exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn** exercises, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Synchronize a Device

Synchronizing a mobile device with the cloud or a computer provides a backup location for your data should your device fail, or become lost or stolen. While companies such as Google and Apple typically will allow you to download your purchased apps again free of charge, you also should synchronize your data so that it is available in the event a problem with your device arises. The following steps guide you through the process of synchronizing a device.



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Synchronize with the Cloud

- Search for an app compatible with your device that allows you to synchronize the data on your device with the cloud. Some device manufacturers, such as Apple, provide a service to synchronize your device with the cloud.
- If necessary, download and install the app.
- The first time you run the app, you may need to enter some personal information so that you are able to sign in and access your data in the future.
- Configure the app to synchronize at your desired interval. If you are synchronizing a smartphone, keep in mind that synchronizing with the cloud will require a data plan. Be sure your data plan supports the amount of data that will be synchronized.
- Once you have configured the synchronization settings successfully, select the option to manually synchronize your device at this time.

Synchronize with a Computer

- Install and run the app designed to synchronize your device with your computer. For instance, iTunes is used to synchronize Apple devices with a computer.
- Connect the device to the computer using the synchronization cable provided.

- When the synchronization is complete, a message will inform you that it is safe to disconnect the device. Do not disconnect the device before the synchronization is complete, as that may damage the data on the device.

Retrieve Synchronized Data

If you lose your device or the data on your device, you can retrieve the data previously synchronized. To retrieve data synchronized previously, follow the instructions in the program or app used to synchronize your data.

Exercises

- What type of device are you attempting to synchronize? What programs and apps are available to synchronize your device with the cloud? What programs and apps are available to synchronize your device with a computer?
- Which program or app did you use to synchronize your device? Why did you choose that program or app instead of the others?
- How long did it take to synchronize your device? What data on your device did the program or app synchronize?

2 Find, Download, and Read an E-Book on an E-Book Reader

Most e-book readers enable you to find and download new e-books without having to connect to a computer first. To search for and download an e-book, you need to establish an Internet connection through either Wi-Fi or a mobile data plan. The following steps guide you through the process of finding, downloading, and reading an e-book on an e-book reader.

- Turn on your e-book reader and establish an Internet connection.
- Navigate to the store on your e-book reader where you can search for and download e-books.
- Locate the option to search available e-books and then enter the desired search text. You usually can search by the book's title, author, or genre.

How To: Your Turn

How To: Your Turn

- d. Perform the search and then browse the search results for the book you want to download and install.
- e. Select the option to download the book. Please note that many books cost money to download. If your payment information was entered previously, you may be charged for downloading this e-book. If you do not want to be charged, locate and download an e-book that is free.
- f. When the download is complete, return to your list of installed e-books.
- g. Select the e-book you have just downloaded to read the e-book.

Exercises

1. What type of e-book reader do you have? Are you happy with the selection of e-books on your e-book reader?
2. In addition to e-book readers, what other types of devices allow you to read e-books?
3. Do e-books cost more or less than traditional print books? What are the advantages and disadvantages of using e-books?



3 Manage Power for Mobile Computers and Devices

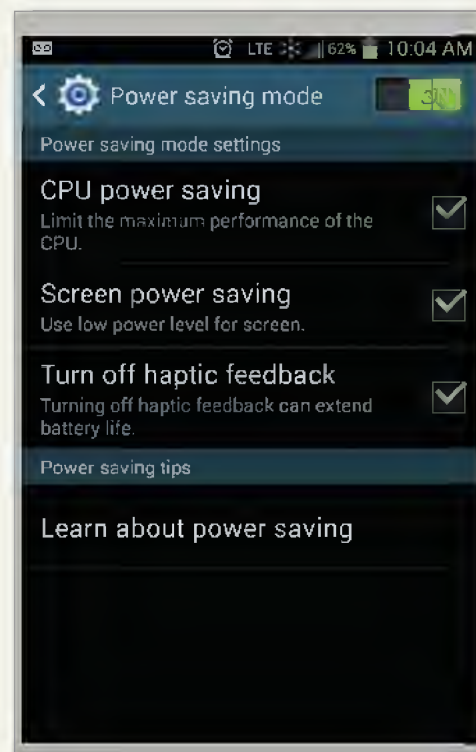
Configuring power management settings on mobile computers and devices will help ensure your battery life is maximized. The following steps guide you

through the process of configuring power management features on mobile computers and devices.

- a. Display the Control Panel or Settings on your mobile computer or device.
- b. Tap or click the option to display power management or battery settings.
- c. If necessary, select a power plan setting to view or modify.
- d. Make the necessary adjustments to the settings that affect power consumption. For example, configure the display to dim or turn off after 30 seconds of inactivity. This will allow you enough time to read what is on the screen without having to touch the screen or move the mouse.
- e. Save all changes.

Exercises

1. What power management settings have you configured on your mobile computer or device?
2. Compare battery life on your device before and after configuring power management settings. Have you noticed an improvement in battery life? If so, how much?
3. What other power management settings are you able to configure on your mobile computer or device?



How To: Your Turn

4 Use your Mobile Device Ergonomically

Individuals are using various mobile devices, such as phones and tablets, more frequently, and using these devices ergonomically can help prevent unnecessary injury. The following guidelines will help you use your mobile device ergonomically:

- Use shortcuts and abbreviations whenever possible to avoid excessive hand movement.
- Make sure your hands, wrists, and arms are at a natural angle, and avoid holding the device in a position that causes discomfort.
- Use hands-free devices and voice recognition features whenever possible to avoid hand movement.
- Do not use the device for extended periods of time without taking frequent breaks.
- Avoid resting the device on your lap during use.
- Sit in an upright position or stand when using the device.
- Consider using a separate keyboard and mouse if you will be interacting with the device extensively.
- Use the device in a setting with natural light.

Exercises

1. Have you been following the above guidelines while using mobile computers and devices? If not, what have you been doing differently?
2. What types of health risks might nonergonomic use of a mobile device pose?
3. What are some additional guidelines you can follow to help minimize health risks while using your mobile device?



5 Transfer Media from a Mobile Device to a Computer

Many individuals take photos and record videos using mobile devices such as digital cameras, smartphones, and tablets. After taking the photos and recording the

videos, transferring them to a computer allows you easily to create backup copies, edit the media, and create digital albums. The following steps describe multiple ways to transfer media from a mobile device to a computer.

To transfer photos from a mobile device to a computer using a memory card:

- a. Safely remove the memory card from the mobile device.
- b. Properly insert the memory card into the appropriate memory card slot on the computer.
- c. When the computer detects the memory card, navigate to the location of the media to transfer.
- d. Select the files to transfer and then drag them to the destination folder on the computer.
- e. Use the operating system's "Eject" or "Safely Remove" feature to remove the memory card from the computer safely and insert it back in the mobile device.

To transfer photos from a mobile device to a computer using a USB cable:

- a. Connect the cable to the mobile device and to the computer.
- b. When the computer detects the mobile device, navigate to the location on the mobile device containing the media to transfer.
- c. Select the files to transfer and then drag them to the destination folder on the computer.
- d. Disconnect the USB cable from the computer and from the mobile device.

Some mobile devices also allow you to transfer media using wireless technologies, such as Bluetooth and Wi-Fi. The steps required to transfer photos wirelessly vary greatly for each device. Thus, read your mobile device's documentation to see if and how you can transfer media to your computer wirelessly. Be aware that transferring photos using your mobile data plan could increase your data charges. Consider using Wi-Fi or Bluetooth to transfer the media.

Exercises

1. Of the above techniques, which way do you find is easiest to transfer media from your mobile device to a computer? Why?
2. What other technologies might you be able to use to transfer media from a mobile device to a computer?
3. Would you rather transfer media from your mobile device to a computer, or transfer it to the cloud? Why?

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to challenge yourself with additional Internet Research exercises, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Retail and Auctions

E-retailers are changing the ways consumers shop for goods. One market research firm reports that nearly three-fourths of shoppers complete one-half of all their transactions online. As shoppers grow increasingly loyal to e-commerce, retail websites have become more sophisticated, and brick-and-mortar stores have adapted to the online presence. Nearly 90 percent of smartphone owners use their devices to compare prices, locate promotional offers, and determine directions and store hours.

Online auctions offer another convenient method of shopping for and selling practically anything imaginable. Most auction sites organize products in categories and provide photos and descriptions. eBay is one of thousands of Internet auction websites and is the world's largest personal online trading community. In addition, craigslist is a free online equivalent of classified advertisements.

Research This: (a) Visit two retail websites and search for the latest e-book readers. Which features do these websites offer compared with the same offerings in brick-and-mortar stores? What are the advantages and disadvantages of shopping online? What policies do these websites offer for returning items? Which items have you purchased online?

(b) Visit an auction website and search for two objects pertaining to your favorite musical artist, sports team, or celebrity. For example, search for an autographed photo or ticket stubs. Describe these two items. How many people have bid on these items? Who are the sellers? What are the opening and current bids?



Source: eBay

2 Social Media

Businesses know that using social media is an efficient and effective method of building brand loyalty and promoting the exchange of ideas. The informal communication between consumers and company representatives can help maintain credibility and promote trust. According to a recent study, more than 70 percent of American Internet users visit online social networks, and 65 percent of these people discover particular brands, products, and services by reading material posted on these websites. Twitter, Facebook, and other social media often are used to befriend customers, give a positive feeling about services and goods, engage readers, and market new ideas. Subscribers share their opinions, thoughts, and experiences, either positive or negative, through product and service reviews.

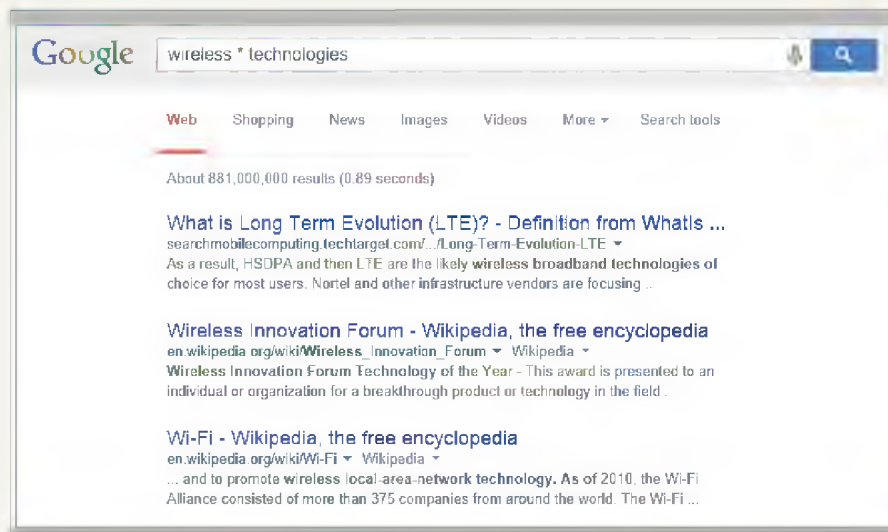
Research This: Visit at least three Twitter, Facebook, or other online social network sites and review the content. How many Twitter followers or Facebook 'likes' does the website have? Identify three organizations, businesses, products, or causes that have a presence on Facebook, Twitter, or other online social networks. How many followers or fans do they have? Which posts are engaging and promote positive attitudes about the company and the products or services offered? How many user-generated reviews and product ratings are shown? How do the online social networks encourage sharing opinions? In which ways do the companies respond to and interact with followers and fans? If negative posts are written, does the company respond professionally and positively?

3 Search Skills Search Operators

Search engines provide operators, or special symbols, that will help narrow down search results. Use quotation marks around search text to search for an exact word or phrase. For example, type the following as your search text: "wireless communications technologies" (be sure to include the quotation marks) to search for those three words in that exact order. Search results will display matching pages with the quoted search phrase highlighted or in bold.

Internet Research

To match one or more words in a phrase, you can use an asterisk (*), also called a wildcard operator, as part of your search text. Each asterisk represents one or more words. For example, type the following as your search text: "wireless * technologies" (with the quotation marks) to find search results that match wireless communications technologies, wireless Internet technologies, wireless and related technologies, and others. If you are searching for a phrase or quotation with many words, consider using the asterisk wildcard operator in place of some of the words in the search text. This technique is useful if you have a quotation, and you want to find out who said it or where it may have appeared.



Source: Google

Research This: Create search queries using quotation marks and/or the wildcard operator to answer the following questions and use a search engine to find the answers. (1) Someone once said, "Life is not fair, get used to it." Who was it? (2) What are three websites containing digital camera reviews? (3) How do businesses use near field communications? (4) Find five different words that complete the phrase, handheld ___ devices, by typing appropriate search text into a search engine.

Security

Surge protectors and uninterruptible power supplies offer protection from electrical power surges, as you learned in the Protecting Hardware section of this chapter. While these surges are part of everyday life, they are more likely to occur during thunderstorms and peak energy consumption periods. These unavoidable occurrences can damage or ruin sensitive electronic equipment. The processor in a computer is particularly sensitive to the fluctuations in current. When shopping for a surge protector, purchase the

best product you can afford. Typically, the amount of protection offered by a surge protector is proportional to its cost. That is, the more expensive the surge protector, the more protection it offers.

Research This: Visit an electronics store or view websites with a variety of surge protectors from several manufacturers. Read the packaging or specifications to determine many of the features. Compare at least three surge protectors by creating a table using these headings: manufacturer, model, price, Joule rating (a Joule is the unit of energy the device can absorb before it can be damaged; the higher the Joule rating, the better the protection), warranty, energy-absorption rating, response time, and other features. Which surge protector do you recommend? Why?

Cloud Services Data Providers and Mashups (DaaS)

The web has made it possible for many information providers to make business, housing, weather, demographic, and other data available on demand to third parties. Accessing online data on demand is an example of DaaS (data as a service), a service of cloud computing that provides current data over the Internet for download, analysis, or use in new applications.

Mashups are apps that combine data from one or more online data providers. Mapping mashups are popular because users can visualize locations associated with data originating from a variety of online sources, including real estate listings, crime statistics, current Tweets, live traffic conditions, or digital photos.

Research This: (1) Use a search engine to find two different online data markets. Write a report sharing the sources or focus of information each provides, the availability of visualization tools to preview data, and how developers can access or incorporate the data into their own apps and websites. (2) Use a search engine to find a popular mapping mashup based on data from one of the sources listed above, or another topic. Identify the provider of the data and the provider of the maps on which the data is displayed. (3) Use a search engine to find an app or website that will help you create your own map mashup showing locations of your online data: Facebook friends, Flickr or Instagram photos, or Tweets. Take a screenshot of the mashup you made.

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Technology Purchases

You are the director of information technology at a company that specializes in designing and selling customizable sportswear for local high school and college sports teams. Most of the technology equipment is out of date and must be replaced. You need to evaluate the requirements of individual employees so that you can order replacements.

Do This: Determine the type of computer or mobile device that might be most appropriate for the following employees: a graphic designer who exclusively works in the office, a cashier who is responsible for assisting customers with purchases, and a sales representative who travels to various locations and needs wireless communications capabilities. Consider the varying requirements of each, including mobility, security, and processing capabilities. Discuss various options that might work for each user, and considerations when purchasing each type of device.

2. Game Devices

You manage a youth recreation center and have been given a grant to purchase a game console and accessories, along with fitness games, for use at the center.

Do This: Use the web to research three popular recent game consoles. Choose five characteristics to compare the game consoles, such as Internet capabilities, multiplayer game support, storage capacity, television connection, and game controllers. Research fitness games for each console and what accessories are needed to run the games. Determine the goals of each game, such as skill-building, weight loss, or

entertainment. Read user reviews of each game, as well as professional reviews by gaming industry experts. If possible, survey your friends and classmates to learn about their experiences with each game, such as heart rate while playing the games, any fitness goals reached, and their enjoyment of the game.

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The league would like to purchase a digital camera to upload pictures of players, games, and fundraising events to its Facebook page and its website.

Do This: You need to prepare information about digital camera options to present to the board of directors. First, research the cost and quality differences between point-and-shoot cameras and SLR cameras. Use the web to find a recent model of both camera types and compare the reviews, as well as the costs, for each. Make a list of additional features, such as video capabilities, editing capabilities, lens, megapixels, GPS, flash, and zoom. Determine how each camera stores the images, the amount of storage available, and how to transfer images to a computer or mobile device. Explore whether software is included with the camera that can be used to edit, store, or organize the images after they are transferred to a computer. Compare your findings with the camera capabilities of a recent model smartphone. Determine what type of camera would be best for the league's needs and the capabilities that are most important.



Courtesy of Samsung

Collaboration

4. National Security Uses for Technology Technology is an integral part of military operations. Many military research projects use simulators that resemble civilian computer games. Your company has been contacted by the Department of Defense for a research project.

Do This: Form a four-member team, and then form two two-member groups. Assign each group one of the following topics to research: (1) How have mobile computers and cloud computing affected issues of national security? (2) How can the utilization of microchips worn by soldiers, or wearable computers, be integrated into civilian use? Meet with your team and discuss your findings. Determine any advantages or disadvantages, as well as any legal ramifications that may arise.

PROGRAMS AND APPS: Productivity, Graphics, Security, and Other Tools

4



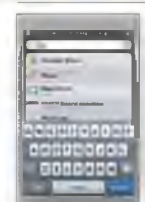
People use a variety of programs and apps on their computers and mobile devices.

“I use my computer and mobile devices to complete homework assignments, pay bills, edit digital photos, post social media updates, and play games. I also use an antivirus program. What other programs and apps could I need?”


While you may be familiar with some of the content in this chapter, do you know how to ...

- Determine safe websites for downloading software?
- Ensure you are not plagiarizing Internet content?
- Safely use a personal finance app?
- Use project management software?
- Avoid risks when using payment apps?
- Edit and share photos?
- Use voice command personal assistant apps?
- Identify different types of viruses and malware?
- Recognize a virus hoax?
- Protect your smartphone against malware threats?
- Recognize a phishing message?
- Uninstall a program or remove an app?
- Compress and uncompress files and folders?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.



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 Objectives

After completing this chapter, you will be able to:

- 1 Identify the general categories of programs and apps
- 2 Describe how an operating system interacts with applications and hardware
- 3 Differentiate among the ways you can acquire programs and apps: retail, custom, web app, mobile app, mobile web app, shareware, freeware, open source, and public-domain
- 4 Identify the key features of productivity applications: word processing, presentation, spreadsheet, database, note taking, calendar and contact management, project management, accounting, personal finance, legal, tax preparation, document management, support services, and enterprise computing
- 5 Identify the key features of graphics and media applications: computer-aided design, desktop publishing, paint/image editing, photo editing and photo management, video and audio editing, multimedia and website authoring, media player, and disc burning
- 6 Identify the uses of personal interest applications: lifestyle, medical, entertainment, convenience, and education
- 7 Identify the purpose of software used in communications
- 8 Identify the key features of security tools: personal firewall, antivirus programs, malware removers, and Internet filters
- 9 Identify the key features of file, disk, and system management tools: file manager, search, image viewer, uninstaller, disk cleanup, disk defragmenter, screen saver, file compression, PC maintenance, and backup and restore

Programs and Apps

Using programs and apps, you can accomplish a variety of tasks on computers and mobile devices (Figure 4-1). Recall from Chapter 1 that a **program**, or **software**, consists of a series of related instructions, organized for a common purpose, that tells the computer what tasks to perform and how to perform them. An **application**, or **app**, sometimes called *application software*, consists of programs designed to make users more productive and/or assist them with personal tasks.

An *operating system* is a set of programs that coordinates all the activities among computer or mobile device hardware. Other programs, often called *tools* or *utilities*, enable you to perform maintenance-type tasks usually related to managing devices, media, and programs used by computers and mobile devices. The operating system and other tools are collectively known as *system software* because they consist of the programs that control or maintain the operations of the computer and its devices.

Role of the Operating System

To use applications, such as a browser or word processing program on a desktop or laptop, your computer must be running an operating system. Similarly, a mobile device must be running an operating system to run a mobile app, such as a navigation or payment app. Desktop operating systems include Mac OS, Windows, Linux, and Chrome OS. Mobile operating systems include Android, iOS, and Windows Phone. The operating system, therefore, serves as the interface between the user, the applications and other programs, and the computer's or mobile device's hardware (Figure 4-2).

 **Internet Research**

Which mobile operating system is the most widely used?

Search for: mobile operating system market share



Figure 4-1 Users work with a variety of programs and apps, some of which are shown in this figure.

© Cengage Learning; Courtesy of NCH Software; Source: Apple Inc.; Source: Google Inc.; Courtesy of AVG Technologies; Source: Microsoft

An Example of How an Operating System Interacts with a User, an Application, and Hardware

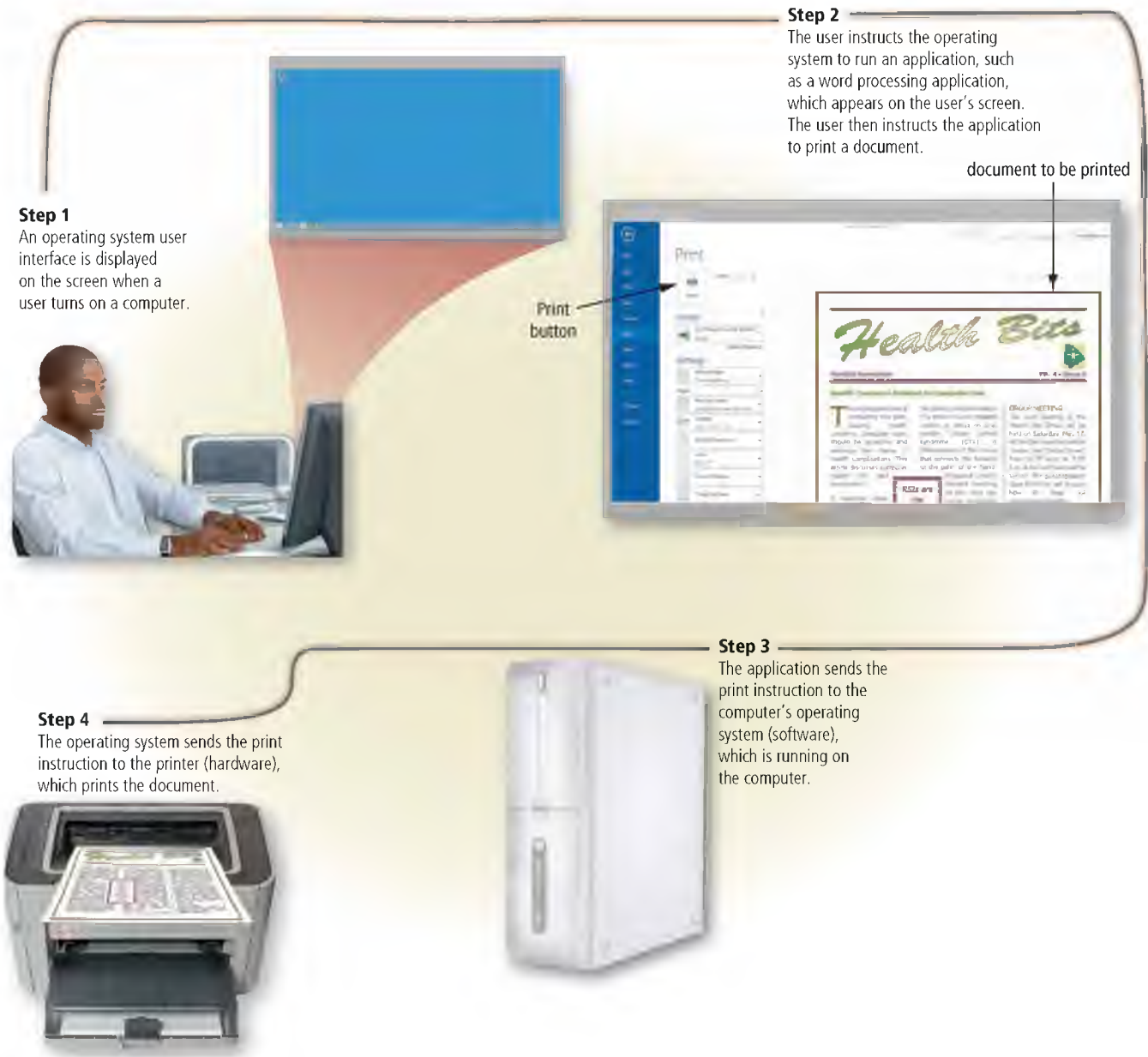


Figure 4-2 This figure shows how the operating system is the interface between the user, the application, and the hardware.
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Each time you start a computer or mobile device, the operating system is loaded (copied) from the computer's hard drive or mobile device's storage media into memory. Once the operating system is loaded, it coordinates all the activities of the computer or mobile device. This includes running applications and transferring data among input and output devices and memory. While the computer or mobile device is running, the operating system remains in memory.

Discover More: Visit this chapter's free resources to learn more about desktop and mobile operating systems.

Obtaining Software

Software is available in a variety of forms: retail, custom, web app, mobile app, mobile web app, shareware, freeware, open source, and public domain.

- *Retail software* is mass-produced, copyrighted software that meets the needs of a wide variety of users, not just a single user or company. Some retail software, such as an operating system, is preinstalled on new computers and mobile devices. You also can purchase retail software from local stores and on the web. With online purchases, you may be able to download purchased programs immediately instead of waiting for the software to arrive by mail.
- *Custom software* performs functions specific to a business or industry. Sometimes a company cannot locate retail software that meets its unique requirements. In this case, the company may use software developers to create tailor-made custom software. Custom software usually costs more than retail software.
- A *web app* is an application stored on a web server that you access through a browser. Users typically interact with web apps directly by visiting a website, but some web apps also can be accessed locally offline. Many websites provide free access to their apps. Some charge a one-time fee, while others charge recurring monthly or annual subscription fees. You may be able to use part of a web app free and pay for access to a more comprehensive program or pay a fee when a certain action occurs.
- A *mobile app* is an application you download from a mobile device's app store, sometimes called a *marketplace*, or other location on the Internet to a smartphone or other mobile device. Some mobile apps are preinstalled on a new mobile computer or device. Many mobile apps are free; others have a minimal cost — often less than a few dollars.
- A *mobile web app* is a web app that is optimized for display in a browser on a mobile device, regardless of screen size or orientation. Many app developers opt for web delivery because they do not have to create a different version for each mobile device's app store. Many web apps use a responsive design, which means the app displays properly on any computer or device.
- *Shareware* is copyrighted software that is distributed at no cost for a trial period. To use a shareware program beyond that period, you send payment to the software developer or you might be billed automatically unless you cancel within a specified period of time. Some developers trust users to send payment if software use extends beyond the stated trial period. Others render the software useless if no payment is received after the trial period expires. In some cases, a scaled-down version of the software is distributed free, and payment entitles the user to the fully functional product.
- *Freeware* is copyrighted software provided at no cost by an individual or a company that retains all rights to the software. Thus, software developers typically cannot incorporate freeware in applications they intend to sell. The word, free, in freeware indicates the software has no charge.
- *Open source software* is software provided for use, modification, and redistribution. This software has no restrictions from the copyright holder regarding modification of the software's internal instructions and its redistribution. Open source software usually can be downloaded from a web server on the Internet, often at no cost. Promoters of open source software state two main advantages: users who modify the software share their improvements with others, and customers can personalize the software to meet their needs.
- *Public-domain software* has been donated for public use and has no copyright restrictions. Anyone can copy or distribute public-domain software to others at no cost.



BTW

Trial Versions

Some retail and other programs have a *trial version*, which is an application you can use at no charge for a limited time, to see if it meets your needs. Some trial versions have limited functionality.



BTW

Copyright

A copyright gives authors, artists, and other creators of original work exclusive rights to duplicate, publish, and sell their materials.

Thousands of shareware, freeware, and public-domain programs are available on the Internet for users to download. Examples include communications, graphics, and game programs. Read Secure IT 4-1 for tips about safely downloading shareware, freeware, or public-domain software.

Discover More: Visit this chapter's free resources to learn more about software availability.

SECURE IT 4-1

Safe Downloading Websites

Websites tempt potential customers with catchy offers for software promising to speed up the computer or to obtain the latest versions of games and music. The temptation to download shareware, freeware, and public-domain software is high, especially when the cost of such useful or fun programs is free or extremely reasonable. This action could be dangerous, however, because some of these websites are filled with virus-infected software just waiting to be installed on an unsuspecting user's computer or mobile device.

Before downloading any software, consider these factors when locating and evaluating shareware, freeware, or public-domain websites:

- Search for popular shareware, freeware, and public-domain download websites.

The software generally is organized into evaluation categories, such as outstanding and recommended, or grouped into purpose, such as tools and gaming.

- Look for websites with programs for your particular type of computer or mobile device. Some websites exclusively offer Windows- or Apple-based products.
- Obtain the latest versions of shareware, freeware, and public-domain software. Many developers update their programs frequently in an effort to include new features and to thwart viruses. The newest versions, therefore, often are safer and easier to use than previous versions.
- Locate websites with a variety of programs in a specific category. For example, if you need antivirus software, you can search

to find which shareware, freeware, and public-domain software is available.

- Read ratings for and reviews of products. Often, comments from users provide guidance in selecting the most desirable software for your needs.

If you follow these tips, you may find shareware, freeware, and public-domain software to be one of the best software bargains in the marketplace.

Consider This: Have you ever used or downloaded programs or apps from a shareware, freeware, or public-domain software website? If so, what software did you acquire? If not, would you consider locating shareware, freeware, or public-domain software for your particular needs? Why or why not?

CONSIDER THIS

What is software as a service?

Software as a service (SaaS) describes a computing environment where an Internet server hosts and deploys applications. Editing projects or photos, sending email messages, and managing finances are common consumer tasks of SaaS applications. For an exercise related to SaaS, see the Internet Research: Cloud Services exercise at the end of this chapter.

Installing Software

Recall from Chapter 1 that you typically need to install desktop apps on a computer. Installing is the process of setting up the software to work with a computer, printer, and other hardware. Mobile apps typically install automatically after you download the app from the device's app store. You usually do not need to install web apps before you can use them, but you may need to install plug-ins, such as Java or Flash, so that the web apps work.

During installation of software or before the first use, a program or app may ask you to register and/or activate the software. *Software registration* typically is optional and usually involves submitting your name and other personal information to the software manufacturer or developer. Registering the software often entitles you to product support. *Product activation* is a technique that some software manufacturers use to ensure that you do not install the software on more computers than legally licensed. Usually, the software can be run a preset number of times, has limited



BTW Syncing Apps

When you install an app on one computer or device, it also will install automatically on any other computers and devices on the same subscription plan.

functionality, or does not function until you activate it via the Internet or by phone. Thus, activation is a required process for programs that request it. Some software allows multiple activations; for example, you can install it and run it on a laptop and a desktop. Registering and/or activating software also usually entitles you to free program updates for a specified time period, such as a year.

Many desktop and mobile apps use an *automatic update* feature, where the updates can be configured to download and install automatically. With web apps, by contrast, you always access the latest version of the software.

CONSIDER THIS

What is a license agreement?

A *license agreement*, sometimes called an end-user license agreement (*EULA*), is the right to use a program or app. The license agreement provides specific conditions for use of the software, which a user typically must accept before using the software (Figure 4-3). Unless otherwise specified by a license agreement, you do not have the right to copy, loan, borrow, rent, or in any way distribute programs or apps. Doing so is a violation of copyright law; it also is a federal crime.

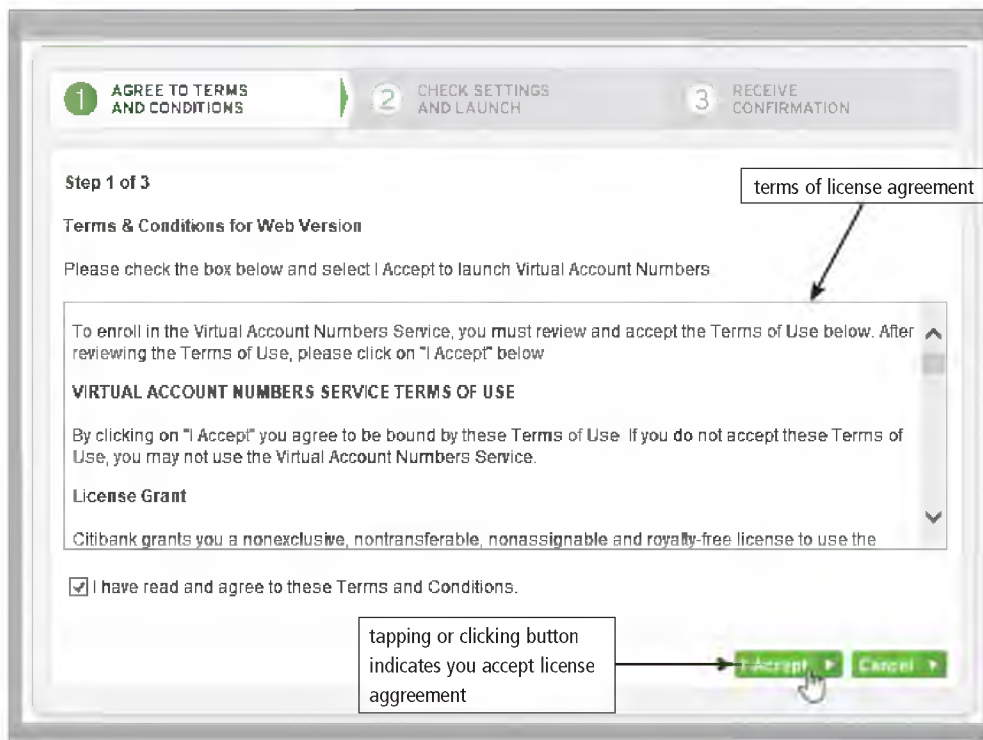


Figure 4-3 A user must accept the terms in a license agreement before using the software.

Source: Citigroup Inc

Categories of Programs and Apps

With programs and apps, you can work on a variety of projects — such as creating letters, memos, reports, and other documents; developing presentations; preparing and filing taxes; drawing and altering images; recording and enhancing audio and video clips; obtaining directions or maps; playing games individually or with others; composing email and other messages; protecting computers and mobile devices from malware; organizing media; locating files; and much more. Table 4-1 categorizes popular categories of programs and apps by their general use.

 **Table 4-1 Programs and Apps by Category**

Category	Types of Programs and Apps	
Productivity (Business and Personal)	<ul style="list-style-type: none"> • Word Processing • Presentation • Spreadsheet • Database • Note Taking • Calendar and Contact Management • Project Management 	<ul style="list-style-type: none"> • Accounting • Personal Finance • Legal • Tax Preparation • Document Management • Support Services • Enterprise Computing
Graphics and Media	<ul style="list-style-type: none"> • Computer-Aided Design (CAD) • Desktop Publishing • Paint/Image Editing • Photo Editing and Photo Management • Clip Art/Image Gallery 	<ul style="list-style-type: none"> • Video and Audio Editing • Multimedia and Website Authoring • Media Player • Disc Burning
Personal Interest	<ul style="list-style-type: none"> • Lifestyle • Medical • Entertainment • Convenience • Education 	
Communications	<ul style="list-style-type: none"> • Blog • Browser • Chat Room • Online Discussion • Email • File Transfer 	<ul style="list-style-type: none"> • Internet Phone • Internet Messaging • Mobile Messaging • Videoconference • Web Feeds
Security	<ul style="list-style-type: none"> • Personal Firewall • Antivirus • Malware Removers • Internet Filters 	
File, Disk, and System Management	<ul style="list-style-type: none"> • File Manager • Search • Image Viewer • Uninstaller • Disk Cleanup 	<ul style="list-style-type: none"> • Disk Defragmenter • Screen Saver • File Compression • PC Maintenance • Backup and Restore



CONSIDER THIS

Are the categories of programs and apps shown in Table 4-1 mutually exclusive?

Programs and apps listed in one category may be used in other categories. For example, photo editing applications, which appear in the graphics and media category, often also are used for business or personal productivity. Additionally, the programs and apps in the last three categories (communications; security; and file, disk, and system management) often are used in conjunction with or to support programs and apps in the first three categories (productivity, graphics and media, and personal interest). For example, email appears in the communications category but also is a productivity application.

Productivity Applications

Productivity applications can assist you in becoming more effective and efficient while performing daily activities at work, school, and home. Productivity applications include word processing, presentation, spreadsheet, database, note taking, calendar and contact management, project management, accounting, personal finance, legal, tax preparation, document management, and enterprise computing.

A variety of manufacturers offer productivity apps in each of these areas, ranging from desktop to mobile to web apps. Many have a desktop version and a corresponding mobile version adapted for smaller screen sizes and/or touch screens.

Developing Projects

With productivity applications, users often create, edit, format, save, and distribute projects. Projects include documents, presentations, spreadsheets, notes, calendars, contact lists, budgets, and more.

During the process of developing a project, you likely will switch back and forth among the following activities.

1. When you *create* a project, you enter text or numbers, insert images, add contacts, schedule appointments, and perform other tasks using a variety of input methods, such as a keyboard, a mouse, touch, or voice.
2. To *edit* a project means to make changes to its existing content. Common editing tasks include inserting, deleting, cutting, copying, and pasting.
 - a. Inserting involves adding text, images, or other content.
 - b. Deleting involves removing text, images, or other content.
 - c. Cutting is the process of removing content and storing it in a temporary storage location, called a *clipboard*.
 - d. Copying is the process of placing content on a clipboard, with the content remaining in the project. Read Ethics & Issues 4-1 for a discussion about unethical copying.
 - e. Pasting is the process of transferring content from a clipboard to a specific location in a project.



ETHICS & ISSUES 4-1



What Can Schools and Employers Do to Prevent Internet Plagiarism?

The Internet has made it easier for students and employees to plagiarize; in contrast, it also provides tools that schools and employers can use to detect illegal copying. Schools often have specific rules about what constitutes plagiarism. Employees, such as journalists, are expected to follow ethical guidelines when copying or citing content.

The Internet offers many ways for students to cheat intentionally, including websites that allow you to purchase a research paper. Students may not realize that copying information without properly citing it also is plagiarism. Students who intentionally plagiarize blame competition. Teachers have several tools to catch plagiarists,

including services that compare papers to others on the Internet and produce a report highlighting content resembling previously published writing.

A journalist might be expected not only to produce multiple articles daily but also to use social media to keep readers engaged. This pressure tempts some journalists to copy content, sometimes without giving credit or linking to the original source. The laws against plagiarism are the same whether copying content from a respected news source, a personal blog, or social media. The pressures of time and expectations of content can create high-profile cases of plagiarism that affect not only the journalist but the news source for which he or she writes.

Some argue that the best way to prevent cheating is to educate. First, teach the values and discuss the consequences of cheating. Next, teach how to cite sources properly and summarize information. Before copying or paraphrasing another person's work, contact him or her to request permission. When in doubt, check with a librarian, editor, or instructor.

Consider This: How should educators and employers deal with plagiarism? Should schools use a paper-comparison service in an attempt to stop cheating? Why or why not? Does linking to the original source excuse a journalist who copies content? Why or why not?

3. When users *format* a project, they change its appearance. Formatting is important because the overall look of a project significantly can affect its capability to communicate information clearly. Examples of formatting tasks are changing the font, font size, and font style (Figure 4-4).
 - a. A *font* is a name assigned to a specific design of characters. Cambria and Calibri are examples of fonts.
 - b. *Font size* indicates the size of the characters in a particular font. Font size is gauged by a measurement system called points. A single point is about 1/72 of an inch in height.
 - c. A *font style* adds emphasis to a font. Bold, italic, underline, and color are examples of font styles.
4. During the process of creating, editing, and formatting a project, the computer or mobile device holds it in memory. To keep the project for future use requires that you save it. When you *save* a project, the computer transfers the project from memory to a local storage medium, such as a USB flash drive or hard drive, or cloud storage, so that you can retrieve it later.
5. You can distribute a project as a hard copy or electronically. A *hard copy* is information that exists on a physical medium, such as paper. To generate a hard copy, you *print* a project. Sending electronic files via email or posting them for others to view, on websites for example, saves paper and printer supplies. Many users opt for electronic distribution because it contributes to green computing.

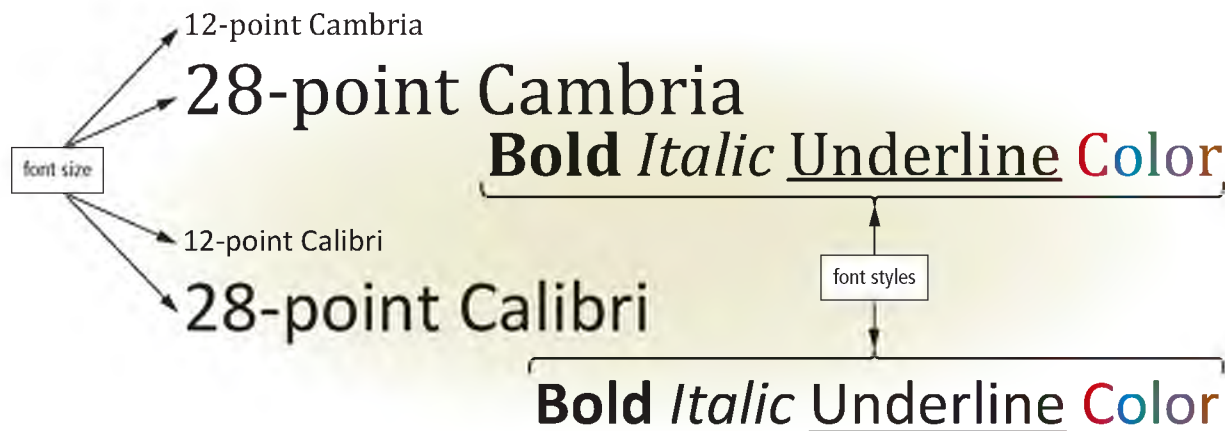


Figure 4-4 The Cambria and Calibri fonts are shown in two font sizes and a variety of font styles.

© Cengage Learning

CONSIDER THIS

How often should you save a project, and why do some apps not require you save?

Saving at regular intervals, such as every 5 or 10 minutes, ensures that the majority of your work will not be lost in the event of a power loss or system failure. Many programs have an AutoSave feature that automatically saves open projects at specified time intervals, such as every 10 minutes.

Some web and mobile apps, such as online productivity apps, save your work instantly as you type. These apps and the document both are stored on the cloud. Thus, the app automatically saves your changes to a cloud server with every keystroke.

CONSIDER THIS

What is a clip art/image gallery?

Applications often include a **clip art/image gallery**, which is a collection of clip art and photos. Some applications contain links to additional clips available on the web or are available as web apps. You also can purchase clip art/image gallery software that contains thousands of images.

In addition to clip art and photos, many clip art/image galleries provide fonts, animations, sounds, video clips, and audio clips. You can use the images, fonts, and other items from the clip art/image gallery in all types of projects, including documents, brochures, worksheets, and slide shows.

Word Processing

Word processing software, sometimes called a word processor, is an application that allows users to create and manipulate documents containing mostly text and sometimes graphics (Figure 4-5). Millions of people use word processing software on their computers and mobile devices every day to develop documents such as letters, memos, reports, mailing labels, newsletters, and webpages.

A major advantage of using word processing software is that it enables users to change their written words easily. Word processing software also has many features to make documents look professional and visually appealing. For example, you can change the font, size, and color of characters; apply special effects, such as three-dimensional shadows; use built-in styles to format documents; and organize text in newspaper-style columns.

Most word processing software allows users to incorporate graphics, such as digital photos and clip art, in documents. In Figure 4-5, a user inserted an image of a tractor in the document. With word processing software, you easily can modify the appearance of an image after inserting it in the document.

You can use word processing software to define the size of the paper on which to print and to specify the margins. A feature, called wordwrap, allows users to type words in a paragraph continually without pressing the ENTER key at the end of each line. While you edit a paragraph or change the paragraph margins, the words in the paragraph automatically wrap, or reflow within the paragraph. As you type more lines of text than can be displayed on the screen, the top portion of the document moves upward, or scrolls, off the screen.

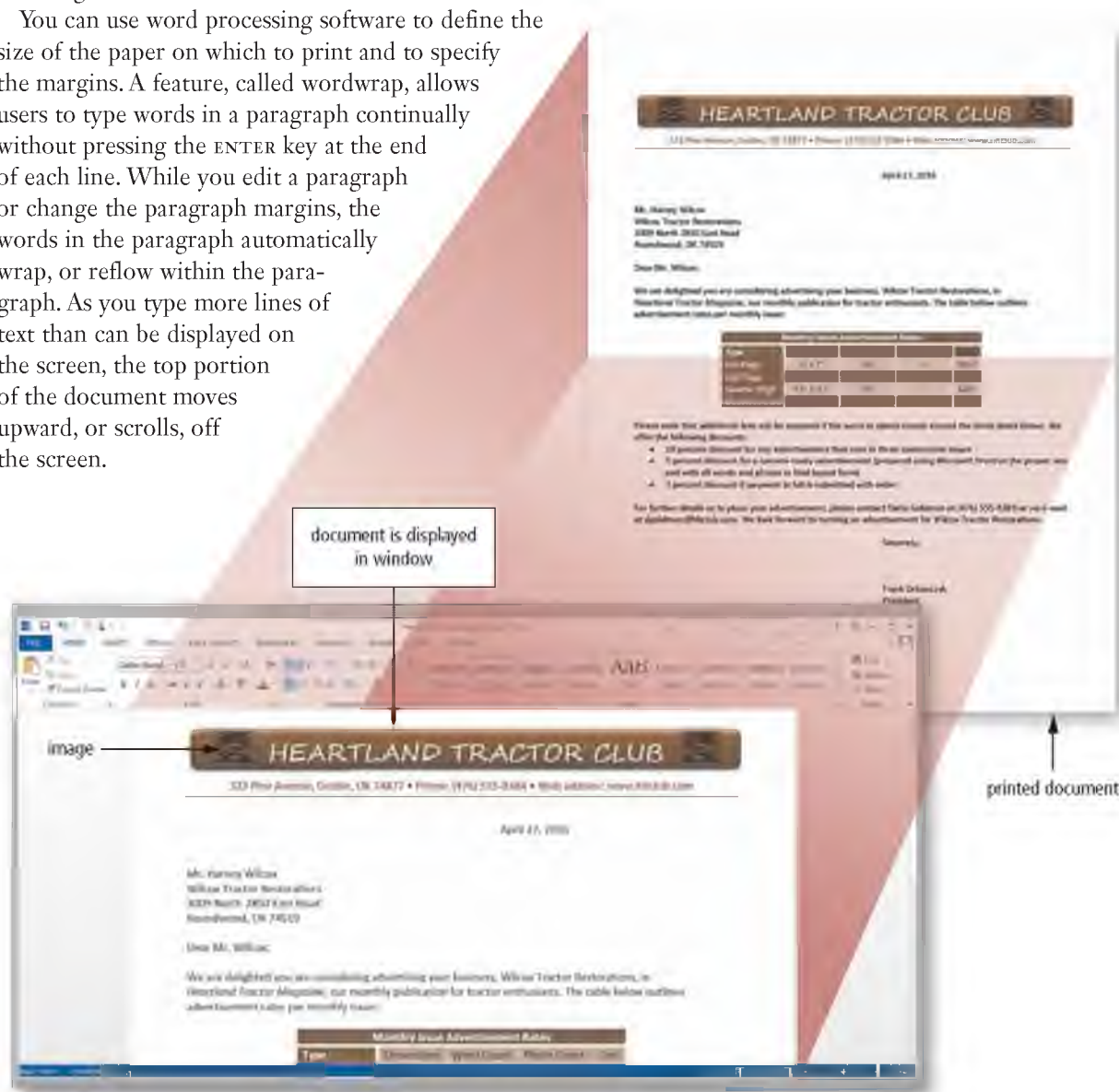


Figure 4-5 Word processing software enables users to create professional and visually appealing documents.

Microsoft; © Cengage Learning



What are the guidelines for writing business letters?

Search for: business letter writing



Figure 4-6 This presentation created with presentation software consists of five slides.

Source: Microsoft, © Cengage Learning

Word processing software typically includes tools to assist you with the writing process. For example, a spelling checker reviews the spelling of individual words, sections of a document, or the entire document. A grammar checker detects passive voice, run-on sentences, and grammatical errors. A format checker identifies extraneous spaces, capitalization errors, and more.

Discover More: Visit this chapter's free resources to learn more about word processing software and features.

Presentation

Presentation software is an application that allows users to create visual aids for presentations to communicate ideas, messages, and other information to a group. The presentations can be viewed as slides, sometimes called a *slide show*, that are displayed on a large monitor or on a projection screen from a computer or mobile device (Figure 4-6).

Presentation software typically provides a variety of predefined presentation formats that define complementary colors for backgrounds, text, and graphical accents on the slides. This software also provides a variety of layouts for each individual slide such as a title slide, a two-column slide, and a slide with clip art, a chart, a table, or a diagram. In addition, you can enhance any text, charts, and graphics on a slide with 3-D effects, animation, and other special effects, such as shading, shadows, and textures.

When building a presentation, users can set the slide timing so that the presentation automatically displays the next slide after a preset delay. Presentation software allows you to apply special effects to the transition between slides. One slide, for example, might fade away as the next slide appears.

Presentation software typically includes a clip gallery that provides images, photos, video clips, and audio clips to enhance presentations. Some audio and video editing applications work with presentation software, providing users with an easy means to record and insert video, music, and audio commentary in a presentation.

You can view or print a finished presentation in a variety of formats, including a hard copy outline of text from each slide and handouts that show completed slides. Presentation software also incorporates features such as checking spelling, formatting, researching, and creating webpages from existing slide shows.

Discover More: Visit this chapter's free resources to learn more about presentation software.

Spreadsheet

Spreadsheet software is an application that allows users to organize data in columns and rows and perform calculations on the data. These columns and rows collectively are called a **worksheet**. Most spreadsheet software has basic features to help users create, edit, and format worksheets. A spreadsheet file also is known as a workbook because it can

contain thousands of related individual worksheets. Data is organized vertically in columns and horizontally in rows on each worksheet (Figure 4-7).

Each worksheet usually can have thousands of columns and rows. One or more letters identify each column, and a number identifies each row. Only a small fraction of these columns and rows are visible on the screen at one time. Scrolling through the worksheet displays different parts of it on the screen.

A cell is the intersection of a column and row. The spreadsheet software identifies cells by the column and row in which they are located. For example, the intersection of column B and row 4 is referred to as cell B4. As shown in Figure 4-7, cell B4 contains the number, \$1,000.29, which represents the wages for January.

Many of the worksheet cells shown in Figure 4-7 contain a number, called a value, that can be used in a calculation. Other cells, however, contain formulas that generate values. A formula performs calculations on the data in the worksheet and displays the resulting value in a cell, usually the cell containing the formula. When creating a worksheet, you can enter your own formulas. In Figure 4-7, for example, cell B17 could contain the formula $=B9+B10+B11+B12+B13+B14+B15+B16$, which would add (sum) the contents of cells B9, B10, B11, B12, B13, B14, B15, and B16. That is, this formula calculates the total expenses for January.

A *function* is a predefined formula that performs common calculations, such as adding the values in a group of cells or generating a value such as the time or date. For example, the function $=SUM(B9:B16)$ instructs the spreadsheet application to add all of the numbers in the range of cells B9 through B16.

One of the more powerful features of spreadsheet software is its capability to recalculate the rest of the worksheet when data in a cell changes. Spreadsheet software's capability of recalculating data also makes it a valuable budgeting, forecasting, and decision-making tool. Another standard feature of spreadsheet software is charting, which depicts the data in graphical form, such as bar charts or pie charts. A visual representation of data through charts often makes it easier for users to see at a glance the relationship among the numbers.

Discover More: Visit this chapter's free resources to learn more about spreadsheet software and built-in functions.



Formulas

In many spreadsheet apps, a formula begins with an equal sign (=).



Technology Innovator

Discover More: Visit this chapter's free resources to learn about Dan Bricklin (cocreator of the first spreadsheet program).

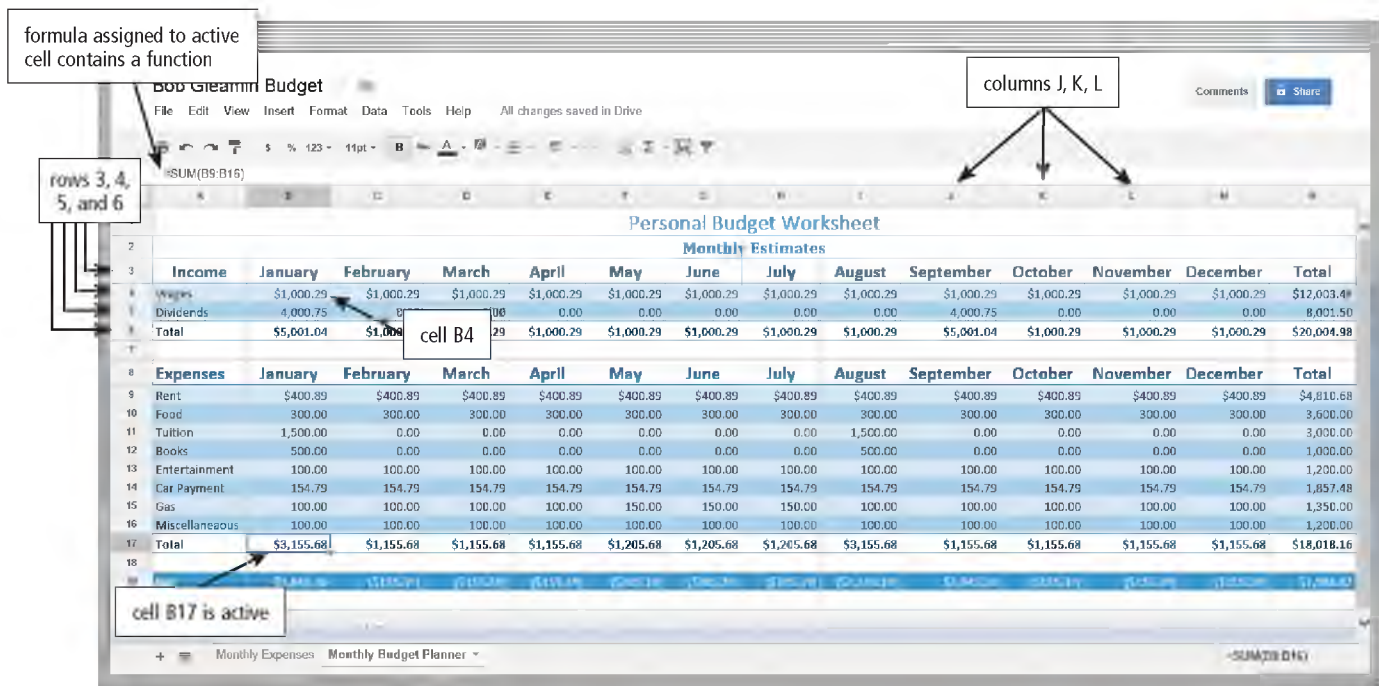


Figure 4-7 With spreadsheet software, you create worksheets that contain data arranged in columns and rows, and you can perform calculations on the data in the worksheets.

Source: Google Inc.



BTW

Web Databases

You likely interact with many databases without realizing it. For example, much of the information you access on the web — including photos, videos, movies, job listings, reservation details, and class registrations — is stored in databases.



BTW

High-Tech Talk

Discover More: Visit this chapter's free resources to learn how to filter data in database and spreadsheet programs.

Database

A **database** is a collection of data organized in a manner that allows access, retrieval, and use of that data. In a manual database, you might record data on paper and store it in a filing cabinet. With a database stored electronically, such as the one shown in Figure 4-8, the computer stores the data on a storage medium, such as a hard drive or optical disc, or on cloud storage.

Database software is an application that allows users to create, access, and manage a database. Using database software, you can add, change, and delete data in a database; sort and retrieve data from the database; and create forms and reports using the data in the database.

With most personal computer database programs, a database consists of a collection of tables, organized in rows and columns. Each row, called a record, contains data about a given item in the database, which is often a person, product, object, or event. Each column, called a field, contains a specific category of data within a record. The Publishing database shown in Figure 4-8 consists of two tables: a Customer table and a Book Rep table. The Customer table contains 15 records (rows), each storing data about one customer. The customer data is grouped into 10 fields (columns): CU # (customer number), Customer Name, Street, City, State, Postal Code, Amount Paid, Current Due, Returns, and BR # (book rep number). The Current Due field, for instance, contains the amount of money the customer owes the publisher. The Customer and Book Rep tables relate to each other through a common field, BR # (book rep number).

Users run queries to retrieve data. A query is a request for specific data from the database. For example, a query might request a list of customers whose balance is greater than \$20,000. After obtaining the results of a query, database applications can present them on the screen, send them to a printer, or save them in a file.

CONSIDER THIS

When should you use a database instead of a spreadsheet program?

Although databases and spreadsheets both store data, these programs have different purposes and capabilities. Spreadsheet programs are ideal for calculating results or creating charts from value in the worksheet. You should use a database program, however, if want to collect, reorganize and filter data, and/or create reports from the data.

The image shows a screenshot of a database application with two tables. The top table is labeled 'Customer table' and has 15 rows and 10 columns. The bottom table is labeled 'Book Rep table' and has 4 rows and 10 columns. A box labeled 'fields' points to the columns of the Customer table. A box labeled 'records' points to the rows of the Customer table. A box labeled 'common BR # field relates the Customer table to the Book Rep table' points to the BR # column in both tables.

Figure 4-8 This database contains two tables: one for customers and one for book reps. The Customer table has 15 records and 10 fields; the Book Rep table has 4 records and 10 fields.

Source: Microsoft

Discover More: Visit this chapter's free resources to learn more about personal computer database programs.

Note Taking

Note taking software is an application that enables users to enter typed text, handwritten comments, drawings, sketches, photos, and links anywhere on a page and then save the page as part of a notebook (Figure 4-9). Users also can include audio recordings as part of their notes. Some enable users to sync their notes to the cloud so that they can access the notes on any computer or mobile device. Many note taking applications also include a calendar feature.

Users find note taking software convenient during meetings, class lectures and conferences, and in libraries and other settings that previously required pencil and paper for recording thoughts and discussions.

Discover More: Visit this chapter's free resources to learn more about note taking applications.

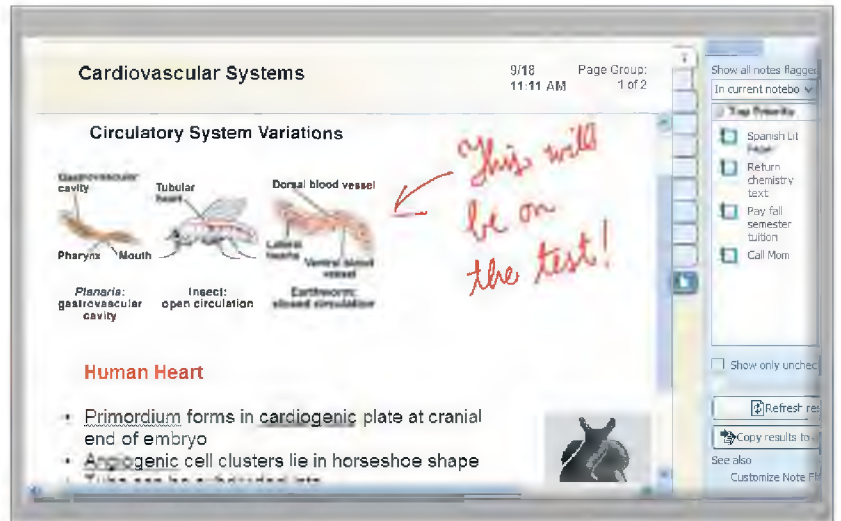


Figure 4-9 With note taking software, mobile users can handwrite notes, draw sketches, insert photos and links, and type text.

Source: Microsoft

Calendar and Contact Management

Calendar and contact management software is an application that helps you organize your calendar, keep track of contacts, and share this information with other users, who can view it on their computers and mobile devices (Figure 4-10). This software provides a way for individuals and workgroups to organize, find, view, and share appointment and contact information easily. Although sometimes available separately, calendar and contact management software often exists as a unit in a single program. Many email applications include calendar and contact management features.



Technology Trend

Discover More: Visit this chapter's free resources to learn about the note taking app, Evernote.

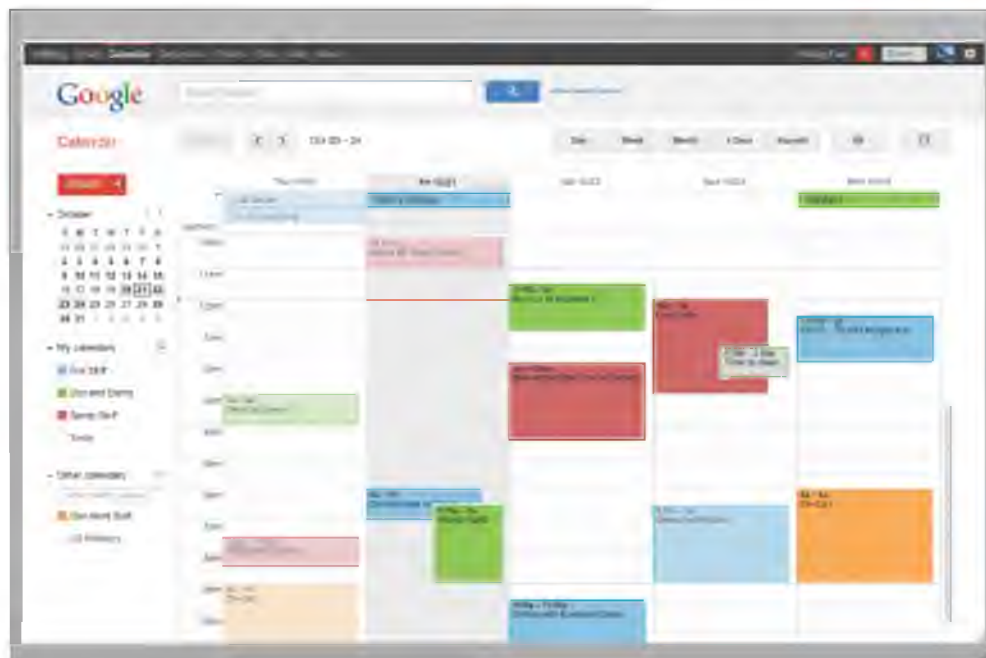


Figure 4-10 Users can share schedules with other users via calendar and contact management applications.

Google Inc.

Calendar and contact management applications enable you to synchronize information. This means that all of your computers and mobile devices, along with your organization's server or cloud storage, have the latest version of any updated information.

Discover More: Visit this chapter's free resources to learn more about calendar and contact management applications.



Forms and Surveys

Some online productivity suites support creating online forms for surveys, which store their results in online spreadsheets.

Software Suite

A **software suite** is a collection of individual related applications available together as a unit. Productivity software suites typically include, at a minimum, word processing, presentation, spreadsheet, and email applications. While several productivity suites are designed to be installed on a local computer, some are web apps and/or mobile web apps that enabling you to share and collaborate with projects stored on the cloud.



CONSIDER THIS

Why would you use a software suite instead of a stand-alone application?

Software suites offer three major advantages: lower cost, ease of use, and integration.

- When you purchase a software suite, the suite usually costs significantly less than purchasing each application individually, or as stand-alone applications.
- Software suites provide ease of use because the applications in the suite normally use a consistent interface and share features, such as clip art and spelling checker.
- Applications in a software suite often are integrated, which makes it easy to share information among them. For example, you can copy a chart created from a worksheet in a spreadsheet program and paste it into a slideshow in the presentation software.



Technology Innovators

Discover More: Visit this chapter's free resources to learn about Google and its founders, Sergey Brin and Larry Page.

Discover More: Visit this chapter's free resources to learn more about software suites.

Project Management

Project management software is an application that allows a user to plan, schedule, track, and analyze the events, resources, and costs of a project. Project management software helps users manage project variables, allowing them to complete a project on time and within budget. A marketing manager, for example, might use project management software to schedule the processes required in a product launch (Figure 4-11). Read How To 4-1 to learn how you can manage a project using project management software.

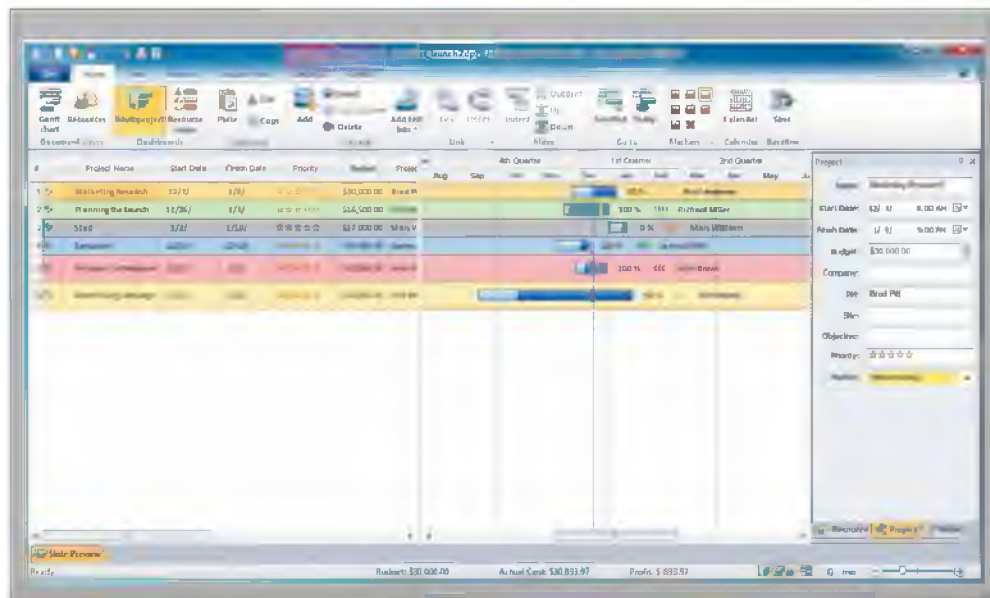


Figure 4-11 With project management software, you can plan and schedule the tasks and processes required in a project.

Courtesy of CS Odessa

HOW TO 4-1

Manage a Project Using Project Management Software

Several project management programs and apps exist that are both free and fee based. Project management programs and apps are designed for projects of specific sizes, so be sure to research the various programs and apps on the market and choose one that best suits your needs. To manage a project using project management software, follow these steps:

1. Make sure you understand the project in its entirety, as well as the steps you must take to bring the project to completion.
2. Determine the date by which the project must be completed.
3. Verify you have the appropriate resources (people and materials) to complete the project. If you do not have the necessary resources, you should obtain them.
4. Determine the order of the steps that must be taken to bring the project to completion. Identify steps that must be taken before other steps, as well as steps that can be completed at the same time as other steps.
5. Verify the feasibility of the plan.
6. During the project, it will be necessary to update the progress and possibly adjust dates. Changes to the project and its dates should be communicated to the entire project team.

Consider This: Do you think project management software can help individuals complete a project more quickly? Why or why not?

CONSIDER THIS

Does the term, project, have two meanings in the technology field?

Yes. As discussed earlier in this chapter, a project can be a deliverable you create using application software, such as a document, presentation, spreadsheet, notes, calendar, contact list, budget, and more. A project also describe the collection of tasks and processes required to develop a solution to a problem.

Accounting

Accounting software is an application that helps businesses of all sizes record and report their financial transactions. With accounting software, business users perform accounting activities related to the general ledger, accounts receivable, accounts payable, purchasing, invoicing (Figure 4-12), and payroll functions. Accounting software also enables business users to write and print checks, track checking account activity, and update and reconcile balances on demand.

Most accounting software supports online credit checks, bill payment, direct deposit, and payroll services. Some offer more complex features, such as job costing and estimating, time tracking, multiple company reporting, foreign currency reporting, and forecasting the amount of raw materials needed for products. The cost of accounting software for small businesses ranges from less than one hundred to several thousand dollars. Accounting software for large businesses can cost several hundred thousand dollars.

Discover More: Visit this chapter's free resources to learn more about accounting software.

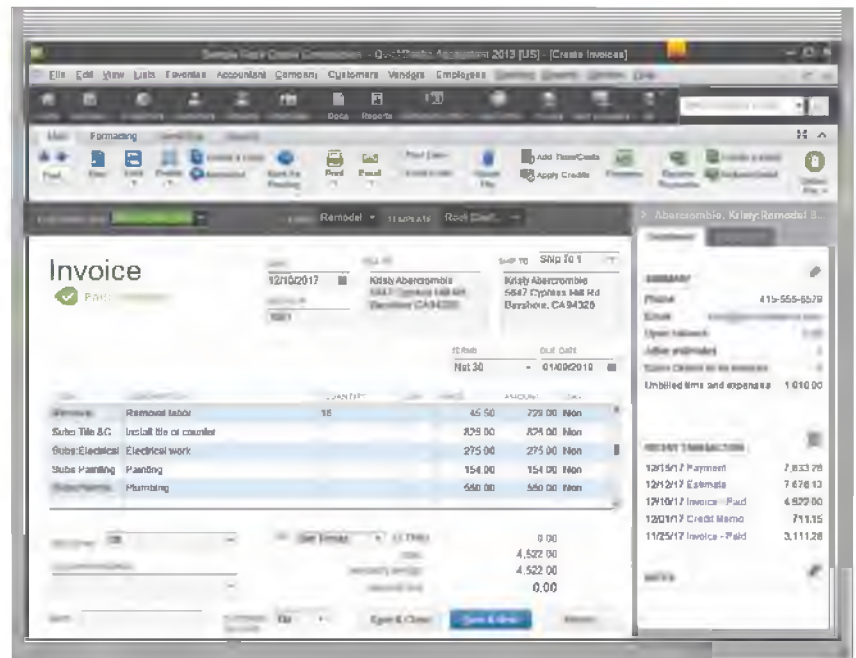


Figure 4-12 Accounting software helps businesses record and report their financial transactions.

Courtesy of Intuit

Personal Finance

Personal finance software is a simplified accounting application that helps home users and small/home office users balance their checkbooks, pay bills, track personal income

and expenses, verify account balances, transfer funds, track investments, and evaluate financial plans (Figure 4-13). Personal finance software helps determine where, and for what purpose, you are spending money so that you can manage your finances.

Most personal finance software includes financial planning features, such as analyzing home and personal loans, preparing income taxes, and managing retirement savings. Other features include managing home inventory and setting up budgets. Most of these applications also offer a variety of online services, such as online banking and online investing. Read Secure IT 4-2 for safety tips when using personal finance apps on your smartphone or other mobile device.



Figure 4-13 Personal finance software assists home users with tracking personal accounts.

Courtesy of Intuit

SECURE IT 4-2



Using Personal Finance Apps Safely

Personal finance apps offer convenient and easy methods to pay bills, deposit checks, examine account balances, verify payments, and transfer funds. They also are a magnet for cybercriminals to snatch an unsuspecting user's personal information and send it to someone else anywhere in the world, who then can use the information for monetary transactions. Nearly one-third of malware banking apps target customers in the United States with malicious instructions that invade their smartphones and gain access to information stored on their devices. Users in Brazil, Australia, and France also are becoming extremely popular targets for banking thieves. By using caution and common sense, however, users can take steps to safeguard their funds and their identities by following these practices:

- **Evaluate the apps.** Fraudulent apps may resemble legitimate apps from financial

institutions. They often, however, are riddled with misspellings and awkward sentences. In addition, legitimate companies rarely promote downloading an app from a pop-up or pop-under advertisement. If you desire an app from a bank or other financial institution, visit that company's website for instructions about downloading and installing its authentic apps.

- **Use strong passwords to access the apps.** Many of the more secure personal finance apps have dual passwords that involve typing a string of characters and also validating a picture. In addition, be certain to password protect your mobile device.
- **Guard your smartphone.** At least 100 smartphones are lost or stolen every minute in the United States according to MicroTrax, an asset protection company. With that figure in mind, store as little

personal information as possible on your phone so that if the mobile device is lost, the chance of having your identity stolen and your accounts compromised is lessened. Also install software to locate your lost or stolen device and to erase its content remotely.

- **Verify the transactions.** Always verify your transactions by scrutinizing monthly statements. In addition, periodically check balances and alert your financial institution if any activity seems abnormal.

Consider This: Have you used finance apps? If so, which ones? When making transactions, do you follow some of the tips described in this box? If not, would you consider downloading an app to complete some common banking transactions? Why or why not?

Legal

Legal software is an application that assists in the preparation of legal documents and provides legal information to individuals, families, and small businesses (Figure 4-14). Legal software provides standard contracts and documents associated with buying, selling, and renting property; estate planning; marriage and divorce; and preparing a will or living trust. By answering a series of questions or completing a form, the legal software tailors the legal document to specific needs. Read Ethics & Issues 4-2 to consider whether an attorney should review documents created with legal software.

Discover More: Visit this chapter's free resources to learn more about legal software.



Figure 4-14 Legal software assists individuals, families, and small businesses in the preparation of legal documents.

Source: Avanquest Software

ETHICS & ISSUES 4-2

Should an Attorney Review Documents Created with Legal Software?

If you want to sublet your apartment or buy or sell a used car, should you seek legal help? Hiring an attorney to create a lease or sale agreement can cost hundreds of dollars. Legal software or website services, on the other hand, typically cost less than \$100 and sometimes are free. While it is tempting to opt for the route that will save money, you should evaluate the program to make sure it is up to date, addresses the latest laws and provisions that are specific to your state, and includes a legal dictionary. If you use a program that is out of date or creates an incomplete or invalid legal document, the cost for an attorney to correct the document

could exceed the amount you originally spent on the program.

A lease that you create or sign regarding subletting or renting an apartment should have provisions for payment of any damages, breaking or extending the agreement, and who is responsible for routine maintenance and repair. In some states, the property owner must disclose any mold, lead paint, or water quality issues. Sales agreements, such as for used cars, should include language that protects the buyer from undisclosed damage to the car, as well as clearly specify any further responsibility of the car seller.

Attorneys caution against using legal software unless you intend to have an attorney review the document. Not only can

they validate the accuracy of the document, attorneys claim they can provide for gaps in the software; further, they are versed in laws specific to your state or circumstance. Others argue that any legal document is better than a verbal agreement and can protect both parties.

Consider This: Would you use legal software to create a legal document? Why or why not? Would you sign a legal document created with software without consulting an attorney? Why or why not? How do mistakes made as a result of using legal software differ from mistakes that result from human error?

Tax Preparation

Tax preparation software is an application that can guide individuals, families, or small businesses through the process of filing federal and state taxes (Figure 4-15). These programs forecast tax liability and offer money-saving tax tips, designed to lower your tax bill.

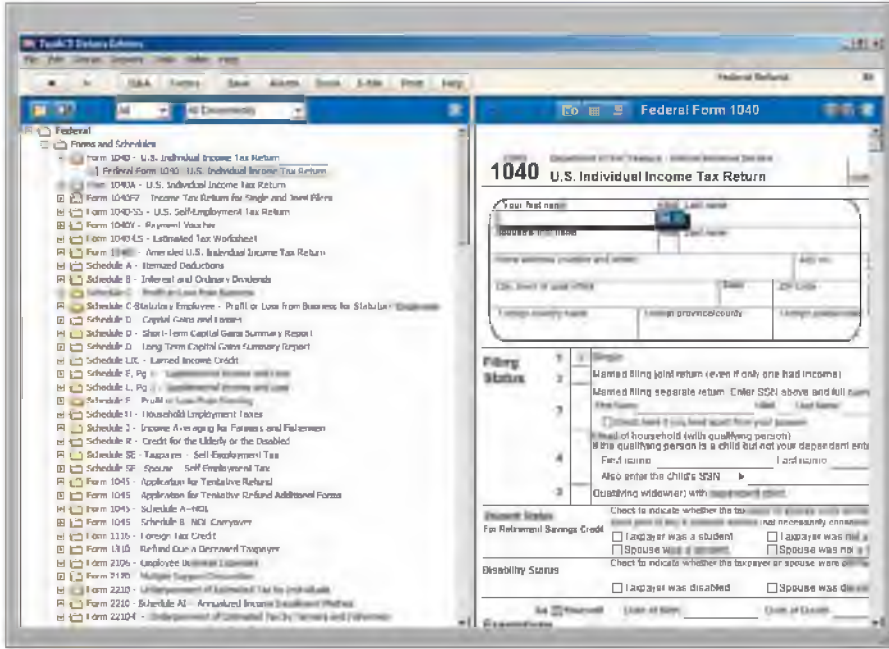


Figure 4-15 Tax preparation software guides individuals, families, or small businesses through the process of filing federal taxes.

Source: 2nd Story Software

After you answer a series of questions and complete basic forms, the software creates and analyzes your tax forms to search for missed potential errors and deduction opportunities.

Once the forms are complete, you can print any necessary paperwork; then, they are ready for filing. Some tax preparation programs also allow you to file your tax forms electronically, a process called *e-filing*.

Discover More: Visit this chapter's free resources to learn more about tax preparation programs.

Document Management

Document management software is an application that provides a means for sharing, distributing, and searching through documents by converting them into a format that can be viewed by any user. The converted document, which mirrors the original document's appearance, can be viewed and printed without the software that created the original document. Some document management software allows users to edit content and add comments to the converted document (Figure 4-16).

Many businesses use document management software to share and distribute company brochures, literature, and other documents electronically. Home users distribute flyers, announcements, and graphics electronically. A popular electronic image file format that document management software uses to save converted documents is PDF (Portable Document Format), developed by Adobe Systems.

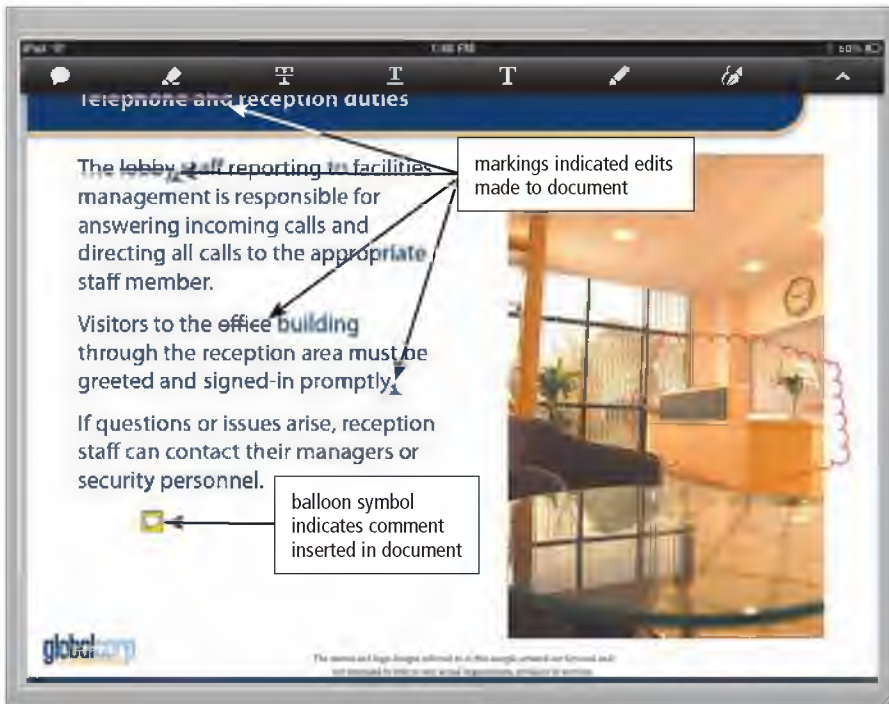


Figure 4-16 Users can edit content and add comments to a converted document.

Source: Adobe Systems Incorporated

To view and print a PDF file, you need Adobe Reader software, which can be downloaded free from Adobe's website.

Discover More: Visit this chapter's free resources to learn more about document management software.

CONSIDER THIS

Can you create a PDF file only in document management applications?

No. Many productivity applications, such as word processing and spreadsheet programs, provide a method of saving a project as a PDF. This enables other users to view your document without requiring the application that created the project.

Enterprise Computing

A large organization, commonly referred to as an enterprise, requires special computing solutions because of its size and geographic distribution. A typical enterprise consists of a wide variety of departments, centers, and divisions — collectively known as functional units. Nearly every enterprise has the following functional units: human resources, accounting and finance, engineering or product development, manufacturing, marketing, sales, distribution, customer service, and information technology.

Software used in functional units is not mutually exclusive; however, each functional unit in an enterprise uses specific software, as outlined below.

- Human resources software manages employee information, such as pay rate, benefits, personal information, performance evaluations, training, and vacation time.
- Accounting software manages everyday transactions, such as sales and payments to suppliers. Finance software helps managers budget, forecast, and analyze.
- Engineering or product development software allows engineers to develop plans for new products and test their product designs.
- Manufacturing software assists in the assembly process, as well as in scheduling and managing the inventory of parts and products.
- Marketing software allows marketing personnel to create marketing campaigns, target demographics, and track their effectiveness.
- Sales software enables the salesforce to manage contacts, schedule meetings, log customer interactions, manage product information, and take customer orders.
- Distribution software analyzes and tracks inventory and manages product shipping status.
- Customer service software manages the day-to-day interactions with customers, such as phone calls, email messages, web interactions, and messaging sessions.
- Information technology staff use a variety of programs and apps to maintain and secure the hardware and software in an enterprise.

Discover More: Visit this chapter's free resources to learn more about software used in an enterprise.

Mini Feature 4-1: Web and Mobile Apps for Personal and Business Productivity

A variety of applications provide a service intended to make business or personal tasks easier to accomplish. Some applications focus on a single service, while others provide several services in a single application. Read Mini Feature 4-1 to learn about some popular web and mobile apps for personal and business productivity.



Internet Research
Are alternatives to Adobe Reader available?

Search for: adobe reader alternatives



BTW Technology Innovator
Discover More: Visit this chapter's free resources to learn about Adobe Systems.



BTW Technology Innovator
Discover More: Visit this chapter's free resources to learn about eBay and PayPal, each with apps that can be used for personal and business productivity.


MINI FEATURE 4-1

Web and Mobile Apps for Personal and Business Productivity

Whether you are checking appointments, sending or reading email messages, arranging travel, banking or looking up information online, making a purchase, scanning QR (quick response) codes or bar codes, or checking in with friends on online social networks, web and mobile apps can assist your personal and business productivity.

Calendar and Email

Maintaining a calendar and checking email messages are common tasks of calendar and email web and mobile apps. Calendar apps keep track of your appointments and synchronize information entered on a mobile device with your online or desktop calendar software. Email mobile apps integrate with your device's address book to display names from your device's contact list that match a recipient's name as you type it, and with your device's photo gallery for sending photos.

Travel

Purchasing flights, hotels, rental cars, or travel services is a common online task for personal and business travelers. Travel apps display available options and allow you to filter results. Many allow you to share travel plans with your online social networks.

Financial

You can access bank accounts or investments using a financial app. Financial mobile apps track expenses as you spend money and notify you when a bill is due. To help secure information, financial mobile apps can disable access if your device is stolen or lost. Some banking mobile apps allow you to upload a photo of a check taken with the device's camera to process the deposit.

Reference

Dictionaries, encyclopedias, books, and directories are available online as reference apps. Many have associated mobile apps that format information for mobile devices, or take advantage of their features. For example, rather than typing a search term in a dictionary web app to look up its definition, a mobile app also might offer voice input. On the mobile version of an encyclopedia app, you might shake the device to display random topics or redisplay the app's home

screen. Some reference mobile apps also can download information directly to your phone for offline access.

Retail

Online marketplaces and payment services support buying and selling items and transferring funds from one party to another. Marketplace apps enable customers to research products, enter or examine product reviews, and make purchases. A retail store mobile app might use a device's GPS to offer special deals closest to the customer's location. You also might use a device's camera to scan a product's bar code and then place the item in a shopping cart. Payment services allow customers to send money or pay for items using mobile devices. Read Secure IT 4-3 for safety tips when using payment apps.

Scanning


Scanning apps use a mobile device's camera to scan a QR code or bar code. A **QR code** is a square-shaped graphic that represents a web address or other information. A QR code reader app scans a QR code, and then displays its corresponding information. A bar code scanner reads a bar code and may provide product information, price, or reviews. Some supermarkets provide shopping apps for customers to scan bar codes of items they purchase. These apps create a customized shopping list, ordering items by their aisle location in the store, to provide a more efficient shopping experience.



© iStockPhoto / frankrepointer

Online Social Networks

Many users connect with family, friends, and coworkers using online social network mobile apps. Online social network web apps often integrate instant messaging and video chat communications. Online social network mobile apps allow users to include photos and videos from their device in their updates easily.

 **Consider This:** Compare the web and mobile versions of the same app for personal and business productivity. Which features are common to both? Which features in the mobile version are not found in the web version? Which features in the web version are not found in the mobile version? Why do you think the developers made these decisions? Which features would you like to see that are missing from either version of the app?

Discover More: Visit this chapter's free resources to learn more about web and mobile apps for personal and business productivity.



Source: Kayak

SECURE IT 4-3

Avoiding Risks Using Payment Apps

Paying for coffee at the local coffee shop or buying tools at the hardware store has become streamlined with the advent of mobile payment apps. More than 15 percent of Starbucks transactions are accomplished using a smartphone app instead of using cash or credit card, and many merchants are accepting this form of payment as mobile wallet apps become more secure. The users enjoy the convenience of maintaining control when they scan their phone at the checkout counter instead of handing a credit card to a clerk. This security factor becomes even more pronounced at restaurants, where unscrupulous employees can take credit cards away from the table and then have full access to the personal information on the cards.

Mobile payment providers state that using their apps is more secure than using plastic

credit cards. The apps use a payment system on phones equipped with an *NFC chip*, which stores data that is transmitted to a contactless terminal and verified as a legitimate sale. A smartphone user never enters an account number at the cash register because all financial information is stored on the mobile payment system. If, however, an unauthorized charge is made, the Electronic Fund Transfer Act protects users as long as the claim is made promptly, generally within two days.

If you use your smartphone to make purchases, follow this advice from the security experts:

- Use a password on your phone.
- Select a payment app that requires you to enter a password to start the transaction.
- Choose a payment app that issues a receipt so that you can verify every purchase.

- Be vigilant about checking mobile transactions against monthly statements from the credit card company.

Consider This: Should additional merchants allow payments using mobile apps? Should merchants be required to pay when customers use payment apps, like they do when customers use credit cards? Why or why not? Where would you like to pay for transactions using your smartphone?



Google Inc.

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Programs and Apps and Productivity Applications as it relates to the chapter objectives.

Now you should know ...

- What categories of programs and apps you might find on a computer or mobile device (Objective 1)
- Why you need an operating system on computers and mobile devices (Objective 2)
- How you can obtain software (Objective 3)
- Which productivity applications might be suited to your needs (Objective 4)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Graphics and Media Applications

In addition to productivity applications, many people work with software designed specifically for their field of work. Power users, such as engineers, architects, desktop publishers, and graphic artists, often use sophisticated software that allows them to work with graphics and media. Many of these applications incorporate user-friendly interfaces or scaled-down versions, making it possible for the home and small business users also to create projects using these types of programs.

Graphics and media applications include computer-aided design, desktop publishing, paint/image editing, photo editing and photo management, video and audio editing, multimedia and website authoring, media players, and disc burning.



Figure 4-17 Architects use CAD software to design building structures
© iStockPhoto / Costantini

Computer-Aided Design

Computer-aided design (CAD) software is a type of application that assists professionals and designers in creating engineering, architectural, and scientific designs and models. For example, engineers create design plans for vehicles and security systems. Architects design building structures and floor plans (Figure 4-17). Scientists design drawings of molecular structures.

Three-dimensional CAD programs allow designers to rotate designs of 3-D objects to view them from any angle. Some CAD software even can generate material lists for building designs.

Home and small business users work with less sophisticated design and modeling software. These applications usually contain thousands of predrawn plans that users can

customize to meet their needs. For example, *home design/landscaping software* is an application that assists users with the design, remodeling, or improvement of a home, deck, or landscape.

Discover More: Visit this chapter's free resources to learn more about CAD software.

Desktop Publishing

Desktop publishing software (DTP software) is an application that enables designers to create sophisticated publications that contain text, graphics, and many colors. Professional DTP software is ideal for the production of high-quality color projects such as textbooks, corporate newsletters, marketing literature, product catalogs, and annual reports. Designers and graphic artists can print finished publications on a color printer, take them to a professional printer, or post them on the web in a format that can be viewed by those without DTP software.

Home and small business users create newsletters, brochures, flyers, advertisements, postcards, greeting cards, letterhead, business cards, banners, calendars, logos, and webpages using personal

DTP software (Figure 4-18). Although many word processing programs include DTP features, home and small business users often prefer to create DTP projects using DTP software because of its enhanced features. These programs typically guide you through the development of a project by asking a series of questions. Then, you can print a finished publication on a color printer or post it on the web.

Many personal DTP programs also include paint/image editing software and photo editing and photo management software (discussed next), enabling users to embellish their publications with images.

Discover More: Visit this chapter's free resources to learn more about professional and personal DTP software.

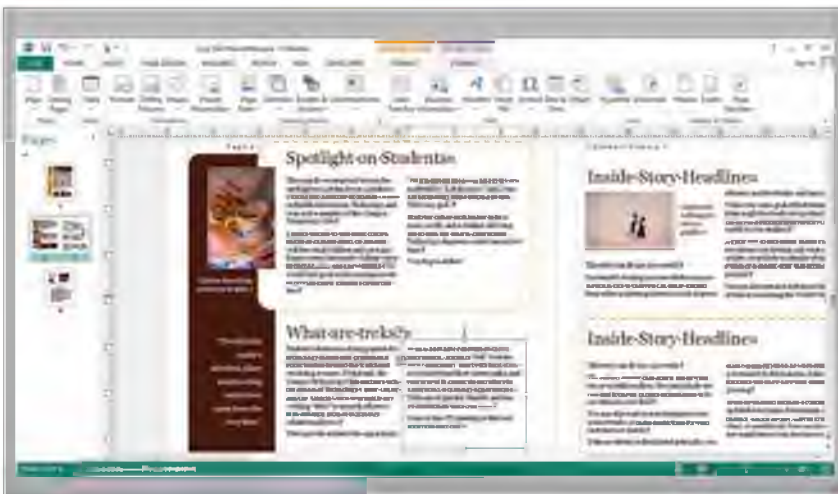


Figure 4-18 With personal DTP software, such as Microsoft Publisher shown here, home users can create newsletters.

Courtesy of Joy Starks; Source: Microsoft

Paint/Image Editing

Graphic artists, multimedia professionals, technical illustrators, and desktop publishers use paint software and image editing software to create and modify graphics, such as those used in DTP projects and webpages. **Paint software**, also called *illustration software*, is an application that allows users to draw pictures, shapes, and other graphics with various on-screen tools, such as a pen, brush, eyedropper, and paint bucket. **Image editing software** is an application that provides the capabilities of paint software and also includes the capability to enhance and modify existing photos and images. Modifications can include adjusting or enhancing image colors, adding special effects such as shadows and glows, creating animations, and image stitching (combining multiple images into a larger image).

Paint/image editing software for the home or small business user provides an easy-to-use interface; includes various simplified tools that allow you to draw pictures, shapes, and other images (Figure 4-19); and provides the capability of modifying existing graphics and photos. These products also include many templates to assist you in adding images to projects, such as greeting cards, banners, calendars, signs, labels, business cards, and letterhead.

Discover More: Visit this chapter's free resources to learn more about paint and image editing software.

Photo Editing and Photo Management

Photo editing software is a type of image editing software that allows users to edit and customize digital photos. With photo editing software, users can retouch photos, crop images, remove red-eye, erase blemishes, restore aged photos, add special effects, enhance image quality, change image shapes, color-correct images, straighten images, remove or rearrange objects in a photo, add layers, and more (Figure 4-20). Many applications also provide a means for creating digital photo albums.



Built-In Image Editing

Word processing, presentation, and other productivity applications usually include basic image editing capabilities.



Figure 4-19 Home users can purchase affordable paint/image editing programs that enable them to draw images.

DrawPlus X5 © Serif (Europe) Ltd, | www.serif.com



Figure 4-20 With photo editing software, users can edit digital photos, such as by adjusting the appearance of images as shown here.

PhotoPlus X6 © Serif (Europe) Ltd | www.serif.com

When you purchase a digital camera, it usually includes photo editing software. Many digital cameras also include basic photo editing software so that you can edit the image directly on the camera. Read *How To 4-2* for instructions about editing and sharing photos. Read *Ethics & Issues 4-3* to consider issues related to altering digital photos.

With **photo management software**, you can view, organize, sort, catalog, print, and share digital photos. Some photo editing software includes photo management functionality. Many online photo storage services enable you to create scrapbooks — selecting photos, adding captions, selecting backgrounds, and more.



BTW

Technology Trend

Discover More: Visit this chapter's free resources to learn about the photo sharing app, Instagram.

HOW TO 4-2

Edit and Share Photos

When you take a photo using a digital camera or smartphone, you sometimes may want to edit the photo to remove unwanted areas, correct imperfections, or change its file size. Many apps allow you to edit photos easily. Several are simple to use and do not require advanced photo editing experience. Before editing a photo, you first should make a backup of the original photo. The table below describes common ways to edit photos using a photo editing app.

After you have edited a photo to your satisfaction, you may want to share the

photo with others. Many mobile devices, such as smartphones and tablets, as well as most photo editing apps, have built-in options that allow you to share photos. To share a photo on a mobile device or from within a photo editing app, follow these steps:

1. Open the photo to share.
2. Select the sharing option in the photo editing app or on the mobile device.
3. Choose the method by which to share the photo. Common ways to share

photos include sending the photo as an email attachment, posting the photo to an online social network or photo sharing site, and sending the photo as a picture message to another mobile device.

Consider This: Examine your digital camera or other mobile device with a camera feature. Which of the photo editing features discussed here does it have? Did you notice any photo editing features in addition to those listed here?



ACTION

PURPOSE

STEPS

<i>Crop</i>	Removes unwanted areas of a photo	<ol style="list-style-type: none"> 1. Select cropping tool. 2. Adjust photo border to define area(s) of the photo to keep and discard.
Remove <i>red-eye</i>	Removes the appearance of red eyes caused by the camera flash	<ol style="list-style-type: none"> 1. Select red-eye removal tool. 2. Tap or click areas of the photo with the red-eye effect <i>or</i> drag a border around the affected areas.
<i>Resize</i>	Changes the physical dimensions of the photo	<ol style="list-style-type: none"> 1. Select resizing tool. 2. Drag sizing handles to increase <i>or</i> decrease the photo's dimensions <i>or</i> type the desired height and width in the appropriate text boxes.
<i>Compress</i>	Decreases the photo's file size	<ol style="list-style-type: none"> 1. Select option to compress photo. 2. Choose desired level of compression.
Adjust <i>sharpness</i>	Increases <i>or</i> decreases crispness of objects in the photo	<ol style="list-style-type: none"> 1. Select option to adjust sharpness. 2. Drag sharpness slider to desired value <i>or</i> type the desired sharpness level into appropriate text box.
Adjust <i>brightness</i>	Adjusts lightness <i>or</i> darkness in the photo	<ol style="list-style-type: none"> 1. Select option to adjust brightness. 2. Drag brightness slider to desired value <i>or</i> type the desired brightness level into appropriate text box.
Adjust <i>contrast</i>	Adjusts the difference in appearance between light and dark areas of the photo	<ol style="list-style-type: none"> 1. Select option to adjust contrast. 2. Drag contrast slider to desired value <i>or</i> type the desired contrast level into appropriate text box.

ETHICS & ISSUES 4-3



Is It Ethical to Alter Digital Photos?

Many commercial artists, photojournalists, and creators of magazine covers and billboards use photo editing software to alter digital photos. Artists use photo editing software to enhance digital photos by changing colors, adding or removing objects, and more. When does photo manipulation become unethical?

In several high-profile cases, news sources published intentionally altered photos that misrepresented the facts, in one case publishing photos of an aging world leader edited to remove his hearing aid. One school received criticism when it altered necklines on yearbook photos to be more modest.

Real estate agents on occasion have altered photos of homes for online listings or print brochures. Also making news are celebrity or model photos that artists retouch to change their physical appearance.

The National Press Photographers Association expresses reservations about digital altering and subscribes to the following belief: "As [photo]journalists we believe the guiding principle of our profession is accuracy; therefore, we believe it is wrong to alter the content of a photo in any way ... that deceives the public." Yet, some insist that the extent to which a photo "deceives the public" is in the eye of the beholder. Many differentiate between

technical manipulation to improve photo quality and an intent to deceive. Some governments are attempting to legislate photo manipulation. One country banned a magazine in which a celebrity's appearance appeared visibly altered. Some celebrities refuse to allow airbrushing or other manipulation of photos of them.

Consider This: Is it ethical to alter digital photos? Why or why not? Does the answer depend on the reason for the alteration, the extent of the alteration, or some other factor? Should magazines stop altering pictures of people to change their appearance? Why or why not?

Video and Audio Editing

Video editing software is an application that allows professionals to modify a segment of a video, called a clip. For example, users can reduce the length of a video clip, reorder a series of clips, or add special effects such as words that move across the screen. Video editing software typically includes audio editing capabilities. **Audio editing software** is an application that enables users to modify audio clips, produce studio-quality soundtracks, and add audio to video clips (Figure 4-21). Most television shows and movies are created or enhanced using video and audio editing software.

Many home users work with easy-to-use video and audio editing software, which is much simpler to use than its professional counterpart, for small-scale movie making projects. With these programs, home users can edit home movies, add music or other sounds to the video, and share their movies on the web. Some operating systems include video editing and audio editing applications.

Discover More: Visit this chapter's free resources to learn more about video and audio editing software.



Figure 4-21 With audio editing software, users modify audio clips.

Source: Adobe Systems Incorporated

Multimedia and Website Authoring

Multimedia authoring software allows users to combine text, graphics, audio, video, and animation in an interactive application (Figure 4-22). With this software, users control the placement of text and images and the duration of sounds, video, and animation. Once created, multimedia presentations often take the form of interactive computer-based presentations or web-based presentations designed to facilitate learning, demonstrate product functionality, and elicit direct user participation. Training centers, educational institutions, and online magazine publishers use multimedia authoring software to develop interactive applications. These applications may be distributed on an optical disc, over a local area network, or via the Internet as web apps.

Website authoring software helps users of all skill levels create related webpages that include graphics, video, audio, animation, special effects with interactive content, and blog posts. In addition, many website authoring programs allow users to organize, manage, and maintain websites. Website authoring software often has capabilities of multimedia authoring software.

CONSIDER THIS

What is computer-based or web-based training?

Computer-based training (CBT) is a type of education in which students learn by using and completing exercises with instructional software. *Web-based training (WBT)* is a type of CBT that uses Internet technology to deliver the training. CBT and WBT typically consist of self-directed, self-paced instruction about a topic so that the user becomes actively involved in the learning process instead of being a passive recipient of information. Beginning athletes use CBT programs to learn the intricacies of participating in a sport. The military and airlines use CBT simulations to train pilots to fly in various conditions and environments. WBT is popular in business, industry, and schools for teaching new skills or enhancing existing skills of employees, teachers, and students.

Discover More: Visit this chapter's free resources to learn more about multimedia and website authoring software.



Figure 4-22 Multimedia authoring software allows you to create dynamic presentations that include text, graphics, audio, video, and animation.

Courtesy of Matchware Inc.

Media Player

A **media player** is a program that allows you to view images and animations, listen to audio, and watch video files on your computer or mobile device (Figure 4-23). Media players also may enable you to organize media files by genre, artist, or other category; create playlists; convert files to different formats; connect to and purchase media from an online media store or market-place; stream radio stations' broadcasting over the Internet; download podcasts; burn audio CDs; and transfer media to portable media players.

Discover More: Visit this chapter's free resources to learn more about media players.



Figure 4-23 A media player.

Source: Rhapsody

Disc Burning

Disc burning software writes text, graphics, audio, and video files on a recordable or rewritable disc. This software enables home users easily to back up contents of their hard drive on an optical disc (CD/DVD) and make duplicates of uncopyrighted music or movies. Disc burning software usually also includes photo editing, audio editing, and video editing capabilities.

Personal Interest Applications

Countless desktop, mobile, and web apps are designed specifically for lifestyle, medical, entertainment, convenience, or education activities. Most of the programs in this category are relatively inexpensive; many are free. Some applications focus on a single service, while others provide several services in a single application.

- **Lifestyle applications:** Access the latest news or sports scores, check the weather forecast, compose music, research genealogy, find recipes, or locate nearby restaurants, gas stations, or points of interest.
- **Medical applications:** Research symptoms, establish a fitness or health program, track exercise activity, refill prescriptions, count calories, or monitor sleep patterns.

Internet Research

What is geocaching?

Search for: geocaching basics



Technology Trend

Discover More: Visit this chapter's free resources to learn about the education app, iTunes U.

- Entertainment applications: Listen to music or the radio, view photos, watch videos or shows, read a book or other publication, organize and track fantasy sports teams, and play games individually or with others.
- Convenience applications: Obtain driving directions or your current location, remotely start your vehicle or unlock/lock the doors, set an alarm or timer, check the time, calculate a tip, use your phone as a flashlight, or use a personal assistant that acts on your voice commands (read How To 4-3 for instructions about using personal assistant apps).
- Education applications: Access how-to guides, learn or fine-tune a particular skill, follow a tutorial, run a simulation, assist children with reading and other elementary skills, or support academics.

HOW TO 4-3

Use Features in Voice Command Personal Assistant and Mobile Search Apps

Many mobile operating systems include a virtual personal assistant that processes voice commands and performs certain tasks. Some mobile search apps also act on spoken commands. For example, you can issue voice commands to set an alarm, add an appointment to your calendar, send a text message, or run an app. The following table describes ways to use features in voice command personal assistant apps:

Task	Sample Voice Command(s)
Change phone settings	"Turn on Wi-Fi." "Turn off Bluetooth."
Dial a number	"Call Madelyn's Cell." "Call Mom Home." "Dial 407-555-8275."
Obtain information	"When was George Washington born?" "How many ounces are in a pound?" "What is the closest Chinese restaurant?"
Obtain driving instructions	"Navigate to 123 Main Street, Orlando, Florida." "Navigate to The Home Depot." "Navigate to Manchester, New Hampshire."
Perform a search	"What is the gas mileage for a Ford Explorer?" "Search butterfly lifespan."
Run an app	"Run calendar." "Run email."
Schedule a meeting	"Schedule a meeting with Traci at the library at 3:00 p.m. tomorrow."
Send a text message	"Text Samuel meet me at the pool."
Set a reminder	"Remind me to go grocery shopping tomorrow."
Set a timer	"Set timer for five minutes."
Set an alarm	"Set an alarm for 6:00 a.m. tomorrow." "Set an alarm for 6:30 a.m. every weekday."

Consider This: What other voice commands are available on your phone? Do you use voice commands? Why or why not?

Mini Feature 4-2: Web and Mobile Apps for Media and Personal Interest

A variety of applications provide a service intended to make media and personal interest tasks easier to accomplish. Some applications focus on a single service, while others provide several services in a single application. Read Mini Feature 4-2 to learn about some popular web and mobile apps for media and personal interests.

MINI FEATURE 4-2

Web and Mobile Apps for Media and Personal Interests

Whether sharing, viewing, and purchasing media, such as photos; streaming audio and video; or playing games by yourself or with others, countless web and mobile apps are available to meet your needs. You also can use web and mobile apps to look up news, sports, and weather; obtain maps and directions; help you reach your health and fitness goals; and assist you with academic objectives.

Media Sharing

With media sharing mobile apps, you use the digital camera on your mobile device to take quality photos and/or videos and then instantly can share the photos or videos on online social networks. Using the corresponding media sharing web app, you can categorize, tag, organize, and rank the media posted by you, your friends, and your contacts.



Instagram

Streaming Audio and Video

Podcasts, video blogs, clips or episodes from a television show, or even entire movies are available through a variety of streaming media web and mobile apps. Some services are available only with membership, and may charge a monthly fee. Others are free, but include ads. Streaming media enables you to view and listen to content without downloading it to your computer or device, saving valuable disc or media storage space.

Gaming

Game web and mobile apps often offer a social component, enabling you to chat within the game environment, find friends who play the same game apps, and post your scores on social media. Word, puzzle, and board games are just some examples of apps you can play by yourself or with friends or others using the same apps.

News, Sports, and Weather

Many apps provide access to the latest news, stories, current events, sports scores, sporting events, and weather forecasts. Some of these mobile apps use GPS technology to provide current or customized information based on the location of your mobile device. You also can configure these apps to deliver text messages and other types of alerts to your device when certain events occur, such as when a football team scores a touchdown or when severe weather is near.

Mapping

Using your mobile device's GPS capability, you can use mapping mobile apps to obtain directions, maps, and recommendations for restaurants or other points of interest based on your current location. Some mapping apps even help you to locate friends based on their GPS signals (if they enable you to do so). Others allow you to share your current location on social media using a check-in feature. Web apps help you decide on a route, print directions or a map, and even find amenities along your route, such as public rest stops or restaurants.

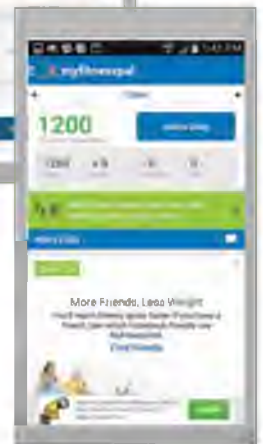
Health and Fitness

Losing weight, training for a race, or following a low-calorie diet are some uses of health and fitness apps.

Using a mobile device as a pedometer or GPS receiver can help you count your steps or create a map of a route you run and then update your profile with the data it tracked. You can use corresponding web apps to chart and analyze your progress, schedule your next workout, or determine the next steps to reach your goals. These apps also can help plan your meals and track the nutritional value of food you consume.



MyFitnessPal LLC



Academic

If you need to study terms or topics, flash card apps can provide reinforcement. This book's premium content for example, has an accompanying Flash Cards app designed to improve your retention of chapter key terms. Schools often subscribe to educational apps that provide students with games, quizzes, and lessons about course topics. Using these apps, teachers can keep track of students' progress and pinpoint areas where they may need extra help. You also can access complete college or high school courses and take advantage of free or fee-based digital content provided by publishers and teachers.

Discover More: Visit this chapter's free resources to learn more about web and mobile apps for media and personal interests.

Consider This: Which web and mobile apps have you used for media sharing; streaming audio and video; gaming; news, sports, and weather; mapping; health and fitness; and education? Will you try others after reading this mini feature? Why or why not?



Mobile Communications Apps

Most of the communications apps in Table 4-2 are available as mobile apps, as well.

Communications Applications

One of the main reasons people use computers is to communicate and share information with others. Earlier chapters presented a variety of communications applications, which are summarized in Table 4-2. Read Ethics & Issues 4-4 to consider whether your email provider should be allowed to read or scan your email messages.

Table 4-2 Communications Applications

Blog

- Time-stamped articles, or posts, in diary or journal format, usually listed in reverse chronological order
- Bloggers (author) use blogging software to create/maintain blog
 - Some blog services provide blogging software so users do not have to install it on their own servers

Browsing

- Allows users to access and view webpages on the Internet
- Requires browser
 - Integrated in most operating systems
 - Alternative browsers are available on the web for download, usually for free

Chat

- Real-time, online typed conversation with one or more users
- Requires chat client software
 - Integrated in some operating systems and most browsers
 - Available for download on the web, usually for free
 - Included with some paid ISPs
 - Built into some websites

Online Discussion

- Online areas where users have written discussions
- May require a reader program
- Integrated in some operating systems, email programs, and browsers

Email

- Messages and files sent via a network, such as the Internet
- Requires an email program
 - Integrated in many software suites and operating systems
 - Available free at portals on the web
 - Included with a paid ISP
 - Can be purchased separately

File Transfer

- Method of uploading files to and downloading files from servers on the Internet
- May require an FTP client program
 - Integrated in some operating systems
 - Available for download on the web; many free or open source alternatives are available
 - Many applications (such as web editing software) that require frequent transfer of files to the Internet have built-in FTP capabilities

Internet Phone

- Allows users to speak to other users via an Internet connection
- Requires a microphone, a speaker, a high-speed Internet connection, and VoIP software
 - Some subscription services also require a separate phone and VoIP router
 - With a webcam, some services also support video chat or videoconferences

Internet Messaging

- Real-time exchange of messages, files, images, audio, and/or video with another online user
- Requires messaging software
 - Integrated in some operating systems
 - Available for download on the web, usually for free, or available as a browser plug-in
 - Included with some paid ISPs

Mobile Messaging

- Short text, picture, or video messages sent and received, mainly on mobile devices
- May require messaging plan from mobile service provider
 - Requires messaging software
 - Integrated in most mobile devices
 - Available for download on the web, usually for free

Videoconference

- Meeting between geographically separated people who use a network to transmit video/audio
- Requires videoconferencing software, a microphone, a speaker, and a webcam

Web Feeds

- Keeps track of changes made to blogs by checking feeds
- Requires a feed reader
 - Integrated in some email programs and browsers
 - Available for download on the web, usually for free

ETHICS & ISSUES 4-4

Should Your Email Provider Be Allowed to Read or Scan Your Email?

When using any email program or service, you expect the app to scan incoming and outgoing mail to prevent the spread of malware. One web-based email service recently released a service update that includes automatic scanning of all email messages in order to provide targeted advertisements. Privacy experts point out that the scan includes all email messages sent or received, whether or not both the sender and recipient subscribe to the service.

Ad-supported web services, including email, often collect information in your profile, as well as your search results and other Internet activity. When you agree to

use these services, you give consent to this type of monitoring. In this case, the extent of the monitoring exceeds the policies of other web-based services. In a court filing, one email provider stated that users of web-based services have no “reasonable expectation” of privacy with respect to the content of email messages.

A further complication to this instance is that many educational institutions use this service for email, collaboration software, and more. The service admits to collecting data from students, even when the school has opted out of ad displays. Laws are unclear whether collecting student data is legal. Several schools have joined to create a class-action lawsuit against the provider. Many

argue that collection of student data, which could include grades received and more, is a violation of the Family Educational Rights and Privacy Act (FERPA). Although FERPA predates cloud-based Internet services, it states that “schools must have written permission from the parent or eligible student in order to release any information from a student's education record.”

Consider This: Should an email service provider disclose data collection practices? Why or why not? Is it ethical for an email provider to scan email sent by a nonsubscriber? Why or why not? Is collecting student data a violation of FERPA? Why or why not?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Graphics and Media Applications, Personal Interest Applications, and Communications Applications, as it relates to the chapter objectives.

Now you should know . . .

- When you might use a graphics or media application (Objective 5)
- Which personal interest applications you would find useful (Objective 6)
- When you are interacting with communications applications (Objective 7)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Security Tools

To protect your computers and mobile devices, you can use one or more security tools. Security tools include personal firewalls, antivirus programs, malware removers, and Internet filters. Although some of these tools are included with the operating system, you also can purchase stand-alone programs that offer improvements or added functionality.

Personal Firewall

A **personal firewall** is a security tool that detects and protects a personal computer and its data from unauthorized intrusions (Figure 4-24). Personal firewalls constantly monitor all transmissions to and from a computer or mobile device and may inform a user of attempted intrusions. When connected to the Internet, your computer or mobile device is vulnerable to attacks from

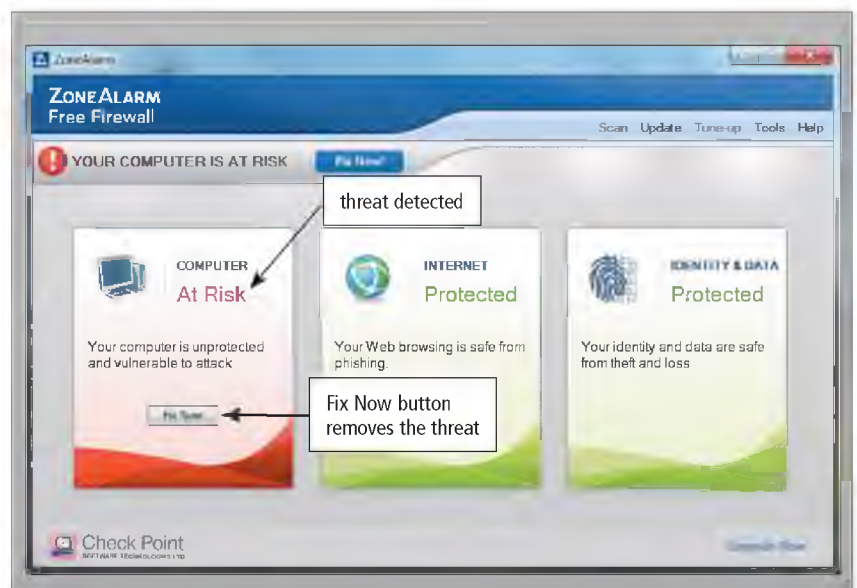


Figure 4-24 This personal firewall detected a threat to the computer and provided a means to remove the threat.

Courtesy of Checkpoint Software Technologies Ltd.

**Security Suites**

A *security suite* is a collection of individual security tools available together as a unit. These programs often are called Internet security programs.

hackers who try to access a computer or network illegally. These attacks may destroy your data, steal information, damage your computer, or carry out some other malicious action.

**CONSIDER THIS****What is a hardware firewall?**

A *hardware firewall* is a device intended to stop network intrusions before they attempt to affect your computer or network maliciously. Many routers also can function as a hardware firewall.

Discover More: Visit this chapter's free resources to learn more about personal firewalls.

Mini Feature 4-3: Viruses and Malware

A computer **virus** is a potentially damaging program that affects a computer or device negatively by altering the way it works. This occurs without the user's knowledge or permission. Once the virus is in a computer or device, it can spread and may damage your files, programs and apps, and operating system. Read Mini Feature 4-3 to learn more about viruses and other malware.

**MINI FEATURE 4-3****Viruses and Malware**

Viruses do not generate by chance. The programmer of a virus, known as a virus author, intentionally writes a virus program. Writing a virus program usually requires significant programming skills. The virus author ensures the virus can replicate itself, conceal itself, monitor for certain events, and then deliver its payload. A *payload* is the destructive event or prank the virus delivers. Viruses can infect all types of computers and devices. Most variations of viruses have two phases involved in their execution: infection and delivery.

The first step in the infection phase is activation of the virus. The most common way viruses spread is by users running infected programs or apps. During the infection phase, viruses typically perform one or more of the following actions:

1. First, a virus replicates by attaching itself to program files. A macro virus hides in a macro, which is a standard feature of many productivity applications, such as word processing and spreadsheet apps. A boot sector virus targets the computer's start-up files. A file virus attaches itself to program files. The next time an infected program or app is run, the virus executes and infects the computer or device.
2. Viruses conceal themselves to avoid detection. A stealth virus disguises itself by hiding in fake code sections, which it inserts within working code in a file. A polymorphic virus actually changes its code as it delivers the infection.
3. Finally, viruses watch for a certain condition or event and activate when that condition or event occurs. The event might be starting the computer or device, or reaching a date on the system clock. A logic bomb activates when it detects a specific condition

(say, a name deleted from the employee list). A time bomb is a logic bomb that activates on a particular date or time. If the triggering condition does not exist, the virus simply replicates.

During the delivery phase, the virus unleashes its payload, which might be a harmless prank that displays a meaningless message — or it might be destructive, corrupting or deleting data and files. The most dangerous viruses do not have an obvious payload. Instead, they quietly modify files. One way antivirus software detects computer viruses is by monitoring files for unknown changes.

In addition to viruses, other malware includes worms, trojan horse programs, and rootkits.

- A *worm* resides in active memory and replicates itself over a network to infect computers and devices, using up system resources and possibly shutting down the system.
- A *trojan horse* is a destructive program disguised as a real program, such as a screen saver. When a user runs a seemingly innocent program, a trojan horse hiding inside can capture information, such as user names and passwords, from your computer or enable someone to control your computer remotely. Unlike viruses, trojan horses do not replicate themselves.
- A *rootkit* is a program that easily can hide and allow someone to take full control of your computer from a remote location, often for nefarious purposes. For example, a rootkit can hide in a folder on your computer. The folder appears empty because the rootkit has instructed your computer not to display the contents of the folder. Rootkits can be very dangerous and often require special software to detect and remove.

Studies show that malware can infect an unprotected computer within minutes after connecting to the Internet. Due to the increasing threat of viruses attacking your computer, it is more important than ever to protect your computer from viruses and other malware. Secure IT 1-2 in Chapter 1 lists steps you can follow to protect your computer from a virus infection.

Discover More: Visit this chapter's free resources to learn more about file viruses, polymorphic viruses, rootkits, and antivirus software.

Consider This: If your computer or mobile device is infected with a virus or malware, how will you know? How will you find instructions for removing a virus?

Signs of Virus Infection

- An unusual message or image is displayed on the computer screen.
- An unusual sound or music plays randomly.
- The available memory is less than what should be available.
- A program or file suddenly is missing.
- An unknown program or file mysteriously appears.
- The size of a file changes without explanation.
- A file becomes corrupted.
- A program or file does not work properly.
- System properties change.
- The computer operates much slower than usual.

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Antivirus Programs

To protect a computer from virus attacks, users should install an antivirus program and keep it updated by purchasing revisions or upgrades to the software. An **antivirus program** protects a computer against viruses by identifying and removing any computer viruses found in memory, on storage media, or on incoming files (Figure 4-25). Antivirus programs scan for programs that attempt to modify a computer's start-up files, the operating system, and other programs that normally are read from but not modified. In addition, many antivirus programs automatically scan files downloaded from the web, email attachments, opened files, and all types of removable media inserted in the computer or mobile device.

If an antivirus program identifies an infected file, it attempts to remove the malware. If the antivirus program cannot remove the infection, it often quarantines the infected file.

A *quarantine* is a separate area of a hard drive that holds the infected file until the infection can be removed. This step ensures other files will not become infected. Quarantined files remain on your computer or mobile device until you delete them or restore them.

Most antivirus programs also include protection against other malware, such as worms, trojan horses, and spyware. When you purchase a new computer, it may include a trial version of antivirus software. Many email servers also have anti-virus programs installed to check incoming and outgoing email messages for viruses and other malware. Read Secure IT 4-4 for tips about recognizing virus hoaxes.



Antivirus and Malware Detection Programs

You should run only one antivirus program on your computer but can run more than one malware detection program.

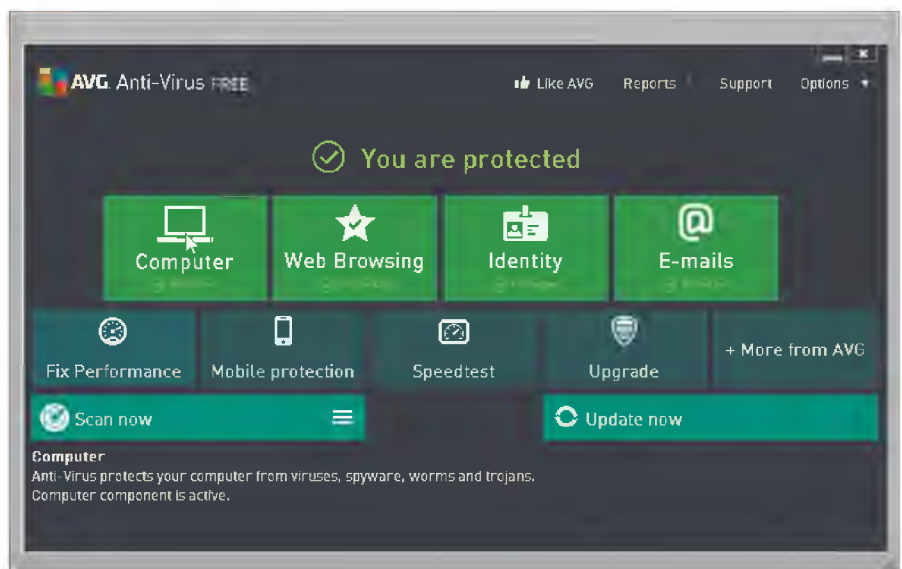



Figure 4-25 An antivirus program scans memory, media, and incoming email messages and attachments for viruses and attempts to remove any viruses it finds.

Courtesy of Checkpoint Software Technologies Ltd.

 **SECURE IT 4-4**
 **Recognizing Virus Hoaxes**

Computer hoaxes spread across the Internet in record time and often are the source of urban legends. These hoaxes take several forms and often disappear for months or years at a time, only to resurface some time later.


Most alarming to some users are the computer virus hoaxes that warn the computer is infected and needs immediate attention. Some warnings state the problem is so severe that the computer or device will

explode or that the entire hard drive will be erased in a matter of seconds. The warnings cite prominent companies, such as Microsoft and Intel Security. These messages claim to offer a solution to the problem, generally requesting a fee for a program to download. Snopes.com compiles these hoaxes and describes their sources and histories.

In reality, these fake messages are generated by unscrupulous scammers preying upon gullible people who panic and follow the directions in the message. These users

divulge credit card information and then often download files riddled with viruses.

If you receive one of these virus hoaxes, never respond to the message. Instead, delete it. Most importantly, never forward it to an unsuspecting friend or coworker. If you receive the virus hoax from someone you know, send him or her a separate email message with information about the hoax.

 **Consider This:** Have you ever received a virus hoax? If so, what action did you take?

 **CONSIDER THIS**
How do antivirus programs detect viruses?

Many antivirus programs identify viruses by looking for virus signatures. A *virus signature*, also called a virus definition, is a known specific pattern of virus code. Computer users should update their antivirus program's signature files regularly. This extremely important activity allows the antivirus program to protect against viruses written since the antivirus program was released and/or its last update. Most antivirus programs contain an automatic update feature or regularly prompts users to download the updated virus signatures, usually at least once a week. The vendor usually provides this service to registered users at no cost for a specified time.

Discover More: Visit this chapter's free resources to learn more about antivirus programs.

Spyware, Adware, and Other Malware Removers

Spyware is a type of program placed on a computer or mobile device without the user's knowledge that secretly collects information about the user and then communicates the information it collects to some outside source while the user is online. Some vendors or employers use spyware to collect information about program usage or employees. Internet advertising firms often collect information about users' web browsing habits. Spyware can enter your computer when you install a new program, through a graphic on a webpage or in an email message, or through malware.

Adware is a type of program that displays an online advertisement in a banner or pop-up or pop-under window on webpages, email messages, or other Internet services. Sometimes, Internet advertising firms hide spyware in adware.

A **spyware remover** is a type of program that detects and deletes spyware and similar programs. An **adware remover** is a program that detects and deletes adware. Malware removers detect and delete spyware, adware, and other malware. Read Secure IT 4-5 for measures you can take to protect your mobile device from malware.

 **CONSIDER THIS**
Are cookies spyware?

A *cookie* is a small text file that a web server stores on your computer. Cookie files typically contain data about you, such as your user name, viewing preferences, or shopping cart contents. Cookies are not considered spyware because website programmers do not attempt to conceal the cookies.

Discover More: Visit this chapter's free resources to learn more about malware removers.

SECURE IT 4-5

Malware Risks to Mobile Devices

Practically every smartphone is vulnerable to hacking attacks. Threats to smartphones and mobile devices are growing in record numbers due to the rising popularity of these products and the variety of marketplace sources for downloading apps.


Often the malware is disguised as a popular app and steals personal and sensitive information and phone numbers. It also can allow hackers to control the mobile device from remote locations. Once the hacker takes over the device, all the information on it is available, including passwords and account numbers. One of the fastest growing threats within mobile apps is *toll fraud malware*,

which is a malicious mobile app that uses a variety of fraudulent schemes to charge unsuspecting users for premium messaging services.

Smartphone users can take several precautions to guard against malware threats. They include:

- Read reviews of apps and the companies that create them before downloading the apps to your mobile device.
- Use mobile malware and antivirus protection.
- Turn off location-based apps that track your movements.
- Do not connect to unknown wireless networks.

- Keep the operating system up to date.
- Enable the screen lock feature, and use a strong password to unlock the device.
- Reset the mobile device before selling or trading it in.
- Practice the same safe computing measures you take on your home computer.

 **Consider This:** Which of these guidelines do you follow now when using your smartphone or mobile device? How will you modify your usage after reading these tips?

Internet Filters

Filters are programs that remove or block certain items from being displayed. Four widely used Internet filters are anti-spam programs, web filters, phishing filters, and pop-up and pop-under blockers.

Anti-Spam Programs **Spam** is an unsolicited email message or posting sent to many recipients or forums at once. Spam is considered Internet junk mail. The content of spam ranges from selling a product or service, to promoting a business opportunity, to advertising offensive material. Spam also may contain links or attachments that contain malware.

An **anti-spam program** is a filtering program that attempts to remove spam before it reaches your inbox or forum. If your email program does not filter spam, many anti-spam programs are available at no cost on the web. ISPs often filter spam as a service for their subscribers.

Web Filters **Web filtering software** is a program that restricts access to certain material on the web. Some restrict access to specific websites; others filter websites that use certain words or phrases. Many businesses use web filtering software to limit employee's web access. Some schools, libraries, and parents use this software to restrict access to websites that are not educational.

Phishing Filters **Phishing** is a scam in which a perpetrator sends an official looking email message that attempts to obtain your personal and/or financial information (Figure 4-26). Some phishing messages ask you to reply with your information; others direct you to a phony website or a pop-up or pop-under window that looks like a legitimate website, which then collects your information.

A **phishing filter** is a program that warns or blocks you from potentially fraudulent or suspicious websites. Some browsers include phishing filters.

Internet Research

What are current phishing scams?

Search for: recent phishing scams

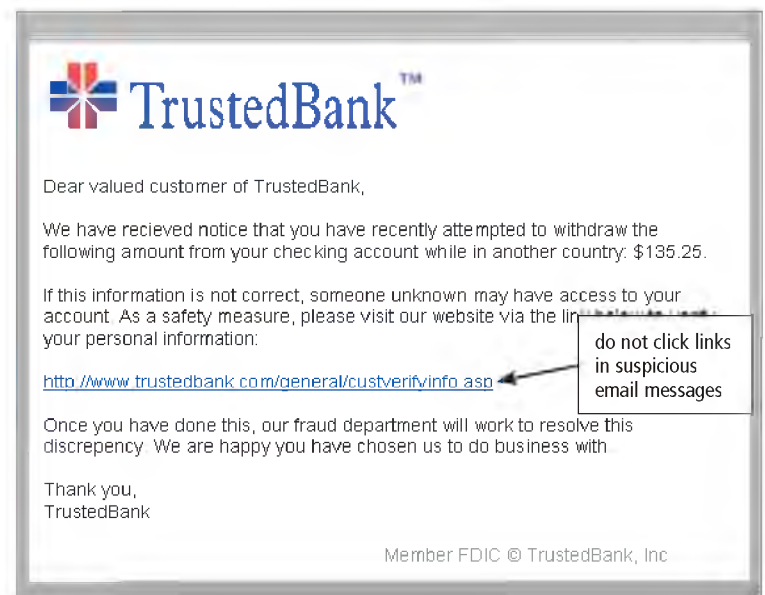


Figure 4-26 An example of a phishing email message.

Source: Andrew Levine

Pop-Up and Pop-Under Blockers A *pop-up ad* is an Internet advertisement that suddenly appears in a new window on top of a webpage. Similarly, a *pop-under ad* is an Internet advertisement that is hidden behind the browser window so that it will be viewed when users close their browser windows. A **pop-up blocker** or **pop-under blocker** is a filtering program that stops pop-up or pop-under ads from displaying on webpages. Many browsers include these blockers. You also can download pop-up and pop-under blockers from the web at no cost.

Discover More: Visit this chapter's free resources to learn more about Internet filters.

File, Disk, and System Management Tools

To perform maintenance-type tasks related to managing a computer, its devices, or its programs, you can use one or more file, disk, and system management tools. Functions provided by these tools include the following: managing files, searching, viewing images, uninstalling software, cleaning up disks, defragmenting disks, setting up screen savers, compressing files, maintaining a personal computer, and backing up files and disks. Although some of these tools are included with the operating system, you also can purchase stand-alone programs that offer improvements or added functionality.

File Manager

A **file manager** is a tool that performs functions related to file management. Some of the file management functions that a file manager performs are displaying a list of files on a storage medium (Figure 4-27); organizing files in folders; and copying, renaming, deleting, moving, and sorting files. A **folder** is a specific named location on a storage medium that contains related files. Operating systems typically include a file manager.

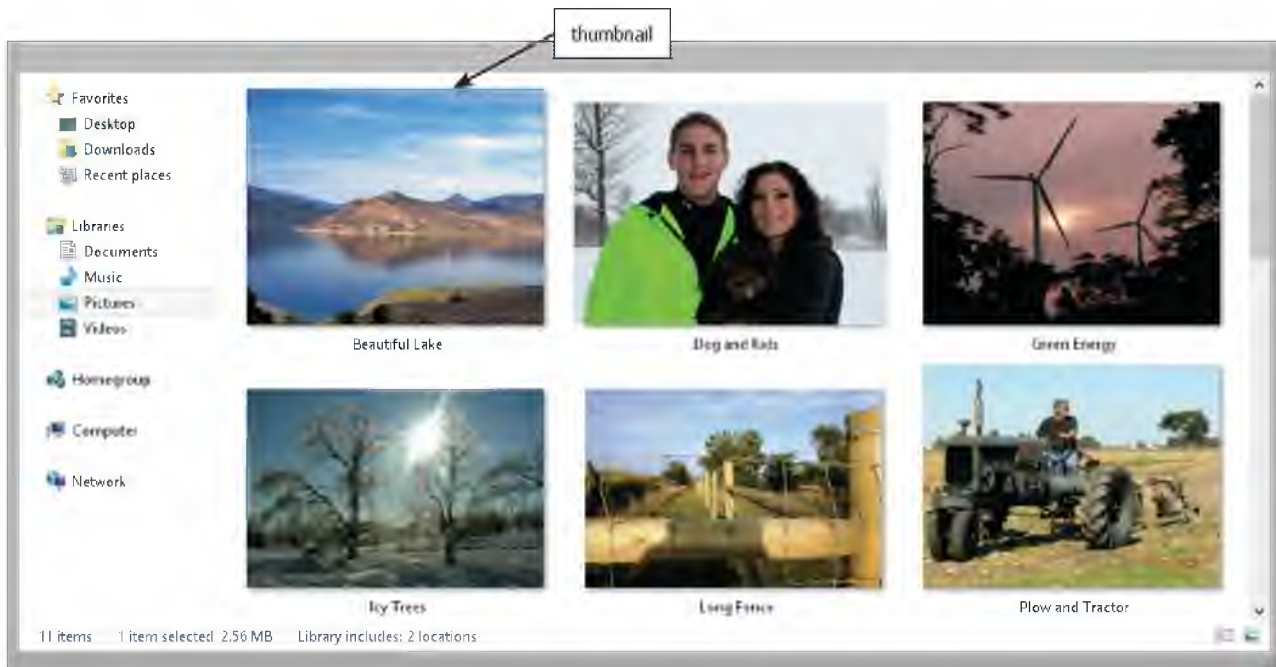


Figure 4-27 With a file manager, you can view files containing documents, photos, and music. In this case, thumbnails of photos are displayed.

Source: Microsoft

Search

A **search tool** is a program, usually included with an operating system, that attempts to locate a file, contact, calendar event, app or any other item stored on your computer or mobile device based on criteria you specify (Figure 4-28). The criteria could be a word(s), date, location, and other similar properties. Search tools can look through documents, photos, music, calendars, contacts, and other items on your computer or mobile device and/or on the Internet, combining search results in a single location.

Search tools typically use an index to assist with locating items quickly. An *index* stores a variety of information about a file, including its name, date created, date modified, author name, and so on. When you enter search criteria, instead of looking through every file and folder on the storage medium, the search tool looks through the index first to find a match. Each entry in the index contains a link to the actual file on the storage media for easy retrieval.

Image Viewer

An **image viewer** is a tool that allows users to display, copy, and print the contents of a graphics file, such as a photo (Figure 4-29). With an image viewer, users can see images without having to open them in a paint or image editing program. Many image viewers include some photo editing capabilities. Most operating systems include an image viewer.

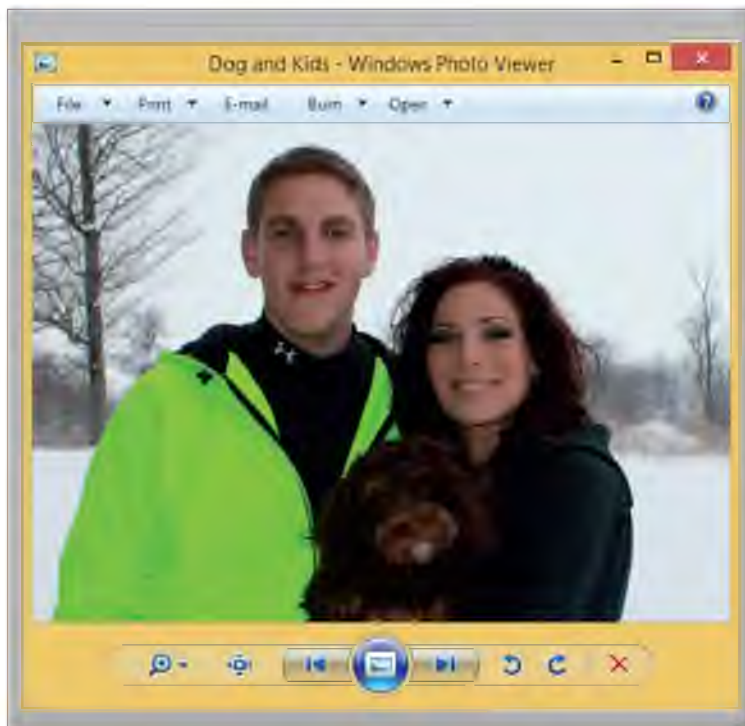


Figure 4-29 An image viewer allows users to see the contents of a photo file.
Source: Microsoft

Uninstaller

An **uninstaller** is a tool that removes a program, as well as any associated entries in the system files. When you install a program, the operating system records the information it uses to run the software in the system files. The uninstaller deletes files and folders from the hard drive, as well as removes program entries from the system files. Read How To 4-4 for instructions about uninstalling programs and removing apps from your computers and mobile devices.



Figure 4-28 This search displays all files on the mobile device that match the search criteria, Map. Notice the search results show map apps, email with a map, and a calendar event.
Source: Apple Inc

HOW TO 4-4

Uninstall a Program or Remove an App

You may choose to uninstall a program or remove an app from your computer or mobile device for a variety of reasons. For example, you may uninstall a program if you need more space on your hard drive, or if you no longer have a use for that program. Uninstalling unwanted programs and apps will keep your hard drive free from clutter and maximize your computer or mobile device's performance. The following steps describe how to uninstall a program or remove an app.

Windows

1. Open the Control Panel.
2. Tap or click the option to uninstall a program.

3. Tap or click to select the program to uninstall.
4. Tap or click the Uninstall button and then follow the prompts on the screen.

Mac

1. Open the Finder.
2. Tap or click Applications in the left pane.
3. Scroll to display the app you wish to uninstall.
4. Drag the app's icon to the Trash.

iPhone, iPad, or iPod Touch

1. Press and hold the icon for the app you wish to delete until the app icons begin to animate.

2. Tap the X on the icon for the app you wish to delete to remove the app from your device.

Android

1. Display the Settings menu.
2. Tap the command to display a list of installed applications.
3. Tap the application to uninstall.
4. Tap the Uninstall button.
5. Tap the OK button.

Consider This: In addition to the reasons stated here, what other reasons might you choose to uninstall an app from your computer or mobile device?

CONSIDER THIS

Can you use a file manager to delete a program?

If an uninstaller exists and you remove software from a computer by deleting the files and folders associated with the program without running the uninstaller, the system file entries might not be updated. This may cause the operating system to display error messages when you start the computer.

Disk Cleanup

A **disk cleanup** tool searches for and removes unnecessary files (Figure 4-30). Unnecessary files may include downloaded program files, temporary Internet files, deleted files, and unused program files. Operating systems usually include a disk cleanup tool.



Figure 4-30 A disk cleanup tool searches for and removes unnecessary files.

Source: Microsoft

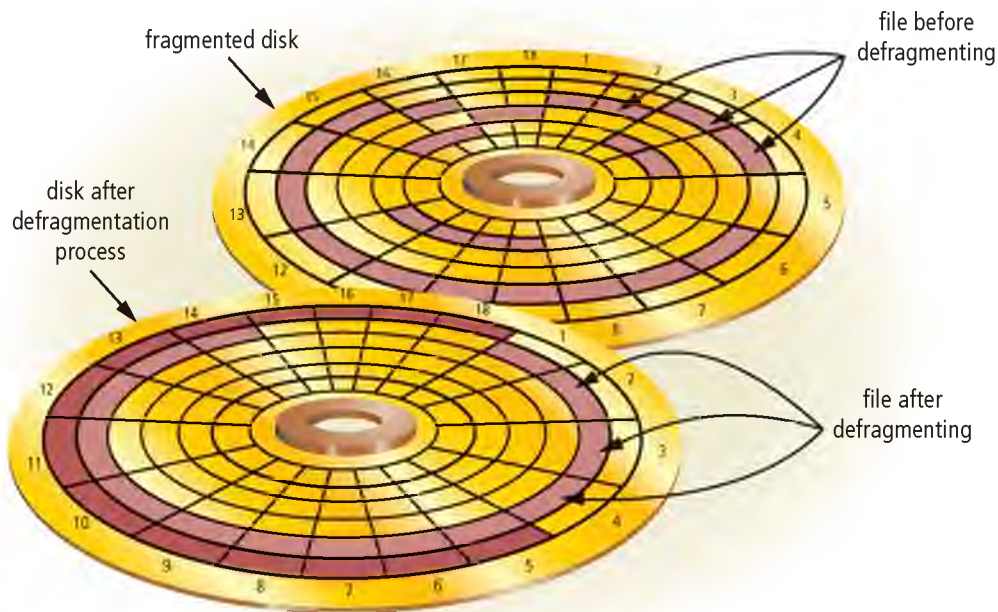
Disk Defragmenter


A **disk defragmenter** is a tool that reorganizes the files and unused space on a computer's hard disk so that the operating system accesses data more quickly and programs run faster. When an operating system stores data on a disk, it places the data in the first available sector (a storage location on a disk in the shape of an arc). The operating system attempts to place data in sectors that are contiguous (next to each other), but this is not always possible. When the contents of a file are scattered across two or more noncontiguous sectors, the file is fragmented.

Fragmentation slows down file access and, thus, the performance of the entire computer. Defragmenting the disk, or reorganizing it so that the files are stored in contiguous sectors, solves this problem (Figure 4-31). Operating systems usually include a disk defragmenter.

 BTW
SSDs

Defragmenting is necessary only on hard disks. You do not need to defragment an SSD (solid-state drive).



 **Figure 4-31** A fragmented disk has many files stored in noncontiguous sectors. Defragmenting reorganizes the files so that they are located in contiguous sectors, which speeds access time.

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Screen Saver

A **screen saver** is a tool that causes a display device's screen to show a moving image or blank screen if no keyboard or mouse activity occurs for a specified time. When you press a key on the keyboard, tap the screen, or move the mouse, the screen saver disappears and the screen returns to the previous state.

CONSIDER THIS

What is the purpose of a screen saver?

Screen savers originally were developed to prevent a problem called ghosting, in which images could be etched permanently on a monitor's screen. Although ghosting is not as severe of a problem with today's displays, manufacturers continue to recommend that users install screen savers for this reason. Screen savers also are popular for security, business, and entertainment purposes. To secure a computer, users configure their screen saver to require a password to deactivate.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn about compression algorithms

File Compression

A **file compression tool** shrinks the size of a file(s). A compressed file takes up less storage space than the original file. Compressing files frees up room on the storage media. You may need to compress a file so that it will fit on a smaller storage medium, such as a USB flash drive. Attaching a compressed file to an email message, for example, reduces the time needed for file transmission. Uploading and downloading compressed files to and from the Internet reduces the file transmission time.

Compressed files sometimes are called **zipped files**. When you receive or download a compressed file, you must uncompress it. To **uncompress** (or unzip or expand) a file, you restore it to its original form. Some operating systems include file compression and uncompression capabilities.

Discover More: Visit this chapter's free resources to learn more about file compression tools.

PC Maintenance

A **PC maintenance tool** is a program that identifies and fixes operating system problems, detects and repairs drive problems, and includes the capability of improving a computer's performance. Additionally, some personal computer maintenance utilities continuously monitor a computer while you use it to identify and repair problems before they occur.

Backup and Restore

A **backup tool** allows users to copy, or back up, selected files or the contents of an entire storage medium to another storage location, such as another hard drive, optical disc, USB flash drive, or cloud storage (Figure 4-32). During the backup process, the backup tool monitors progress and alerts you if it needs additional media, such as another disc. Many backup programs compress files during the backup process. By compressing the files, the backup program requires less storage space for the backup files than for the original files.

Because they are compressed, you usually cannot use backup files in their backed up form. In the event you need to use a backup file, a **restore tool** reverses the process and returns backed up files to their original form. Backup tools work with a restore tool. You should back up files and disks regularly in the event your originals are lost, damaged, or destroyed.

Discover More: Visit this chapter's free resources to learn more about backup tools.

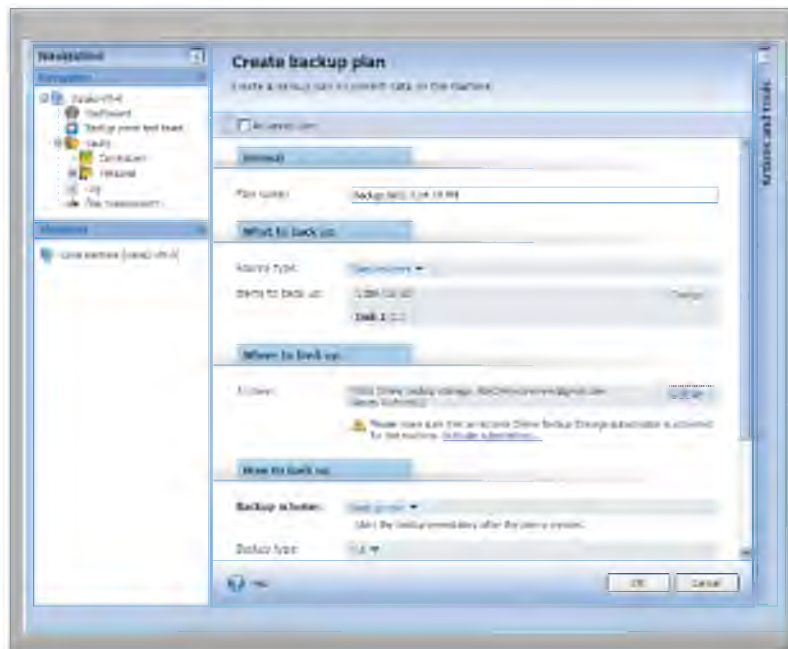


Figure 4-32 A backup tool allows users to copy files, folders, or the entire contents from one storage medium to another location.

Source: Acronis

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Security Tools and File, Disk, and System Management Tools as it relates to the chapter objectives.

Now you should know ...


- Why you should use personal firewalls, antivirus programs, malware removers, and Internet filters (Objective 8)
- Which file, disk, and system management tools you would find useful (Objective 9)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter presented a variety of programs and apps available for computers and mobile devices. You learned about the role of the operating system and the various ways software is distributed. The chapter presented the features of a variety of productivity applications, graphics and media applications, and personal interest applications. It reviewed several communications applications and then presented features of a variety of security tools and file, disk, and system management tools.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Dan Bricklin, Google/Sergey Brin/Larry Page, Adobe Systems, and eBay/PayPal; Technology Trends: Evernote, Instagram, and iTunes U; and High-Tech Talks: Filtering Data and Compression Algorithms.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Entertainment

Do you wonder how music on the radio sounds so perfectly in tune, how animated motion pictures are created, or how one controls and technology lighting during a concert? Not only does the entertainment industry rely on computers and technology to advertise and sell their services, computers also assist in other aspects, including audio and video composition, lighting control, computerized animation, and computer gaming.

Entertainment websites provide music and movies you can purchase and download to your computer or mobile device; live news broadcasts, performances, and sporting events; games you can play with other online users; and much more.

As early as 1951, computers were used to record and play music. Today, computers play a much larger role in the music industry. For example, if you are listening to a song on the radio and notice that not one note is out of tune, it is possible that a program or app was used to change individual notes without altering the rest of the song.

Many years ago, creating cartoons or animated motion pictures was an extremely time-consuming task because artists were responsible for sketching thousands of drawings by hand. Currently, artists use computers to create these drawings in a fraction of the time, which significantly reduces the time and cost of development. Technology also is used in other areas of movie production to add visual effects.

Technology also is used in the gaming industry. While some game developers create games from scratch, others might use game engines that simplify the development process. For example, LucasArts created the GrimE game engine, which is designed to create adventure games.

During a concert, lighting technicians use computer programs to control lights by turning them off and on, changing their color, or changing their placement at specified intervals. In fact, once a performance begins, the technicians often merely are standing by, monitoring the computer as it performs most of the

work. A significant amount of time and effort, however, is required to program the computer to execute its required tasks during a live show.

The next time you listen to a song, watch a movie, play a game, or attend a concert, think about the role technology plays in contributing to your entertainment.

 **Consider This:** How else might computers and technology be used in the entertainment industry?



© Horizons WWVP / Alamy

Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to **test your knowledge of digital content** associated with this chapter and **access the Study Guide resource** from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- List categories of programs and apps. _____ is another word for program.
- Define these terms: operating system, tools, and system software.
- List examples of desktop and mobile operating systems.
- Describe how an operating system interacts with the computer.
- _____ software performs functions specific to a business or industry.
- Differentiate among web apps, mobile apps, and mobile web apps.
- List any restrictions for shareware, freeware, open source, and public-domain software.
- Explain considerations for safely downloading software and apps.
- Describe steps to register and activate software.
- Explain the purpose of a license agreement.
- List types of productivity applications.
- Describe the activities that occur during project development.
- Differentiate among font, font size, and font style.
- Explain the impact of the Internet on plagiarism.
- Applications often include a(n) _____ gallery, which is a collection of clip art and photos.
- Identify functions of the following software: word processing, presentation, spreadsheet, database, note taking, calendar and contact management, software suite, project management, accounting, personal finance, legal, tax preparation, and document management.
- Identify tools word processing programs provide that can assist you when writing.
- Define the following terms: worksheet and function.
- Describe when you should use a database and when to use a spreadsheet.
- List advantages of using a software suite.
- Identify ways you can manage a project using project management software.
- List safety considerations when using personal finance apps.
- Describe issues that might arise when using legal software.
- Name the types of software used by various functional units in an enterprise.
- Identify functions of the following apps: calendar and email, scanning, financial, reference, retail, travel, and online social networks.
- Identify risks when using payment apps.
- Identify functions of the following software: computer-aided design, desktop publishing, paint/image editing, photo editing and photo management, video and audio editing, multimedia and website authoring, media player, and disc burning.
- List ways to edit digital photos. Identify issues surrounding altered digital photos.
- _____ authoring software allows users to combine text, graphics, audio, video, and animation in an interactive application.
- Define the terms, CBT and WBT.
- List types of personal interest applications.
- Describe ways to use voice command personal assistant apps.
- Identify functions of the following apps: media sharing; streaming audio and video; game; news, sports, and weather; mapping; health and fitness; and academic.
- Identify types of communications applications.
- List issues surrounding an email provider scanning users' emails.
- Identify functions of the following tools: personal firewalls, hardware firewalls, antivirus programs, malware removers, and Internet filters.
- Describe ways a virus infects programs or apps.
- List types of malware. Identify signs of a virus infection.
- Explain the risks of and how to avoid computer virus hoaxes.
- A virus _____ is a known specific pattern of virus code. Differentiate between spyware and adware.
- Identify ways to avoid malware when using a mobile device.
- List and describe four types of Internet filters.
- Identify functions of the following tools: file manager, search, image viewer, uninstaller, disk cleanup, disk defragmenter, screen saver, file compression, PC maintenance, and backup and restore.
- Define the terms, folder and index.
- List steps to uninstall a program or remove an app.
- Describe the disk defragmentation process.
- Compressed files are sometimes called _____ files.
- List storage media for backups.
- Describe uses of technology in the entertainment industry.

Key Terms

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

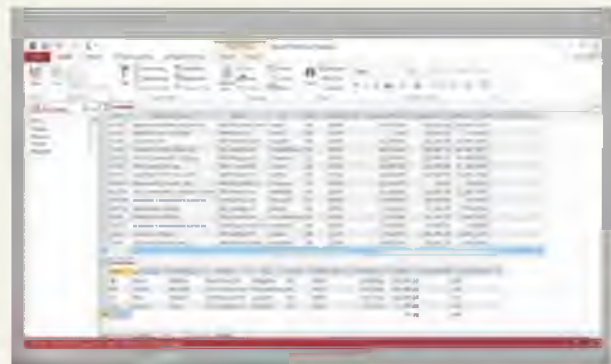
Discover More: Visit this chapter's premium content to **view definitions** for each term and to **access the Flash Cards resource** from your smartphone, tablet, laptop, or desktop

Primary Terms (shown in bold-black characters in the chapter)

accounting software (173)	disc burning software (185)	PDF (176)	software suite (172)
adware remover (192)	disk cleanup (196)	personal finance software (174)	spam (193)
anti-spam program (193)	disk defragmenter (197)	personal firewall (189)	spreadsheet software (168)
antivirus program (191)	document management software (176)	phishing (193)	spyware remover (192)
app (158)	file compression tool (198)	phishing filter (193)	tax preparation software (176)
application (158)	file manager (194)	photo editing software (181)	uncompress (198)
audio editing software (183)	folder (194)	photo management software (182)	uninstaller (195)
backup tool (198)	image editing software (181)	pop-under blocker (194)	video editing software (183)
calendar and contact management software (171)	image viewer (195)	pop-up blocker (194)	virus (190)
clip art/image gallery (166)	legal software (175)	presentation software (168)	web filtering software (193)
computer-aided design (180)	media player (185)	program (158)	website authoring software (184)
database (170)	multimedia authoring software (184)	project management software (172)	word processing software (167)
database software (170)	note taking software (171)	QR code (178)	worksheet (168)
desktop publishing software (180)	paint software (181)	restore tool (198)	zipped files (198)
	PC maintenance tool (198)	screen saver (197)	
		search tool (195)	
		software (158)	

Secondary Terms (shown in *italic* characters in the chapter)

<i>adware</i> (192)	<i>hard copy</i> (166)	<i>resize</i> (182)	<i>system software</i> (158)
<i>application software</i> (158)	<i>hardware firewall</i> (190)	<i>retail software</i> (161)	<i>toll fraud malware</i> (193)
<i>automatic update</i> (163)	<i>home design/landscaping software</i> (180)	<i>rootkit</i> (190)	<i>tools</i> (158)
<i>brightness</i> (182)	<i>illustration software</i> (181)	<i>save</i> (165)	<i>trial version</i> (161)
<i>clipboard</i> (165)	<i>index</i> (195)	<i>security suite</i> (189)	<i>trojan horse</i> (190)
<i>compress</i> (182)	<i>license agreement</i> (163)	<i>shareware</i> (161)	<i>utilities</i> (158)
<i>computer-based training (CBT)</i> (184)	<i>marketplace</i> (161)	<i>sharpness</i> (182)	<i>virus signature</i> (192)
<i>contrast</i> (182)	<i>mobile app</i> (161)	<i>slide show</i> (168)	<i>web app</i> (161)
<i>cookie</i> (192)	<i>mobile web app</i> (161)	<i>software as a service (SaaS)</i> (162)	<i>web-based training (WBT)</i> (184)
<i>create</i> (165)	<i>NFC chip</i> (179)	<i>software registration</i> (162)	<i>worm</i> (190)
<i>crop</i> (182)	<i>open source software</i> (161)	<i>spyware</i> (192)	
<i>custom software</i> (161)	<i>operating system</i> (158)		
<i>edit</i> (165)	<i>payload</i> (190)		
<i>e-filing</i> (176)	<i>pop-under ad</i> (194)		
<i>EULA</i> (163)	<i>pop-up ad</i> (194)		
<i>font</i> (166)	<i>print</i> (166)		
<i>font size</i> (166)	<i>product activation</i> (162)		
<i>font style</i> (166)	<i>productivity applications</i> (165)		
<i>format</i> (166)	<i>public-domain software</i> (161)		
<i>freeware</i> (161)	<i>quarantine</i> (191)		
<i>function</i> (169)	<i>red-eye</i> (182)		



database software (170)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. Application software serves as the interface between the user, the apps, and the computer's or mobile device's hardware. (158)
- _____ 2. While a computer or mobile device is running, the operating system remains in memory. (160)
- _____ 3. Open source software is mass-produced, copyrighted software that meets the needs of a wide variety of users. (161)
- _____ 4. When downloading shareware, freeware, or public-domain software, it is good practice to seek websites with ratings for and reviews of products. (162)
- _____ 5. With web apps, you always access the latest version of the software. (163)
- _____ 6. With database software, users run functions to retrieve data. (170)
- _____ 7. Software suites offer three major advantages: lower cost, ease of use, and integration. (172)
- _____ 8. A PDF file can be viewed and printed without the software that created the original document. (176)
- _____ 9. The military and airlines use CBT simulations to train pilots to fly in various conditions and environments. (184)
- _____ 10. A router also can function as a hardware firewall. (190)
- _____ 11. A worm is a destructive program designed as a real program. (190)
- _____ 12. Cookies typically are considered a type of spyware. (192)

Multiple Choice


Select the best answer.

1. _____ software performs functions specific to a business or industry. (161)
 - a. Retail
 - b. Open source
 - c. Shareware
 - d. Custom
2. A(n) _____ is the right to use a program or app. (163)
 - a. license agreement
 - b. product activation
 - c. software registration
 - d. automatic update
3. _____ software is an application that allows users to organize data in columns and rows and perform calculations on the data. (168)
 - a. Spreadsheet
 - b. Database
 - c. Presentation
 - d. Document management
4. Mobile payment apps use a payment system on phones equipped with a(n) _____, which stores data that is transmitted to a contactless terminal and verified as a legitimate sale. (179)
 - a. QR chip
 - b. EULA
 - c. NFC chip
 - d. trojan horse
5. _____ is a type of application that assists professionals and designers in creating engineering, architectural, and scientific designs and models. (180)
 - a. Enterprise software
 - b. CAD software
 - c. Public-domain software
 - d. A software suite
6. The term _____ refers to removing unwanted areas of a photo. (182)
 - a. crop
 - b. snip
 - c. compress
 - d. shrink
7. A(n) _____ is a device intended to stop network intrusions before they attempt to affect your computer or network maliciously. (190)
 - a. anti-spam program
 - b. pop-under blocker
 - c. hardware firewall
 - d. quarantine drive
8. _____ is a small text file that a web server stores on your computer. (192)
 - a. A pop-under blocker
 - b. A cookie
 - c. Adware
 - d. Spyware

Checkpoint

Matching Match the terms with their definitions.

- | | |
|--------------------------------------|--|
| _____ 1. tools (158) | a. destructive event or prank a virus was created to deliver |
| _____ 2. shareware (161) | b. copyrighted software that is distributed at no cost for a trial period |
| _____ 3. software as a service (162) | c. malware that resides in active memory and replicates itself over a network to infect computers and devices, using up the system resources and possibly shutting down the system |
| _____ 4. QR code (178) | d. program that enables you to perform maintenance-type tasks usually related to managing devices, media, and programs used by computers and mobile devices |
| _____ 5. CBT (184) | e. computing environment where an Internet server hosts and deploys applications |
| _____ 6. personal firewall (189) | f. security tool that detects and protects a personal computer and its data from unauthorized intrusions |
| _____ 7. payload (190) | g. type of education in which students learn by using and completing exercises with instructional software |
| _____ 8. worm (190) | h. scam in which a perpetrator sends an official looking email message that attempts to obtain personal and/or financial information |
| _____ 9. quarantine (191) | i. square-shaped graphic that represents a web address or other information |
| _____ 10. phishing (193) | j. separate area of a hard drive that holds an infected file until the infection can be removed |

 **Consider This** Answer the following questions in the format specified by your instructor.

1. Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (165, 175, 183, 189), How To (173, 182, 186, 196), Mini Features (178, 187, 190), Secure IT (162, 174, 179, 192, 193), and Technology @ Work (199).
2. What is the role of the operating system? (158)
3. What is system software? (158)
4. What are the advantages of open source software? (161)
5. Why do app developers opt for web delivery? (161)
6. What is the difference between software registration and product activation? (162)
7. What activities does a license agreement restrict? (163)
8. What does it mean to edit a project? (165)
9. What is the clipboard? (165)
10. What is meant by font style? (166)
11. How often should you save a project? (166)
12. How does a spreadsheet organize data? (169)
13. How are cells identified in a spreadsheet? (169)
14. When might you choose to use a database instead of a spreadsheet? (170)
15. What features are included in personal finance software? (174)
16. What steps can you take to safeguard your funds and identity when using personal finance apps? (174)
17. Who might use CAD? (180)
18. Should journalists edit or enhance digital photos? Why or why not? (183)
19. What tasks can you accomplish using mapping apps? (187)
20. How does a personal firewall protect your computer? (189)
21. What happens during the delivery phase of a virus? (190)
22. How do a virus, worm, trojan horse, and rootkit differ? (190)
23. In reference to malware, what is a quarantine? (191)
24. What is a phishing scam? (193)
25. Why is spam potentially dangerous? (193)
26. What are the different types of file, disk, and system management tools? (194)
27. How does a search tool locate a file on your computer or mobile device? (195)
28. What is a fragmented disk? (197)
29. How does fragmentation affect a computer's performance? (197)
30. What tasks does a PC maintenance tool perform? (198)

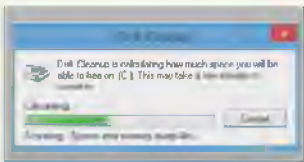
Problem Solving

The Problem Solving exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, work, or with nonprofit organizations. The Collaboration exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Antivirus Program Not Updating** You are attempting to update your antivirus program with the latest virus definitions, but you receive an error message. What steps will you take to resolve this issue?
- 2. Operating System Does Not Load** Each time you turn on your computer, the operating system attempts to load for approximately 30 seconds and then the computer restarts. You have tried multiple times to turn your computer off and on, but it keeps restarting when the operating system is trying to load. What are your next steps?
- 3. Unwanted Programs** When you displayed a list of programs installed on your computer so that you could uninstall one, you noticed several installed programs that you do not remember installing. Why might these programs be on your computer?



Source: Microsoft

- 4. News Not Updating** Each morning, you run an app on your smartphone to view the news for the current day. For the past week, however, you notice that the news displayed in the app is out of date. In fact, the app now is displaying news that is nearly one week old. Why might the app not be updating? What are your next steps?
- 5. Incompatible App** You are using your Android tablet to browse for apps in the Google Play store. You found an app you want to download, but you are unable to download it because a message states it is incompatible with your device. Why might the app be incompatible with your device?

Professional

- 6. Videoconference Freezes** While conducting a videoconference with colleagues around the country, the audio sporadically cuts out and the video freezes. You have attempted several times to terminate and then reestablish the connection, but the same problem continues to occur. What might be the problem?
- 7. License Agreement** You are planning to work from home for several days, but you are unsure of whether you are allowed to install a program you use at work on your home computer. What steps will you take to determine whether you are allowed to install the software on your home computer?
- 8. Low on Space** The computer in your office is running low on free space. You have attempted to remove as many files as possible, but the remaining programs and files are necessary to perform your daily job functions. What steps might you take to free enough space on the computer?
- 9. Unacceptable File Size** Your boss has asked you to design a new company logo using a graphics application installed on your computer. When you save the logo and send it to your boss, she responds that the file size is too large and tells you to find a way to decrease the file size. What might you do to make the image file size smaller?
- 10. Disc Burning Not Working** While attempting to back up some files on your computer on an optical disc, the disc burning software on your computer reports a problem and ejects the disc. When you check the contents of the disc, the files you are trying to back up are not there. What might be wrong?

Collaboration

- 11. Technology in Entertainment** The film department at a local high school is considering developing a movie and has asked for your help. The film teacher would like to incorporate technology wherever possible, in hopes that it would decrease the cost of the movie's production. Form a team of three people to determine what technology can be used to assist in the movie's production. One team member should research the type of technology that can be used during the filming process. Another team member should research the types of hardware and software available for editing footage, and the third team member should research the hardware and software requirements for producing and distributing the media.

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

How To: Your Turn

Discover More: Visit this chapter's premium content to challenge yourself with **additional How To: Your Turn exercises**, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Obtain Help about Programs and Apps

Multiple ways are provided to obtain help while using the programs and apps on a computer or mobile device. The program or app developer usually includes a Help feature in the program and/or online. In addition, third parties often post resources online that can provide further assistance. The following steps describe how to obtain help about various programs and apps using various methods.

Help System

You typically can access help in a program or app using one of the following methods:

- Tap or click the Help or Information icon in the program or app. The appearance of Help or Information icons may vary, but typically they are identified by a question mark or the letter 'i' formatted in italic.
- Navigate the program or app's menu to locate the Help command.
- If you are using a program or app on a Windows laptop or desktop, press the F1 key on the keyboard to display Help content.

Online Help

Online help usually is available from the program or app developer. The following steps describe how to obtain online help.

- a. Navigate to the program or app developer's website.
- b. Locate, and then tap or click a Help or Support link.
- c. Select the program or app for which you wish to obtain help to display the help information.

Searching for Help

In addition to obtaining help from within a program or app or on the developer's website, you also can search the web for help as described in the following steps.

- a. Navigate to a search engine, such as google.com or yahoo.com.
- b. Type the program or app name, as well as the type of help for which you are searching, as the search text, and then press the ENTER key or tap or click the Search (or a similar) button.
- c. Scroll through the search results and then tap or click the search result to display more information. Be aware that not all help originates from reputable or accurate sources.

Exercises

1. Under what circumstances would you use each of these methods to obtain help with a program or app you are using?
2. Compare and contrast the different methods of obtaining help. Which method do you think is the best? Why?
3. What are some reputable websites that can provide you with help for the operating system installed on your computer? Why do you consider them reputable?

2 Compress/Uncompress Files and Folders

You may want to compress files if your hard drive is running out of available space. While the operating system may be able to compress some files by 50 percent or more, other files' sizes may not decrease significantly when they are compressed. Compressed files typically are stored by default in a file with a .zip file extension. The following steps describe how to compress a file or folder and then uncompress (expand or extract) the compressed file.

- a. Press and hold or right-click the file(s) or folders you wish to compress to display a shortcut menu.
- b. Tap or click the option to compress the file(s) or folder(s). (You may need to select a Send to or other command to display the compression options.)
- c. If necessary, type the desired file name for the compressed file.

Uncompressing (or expanding) compressed files or folders returns them to their original form. The following steps uncompress a compressed file.

- a. Double-tap or double-click the compressed file.
- b. If necessary, tap or click the option to uncompress (expand or extract) the file.

or

- a. Press and hold or right-click the compressed file to display a shortcut menu.
- b. Tap or click the option to uncompress (expand or extract) the file.

How To: Your Turn

Exercises

1. In addition to the operating system's built-in functionality to compress files and folders, what other programs and apps exist that can compress files and folders?
2. In addition to trying to free space on your storage device, for what other reasons might you want to compress files and folders?
3. Try compressing various types of files on your hard drive, such as a Word document and an image. Compare the file sizes before and after compression. What did you notice with each type of file?

View Current Virus Threats

One important way to protect your computer or mobile device from viruses is to be aware of current threats. Several websites exist that not only provide a list of current virus threats but also describe how best to protect your computer or mobile device from these threats. As new virus threats are introduced, it is important to make sure your antivirus program is updated and running properly. The following steps describe how to view a list of current virus threats.

- a. Run a browser and then navigate to a search engine of your choice.
 - b. Perform a search for websites that display current virus threats.
 - c. Review the search results and visit at least two websites that display current virus threats.
 - d. View the list of virus threats on each of these websites.
- or
- a. Run a browser and then navigate to a search engine of your choice.
 - b. Perform a search for websites created by companies that make antivirus software. Some companies that make antivirus software include Symantec, McAfee, and Microsoft.
 - c. Navigate to one of these company's websites and then search for a link to a webpage displaying current virus threats.
 - d. Tap or click the link to display current virus threats.



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Exercises

1. Which websites did you access? Compare these websites and determine which you think provided the most helpful information. Why, in your opinion, does the website you chose provide the best information?
2. Has your computer or mobile device ever been infected with a virus? If so, what steps have you taken to remove the virus?
3. Is your computer or mobile device adequately protected from viruses? What steps do you take to keep your computer safe?

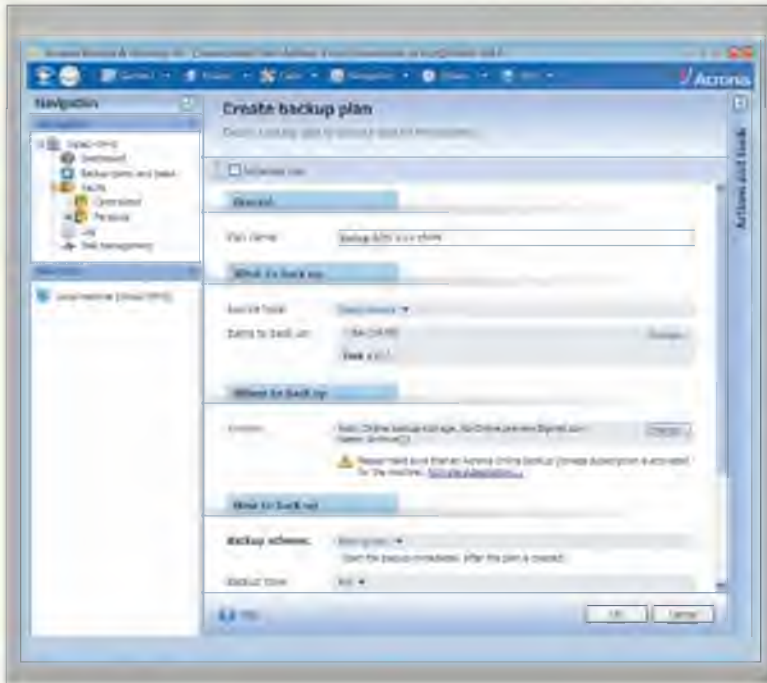
Back Up Your Computer

Backing up your computer is an important way to protect your programs, apps, and data from loss. The frequency at which people back up their computers can vary. For instance, if you create and modify a lot of files on your computer, you may choose to back up your computer frequently. If you rarely use your computer or primarily use your computer for answering email messages and browsing the web, you might not back up your computer as often. The following steps guide you through the process of backing up a computer.

- a. Decide which backup program you wish to use. Some operating systems have built-in tools you can use to back up a computer, or you can install a third-party program.
- b. Run the program you will use to back up the computer.
- c. If necessary, connect the storage device, such as an external hard drive, you will use to store the backup. If you plan to store the backup on an optical disc or another hard drive that already is installed, you will not need to connect an additional storage device.
- d. Make sure the storage medium has enough available space for the backed up files. If you are storing the backup on optical discs, make sure you have enough optical discs for the backup.
- e. Select the type of backup (full, incremental, differential, or selective) you wish to perform.
- f. If you are performing a selective backup, choose the files, programs, and apps you wish to include in the backup.
- g. Run the backup. The backup process may take up to several hours, depending on the number of files you are including in the backup.
- h. If you are storing the backup on optical discs, the backup program may prompt you to insert new, blank optical discs throughout the backup process.

How To: Your Turn

- i. When the backup is complete, store the backup in a safe location. In the event you lose data or information on the computer, you will need to retrieve the backup.



Source: Acronis

Exercises

1. How often do you feel you should back up your computer? Justify your answer.
2. Which storage medium do you feel is most appropriate for your backup? Justify your answer.
3. Research at least three programs that you can use to back up your computer. Which programs did you research? Which program or app do you feel is the best? Why?

5 Share Your Online Calendar

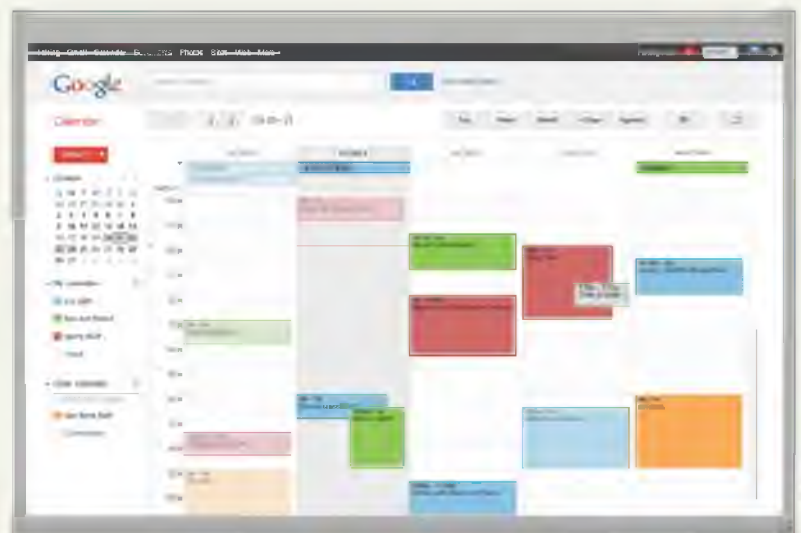
If you keep track of your meetings, appointments, and other obligations using an online calendar, you might want to share your calendar with others so that they know when you are available. For instance, you might want to share your calendar with fellow employees so that they can verify your availability before scheduling meetings. Your family members may share their calendars with one another so that it is easier to plan family events when everyone is available. The

following steps describe how to share your online calendar.

- a. If necessary, run a browser and navigate to an online calendar.
 - b. Display the calendar's settings.
 - c. Select the option to display the calendar's sharing settings.
 - d. Specify with whom you want to share the calendar.
 - e. Determine your sharing settings for each person. For example, you may select whether a person only can view your calendar or view and edit your calendar. You also can select the level of detail you want to share with others. For example, you can share the times you are free or busy, or you can share the specific details for each appointment.
 - f. If necessary, repeat the two previous steps for each additional person with whom you wish to share the calendar.
 - g. Save the settings.
 - h. Verify the people with whom you shared the calendar are able to access the calendar.

Exercises

1. For what other reasons might you share your calendar?
2. In addition to the steps outlined previously, in what other ways can you share your calendar online?
3. In addition to sharing online calendars, is it possible to share calendars you create in programs such as Microsoft Outlook? If so, how?



Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to **challenge yourself with additional Internet Research exercises**, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Website Creation and Management

Retailers and organizations realize the importance of having a website to promote their goods and services. An online presence helps a business connect with an audience and ultimately builds trust and respect. Innovative and dynamic websites deliver information to current and potential customers and clients. Creating these websites requires a methodology of planning, designing, creating, hosting, and maintaining. A business must identify the website's purpose, demographics of the target audience, appropriate content and functionality, page layout, and usability. Once the website is implemented, it must be monitored to determine usage. Logs list the number of visitors, the browsers they used, and usage patterns. In addition, the website should be maintained to update content and features.

Products are available to help build and manage a website. Most offer well-designed templates that can be customized to accommodate specific personal and business needs. They can include calendars, photos, videos, maps, and blogs. Some of these design and management tools, such as those offered on Google Sites, are available at no cost, while others require fees for specific features, such as technical support or exclusive designs.



Google Inc.

Research This: Visit Google Sites and two other online content management systems for building web-sites. Compare these web apps by creating a table using these headings: Name, Number of Templates, Price, Maximum Storage, Customer Support, and Features. The Features column could include the availability of items such as customizable color schemes, e-commerce, drag and drop, website logs and analytics, and mobile editing. Which website builder would you choose if you were creating a website? Why?

2 Social Media

Gaming via social media has seen explosive growth in recent years, especially among adult males. Exponential gaming growth has spawned companion businesses that facilitate and manage the gaming experience. Some mobile and desktop apps provide gamers a portal for tracking all their online gaming results in a central location that can be shared with friends and others with similar game interests. These apps integrate with the major Internet messaging services, have personalized news feeds, and incorporate a “suggestion” engine for new game discoveries. Many gaming blogs offer game tricks, work-arounds, and hidden features. Beginning gamers can engage their minds during downtime and expand their circle of online friends.

Research This: Visit at least two online social networks for gamers. How many games are shown? Which topics are featured in community discussions and live chats? Are rewards available? If so, what are they? Which online leagues and tournaments are offered? What are some of the latest news articles about specific games and the gaming industry? Have you participated in gaming online social networks? If so, which ones?

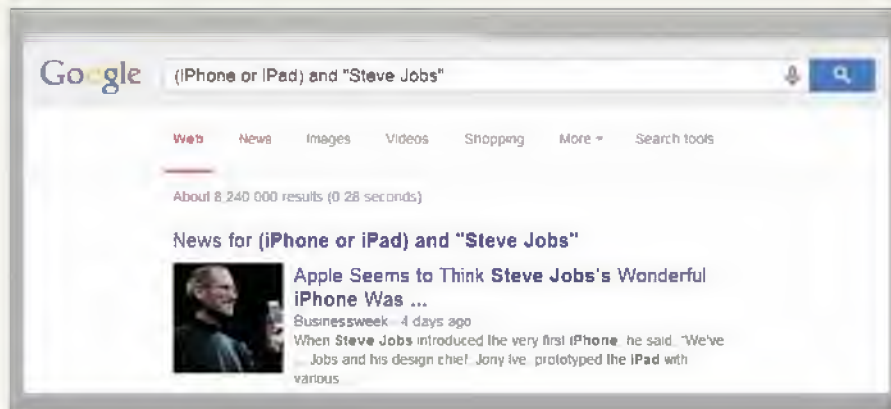
Internet Research

3 Search Skills

Narrowing Your Search Results

One strategy for narrowing search results is to specify what you are or are not looking for as part of your search text. Precede words with a plus sign (+) if you want to ensure that they appear in your search results, and precede a word with a minus sign (-) if you want to exclude that word from search results. For example, typing the phrase, windows +microsoft, will search for information about the operating system; typing the phrase, windows -microsoft, also will find information about windows that are made of glass.

Include the keyword, and, between words or phrases in search text if you want search results to include both words or phrases, or the keyword, or, if search results containing either word or phrase are acceptable. Group terms with parentheses to clarify search text. For example, type the phrase, iPhone and "Steve Jobs" (including the quotation marks), to search for articles about the inventor of the iPhone. Type the phrase, (iPhone or iPad) and "Steve Jobs" (including the parentheses and quotation marks), to search for information about iPhone or iPad devices that also mentions Steve Jobs.



Research This: Create search text using the techniques described above or in previous Search Skills exercises, and type it in a search engine to answer these questions. (1) What is an open source FTP application that has versions for both Windows and Mac? (2) Other than TurboTax, what are two examples of online tax preparation software? (3) Find reviews comparing Internet Explorer, Chrome, and Firefox browsers. (4) What are the more popular calendar management and task management apps on Google Play?

4 Security

Virus hoaxes are widespread and sometimes cause panic among Internet users. Secure IT 4-4 in this chapter gives advice on recognizing and avoiding virus hoaxes. Snopes.com provides further insight on the sources and variations of a wide variety of rumors, deceptions, and folklore.

Research This: Visit snopes.com and type the search text phrase, virus hoaxes & realities, in the Search box at the top of the page. Review the list of the more recent real (indicated by a green dot) and false (indicated by a red dot) rumors circulating on the Internet. Which are the three newest actual warnings, and which are the three latest virus hoaxes? What harm is predicted to occur if a user downloads each of these real or false viruses or views a website laden with malware? What is the origin of the website's name, Snopes?

5 Cloud Services

Photo Editing (SaaS)

Online photo editing apps provide browser-based capabilities to modify digital images, and often contain many similar features as their desktop counterparts. They are an example of SaaS (software as a service),

a service of cloud computing that provides access to software solutions accessed through a browser. In addition to drawing shapes, touching up colors, and adding filters to images, online photo editing apps allow users to access, store, and share their photos on the cloud. Online photo editing apps often include the ability to share photos with friends easily by sending a link, or posting the photo to online social networks.

Research This: (1) Use a search engine to research various online photo editing apps. Compare the features of two of them as you explore their capabilities. Summarize your findings in a table, regarding image formats you can import or save, sharing capabilities, special editing features, and ways to organize photos online. Which features take advantage of the fact that the app is cloud based? (2) If you have access to computers running two different operating systems, such as Windows and Mac, try running the photo editing app in a browser on both computers. What similarities and differences do you notice between the two versions?

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Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. File, Disk, and System Management Tools

You are the director of information technology at a company that frequently hires student interns. The interns tend to have limited experience with using file, disk, and system management tools. As part of your job, you lead workshops that teach the interns the many tasks and functions they can perform using these tools.

Do This: Choose three categories of tools, such as disk cleanup, PC maintenance, and file compression. Determine whether your computer's operating system includes these tools. Use the web to research popular tools for each category, whether they can be purchased separately or if they are available only as part of an operating system, and the costs for each tool. Choose one program from each category, and read user reviews and articles by industry experts. Describe situations where you would use each type of tool. Share any experiences you have with using the tools.

2. Web and Mobile App Comparison

You recently purchased a new smartphone and want to research mobile apps that also have accompanying web apps.

Do This: Choose three categories of apps, and find an example for each that has both a free web and mobile version. Read user reviews of each app, and search for articles by industry experts. Research any known safety risks for the apps. If you determine the app is safe, have access to the appropriate device, and would like to test the mobile app, you can download it

to a smartphone or other mobile device. Try accessing the web app on a computer. Using your experience or research, note the differences in functionality between the web and mobile app. Is one or the other easier to use? Why or why not?

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The league needs productivity software in order to keep track of participant and budget information and to prepare flyers. You prepare information about productivity software options to present to the board of directors.

Do This: Use the web to research popular word processing, spreadsheet, and accounting software. Choose three programs from each category. List common features of each, find pricing information, and note any feedback or ratings by users. Which programs would you recommend? Why? Describe the steps involved in developing a project, creating a flyer for the league as an example. Identify possible uses the league may have for the spreadsheet and accounting software. Compile your findings.



Source: © Cengage Learning

Collaboration

4. Educational Program and App Effectiveness

The principal of the local elementary school has recommended that educational apps should play a major role in the learning process, believing that these apps enable students to learn at their own pace. Some enable teachers to track an individual student's progress and understanding.

Do This: Form a three-member team and research the use of educational apps. Each member of your team should choose a different type of app, such as flash cards, testing, or CBT. List the advantages and disadvantages of using that type of app. If possible, download or access a free version of an educational app from each category and spend some time using it. Read user reviews of popular apps, and search for articles by industry experts. Would you recommend using an app for educational purposes? Why or why not? Meet with your team, and discuss and compile your findings.

DIGITAL SECURITY, ETHICS, AND PRIVACY: Threats, Issues, and Defenses

5



Users should take precautions to protect their digital content.

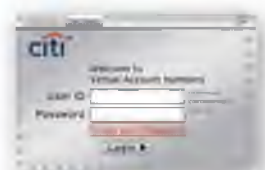
“I am careful when browsing the web, use antivirus software, and never open email messages from unknown senders. I use a cloud storage provider to back up my computer and mobile devices. What more do I need to know about digital safety and security?”

While you may be familiar with some of the content in this chapter, do you know how to . . .

- Avoid risks when playing online games?
- Determine if an email message has been spoofed?
- Tell if your computer or device is functioning as a zombie?
- Set up a personal firewall?
- Protect computers and devices from viruses and other malware?
- Protect your passwords?
- Use two-step verification?
- Prevent your data from being lost on the cloud?
- Follow a disaster recovery plan?
- Secure your wireless network?
- Safeguard your hardware and data from a disaster?
- Protect against a phishing scam?
- Protect yourself from social engineering scams?
- Evaluate your electronic profile?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

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Objectives

After completing this chapter, you will be able to:

- 1 Define the term, digital security risks, and briefly describe the types of cybercriminals
- 2 Describe various types of Internet and network attacks (malware, botnets, denial of service attacks, back doors, and spoofing) and explain ways to safeguard against these attacks, including firewalls
- 3 Discuss techniques to prevent unauthorized computer access and use, including access controls, user names, passwords, possessed objects, and biometric devices
- 4 Explain ways that software manufacturers protect against software piracy
- 5 Discuss how encryption, digital signatures, and digital certificates work
- 6 Identify safeguards against hardware theft, vandalism, and failure
- 7 Explain options available for backing up
- 8 Identify risks and safeguards associated with wireless communications
- 9 Recognize issues related to information accuracy, intellectual property rights, codes of conduct, and green computing
- 10 Discuss issues surrounding information privacy, including electronic profiles, cookies, phishing, spyware and adware, social engineering, privacy laws, employee monitoring, and content filtering

Digital Security Risks

Today, people rely on technology to create, store, and manage their critical information. Thus, it is important that computers and mobile devices, along with the data and programs they store, are accessible and available when needed. It also is crucial that users take measures to protect or safeguard their computers, mobile devices, data, and programs from loss, damage, and misuse. For example, organizations must ensure that sensitive data and information, such as credit records, employee and customer data, and purchase information, is secure. Home users must ensure that their credit card numbers are secure when they make online purchases.

A **digital security risk** is any event or action that could cause a loss of or damage to computer or mobile device hardware, software, data, information, or processing capability. The more common digital security risks include Internet and network attacks, unauthorized access and use, hardware theft, software theft, information theft, and system failure (Figure 5-1).

While some breaches to digital security are accidental, many are intentional. Some intruders do not disrupt a computer or device's functionality; they merely access data, information, or programs on the computer or mobile device before signing out. Other intruders indicate some evidence of their presence either by leaving a message or by deliberately altering or damaging data.

Cybercrime

An intentional breach to digital security often involves a deliberate act that is against the law. Any illegal act involving the use of a computer or related devices generally is referred to as a **computer crime**. The term **cybercrime** refers to online or Internet-based illegal acts such as distributing malicious software or committing identity theft. Software used by cybercriminals sometimes is called *crimeware*. Today, combating cybercrime is one of the FBI's top priorities.

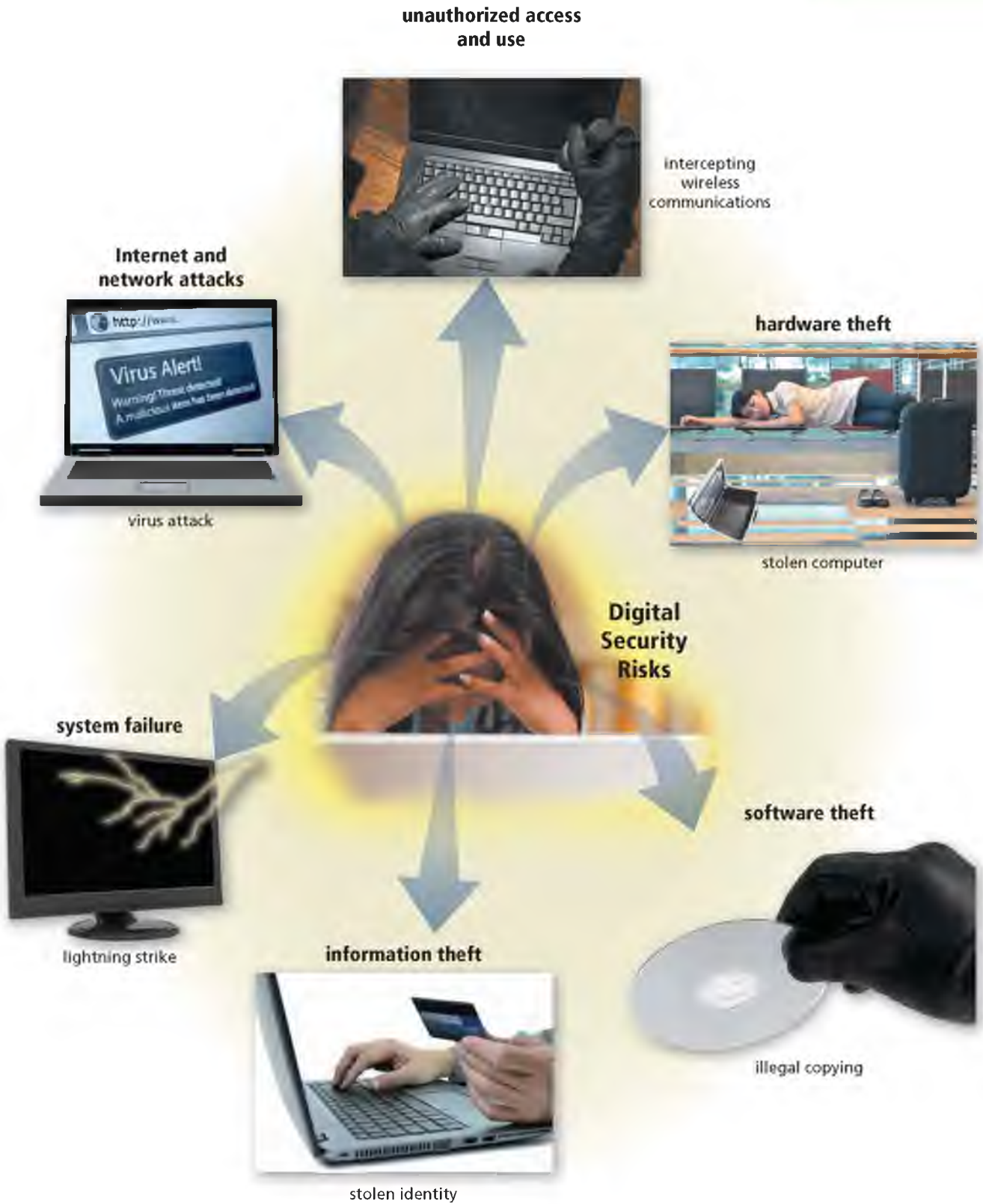


Figure 5-1 Computers and mobile devices, along with the data and programs they store, are exposed to several types of digital security risks.

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Perpetrators of cybercrime typically fall into one of these basic categories: hacker, cracker, script kiddie, corporate spy, unethical employee, cyberextortionist, and cyberterrorist.

- The term **hacker**, although originally a complimentary word for a computer enthusiast, now has a derogatory meaning and refers to someone who accesses a computer or network illegally. Some hackers claim the intent of their security breaches is to improve security.
- A **cracker** also is someone who accesses a computer or network illegally but has the intent of destroying data, stealing information, or other malicious action. Both hackers and crackers have advanced computer and network skills.
- A **script kiddie** has the same intent as a cracker but does not have the technical skills and knowledge. Script kiddies often use prewritten hacking and cracking programs to break into computers and networks.
- Some corporate spies have excellent computer and networking skills and are hired to break into a specific computer and steal its proprietary data and information, or to help identify security risks in their own organization. Unscrupulous companies hire corporate spies, a practice known as corporate espionage, to gain a competitive advantage.
- Unethical employees may break into their employers' computers for a variety of reasons. Some simply want to exploit a security weakness. Others seek financial gains from selling confidential information. Disgruntled employees may want revenge.
- A **cyberextortionist** is someone who demands payment to stop an attack on an organization's technology infrastructure. These perpetrators threaten to expose confidential information, exploit a security flaw, or launch an attack that will compromise the organization's network — if they are not paid a sum of money.
- A **cyberterrorist** is someone who uses the Internet or network to destroy or damage computers for political reasons. The cyberterrorist might target the nation's air traffic control system, electricity-generating companies, or a telecommunications infrastructure. The term, *cyberwarfare*, describes an attack whose goal ranges from disabling a government's computer network to crippling a country. Cyberterrorism and cyberwarfare usually require a team of highly skilled individuals, millions of dollars, and several years of planning.

Read Ethics & Issues 5-1 to consider how cybercriminals should be punished. Some organizations hire individuals previously convicted of computer crimes to help identify security risks and implement safeguards because these individuals know how criminals attempt to breach security.

Discover More: Visit this chapter's free resources to learn more about cybercriminals.

Internet Research

How do script kiddies use malware?

Search for: script kiddie malware

ETHICS & ISSUES 5-1

How Should Cybercriminals Be Punished?

A hacker received a 10-year jail sentence for selling credit card information from several large corporations, costing one company approximately \$200 million. In another case, a hacker accessed the personal online accounts of celebrities, as well as people he knew, and distributed revealing photos and information. He also received 10 years in jail, in part for the emotional distress his actions caused his victims. Do these sentences seem too harsh? Some legal experts point out that the punishment given to some hackers is not in line with crimes of a violent nature.

In addition to the extent of the punishment, other issues surrounding

cybercrime laws include whether an action is defamation or free speech and who should be punished, the hacker or those who were hacked. If a hacker's actions damage the reputation of another via libel or slander, should the hacker be prosecuted under the defamation law or be protected under the First Amendment? A *hacktivist*, which is a type of hacker whose actions are politically or socially motivated, believes his or her actions should be protected under the First Amendment. Should companies whose systems have been breached be punished for their lax security? The Federal Trade Commission (FTC) has fined companies whose security flaws enabled hackers to access their systems.

Legislators have made efforts to define and prevent cybercrime, both with new laws and the expansion of existing laws. Cybercrime laws vary between states and countries, making it difficult to establish what is illegal. Determining who has jurisdiction over a case can create more legal hassles. For example, which area is responsible for determining punishment: where the victim(s) resides or where the criminal lives?

Consider This: Should hacktivism be punishable? Why or why not? Should corporations be liable for damages caused by hackers? Why or why not? Should hackers receive comparable punishment to violent criminals? Why or why not?

Internet and Network Attacks

Information transmitted over networks has a higher degree of security risk than information kept on an organization’s premises. In an organization, network administrators usually take measures to protect a network from security risks. On the Internet, where no central administrator is present, the security risk is greater. Internet and network attacks that jeopardize security include malware, botnets, denial of service attacks, back doors, and spoofing.

Internet Research
 Does a list of known malware exist?
 Search for: malware list

Malware

Recall that **malware**, short for *malicious software*, consists of programs that act without a user’s knowledge and deliberately alter the operations of computers and mobile devices. Table 5-1 summarizes common types of malware, all of which have been discussed in previous chapters. Some malware contains characteristics in two or more classes. For example, a single threat could contain elements of a virus, worm, and trojan horse.

Malware can deliver its *payload*, or destructive event or prank, on a computer or mobile device in a variety of ways, such as when a user opens an infected file, runs an infected program, connects an unprotected computer or mobile device to a network, or when a certain condition or event occurs, such as the computer’s clock changing to a specific date. A common way that computers and mobile devices become infected with viruses and other malware is through users opening infected email attachments (Figure 5-2). Read Secure IT 5-1 to learn about how malware can affect online gaming.

Discover More: Visit this chapter’s free resources to learn more about malware.

Table 5-1 Common Types of Malware	
Type	Description
Virus	A potentially damaging program that affects, or infects, a computer or mobile device negatively by altering the way the computer or device works without the user’s knowledge or permission.
Worm	A program that copies itself repeatedly, for example in memory or on a network, using up resources and possibly shutting down the computer, device, or network.
Trojan horse	A program that hides within or looks like a legitimate program. Unlike a virus or worm, a trojan horse does not replicate itself to other computers or devices.
Rootkit	A program that hides in a computer or mobile device and allows someone from a remote location to take full control of the computer or device.
Spyware	A program placed on a computer or mobile device without the user’s knowledge that secretly collects information about the user and then communicates the information it collects to some outside source while the user is online.
Adware	A program that displays an online advertisement in a banner, pop-up window, or pop-under window on webpages, email messages, or other Internet services.

How a Virus Can Spread via an Email Message

Step 1
 Unscrupulous programmers create a virus program that deletes all files. They hide the virus in a word processing document and attach the document to an email message.

Unscrupulous Programmers

Step 2
 They send the email message that contains the infected attachment to thousands of users around the world.



Step 3a
 Some users open the attachment and their computers become infected with the virus.



Step 3b
 Other users do not recognize the name of the sender of the email message. These users do not open the email message — instead they immediately delete the email message and continue using their computers. These users’ computers are not infected with the virus.

Figure 5-2 This figure shows how a virus can spread via an email message.
 © Cengage Learning.
 © iStockphoto / Steve Cukrov,
 © iStockphoto / Casarsa

**CONSIDER THIS****What if you cannot remove malware?**

In extreme cases, in order to remove malware from a computer or mobile device, you may need to erase, or reformat, an infected computer's hard drive, or reset a mobile device to its factory settings. For this reason, it is critical you have uninfected (clean) backups of all files. Consider creating recovery media when you purchase a new computer, and be sure to keep all installation media in the event you need to reinstall the computer's operating system and your apps. Seek advice from a technology specialist before performing a format or reformat instruction on your media.

**Internet Research**

What are the latest malware threats?

Search for: malware news

**SECURE IT 5-1****Play It Safe to Avoid Online Gaming Risks**

Gamers often understand general security issues regarding online behavior, but they may not be aware of a different set of technology and social risks they may encounter as they interact in the online world. Anyone experiencing the joys of playing games online or playing games with others through online services should realize that thieves and hackers lurking behind the scenes may take advantage of security holes and vulnerabilities that can turn a gaming session into a nightmare.

Viruses, worms, and malware can be hidden in downloaded game files, mobile apps, email message attachments, and messaging software. In addition, messages on online social networks may encourage gamers to visit fraudulent websites filled with malware. If the game requires a connection to the Internet, then any computer connected to the game's

server is subject to security cyberthreats. Thieves can take control of a remote computer that does not have a high level of security protection and use it to control other computers, or they could break into the computer and install malware to discover personal information.

Malicious users know that the gaming community uses social media intensely, so they also create accounts and attempt to mislead uninformed users into revealing personal information. The thieves may claim to have software updates and free games, when they really are luring users to bogus websites that ask users to set up profiles and accounts.

Gamers should follow these practices to increase their security:

- Before downloading any software or apps, including patches to games, or disclosing any private details, check the developer to be certain the website or the person making the request is legitimate.

- Read the permissions notices to learn what information is being requested or being collected. Avoid games requiring passwords to be saved to an online account on a smartphone.
- Exercise extreme caution if the game requires ActiveX or JavaScript to be enabled or if it must be played in administrator mode.
- Use a firewall and make exceptions to allow only trusted individuals to access your computer or mobile device when playing multiplayer online games.
- Do not share personal information with other gamers whom you meet online.



Consider This: Have you played online games or downloaded gaming apps and followed the advice listed here? How will you change your gaming behavior now that you are aware of specific security threats?

Botnets

A **botnet**, or *zombie army*, is a group of compromised computers or mobile devices connected to a network, such as the Internet, that are used to attack other networks, usually for nefarious purposes. A compromised computer or device, known as a **zombie**, is one whose owner is unaware the computer or device is being controlled remotely by an outsider.

A *bot* is a program that performs a repetitive task on a network. Cybercriminals install malicious bots on unprotected computers and devices to create a botnet. The perpetrator then uses the botnet to send spam via email, spread viruses and other malware, or commit a distributed denial of service attack (discussed in the next section).

**CONSIDER THIS****How can you tell if your computer or mobile device is functioning as a zombie?**

Your computer or mobile device may be a zombie if you notice an unusually high drive activity, a slower than normal Internet connection, or connected devices becoming increasingly unresponsive. The chances of your computer or devices becoming part of a botnet greatly increase if your devices are not protected by an effective firewall.

Denial of Service Attacks

A **denial of service attack (DoS attack)** is an assault whose purpose is to disrupt computer access to an Internet service, such as the web or email. Perpetrators carry out a DoS attack in a variety of ways. For example, they may use an unsuspecting computer to send an influx of confusing data messages or useless traffic to a computer network. The victim computer network slows down considerably and eventually becomes unresponsive or unavailable, blocking legitimate visitors from accessing the network.

A more devastating type of DoS attack is the *distributed DoS attack (DDoS attack)* in which a zombie army is used to attack computers or computer networks. DDoS attacks have been able to stop operations temporarily at numerous websites, including powerhouses such as Yahoo!, eBay, Amazon.com, and CNN.com.

The damage caused by a DoS or DDoS attack usually is extensive. During the outage, retailers lose sales from customers, news websites and search engines lose revenue from advertisers, and time-sensitive information may be delayed. Repeated attacks could tarnish reputations, causing even greater losses.



Internet Research

Are DoS attacks still prevalent?

Search for: news of dos attacks



CONSIDER THIS

Why would someone execute a Dos or DDoS attack?

Perpetrators have a variety of motives for executing a DoS or DDoS attack. Hactivists, or those who disagree with the beliefs or actions of a particular organization, claim political anger motivates their attacks. Some perpetrators use the attack as a vehicle for extortion. Others simply want the recognition, even though it is negative.

Back Doors

A **back door** is a program or set of instructions in a program that allows users to bypass security controls when accessing a program, computer, or network. Once perpetrators gain access to unsecure computers, they often install a back door or modify an existing program to include a back door, which allows them to continue to access the computer remotely without the user's knowledge. A rootkit can be a back door. Some worms leave back doors, which have been used to spread other worms or to distribute spam from the unsuspecting victim computers.

Programmers often build back doors into programs during system development. These back doors save development time because the programmer can bypass security controls while writing and testing programs. Similarly, a computer repair technician may install a back door while troubleshooting problems on a computer. If a programmer or computer repair technician fails to remove a back door, a perpetrator could use the back door to gain entry to a computer or network.

Spoofing

Spoofing is a technique intruders use to make their network or Internet transmission appear legitimate to a victim computer or network. Two common types of spoofing schemes are IP and email spoofing.

- *IP spoofing* occurs when an intruder computer fools a network into believing its IP address is associated with a trusted source. Perpetrators of IP spoofing trick their victims into interacting with the phony website. For example, the victim may provide confidential information or download files containing viruses, worms, or other malware.
- *Email spoofing* occurs when the sender's address or other components of an email header are altered so that it appears that the email message originated from a different sender. Email spoofing commonly is used in virus hoaxes, spam, and phishing scams (Figure 5-3). Read How To 5-1 to learn about how to determine if an email message has been spoofed.

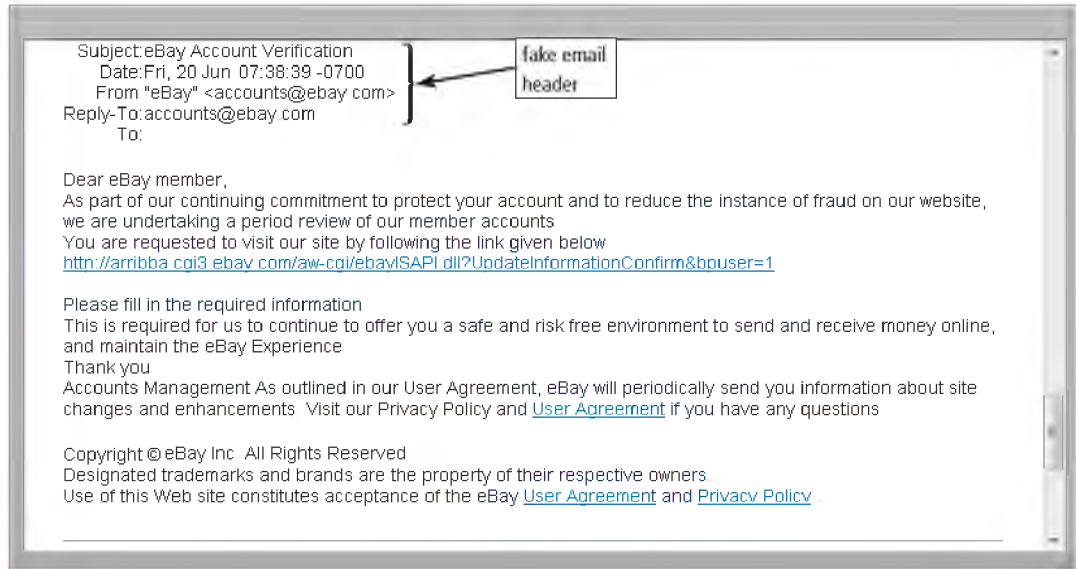


Figure 5-3 With email spoofing, the components of an email header are altered so that it appears the email message originated from a different sender.

Source: Privacy Rights Clearinghouse

HOW TO 5-1

Determine If an Email Message Has Been Spoofed

Spoofed email messages appear to originate from one source, but in reality originate from another source. Spoofed email messages often are sent by nefarious people attempting to obtain personal information. For example, an email message appearing to be sent from a reputable source, such as your financial institution, may ask you to reply with personal information, such as a password, Social Security number, or account number. If you reply, you will be sending personal information to an unknown third party that could use

the information to steal your identity, make unauthorized purchases, and more. The following steps describe some ways to determine if an email message has been spoofed.

- The email message requests personal information, such as account numbers, passwords, Social Security numbers, and credit card numbers.
- The email message contains spelling and/or grammatical errors.
- The email message encourages you to tap or click a link that takes you to another website.

- The header in the email message contains a different domain in the MessageID than the domain of the supposed sender.
- The "From" and "Reply-To" email addresses do not match.

If you ever are unsure of whether an email message was spoofed, contact the supposed sender either via phone or a new email message (do not reply to the original email message) to verify the authenticity of the message.

Consider This: Have you ever received a spoofed email message? Did you know it was spoofed? What steps did you take?

Safeguards against Internet and Network Attacks

Methods that protect computers, mobile devices, and networks from attacks include the following:

- Use antivirus software.
- Be suspicious of unsolicited email attachments.
- Scan removable media for malware before using it.
- Implement firewall solutions.
- Back up regularly.

Secure IT 1-2 in Chapter 1 provided some measures you can take to protect your computers and mobile devices from malware. Read Secure IT 5-2 for additional tips to protect home users against Internet and network attacks. The next section discusses firewalls in more depth.



Antivirus Programs

In addition to protecting against viruses and other malware, many antivirus programs also include protection from DoS and DDoS attacks.

SECURE IT 5-2



Protection from Viruses and Other Malware


It is impossible to ensure a virus or malware never will attack a computer, but you can take steps to protect your computer by following these practices:

- **Use virus protection software.** Install a reputable antivirus program and then scan the entire computer to be certain it is free of viruses and other malware. Update the antivirus program and the virus signatures (known specific patterns of viruses) regularly.
- **Use a firewall.** Set up a hardware firewall or install a software firewall that protects your network's resources from outside intrusions.
- **Be suspicious of all unsolicited email and text messages.** Never open an email message unless you are expecting it, *and* it is from a trusted source. When in doubt, ask the sender to confirm the message is legitimate before you open it. Be especially

cautious when deciding whether to tap or click links in email and text messages or to open attachments.

- **Disconnect your computer from the Internet.** If you do not need Internet access, disconnect the computer from the Internet. Some security experts recommend disconnecting from the computer network before opening email attachments.
- **Download software with caution.** Download programs or apps only from websites you trust, especially those with music and video sharing software.
- **Close spyware windows.** If you suspect a pop-up or pop-under window may be spyware, close the window. Never tap or click an Agree or OK button in a suspicious window.
- **Before using any removable media, scan it for malware.** Follow this procedure even for shrink-wrapped software

from major developers. Some commercial software has been infected and distributed to unsuspecting users. Never start a computer with removable media inserted in the computer unless you are certain the media are uninfected.

- **Keep current.** Install the latest updates for your computer software. Stay informed about new virus alerts and virus hoaxes.
 - **Back up regularly.** In the event your computer becomes unusable due to a virus attack or other malware, you will be able to restore operations if you have a clean (uninfected) backup.
-  **Consider This:** What precautions do you take to prevent viruses and other malware from infecting your computer? What new steps will you take to attempt to protect your computer?

CONSIDER THIS

How can you determine if your computer or mobile device is vulnerable to an Internet or network attack?

You could use an **online security service**, which is a web app that evaluates your computer or mobile device to check for Internet and email vulnerabilities. The online security service then provides recommendations of how to address the vulnerabilities.

Organizations requiring assistance or information about Internet security breaches can contact or visit the website for the *Computer Emergency Response Team Coordination Center*, or *CERT/CC*, which is a federally funded Internet security research and development center.

Discover More: Visit this chapter's free resources to learn more about online security services.

Firewalls

A **firewall** is hardware and/or software that protects a network's resources from intrusion by users on another network, such as the Internet. All networked and online users should implement a firewall solution.

Organizations use firewalls to protect network resources from outsiders and to restrict employees' access to sensitive data, such as payroll or personnel records. They can implement a firewall solution themselves or outsource their needs to a company specializing in providing firewall protection.

Large organizations often route all their communications through a proxy server, which typically is a component of the firewall. A *proxy server* is a server outside the organization's network that controls which communications pass in and out of the organization's network. That is, a proxy server carefully screens all incoming and outgoing messages. Proxy servers use a variety of screening techniques. Some check the domain name or IP address of the message for legitimacy. Others require that the messages have digital signatures (discussed later in this chapter).



Technology Innovators

Discover More: Visit this chapter's free resources to learn about AVG, Intel Security, and Symantec (security product developers).

Home and small/home office users often protect their computers with a personal firewall. As discussed in Chapter 4, a **personal firewall** is a software firewall that detects and protects a personal computer and its data from unauthorized intrusions. Personal firewalls constantly monitor all transmissions to and from the computer and may inform a user of any attempted intrusions. Both Windows and Mac operating systems include firewall capabilities, including monitoring Internet traffic to and from installed applications. Read How To 5-2 for instructions about setting up a personal firewall.

Some small/home office users purchase a hardware firewall, such as a router or other device that has a built-in firewall, in addition to or instead of a personal firewall. Hardware firewalls stop malicious intrusions before they attempt to affect your computer or network. Figure 5-4 illustrates the purpose of hardware and software firewalls.



Figure 5-4 A firewall is hardware and/or software that protects a home or business's network resources from intrusion by users on another network, such as the Internet.

Courtesy of NETGEAR; © Cengage Learning; Courtesy of CheckPoint Software Technologies; © iStockphoto / Skip Odonnell; Source: Nutrition Blog Network; © iStockphoto / 123render; Source: Microsoft; © Iakov Filimonov / Shutterstock.com; © iStockphoto / Oleksiy Mark; Source: Microsoft; © iStockphoto / Ayaaaz Rattansi; Source: Microsoft; © iStockphoto / Oleksiy Mark; Source: Microsoft; © Cengage Learning; Microsoft

HOW TO 5-2



Set Up a Personal Firewall

A personal firewall is a program that helps protect your computer from unauthorized access by blocking certain types of communications. For example, if somebody knows the IP address of your computer and attempts to access it using a browser or other program, the personal firewall can be configured to deny the incoming connection. The following steps describe how to set up a personal firewall.

1. Locate and purchase a personal firewall. You can purchase personal firewalls online and in stores that sell software. Many operating systems include a personal firewall. Computers typically can have only one active personal firewall running at a time. If you purchase a personal firewall, you may need to disable the one that is included with the operating system.
2. If you purchase a personal firewall, follow the instructions to install the program on your computer.
3. Run the personal firewall.
4. If necessary, ensure the personal firewall is enabled.
5. Review the settings for the incoming and outgoing rules. Incoming rules display programs and services that are allowed to access your computer. Outgoing rules display programs and services on your computer that are allowed to communicate with other computers and mobile devices on your network or the Internet.
6. Back up or export your current list of incoming and outgoing rules. If your computer does not function properly after you adjust the rules (in Steps 7 and 8), you will be able to restore the current rules.
7. Adjust your incoming rules to disallow devices, programs, and services you do not want accessing your computer. Be careful adjusting these settings, as adding or removing rules may hinder a legitimate program's capability to work properly.
8. Adjust your outgoing rules to allow only appropriate programs on your computer to communicate with other computers and mobile devices on your network or the Internet. Examples include a browser, email program, or other communications programs.
9. Save your settings.
10. Test programs on your computer that require Internet access. If any do not function properly, restore the list of rules you backed up or exported in Step 6.
11. Exit the personal firewall.



Consider This: Which programs on your computer should have access to the Internet? Which programs should not?

Unauthorized Access and Use

Unauthorized access is the use of a computer or network without permission. *Unauthorized use* is the use of a computer or its data for unapproved or possibly illegal activities.

Home and business users can be a target of unauthorized access and use. Unauthorized use includes a variety of activities: an employee using an organization's computer to send personal email messages, an employee using the organization's word processing software to track his or her child's soccer league scores, or a perpetrator gaining access to a bank computer and performing an unauthorized transfer.

Safeguards against Unauthorized Access and Use

Organizations take several measures to help prevent unauthorized access and use. At a minimum, they should have a written *acceptable use policy (AUP)* that outlines the activities for which the computer and network may and may not be used. An organization's AUP should specify the acceptable use of technology by employees for personal reasons. Some organizations prohibit such use entirely. Others allow personal use on the employee's own time, such as a lunch hour. Whatever the policy, an organization should document and explain it to employees. The AUP also should specify the personal activities, if any, that are allowed on company time. For example, can employees check personal email messages or respond to personal text messages during work hours?

To protect your personal computer from unauthorized intrusions, you should disable file and printer sharing in your operating system (Figure 5-5). This security measure attempts to ensure that others cannot access your files or your printer. You also should be sure to use a firewall. The following sections address other techniques for protecting against unauthorized access and use. The technique(s) used should correspond to the degree of risk that is associated with the unauthorized access.

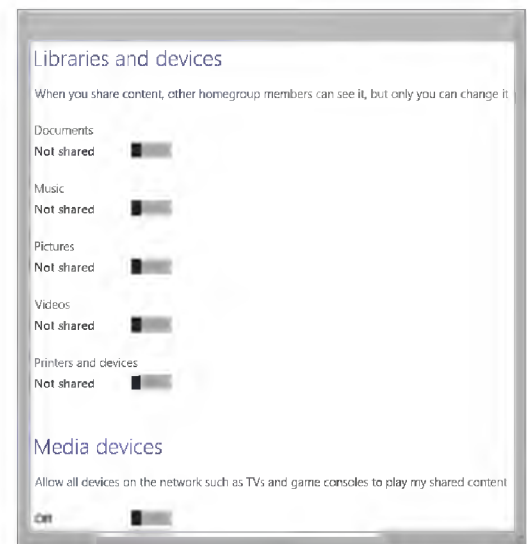


Figure 5-5 To protect files on your device's hard drive from hackers and other intruders, turn off file and printer sharing on your device.

Source: Microsoft

Access Controls

Many organizations use access controls to minimize the chance that a perpetrator intentionally may access or an employee accidentally may access confidential information on a computer, mobile device, or network. An *access control* is a security measure that defines who can access a computer, device, or network; when they can access it; and what actions they can take while accessing it. In addition, the computer, device, or network should maintain an *audit trail* that records in a file both successful and unsuccessful access attempts. An unsuccessful access attempt could result from a user mistyping his or her password, or it could result from a perpetrator trying thousands of passwords.

Organizations should investigate unsuccessful access attempts immediately to ensure they are not intentional breaches of security. They also should review successful access for irregularities, such as use of the computer after normal working hours or from remote computers. The security program can be configured to alert a security administrator whenever suspicious or irregular activities are suspected. In addition, an organization regularly should review users' access privilege levels to determine whether they still are appropriate.

User Names and Passwords

A **user name** — also called a *user ID* (identification), log on name, or sign in name — is a unique combination of characters, such as letters of the alphabet or numbers, that identifies one specific user. A **password** is a private combination of characters associated with the user name that allows access to certain computer resources.



Figure 5-6 Many websites that maintain personal and confidential data, such as Citibank's credit card system, require a user to enter a user name (user ID) and password.

Source: Citigroup Inc



Single Sign On

When you enter your user name into a *single sign on* account, such as for Microsoft, Google, Twitter, and Facebook, you automatically are signed in to other accounts and services. Many also recognize your information to provide additional customized content.


names. Many online social networks, media sharing sites, and retail and other websites allow you to choose your own user name. You might select a name that is formed from parts of your real name or nickname and possibly some numbers, if the name you want is taken (such as britstearns04). If you wish to remain more anonymous, choose a user name that combines common words, or reflects your interests (such as guitarboston27).

Once you select a password, change it frequently. Read Secure IT 1-3 in Chapter 1 for tips about creating strong passwords. Do not disclose your password to anyone or write it on a slip of paper kept near the computer, especially taped to the monitor or under the keyboard. Email and telemarketing scams often ask unsuspecting users to disclose their credit card numbers, so be wary if you did not initiate the inquiry or phone call. Read Secure IT 5-3 for tips about using a password manager.

Most operating systems that enable multiple users to share computers and devices or that access a home or business network require users to enter a user name and a password correctly before they can access the data, information, and programs stored on a computer, mobile device, or network. Many systems that maintain financial, personal, and other confidential information also require a user name and password as part of their sign-in procedure (Figure 5-6).

Some systems assign a user name and/or password to each user. For example, a school may use a combination of letters from a student's first and last names as a user name. For example, Brittany Stearn's user name might be stearns_brit. Some websites use your email address as the user name. Information technology (IT) departments may assign passwords so that they have a record in case the employee leaves or forgets the password.

With other systems, users select their own user names and/or passwords. Many users select a combination of their first and last names for their user

 **SECURE IT 5-3**
 **Safely Use a Password Manager**

If you use the same password to access your banking, shopping, online social networks, and school accounts, you are not alone. Many people think one password is sufficient protection for all their vital online accounts, but cyberthieves are aware of this flawed thinking and take advantage of this practice. Security experts recommend using different user names and passwords for every account and changing the passwords frequently.


Keeping track of all these accounts can be an overwhelming task. A *password manager*, also called a *password organizer*, is a convenient service that stores all your account information securely. Once you select a service, you download and install the software and create

one master password. The first time you view a password-protected website and enter your user name and password, the password manager saves this information. The next time you visit one of these websites or apps, the software supplies the account information automatically. Password managers use two-step verification and advanced encryption techniques (discussed later in this chapter) to ensure information is stored securely.

Some managers offer the option to generate random passwords, which have a unique combination of jumbled numbers and letters that are difficult for criminals to steal, for each account. Other features include the ability to auto-fill information, such as your name, address, and phone number, on forms

and to provide a hint if you have forgotten your master password.

Password manager services can be free to use or may require a small annual fee. Some security experts recommend using a service that charges a fee, stating that these companies may provide more features. Before using any manager, call the company and ask about security measures, the ability to sync with multiple mobile devices, 24-hour customer service via live chat or phone, and limits on the number of passwords that can be saved.

 **Consider This:** Do you use a password manager? If so, do you feel secure storing all your sign in and password information in this service? If not, how do you keep track of your passwords?

 **CONSIDER THIS**
Why do some websites allow you to use your email address as a user name?

No two users can have the same email address; that is, your email address is unique to you. This means you can use your email address and password from one website to validate your identity on another website. Facebook, Google, and Twitter, for example, are three popular websites that provide authentication services to other applications. By using your email address from one of these websites to access other websites, you do not have to create or remember separate user names and passwords for the various websites you visit.

In addition to a user name and password, some systems ask users to enter one of several pieces of personal information. Such items can include a grandparent's first name, your favorite food, your first pet's name, or the name of the elementary school you attended. These items should be facts that you easily remember but are not easy for others to discover about you when using a search engine or examining your profiles on online social networks. As with a password, if the user's response does not match information on file, the system denies access.

Passphrase Instead of passwords, some organizations use passphrases to authenticate users. A *passphrase* is a private combination of words, often containing mixed capitalization and punctuation, associated with a user name that allows access to certain computer resources. Passphrases, which often can be up to 100 characters in length, are more secure than passwords, yet can be easy to remember because they contain words.

PIN A **PIN** (personal identification number), sometimes called a *passcode*, is a numeric password, either assigned by a company or selected by a user. PINs provide an additional level of security. Select PINs carefully and protect them as you do any other password. For example, do not use the same four digits, sequential digits, or dates others could easily determine, such as birth dates.


BTW
Default Passwords

If a program or device has a default or preset password, such as admin, be sure to change it to prevent unauthorized access.



CONSIDER THIS

Why do some websites display distorted characters you must reenter along with your password?

These websites use a CAPTCHA, which stands for Completely Automated Public Turing test to tell Computers and Humans Apart. A CAPTCHA is a program developed at Carnegie Mellon University that displays an image containing a series of distorted characters for a user to identify and enter in order to verify that user input is from humans and not computer programs (Figure 5-7).

A CAPTCHA is effective in blocking computer-generated attempts to access a website, because it is difficult to write programs for computers to detect distorted characters, while humans generally can recognize them. For visually impaired users or if words are too difficult to read, the CAPTCHA text can be read aloud; you also have the option of generating a new CAPTCHA.

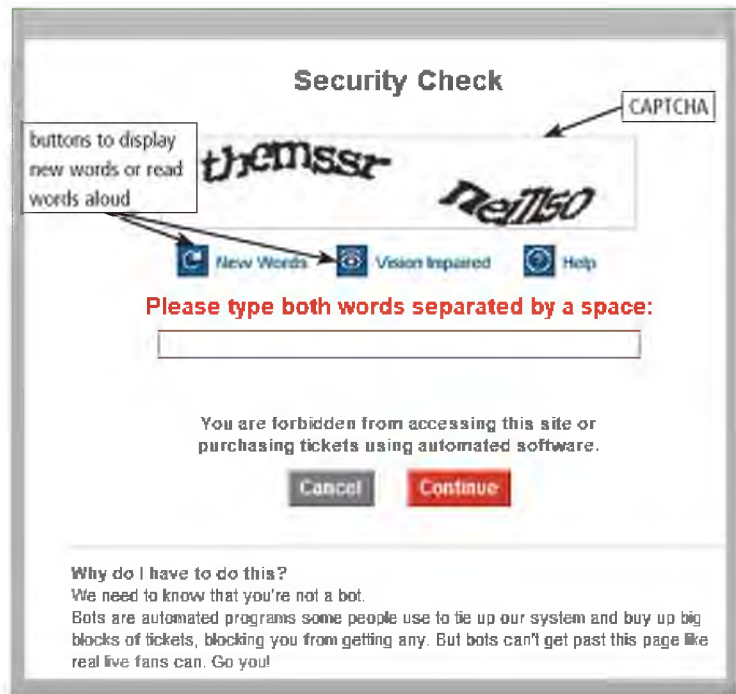


Figure 5-7 To continue with the ticket order process at the Ticketmaster website, the user must enter the characters in the CAPTCHA, which consists of the letters, themssr neillso, in this case.
Source: Carnegie Mellon University

Possessed Objects

A possessed object is any item that you must possess, or carry with you, in order to gain access to a computer or computer facility. Examples of possessed objects are badges, cards, smart cards, and keys. The card you use in an ATM (automated teller machine), for example, is a possessed object that allows access to your bank account.

Biometric Devices

A **biometric device** authenticates a person's identity by translating a personal characteristic, such as a fingerprint, into a digital code that is compared with a digital code stored in a computer or mobile device verifying a physical or behavioral characteristic. If the digital code in the computer or mobile device does not match the personal characteristic code, the computer or mobile device denies access to the individual.

Biometric devices grant access to programs, computers, or rooms using computer analysis of some biometric identifier. Examples of biometric devices and systems include fingerprint readers, face recognition systems, hand geometry systems, voice verification systems, signature verification systems, iris recognition systems, and retinal scanners.

Fingerprint Reader A **fingerprint reader**, or fingerprint scanner, captures curves and indentations of a fingerprint (Figure 5-8). Organizations use fingerprint readers to secure doors, computers, and software. With the cost of fingerprint readers often less than \$100, some home and small business users install fingerprint readers to authenticate users before they can access a personal computer.



Figure 5-8 A fingerprint reader.
© Flynavjip / Dreamstime.com

The reader also can be set up to perform different functions for different fingers; for example, one finger starts a program and another finger shuts down the computer. External fingerprint readers usually plug into a USB port.

Some laptops, smartphones, and smartwatches have a built fingerprint reader. Using their fingerprint, users can unlock the computer or device, sign in to programs and websites via their fingerprint instead of entering a user name and password, and on some devices, even test their blood pressure and heart rate.

Discover More: Visit this chapter's free resources to learn more about fingerprint readers.

CONSIDER THIS

What is a lock screen?

A *lock screen* is a screen that restricts access to a computer or mobile device until a user performs a certain action. Some simply require a user swipe the screen to unlock the screen. Others verify a user's identity by requiring entry of a password, PIN, or passcode; a fingerprint scan; or a gesture swipe (Figure 5-9). Gestures are motions users make on a touch screen with the tip of one or more fingers or their hand. For example, to unlock the screen on a phone, a user could connect the dots on the screen using a pattern previously defined by the user.



Figure 5-9 Some ways users unlock screens include entering a passcode, scanning a fingerprint, and swiping a gesture.

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BTW Technology Trend

Discover More: Visit this chapter's free resources to learn more about uses of face recognition technology.

Face Recognition System A *face recognition system* captures a live face image and compares it with a stored image to determine if the person is a legitimate user. Some buildings use face recognition systems to secure access to rooms. Law enforcement, surveillance systems, and airports use face recognition to protect the public. Some mobile devices use face recognition systems to unlock the device. Face recognition programs are becoming more sophisticated and can recognize people with or without glasses, makeup, or jewelry, and with new hairstyles.

Hand Geometry System A *hand geometry system* measures the shape and size of a person's hand (Figure 5-10). Because hand geometry systems can be expensive, they often are used in larger companies to track workers' time and attendance or as security devices. Colleges use hand geometry systems to verify students' identities. Daycare centers and hospital nurseries use them to identify parents who pick up their children.

Voice Verification System A *voice verification system* compares a person's live speech with their stored voice pattern. Larger organizations sometimes use voice verification systems as time and attendance devices. Many companies also use this technology for access to sensitive files and networks. Some financial services use voice verification systems to secure phone banking transactions.

Signature Verification System A *signature verification system* recognizes the shape of your handwritten signature, as well as measures the pressure exerted and the motion used to write the signature. Signature verification systems use a specialized pen and tablet. Signature verification systems often are used to reduce fraud in financial institutions.



Figure 5-10 A hand geometry system verifies identity based on the shape and size of a person's hand.

Courtesy of Ingersoll Rand Security Technologies

CONSIDER THIS

Do retailers use a signature verification system for credit card purchases?

No. With a credit card purchase, users sign their name on a signature capture pad using a stylus attached to the device. Software then transmits the signature to a central computer, where it is stored. Thus, the retailers use these systems simply to record your signature.



Figure 5-11 An iris recognition system.

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Iris Recognition System

High security areas use iris recognition systems. The camera in an iris recognition system uses iris recognition technology to read patterns in the iris of the eye (Figure 5-11). These patterns are as unique as a fingerprint. Iris recognition systems are quite expensive and are used by government security organizations, the military, and financial institutions that deal with highly sensitive data. Some organizations use retinal scanners, which work similarly but instead scan patterns of blood vessels in the back of the retina.

CONSIDER THIS

How popular are biometric devices?

Biometric devices are gaining popularity as a security precaution because they are a virtually foolproof method of identification and authentication. For example, some grocery stores, retail stores, and gas stations use *biometric payment*, where the customer's fingerprint is read by a fingerprint reader that is linked to a payment method, such as a checking account or credit card. Users can forget their user names and passwords. Possessed objects can be lost, copied, duplicated, or stolen. Personal characteristics, by contrast, are unique and cannot be forgotten or misplaced.

Biometric devices do have disadvantages. If you cut your finger, a fingerprint reader might reject you as a legitimate user. Hand geometry readers can transmit germs. If you are nervous, a signature might not match the one on file. If you have a sore throat, a voice recognition system might reject you. Many people are uncomfortable with the thought of using an iris scanner.



Two-Step Verification

Users should register a landline phone number, alternate email address, or other form of contact beyond a mobile phone number so that they still can access their accounts even if they lose their mobile phone.

Two-Step Verification

In an attempt to further protect personal data and information from online thieves, many organizations such as financial institutions or universities that store sensitive or confidential items use a two-step verification process. With **two-step verification**, also known as *two-factor verification*, a computer or mobile device uses two separate methods, one after the next, to verify the identity of a user.

ATMs (automated teller machines) usually requires a two-step verification. Users first insert their ATM card into the ATM (Step 1) and then enter a PIN (Step 2) to access their bank account. Most debit cards and some credit cards use PINs. If someone steals these cards, the thief must enter the user's PIN to access the account.

Another use of two-step verification requires a mobile phone and a computer. When users sign in to an account on a computer, they enter a user name and a password (Step 1). Next, they are prompted to enter another authentication code (Step 2), which is sent as a text or voice message or via an app on a smartphone (Figure 5-12). This second code generally is valid for a set time, sometimes only for a few hours. If users do not sign in during this time limit, they must repeat the process and request another verification code. Microsoft and Google commonly use two-step verification when you sign in to their websites. If you sign in from a device you use frequently, you can elect to bypass this step.

Internet Research

Which websites use two-step verification?

Search for: two-step verification websites

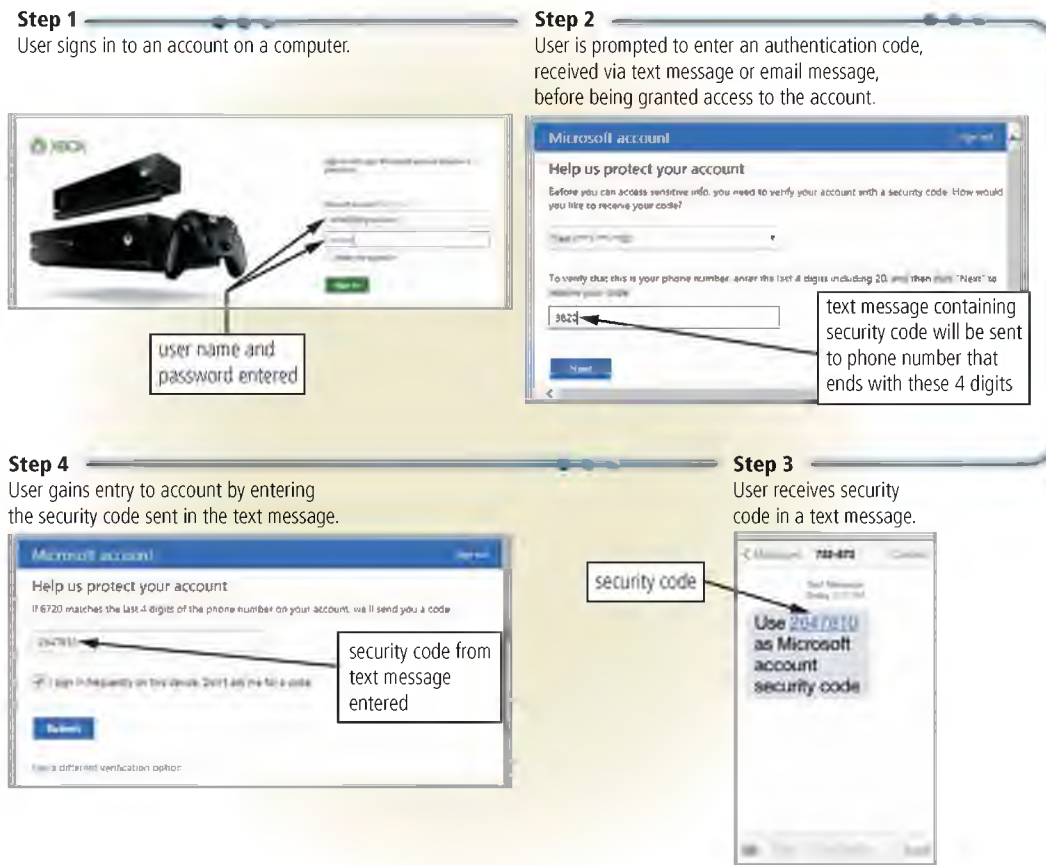


Figure 5-12 This figure shows an example of two-step authentication.

Source: Microsoft

CONSIDER THIS

Can users circumvent the two-step verification process?

Users may be able to specify a computer as a trusted device during a two-step verification so that future sign-in attempts on that same computer will bypass the two-step verification. Only limited-use computers in safe areas should be identified as a trusted device.

Digital Forensics

Digital forensics, also called *cyberforensics*, is the discovery, collection, and analysis of evidence found on computers and networks. Digital forensics involves the examination of media, programs, data and log files on computers, mobile devices, servers, and networks. Many areas use digital forensics, including law enforcement, criminal prosecutors, military intelligence, insurance agencies, and information security departments in the private sector.

A digital forensics examiner must have knowledge of the law, technical experience with many types of hardware and software products, superior communication skills, familiarity with corporate structures and policies, a willingness to learn and update skills, and a knack for problem solving.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn more about digital forensics.

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Digital Security Risks, Internet and Network Attacks, and Unauthorized Access and Use, as it relates to the chapter objectives.

Now you should know ...

- How cybercriminals' backgrounds and intent vary (Objective 1)
- How you can protect your computers and devices from malware, botnets, DoS attacks, back doors, and spoofing (Objective 2)
- Why you should use a firewall (Objective 2)
- How you can prevent unauthorized users from accessing your home or office computers and devices (Objective 3)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Software Theft

Software theft occurs when someone steals software media, intentionally erases programs, illegally registers and/or activates a program, or illegally copies a program.

- **Physically stealing software:** A perpetrator physically steals the media that contains the software, or steals the hardware that contains the media that contains the software. For example, an unscrupulous library patron might steal a game CD/DVD.
- **Intentionally erasing software:** A perpetrator erases the media that contains the software. For example, a software developer who is terminated from a company may retaliate by removing or disabling the programs he or she has written from company computers.
- **Illegal registration/activation:** A perpetrator illegally obtains registration numbers and/or activation codes. A program called a *keygen*, short for key generator, creates software registration numbers and sometimes activation codes. Some unscrupulous individuals create and post keygens so that users can install software without legally purchasing it.
- **Illegal copying:** A perpetrator copies software from manufacturers. **Software piracy**, often referred to simply as **piracy**, is the unauthorized and illegal duplication of copyrighted software. Piracy is the most common form of software theft.

Safeguards against Software Theft

To protect software media from being stolen, owners should keep original software boxes and media or the online confirmation of purchased software in a secure location, out of sight of prying eyes. All computer users should back up their files and drives regularly, in the event of theft. When some companies terminate a software developer or if the software developer quits, they escort the employee off the premises immediately. These companies believe that allowing terminated employees to remain on the premises gives them time to sabotage files and other network procedures.

Many manufacturers incorporate an activation process into their programs to ensure the software is not installed on more computers than legally licensed. During the **product activation**, which is conducted either online or by phone, users provide the software product's identification number to associate the software with the computer or mobile device on which the software is installed. Usually, the software can be run a preset number of times, has limited functionality, or does not function until you activate it.

To further protect themselves from software piracy, software manufacturers issue users license agreements. As discussed in Chapter 4, a **license agreement** is the right to use software. That is, you do not own the software. The most common type of license included with software purchased by individual users is a *single-user license agreement*, also called an *end-user license agreement (EULA)*. The license agreement provides specific conditions for use of the software, which a user must accept before using the software. These terms usually are displayed when you install



BTW

BSA

To promote understanding of software piracy, a number of major worldwide software companies formed the *Business Software Alliance (BSA)*. The BSA operates a website and antipiracy hotlines around the world.



Internet Research

What are the penalties for piracy?

Search for: piracy penalties

the software. Use of the software constitutes acceptance of the terms on the user's part. Figure 5-13 identifies the conditions of a typical single-user license agreement.

To support multiple users' access of software, most manufacturers sell network versions or site licenses of their software, which usually costs less than buying individual stand-alone copies of the software for each computer. A *network license* is a legal agreement that allows multiple users to access the software on the server simultaneously. The network license fee usually is based on the number of users or the number of computers attached to the network. A *site license* is a legal agreement that permits users to install the software on multiple computers — usually at a volume discount.

Discover More: Visit this chapter's free resources to learn more about license agreements.

Typical Conditions of a Single-User License Agreement

You can...

- Install the software on only one computer or device. (Some license agreements allow users to install the software on a specified number of computers and/or mobile devices.)
- Make one copy of the software as a backup.
- Give or sell the software to another individual, but only if the software is removed from the user's computer first.

You cannot...

- Install the software on a network, such as a school computer lab.
- Give copies to friends and colleagues, while continuing to use the software.
- Export the software.
- Rent or lease the software.

Figure 5-13 A user must accept the terms of a license agreement before using the software.

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CONSIDER THIS

Can you install software on work computers or work-issued smartphones?

Many organizations and businesses have strict written policies governing the installation and use of software and enforce their rules by checking networked or online computers or mobile devices periodically to ensure that all software is licensed properly. If you are not completely familiar with your school's or employer's policies governing installation of software, check with the information technology department or your school's technology coordinator.

Information Theft

Information theft occurs when someone steals personal or confidential information. Both business and home users can fall victim to information theft. An unethical company executive may steal or buy stolen information to learn about a competitor. A corrupt individual may steal credit card numbers to make fraudulent purchases. Information theft often is linked to other types of cybercrime. For example, an individual first might gain unauthorized access to a computer and then steal credit card numbers stored in a firm's accounting department.

Safeguards against Information Theft

Most organizations will attempt to prevent information theft by implementing the user identification and authentication controls discussed earlier in this chapter. These controls are best suited for protecting information on computers located on an organization's premises. To further protect information on the Internet and networks, organizations and individuals use a variety of encryption techniques.

Encryption

Encryption is the process of converting data that is readable by humans into encoded characters to prevent unauthorized access. You treat encrypted data just like any other data. That is, you can store it or send it in an email message. To read the data, the recipient must **decrypt**, or decode it. For example, users may specify that an email application encrypt a message before sending it securely. The recipient's email application would need to decrypt the message in order for the recipient to be able to read it.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn more about encryption algorithms.

In the encryption process, the unencrypted, readable data is called *plaintext*. The encrypted (scrambled) data is called *ciphertext*. An *encryption algorithm*, or *cypher*, is a set of steps that can convert readable plaintext into unreadable ciphertext. A simple encryption algorithm might switch the order of characters or replace characters with other characters. Encryption programs typically use more than one encryption algorithm, along with an encryption key. An *encryption key* is a set of characters that the originator of the data uses to encrypt the plaintext and the recipient of the data uses to decrypt the ciphertext.

Two basic types of encryption are private key and public key. With *private key encryption*, also called *symmetric key encryption*, both the originator and the recipient use the same secret key to encrypt and decrypt the data. *Public key encryption*, also called *asymmetric key encryption*, uses two encryption keys: a public key and a private key (Figure 5-14). Public key encryption software generates both the private key and the public key. A message encrypted with a public key can be decrypted only with the corresponding private key, and vice versa. The public key is made known to message originators and recipients. For example, public keys may be posted on a secure webpage or a public-key server, or they may be emailed. The private key, by contrast, should be kept confidential.

Some operating systems and email programs allow you to encrypt the contents of files and messages that are stored on your computer. You also can purchase an encryption program to encrypt files. Many browsers use encryption when sending private information, such as credit card numbers, over the Internet.

Mobile users today often access their company networks through a virtual private network. When a mobile user connects to a main office using a standard Internet connection, a *virtual private network (VPN)* provides the mobile user with a secure connection to the company network server, as if the user has a private line. VPNs help ensure that data is safe from being intercepted by unauthorized people by encrypting data as it transmits from a laptop, smartphone, or other mobile device.

Discover More: Visit this chapter's free resources to learn more about encryption algorithms and programs.

An Example of Public Key Encryption

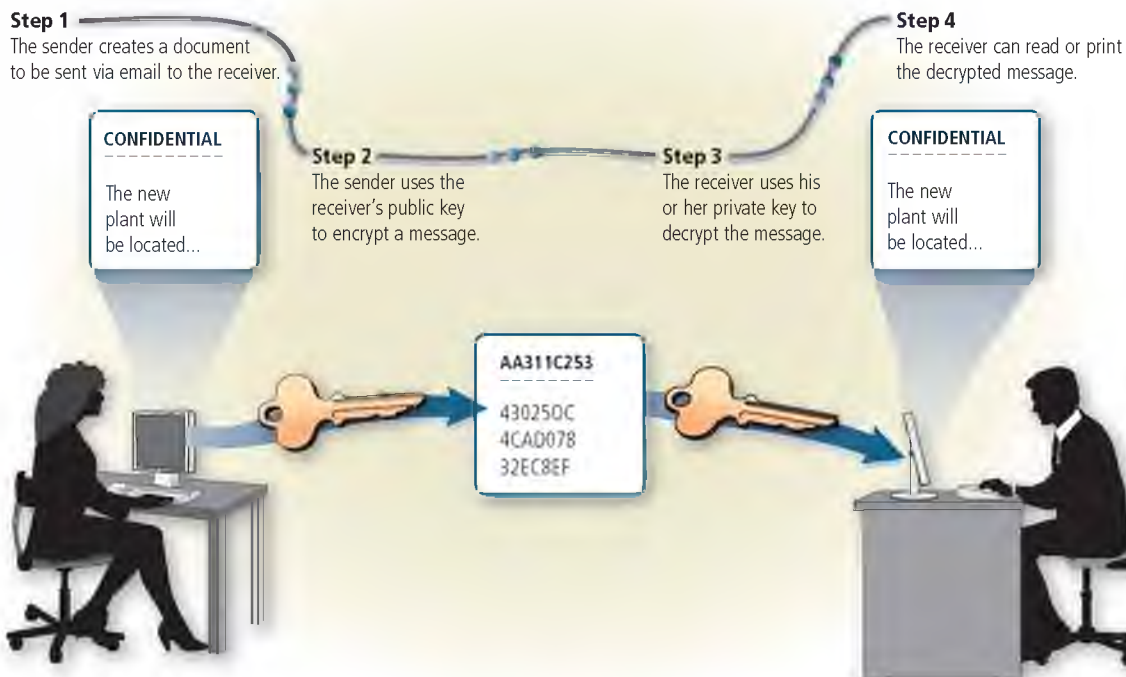


Figure 5-14 This figure shows an example of public key encryption.

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Digital Signatures and Certificates

A **digital signature** is an encrypted code that a person, website, or organization attaches to an electronic message to verify the identity of the message sender. Digital signatures often are used to ensure that an impostor is not participating in an Internet transaction. That is, digital signatures can help to prevent email forgery. A digital signature also can verify that the content of a message has not changed.

A **digital certificate** is a notice that guarantees a user or a website is legitimate. E-commerce applications commonly use digital certificates. Browsers often display a warning message if a website does not have a valid digital certificate.

A website that uses encryption techniques to secure its data is known as a **secure site** (Figure 5-15). Web addresses of secure sites often begin with https instead of http. Secure sites typically use digital certificates along with security protocols.

CONSIDER THIS

Who issues digital certificates?

A *certificate authority (CA)* is an organization that issues digital certificates. Each CA is a trusted third party that takes responsibility for verifying the sender's identity before issuing a certificate. Individuals and companies can purchase digital certificates from one of more than 35 online CA providers. The cost varies depending on the desired level of data encryption, with the strongest levels recommended for financial and e-commerce transactions.

Discover More: Visit this chapter's free resources to learn more about security protocols, digital certificates and signatures, and CA providers.



Figure 5-15 Web addresses of secure sites, such as the Amazon.com checkout, often begin with https instead of http. Browsers also often display a lock symbol in the window, which you usually can tap or click to see the associated digital certificate.

Source: Amazon.com and Microsoft

Mini Feature 5-1: Cloud Data Privacy

Privacy and security concerns arise when consumers and businesses consider moving their data to an online storage service. Read Mini Feature 5-1 to learn about privacy issues surrounding cloud data storage. Read Ethics & Issues 5-2 to consider who is responsible for data left on the cloud.


MINI FEATURE 5-1

Cloud Data Privacy

Privacy and security concerns arise when consumers and businesses consider moving their data to an online storage service. While the cloud offers a tremendous amount of storage space at a relatively low cost, the security of data and the reliability of cloud companies trigger concerns.

When people register for a cloud computing service, they sign a written contract or tap or click an online OK or Agree button to affirm they read and understand the terms of the agreement. Any data saved on the cloud is entrusted to the third-party provider, which has a legal obligation to protect the data from security breaches. The company also must guard against data loss due to physical disasters, such as power outages, cooling failures, and fire. When data has been compromised, many states require the company to disclose the issue to the data owner promptly.

The Cloud Security Alliance (CSA) warns of hackers who register for the service with a credit card or for a free trial period and then unleash malware in an attempt to gain access to passwords. Because the registration and validation procedure for accessing the cloud is relatively anonymous, authorities can have difficulty locating the abusers.

Another concern arises when transferring data over a network to the cloud. When the data is traveling to or from a computer and the cloud service, it is subject to interception. To minimize risk, security experts emphasize that the web address of the website you are visiting must begin with https, and the data should be encrypted and authenticated.


Law enforcement's access to the data raises another security issue. Email messages stored on a private server belong to the company or individual who owns the computer, so law enforcement officials must obtain a search warrant to read a particular user's messages. In contrast, law enforcement officials can access email messages stored on the cloud by requesting the information from the company that owns the cloud service. The user might not be notified of the search until up to 90 days after the search occurred; moreover, the search may occur without limitations and may include continuous monitoring of an individual's email communications.

International laws and industry regulations protect sensitive and personal data. Germany has some of the strictest cloud data privacy laws, and, in general, the European Union's privacy regulations are more

protective than those in the United States. In much of Europe, for example, consumers must agree to have their personal information collected, and they can review the data for accuracy. The education, health care, and financial services industries in the United States have strict data privacy regulations that affect cloud storage. For example, the Family Educational Rights and Privacy Act (FERPA) regulates the confidentiality of students' educational records, so colleges must obtain students' consent to share data with cloud storage providers and other third parties.

Cloud storage companies have increased their privacy and security features in recent years. Many allow consumers and businesses to protect files with passwords or require two-step authentication to access files, to delete data if a mobile device has been stolen or lost, and to delete data that has been stored past an expiration date.

Discover More: Visit this chapter's free resources to learn more about cloud security breaches, international laws and industry regulations, and protecting online data.

 **Consider This:** How much of your personal data is stored on the cloud? Do you have concerns about the security of this data? Have you ever received a notice that any of your online data has been compromised? Should online social networks or email providers give more explicit notice that data is stored on the cloud? Should law enforcement officials be able to access your data without your consent? Why or why not?



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BTW

Technology Trend

Discover More: Visit this chapter's free resources to learn more about cloud security.

ETHICS & ISSUES 5-2

Who Is Responsible for Data Left on the Cloud?

Businesses often contract with cloud storage providers for data storage. Many businesses also use cloud storage providers to store customer data. This data could include contact information, credit card numbers, and ordering history.

Ownership of cloud data becomes an issue when a cloud storage provider or the business using the cloud services closes. Other issues include what happens if the business fails to pay the cloud storage provider, or when a contract ends. Many feel that it is the responsibility of the business owner to remove and destroy company

data before a contract ends. Supporters of this argument believe that cloud storage providers should not be accessing data they host. Others contend that if a business fails to remove and destroy its data before its cloud storage contract ends, cloud storage providers should return the data, or remove the data permanently.

An ongoing debate exists related to who is responsible for cloud data security. Many experts put the responsibility of securing data in the hands of the data owner. Others advocate for a shared security model, in which the cloud storage provider includes security tools, but the company provides additional security as needed.

Ownership and security of data should be included in any contract between a business and cloud storage provider. Contracts also should specify what happens in a variety of scenarios, including if either party stops its operations, or if hackers access the data.

Consider This: If a business stops its operations, who should remove its data from cloud storage? Why? If a customer does not remove its data before a contract ends, should a cloud storage provider return the data, or can it remove or sell the data? Why or why not? Who is responsible for data security? Why?

Hardware Theft, Vandalism, and Failure

Users rely on computers and mobile devices to create, store, and manage important information. As discussed in Chapter 3, you should take measures to protect computers and devices from theft, vandalism, and failure.

Hardware theft is the act of stealing digital equipment. Hardware vandalism involves defacing or destroying digital equipment. Hardware can fail for a variety of reasons: aging hardware, natural or man-made disasters, or random events such as electrical power problems, and even errors in programs or apps. Figure 5-16 summarizes the techniques you can use to safeguard hardware from theft, vandalism, and failure.

Hardware Theft and Vandalism Safeguards

- Physical access controls (i.e., locked doors and windows)
- Alarm system
- Physical security devices (i.e., cables and locks)
- Device-tracking app

Hardware Failure Safeguards

- Surge protector
- Uninterruptible power supply (UPS)
- Duplicate components or duplicate computers
- Fault-tolerant computer

Figure 5-16 Summary of safeguards against hardware theft, vandalism, and failure.

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Backing Up — The Ultimate Safeguard

To protect against data loss caused by hardware/software/information theft or system failure, users should back up computer and mobile device files regularly. As previously described, a **backup** is a duplicate of a file, program, or media that can be used if the original is lost, damaged, or destroyed; and to **back up** a file means to make a copy of it. In the case of system failure or the discovery of corrupted files, you **restore** the files by copying the backed up files to their original location on the computer or mobile device.

If you choose to back up locally, be sure to use high-quality media. A good choice for a home user might be optical discs or an external hard drive. Keep your backup media in a fireproof and heat-proof safe or vault, or offsite. *Off-site* means in a location separate from where you typically store or use your computer or mobile device. Keeping backup copies off-site minimizes the chance that a single disaster, such as a fire, would destroy both the original and the backup media. An off-site location can be a safe deposit box at a bank, a briefcase, or cloud storage or cloud backup.

Cloud storage provides storage to customers, usually along with synchronization services but often on smaller amounts of data. By contrast, cloud backup provides only backup and retrieval services, but generally provides continuous data protection (discussed next) to the cloud. More customers are opting for cloud backup because it saves them the cost of maintaining hardware (Figure 5-17).



Technology Innovator

Discover More: Visit this chapter's free resources to learn about the device-tracking app, LoJack.

Backup programs are available from many sources. Most operating systems include a backup program. Backup devices, such as external disk drives, also include backup programs. Numerous stand-alone backup tools exist. Cloud storage providers may offer backup services. Users of a cloud backup service install software on their computers that backs up files to the cloud as they are modified.

Business and home users can perform four types of backup: full, differential, incremental, or selective. A fifth type, continuous data protection, often is used only by large enterprises to back up data to an in-house network storage device purchased and maintained by the enterprise. Cloud backup services, a sixth option, are providing continuous data protection capabilities at a lower cost. Table 5-2 summarizes the purpose, advantages, and disadvantages of each of these backup methods.

Some users implement a three-generation backup policy to preserve three copies of important files. The *grandparent* is the oldest copy of the file. The *parent* is the second oldest copy of the file. The *child* is the most recent copy of the file. When a new backup is performed, the child becomes the parent, the parent becomes the grandparent, and the media on which the grandparent copy was stored may be erased and reused for a future backup.

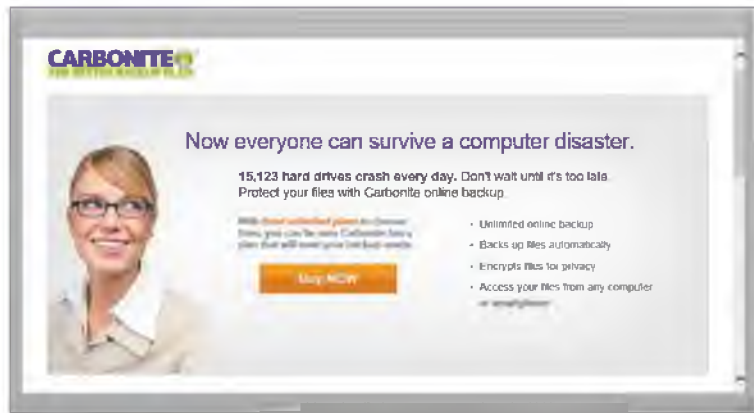


Figure 5-17 Cloud storage, such as Carbonite shown here, is a popular method for off-site backups.

Source: Carbonite, Inc.



Table 5-2 Various Backup Methods

Type of Backup	Description	Advantages	Disadvantages
<i>Full backup</i>	Copies all of the files on media in the computer.	Fastest recovery method. All files are saved.	Longest backup time.
<i>Differential backup</i>	Copies only the files that have changed since the last full backup.	Fast backup method. Requires minimal storage space to back up.	Recovery is time-consuming because the last full backup plus the differential backup are needed.
<i>Incremental backup</i>	Copies only the files that have changed since the last full or incremental backup.	Fastest backup method. Requires minimal storage space to back up. Only most recent changes saved.	Recovery is most time-consuming because the last full backup and all incremental backups since the last full backup are needed.
<i>Selective backup</i>	Users choose which folders and files to include in a backup.	Fast backup method. Provides great flexibility.	Difficult to manage individual file backups. Least manageable of all the backup methods.
<i>Continuous data protection (CDP)</i>	All data is backed up whenever a change is made.	The only real-time backup. Very fast recovery of data.	Very expensive and requires a great amount of storage.
<i>Cloud backup</i>	Files are backed up to the cloud as they change.	Cloud backup provider maintains backup hardware. Files may be retrieved from anywhere with an Internet connection on any device.	Requires an Internet connection, otherwise files are marked for backup when the computer goes back online.

Mini Feature 5-2: Disaster Recovery

A **disaster recovery plan** is a written plan that describes the steps an organization would take to restore its computer operations in the event of a disaster. Read Mini Feature 5-2 to learn about steps an organization takes in the event of a disaster.

MINI FEATURE 5-2

Disaster Recovery

A disaster can be natural or man-made (hackers, viruses, etc.). Each company and each department or division within an organization usually has its own disaster recovery plan. The following scenario illustrates how an organization might implement a disaster recovery plan.

Rosewood Associates is a consulting firm that helps clients use social media for marketing and customer outreach. Last week, a fire broke out in the office suite above Rosewood. The heat and smoke, along with water from the sprinkler system, caused extensive damage. As a result, Rosewood must replace all computers, servers, and storage devices. Also, the company lost all of the data it had not backed up.

Rosewood currently backs up its systems daily to an internal server and weekly to a remote cloud server. Because of damage to the internal server, the company lost several days of data. Rosewood does not have a plan for replacing hardware. Thus, they will lose several additional days of productivity while purchasing, installing, and configuring new hardware.

To minimize the chance of this type of loss in the future, the company hired you as a consultant to help create a disaster recovery plan. You first discuss the types of disasters that can strike, as shown in the table. You then explain that the goal of a disaster recovery plan is to prevent, detect, and correct system threats, and to restore the most critical systems first.

A disaster recovery plan typically contains these four components: emergency plan, backup plan, recovery plan, and test plan.

Emergency Plan: An emergency plan specifies the steps Rosewood will take as soon as a disaster strikes. The emergency plan is organized by type of disaster, such as fire, flood, or earthquake, and includes:

1. Names and phone numbers of people and organizations to notify (company management, fire and police department, clients, etc.)
2. Computer equipment procedures, such as equipment or power shutoff, and file removal; employees should follow these procedures only if it is safe to do so
3. Employee evacuation procedures
4. Return procedures (who can enter the facility and what actions they are to perform)

Backup Plan: The backup plan specifies how Rosewood will use backup files and equipment to resume computer operations, and includes:

1. The location of backup data, supplies, and equipment
2. Who is responsible for gathering backup resources and transporting them to an alternate computer facility
3. The methods by which data will be restored from cloud storage

Considerations for Disaster Recovery

Disaster Type	What to Do First	What Might Occur	What to Include in the Plan
Natural (earthquake, hurricane, tornado, etc.)	Shut off power Evacuate, if necessary Pay attention to advisories Do not use phone lines if lightning occurs	Power outage Phone lines down Structural damage to building Road closings, transportation interruptions Flooding Equipment damage	Generator Satellite phone, list of employee phone numbers Alternate worksite Action to be taken if employees are not able to come to work/leave the office Wet/dry vacuums Make and model numbers and vendor information to get replacements
Man-made (hazardous material spill, terrorist attacks, fire, hackers, malware, etc.)	Notify authorities (fire departments, etc.) of immediate threat Attempt to suppress fire or contain spill, if safe to do so Evacuate, if necessary	Data loss Dangerous conditions for employees Criminal activity, such as data hacking and identity theft Equipment damage	Backup data at protected site Protective equipment and an evacuation plan Contact law enforcement Make and model numbers and vendor information to obtain replacements


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4. A schedule indicating the order and approximate time each application should be up and running

Recovery Plan: The recovery plan specifies the actions Rosewood will take to restore full computer operations. As with the emergency plan, the recovery plan differs for each type of disaster. You recommend that Rosewood set up planning committees. Each committee would be responsible for different forms of recovery, such as replacing hardware or software.

Test Plan: The test plan includes simulating various levels of disasters and recording Rosewood's ability to recover. You run a test in which the employees follow the steps in the disaster recovery plan. The test uncovers a few needed recovery actions not specified in the plan, so you modify the plan. A few days later, you run another test without giving the employees any advance notice to test the plan again.

Discover More: Visit this chapter's free resources to learn more about lost productivity, backup plans, and alternate computer facilities.

 **Consider This:** For what kinds of natural and man-made disasters should a company plan? What roles can cloud storage providers play in helping to recover from a disaster? How involved should employees be in developing and testing disaster recovery plans?



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Figure 5-18 Wireless access points or routers around campus allow students to access the school network wirelessly from their classrooms, the library, dorms, and other campus locations.

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Wireless Security

Billions of home and business users have laptops, smartphones, and other mobile devices to access the Internet, send email and Internet messages, chat online, or share network connections — all wirelessly. Home users set up wireless home networks. Mobile users access wireless networks in hot spots at airports, hotels, shopping malls, bookstores, restaurants, and coffee shops. Schools have wireless networks so that students can access the school network using their mobile computers and devices as they move from building to building (Figure 5-18).

Although wireless access provides many conveniences to users, it also poses additional security risks. Some perpetrators connect to other's wireless networks to gain free Internet access; others may try to access an organization's confidential data.

To access a wireless network, the individual must be in range of the wireless network. Some intruders intercept and monitor communications as they transmit through the air. Others connect to a network through an unsecured wireless access point (WAP) or combination router/WAP. Read How To 5-3 for instructions about ways to secure a wireless network, in addition to using firewalls.

HOW TO 5-3

Secure Your Wireless Network

When you set up a wireless network, it is important to secure the network so that only your computers and mobile devices can connect to it. Unsecured wireless networks can be seen and accessed by neighbors and others nearby, which may make it easier for them to connect to and access the data on the computers and mobile devices on your network. The following list provides suggestions for securing your wireless network.

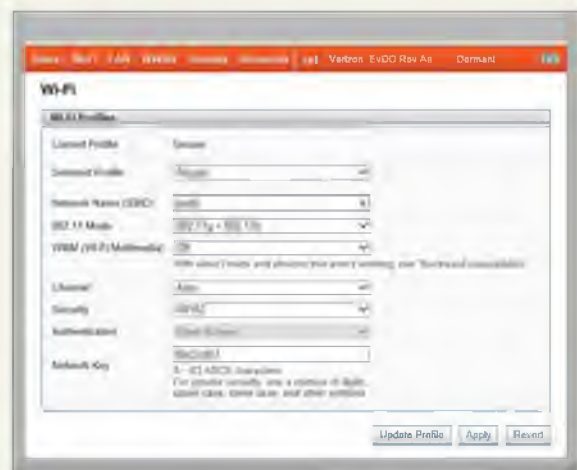
- Immediately upon connecting your wireless access point and/or router, change the password required to access administrative features. If the password remains at its default setting, others may possibly be able to connect to and configure your wireless network settings.
- Change the *SSID* (service set identifier), which is a network name, from the default to something that uniquely identifies your network, especially if you live in close proximity to other wireless networks.
- Do not broadcast the SSID. This will make it more difficult for others to detect your

wireless network. When you want to connect a computer or mobile device to your wireless network, it will be necessary to enter the SSID manually.

- Enable an encryption method such as WPA2 (Wi-Fi Protected Access 2), and specify a password or passphrase that is difficult for others to guess. The most secure passwords and passphrases contain more than eight characters, uppercase and lowercase letters, numbers, and special characters.
- Enable and configure the MAC (Media Access Control) address control feature. A *MAC address* is a unique hardware identifier for your computer or device. The *MAC address control* feature specifies the computers and mobile devices that can connect to your network. If a computer or device is not specified, it will not be able to connect.
- Choose a secure location for your wireless router so

that unauthorized people cannot access it. Someone who has physical access to a wireless router can restore factory defaults and erase your settings.

Consider This: In addition to safeguarding the data and information on your computers from others, why else might it be a good idea to secure your wireless network?



Source: Verizon Wireless

CONSIDER THIS

Can you detect if someone is accessing your wireless home network?

If you notice the speed of your wireless connection is slower than normal, it may be a sign that someone else is accessing your network. You also may notice indicator lights on your wireless router flashing rapidly when you are not connected to your wireless network. Most wireless routers have a built-in utility that allows you to view the computers currently connected to your network. If you notice a computer that does not belong to you, consult your wireless router's documentation to determine how to remove it from the network.

Mini Feature 5-3: Mobile Security

As the number of smartphones and mobile devices in use increases, the possibility of security breaches and lost devices increases proportionally. Read Mini Feature 5-3 to learn about ways you can protect sensitive and personal data on your mobile devices.

MINI FEATURE 5-3

Mobile Security

The consequences of losing a smartphone or mobile device are significant given the amount of storage and the variety of personal and business data stored. Symantec, one of the world's leading online security companies, projects that only one-half of lost or stolen phones eventually will be returned to their owners. Chances are that the people who find the missing phones likely will have viewed much of the content on the devices in a quest to find the owners and possibly to gain access to private information.

The goal, therefore, for mobile device users is to make their data as secure as possible. Follow these steps to protect sensitive and personal data and to fight mobile cybercrime.

- **Be extra cautious locating and downloading apps.** Any device that connects to the Internet is susceptible to mobile malware. Cyberthieves target apps on widely used phones and tablets. Popular games are likely candidates to house malware, and it often is difficult to distinguish the legitimate apps from the fake apps. Obtain mobile device apps from well-known stores, and before downloading anything, read the descriptions and reviews. Look for

misspellings and awkward sentence structure, which could be clues that the app is fake. If something looks awry, do not download. Scrutinize the number and types of permissions the app is requesting. If the list seems unreasonable in length or in the personal information needed, deny permission and uninstall the app.

- **Use a PIN.** Enable the passcode feature on a mobile device as the first step in stopping prying eyes from viewing contents. This four-to-eight-digit code adds a layer of protection. Only emergency functions can be accessed without entering the correct sequence of numbers. This strong code should not be information easily guessed, such as a birthdate.
- **Turn off GPS tracking.** GPS technology can track the mobile device's location as long as it is transmitting and receiving signals to and from satellites. This feature is helpful to obtain directions from your current location, view local news and weather reports, find a lost device, summon emergency personnel, and locate missing children. Serious privacy concerns can arise, however, when the technology is used in malicious ways, such as to stalk individuals or trace their whereabouts. Unless you want to allow others to follow your locations throughout the day, disable the GPS tracking feature until needed.

- **Use mobile security software.** Protection is necessary to stop viruses and spyware and to safeguard personal and business data. Mobile security apps can allow you to lock your mobile device and SIM card remotely, erase the



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(Continued)

memory, and activate the GPS function. Other apps prevent cyberthieves from hijacking your phone and taking pictures, making recordings, placing calls to fee-imposed businesses, and sending infected messages to all individuals in your contact list. Look for security software that can back up data to a cloud account, set off a screeching alarm on the lost or stolen mobile device, offer live customer service, and provide theft, spam, virus, and malware protection.

- **Avoid tapping or clicking unsafe links.** Tapping or clicking an unknown link can lead to malicious websites. If you receive a text message from someone you do not know or an invitation to tap or click a link, resist the urge to fulfill the request. Your financial institution never will send you a message requesting you to enter your account user name and password. Malicious links can inject malware on the mobile

device to steal personal information or to create toll fraud, which secretly contacts wireless messaging services that impose steep fees on a monthly bill.

Discover More: Visit this chapter's free resources to learn more about methods to protect your mobile device and personal information.

 **Consider This:** As the number of smartphones and mobile devices in use increases, the possibility of security breaches and lost devices increases proportionally. How can manufacturers and wireless carriers emphasize the importance of mobile security and convince users to take the precautions suggested in this mini feature? What mobile security safeguards have you taken to protect your smartphone or mobile device? What steps will you take after reading this mini feature?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Software Theft; Information Theft; Hardware Theft, Vandalism, and Failure; Backing Up – The Ultimate Safeguard; and Wireless Security as it relates to the chapter objectives.

Now you should know ...

- What actions you are allowed according to a software license agreement (Objective 4)
- Why you would want to use encryption, digital signatures, or digital certificates (Objective 5)
- How you can protect your hardware from theft, vandalism, and failure (Objective 6)
- Which backup method is most suited to your needs (Objective 7)
- How you can protect your wireless communications (Objective 8)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Ethics and Society

As with any powerful technology, computers and mobile devices can be used for both good and bad intentions. The standards that determine whether an action is good or bad are known as ethics.

Technology ethics are the moral guidelines that govern the use of computers, mobile devices, information systems, and related technologies. Frequently discussed areas of computer ethics are unauthorized use of computers, mobile devices, and networks; software theft (piracy); information accuracy; intellectual property rights; codes of conduct; green computing; and information privacy. The questionnaire in Figure 5-19 raises issues in each of these areas.

Previous sections in this chapter discussed unauthorized use of computers, mobile devices and networks, and software theft (piracy). The following sections discuss issues related to information accuracy, intellectual property rights, codes of conduct, green computing, and information privacy.

Your Thoughts?

	Ethical	Unethical
1. An organization requires employees to wear badges that track their whereabouts while at work.	<input type="checkbox"/>	<input type="checkbox"/>
2. A supervisor reads an employee's email message.	<input type="checkbox"/>	<input type="checkbox"/>
3. An employee uses his computer at work to send email messages to a friend.	<input type="checkbox"/>	<input type="checkbox"/>
4. An employee sends an email message to several coworkers and blind copies his supervisor.	<input type="checkbox"/>	<input type="checkbox"/>
5. An employee forwards an email message to a third party without permission from the sender.	<input type="checkbox"/>	<input type="checkbox"/>
6. An employee uses her computer at work to complete a homework assignment for school.	<input type="checkbox"/>	<input type="checkbox"/>
7. The vice president of your Student Government Association (SGA) downloads a photo from the web and uses it in a flyer recruiting SGA members.	<input type="checkbox"/>	<input type="checkbox"/>
8. A student copies text from the web and uses it in a research paper for his English Composition class.	<input type="checkbox"/>	<input type="checkbox"/>
9. An employee sends political campaign material to individuals on her employer's mailing list.	<input type="checkbox"/>	<input type="checkbox"/>
10. As an employee in the registration office, you have access to student grades. You look up grades for your friends, so that they do not have to wait for grades to be posted online.	<input type="checkbox"/>	<input type="checkbox"/>
11. An employee makes a copy of software and installs it on her home computer. No one uses her home computer while she is at work, and she uses her home computer only to finish projects from work.	<input type="checkbox"/>	<input type="checkbox"/>
12. An employee who has been laid off installs a computer virus on his employer's computer.	<input type="checkbox"/>	<input type="checkbox"/>
13. A person designing a webpage finds one on the web similar to his requirements, copies it, modifies it, and publishes it as his own webpage.	<input type="checkbox"/>	<input type="checkbox"/>
14. A student researches using only the web to write a report.	<input type="checkbox"/>	<input type="checkbox"/>
15. In a society in which all transactions occur online (a cashless society), the government tracks every transaction you make and automatically deducts taxes from your bank account.	<input type="checkbox"/>	<input type="checkbox"/>
16. Someone copies a well-known novel to the web and encourages others to read it.	<input type="checkbox"/>	<input type="checkbox"/>
17. A person accesses an organization's network and reports to the organization any vulnerabilities discovered.	<input type="checkbox"/>	<input type="checkbox"/>
18. Your friend uses a neighbor's wireless network to connect to the Internet and check email.	<input type="checkbox"/>	<input type="checkbox"/>
19. A company uses recycled paper to print a 50-page employee benefits manual that is distributed to 425 employees.	<input type="checkbox"/>	<input type="checkbox"/>
20. An employee is fired based on the content of posts on his or her online social network.	<input type="checkbox"/>	<input type="checkbox"/>

Figure 5-19 Indicate whether you think the situation described is ethical or unethical. Be prepared to discuss your answers.

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Information Accuracy

Information accuracy is a concern today because many users access information maintained by other people or companies, such as on the Internet. Do not assume that because the information is on the web that it is correct. As discussed in Chapter 2, users should evaluate the value of a webpage before relying on its content. Be aware that the organization providing access to the information may not be the creator of the information. Read Secure IT 5-4 to consider the risks associated with inaccurate data.

SECURE IT 5-4



Risks Associated with Inaccurate Data

Mapping and navigation software is invaluable for locating unfamiliar destinations. Problems arise, however, when satellite images are outdated or when the desired address cannot be found on a map. Inaccurate data can result in lost revenues for businesses when potential customers cannot find the storefront. It also has caused accidents when drivers followed turn-by-turn GPS directions and drove the wrong way on one-way streets, made illegal turns, or ended at ponds where a road stopped.

Business owners can report incorrect address data to some mapping services. They can, for example, state that the satellite image needs updating, their address has changed, the directions are incorrect, or the street names are inaccurate. In some cases,

the maps and addresses are updated quickly, often within a day.

Data entry errors also can lead to lost business, lawsuits, and expenses. In an extreme example, a \$125 million Mars Climate Orbiter spacecraft was lost in space because Lockheed Martin engineers performed calculations using English units (pounds) to fire the thrusters guiding the spacecraft, but NASA engineers assumed the data was in metric units (Newtons) and sent the spacecraft 60 miles off course. In another unit conversion error, an axle broke on a Space Mountain roller coaster car at Tokyo Disneyland because it was the wrong size; the error occurred when engineers performed calculations to convert the original Space Mountain master plan from English units to metric units.

In the business world, mistakes can occur when software has not been updated or when employees are overworked, distracted, or faced with repetitive tasks. Software should have safeguards to verify valid data has been entered, such as checking that phone numbers have 10 numeric characters. Data cleaning software can eliminate duplicate database records, locate missing data, and correct discrepancies.

Consider This: Have you ever used a mapping app or website and encountered incorrect information? Would you consider notifying mapping companies of errors in their satellite images or directions? What steps can companies take to help employees enter data accurately?



Figure 5-20 This digitally edited photo shows a fruit that looks like an apple on the outside and an orange on the inside.

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In addition to concerns about the accuracy of computer input, some individuals and organizations raise questions about the ethics of using computers to alter output, primarily graphic output, such as a retouched photo. With graphics equipment and software, users easily can digitize photos and then add, change (Figure 5-20), or remove images.

Intellectual Property Rights

Intellectual property (IP) refers to unique and original works, such as ideas, inventions, art, writings, processes, company and product names, and logos. *Intellectual property rights* are the rights to which creators are entitled for their work. Certain issues arise surrounding IP today because many of these works are available digitally and easily can be redistributed or altered without the creator's permission.

A *copyright* gives authors, artists, and other creators of original work exclusive rights to duplicate, publish, and sell their materials. A copyright protects any tangible form of expression.

A common infringement of copyright is piracy, where people illegally copy software, movies, and music. Many areas are not clear-cut with respect to the law, because copyright law gives the public fair use to copyrighted material. The issues surround the phrase, fair use, which allows use for educational and critical purposes. This vague definition is subject to widespread interpretation and raises many questions:

- Should individuals be able to download contents of your website, modify it, and then put it on the web again as their own?
- Should a faculty member have the right to print material from the web and distribute it to all members of the class for teaching purposes only?
- Should someone be able to scan photos or pages from a book, publish them on the web, and allow others to download them?
- Should someone be able to put the lyrics of a song on the web?
- Should students be able to take term papers they have written and post them on the web, making it tempting for other students to download and submit them as their own work?

These issues with copyright law led to the development of *digital rights management (DRM)*, a strategy designed to prevent illegal distribution of movies, music, and other digital content.



Internet Research

What is meant by fair use?

Search for: fair use definition



Internet Research

What is creative commons?

Search for: creative commons

Codes of Conduct

A **code of conduct** is a written guideline that helps determine whether a specification is ethical/unethical or allowed/not allowed. An IT code of conduct focuses on acceptable use of technology. Employers and schools often specify standards for the ethical use of technology in an IT code of conduct and then distribute these standards to employees and students (Figure 5-21). You also may find codes of conduct online that define acceptable forms of communications for websites where users post commentary or other communications, such as blogs, wikis, online discussions, and so on.

Sample IT Code of Conduct

1. Technology may not be used to harm other people.
2. Employees may not meddle in others' files.
3. Employees may use technology only for purposes in which they have been authorized.
4. Technology may not be used to steal.
5. Technology may not be used to bear false witness.
6. Employees may not copy or use software illegally.
7. Employees may not use others' technology resources without authorization.
8. Employees may not use others' intellectual property as their own.
9. Employees shall consider the social impact of programs and systems they design.
10. Employees always should use technology in a way that demonstrates consideration and respect for fellow humans.

Figure 5-21 Sample IT code of conduct employers may distribute to employees.
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Green Computing

People use, and often waste, resources such as electricity and paper while using technology. Recall from Chapter 1 that **green computing** involves reducing the electricity and environmental waste while using computers, mobile devices, and related technologies. Figure 5-22 summarizes measures users can take to contribute to green computing.

Personal computers, displays, printers, and other devices should comply with guidelines of the ENERGY STAR program. The United States Department of Energy (DOE) and the United States Environmental Protection Agency (EPA) developed the *ENERGY STAR program* to help reduce the amount of electricity used by computers and related devices. This program encourages manufacturers to create energy-efficient devices. For example, many devices switch to sleep or power save mode after a specified number of inactive minutes or hours. Computers and devices that meet the ENERGY STAR guidelines display an ENERGY STAR label (shown in Figure 5-22).

Enterprise data centers and computer facilities consume large amounts of electricity from computer hardware and associated devices and utilities, such as air conditioning, coolers, lighting, etc. Organizations can implement a variety of measures to reduce electrical waste:

- Consolidate servers by using virtualization.
- Purchase high-efficiency equipment.
- Use sleep modes and other power management features for computers and devices.
- Buy computers and devices with low power consumption processors and power supplies.
- When possible, use outside air to cool the data center or computer facility.

Some organizations continually review their *power usage effectiveness (PUE)*, which is a ratio that measures how much power enters the computer facility or data center against the amount of power required to run the computers and devices.

Green Computing Tips

1. **Conserve Energy**
 - a. Use computers and devices that comply with the ENERGY STAR program.
 - b. Do not leave a computer or device running overnight.
 - c. Turn off the monitor, printer, and other devices when not in use.
2. **Reduce Environmental Waste**
 - a. Use paperless methods to communicate.
 - b. Recycle paper and buy recycled paper.
 - c. Recycle toner and ink cartridges, computers, mobile devices, printers, and other devices.
 - d. Telecommute.
 - e. Use videoconferencing and VoIP for meetings.



Figure 5-22 A list of suggestions to make computing healthy for the environment.

US Environmental Protection Agency, ENERGY STAR program; © Roman Sotola / Shutterstock.com; © Cengage Learning



Internet Research

Where can I recycle outdated electronics?

Search for: recycle old electronics

**CONSIDER THIS****Should you save out-of-date computers and devices?**

Users should not store obsolete computers and devices in their basement, storage room, attic, warehouse, or any other location. Computers, monitors, and other equipment contain toxic materials and potentially dangerous elements including lead, mercury, and flame retardants. In a landfill, these materials release into the environment. Recycling and refurbishing old equipment are much safer alternatives for the environment. Manufacturers can use the millions of pounds of recycled raw materials to make products such as outdoor furniture and automotive parts. Before recycling, refurbishing, or discarding your old computer, be sure to erase, remove, or destroy its hard drive so that the information it stored remains private.

Discover More: Visit this chapter's free resources to learn more about the ENERGY STAR program.

How to Safeguard Personal Information

1. Fill in only necessary information on rebate, warranty, and registration forms.
2. Do not preprint your phone number or Social Security number on personal checks.
3. Have an unlisted or unpublished phone number.
4. If you have Caller ID, find out how to block your number from displaying on the receiver's system.
5. Do not write your phone number on charge or credit receipts.
6. Ask merchants not to write credit card numbers, phone numbers, Social Security numbers, and driver's license numbers on the back of your personal checks.
7. Purchase goods with cash, rather than credit or checks.
8. Avoid shopping club and buyer cards.
9. If merchants ask personal questions, find out why they want to know before releasing the information.
10. Inform merchants that you do not want them to distribute your personal information.
11. Request, in writing, to be removed from mailing lists.
12. Obtain your credit report once a year from each of the three major credit reporting agencies (Equifax, Experian, and TransUnion) and correct any errors.
13. Request a free copy of your medical records once a year from the Medical Information Bureau.
14. Limit the amount of information you provide to websites. Fill in only required information.
15. Install a cookie manager to filter cookies.
16. Clear your history file when you are finished browsing.
17. Set up a free email account. Use this email address for merchant forms.
18. Turn off file and printer sharing on your Internet connection.
19. Install a personal firewall.
20. Sign up for email filtering through your ISP or use an anti-spam program.
21. Do not reply to spam for any reason.
22. Surf the web anonymously or through an anonymous website.

Information Privacy

Information privacy refers to the right of individuals and companies to deny or restrict the collection, use, and dissemination of information about them. Organizations often use huge databases to store records, such as employee records, medical records, financial records, and more. Much of the data is personal and confidential and should be accessible only to authorized users. Many individuals and organizations, however, question whether this data really is private. That is, some companies and individuals collect and use this information without your authorization. Websites often collect data about you, so that they can customize advertisements and send you personalized email messages. Some employers monitor your computer usage and email messages.

Figure 5-23 lists measures you can take to make your personal data more private. The following sections address techniques companies and employers use to collect your personal data.

Discover More: Visit this chapter's free resources to learn more about your credit report.

Electronic Profiles

When you fill out a printed form, such as a magazine subscription or contest entry, or an online form to sign up for a service, create a profile on an online social network, or register a product warranty, the merchant that receives the form usually stores the information you provide in a database. Likewise, every time you tap or click an advertisement on the web or perform a search online, your information and preferences enter a database. Some merchants may sell or share the contents of their databases with national marketing firms and Internet advertising firms. By combining this data with information from public records, such as driver's licenses and vehicle registrations, these firms can create an electronic profile of individuals. Electronic profiles may

Figure 5-23 Techniques to keep personal data private.

© iStockphoto / Norebbo; © Cengage Learning

include personal details, such as your age, address, phone number, marital status, number and ages of dependents, interests, and spending habits.

Direct marketing supporters claim that using information in this way lowers overall selling costs, which lowers product prices. Critics contend that the information in an electronic profile reveals more about an individual than anyone has a right to know. They argue that companies should inform people if they plan to provide personal information to others, and people should have the right to deny such use. Many websites allow people to specify whether they want their personal information shared or preferences retained (Figure 5-24).

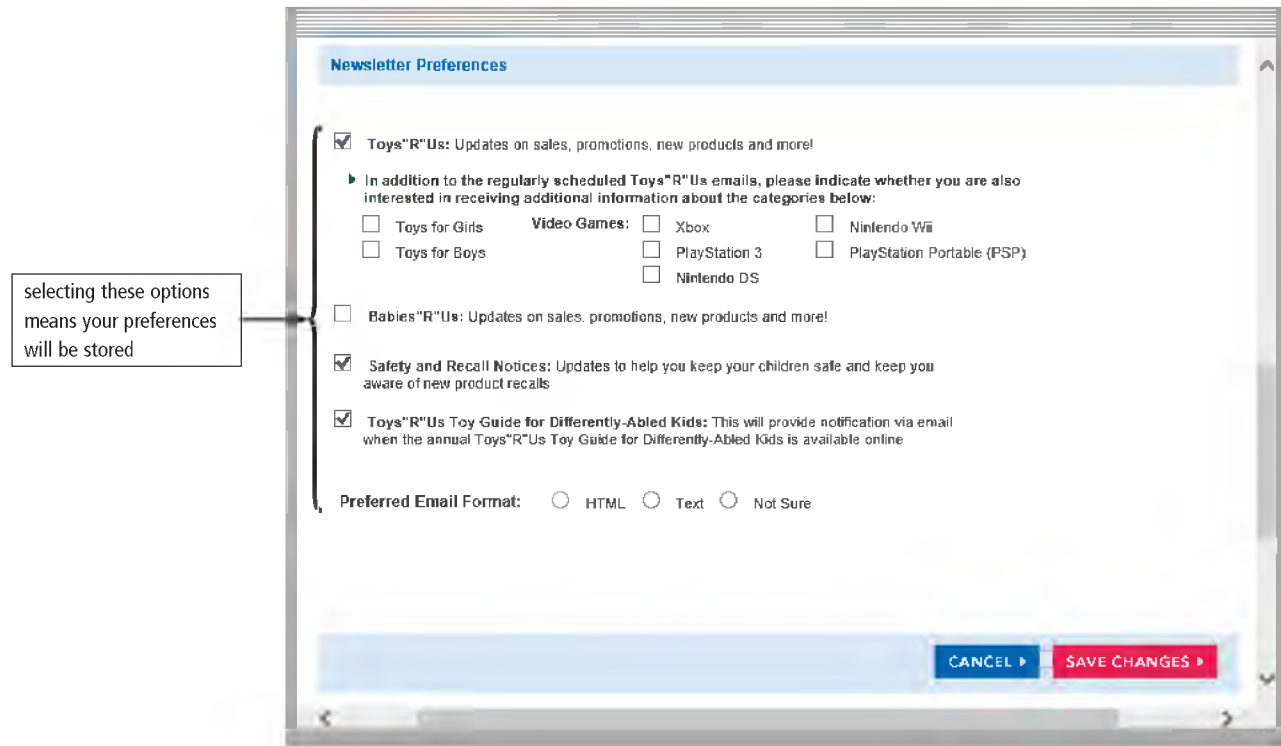


Figure 5-24 Many companies, such as Toys“R”Us shown here, allow users to specify whether they want the company to retain their preferences.

Source: Geoffrey, LLC

Cookies

A **cookie** is a small text file that a web server stores on your computer. Cookie files typically contain data about you, such as your user name, postal code, or viewing preferences. Websites use cookies for a variety of purposes:

- Most websites that allow for personalization use cookies to track user preferences. These cookies may obtain their values when a user fills in an online form requesting personal information. Some websites, for example, store user names in cookies in order to display a personalized greeting that welcomes the user, by name, back to the website. Other websites allow users to customize their viewing experience with preferences, such as local news headlines, the local weather forecast, or stock quotes.
- Some websites use cookies to store user names and/or passwords, so that users do not need to enter this information every time they sign in to the website.
- Online shopping sites generally use a *session cookie* to keep track of items in a user’s shopping cart. This way, users can start an order during one web session and finish it on another day in another session. Session cookies usually expire after a certain time, such as a week or a month.

- Some websites use cookies to track how often users visit a site and the webpages they visit while at the website.
- Websites may use cookies to target advertisements. These websites store a user's interests and browsing habits in the cookie.

 **CONSIDER THIS**

Do websites ever sell information stored in cookies?

Some websites sell or trade information stored in your cookies to advertisers — a practice many believe to be unethical. If you do not want personal information distributed, you should limit the amount of information you provide to a website or adjust how your browser handles cookies. You can regularly clear cookies or set your browser to accept cookies automatically, prompt if you want to accept a cookie, or disable all cookie use. Keep in mind if you disable cookie use, you may not be able to use some e-commerce websites. As an alternative, you can purchase software that selectively blocks cookies.

Many commercial websites send a cookie to your browser; your computer's hard drive then stores the cookie. The next time you visit the website, your browser retrieves the cookie from your hard drive and sends the data in the cookie to the website. Figure 5-25 illustrates how websites work with cookies. A website can read data only from its own cookie file stored on your hard drive. That is, it cannot access or view any other data on your hard drive — including another cookie file.

How Cookies Work

Step 1

When you enter the address of a website in a browser, the browser searches your hard drive for a cookie associated with the website.


Step 2

If the browser finds a cookie, it sends information in the cookie file to the website.

Step 3

If the website does not receive cookie information, and is expecting it, the website creates an identification number for you in its database and sends that number to your browser. The browser in turn creates a cookie file based on that number and stores the cookie file on your hard drive. The website now can update information in the cookie file whenever you access the website.



 **Figure 5-25** This figure shows how cookies work.
 © Alex Staroseltsev / Shutterstock.com; Source: Omaha Steaks International, Inc; © iStockphoto / Norman Chan; © Cengage Learning

Phishing

Recall from Chapter 4 that **phishing** is a scam in which a perpetrator sends an official looking email message that attempts to obtain your personal and/or financial information. These messages look legitimate and request that you update credit card numbers, Social Security numbers, bank account numbers, passwords, or other private information. Read How To 5-4 for instructions about protecting yourself from phishing scams.

HOW TO 5-4

Protect against a Phishing Scam

Phishing scams can be perpetrated via email messages, websites, and even on the phone. The following guidelines will help protect you against a phishing scam.

Phone Scams


- If you receive a phone call from someone claiming to be from a company with which you do business, record his or her name and the time of the call. Do not disclose personal or financial information to the caller. If the caller is offering a product or service and is requesting a payment, call the company back at the number you have on file, and ask to be transferred to the person who called you initially.
- Whenever possible, enter your payment information on secure websites instead of reading credit card numbers or bank account information on the phone. You never know whether the caller is recording your payment information to use later for malicious purposes.

Email Scams

- If you receive an email message from someone requesting you to verify online account or financial information, do not reply with this information.
- Never tap or click links in email messages, even if the message appears to be from someone you know. Nor should you copy and paste the link from the email message to a browser. Instead, type the link's web address into a browser's address bar manually, and make sure you type it correctly. If you are visiting your financial institution's website, make sure the web address you enter matches the web address you have on file for them.
- Do not reply to email messages asking you for financial assistance — even if the email message appears to originate from someone you know. If you receive this type of email message from someone you know, call the person to verify the message's authenticity.

Website Scams

- When visiting a website, such as your financial institution's website, that will require you to enter confidential information, be sure to type the web address correctly. Typing it incorrectly may take you to a phishing website where the information you enter can be collected by an unknown party.
- Make sure websites requiring your confidential information use the https://protocol.
- Websites with misspellings, poor grammar, or formatting problems may indicate a phishing website. Do not enter personal or financial information on a website that looks suspicious.
- Enable the *phishing filter* in your browser that can warn or block you from potentially fraudulent or suspicious websites.

 **Consider This:** Have you experienced a phishing scam? If so, how did it attempt to trick you into providing personal or financial information? How did you respond?

Clickjacking is yet another similar scam. With *clickjacking*, an object that can be tapped or clicked — such as a button, image, or link — on a website, pop-up ad, pop-under ad, or in an email message or text message contains a malicious program. When a user taps or clicks the disguised object, a variety of nefarious events may occur. For example, the user may be redirected to a phony website that requests personal information, or a virus may download to the computer or mobile device. Browsers typically include clickjacking protection.

Spyware and Adware

Recall from Chapter 4 that **spyware** is a program placed on a computer or mobile device without the user's knowledge that secretly collects information about the user and then communicates the information it collects to some outside source while the user is online. Some vendors or employers use spyware to collect information about program usage or employees. Internet advertising firms often collect information about users' web browsing habits. Spyware can enter your computer when you install a new program, through malware, or through a graphic on a webpage or in an email message.

Adware is a program that displays an online advertisement in a banner, a pop-up window, or pop-under window on webpages, email messages, or other Internet services. Adware on mobile phones is known as *malware*, for mobile adware. Sometimes, spyware is hidden in adware.

To remove spyware and adware, you can obtain spyware removers, adware removers, or malware removers that can detect and delete spyware and adware. Some operating systems and browsers include spyware and adware removers.

Social Engineering

As related to the use of technology, **social engineering** is defined as gaining unauthorized access to or obtaining confidential information by taking advantage of the trusting human nature of some victims and the naivety of others. Some social engineers trick their victims into revealing confidential information, such as user names and passwords, on the phone, in person, or on the Internet. Techniques they use include pretending to be an administrator or other

Internet Research

Which phishing scams are prevalent?

Search for: recent phishing scams

authoritative figure, feigning an emergency situation, or impersonating an acquaintance. Social engineers also obtain information from users who do not destroy or conceal information properly. These perpetrators sift through company dumpsters, watch or film people dialing phone numbers or using ATMs, and snoop around computers or mobile devices looking for openly displayed confidential information.

To protect yourself from social engineering scams, follow these tips:

- Verify the identity of any person or organization requesting personal or confidential information.
- When relaying personal or confidential information, ensure that only authorized people can hear your conversation.
- When personal or confidential information appears on a computer or mobile device, ensure that only authorized people can see your screen.
- Shred all sensitive or confidential documents.
- After using a public computer, clear the cache in its browser.
- Avoid using public computers to conduct banking or other sensitive transactions.

Privacy Laws

The concern about privacy has led to the enactment of federal and state laws regarding the storage and disclosure of personal data, some of which are shown in Table 5-3. Common points in some of these laws are as follows:

1. Information collected and stored about individuals should be limited to what is necessary to carry out the function of the business or government agency collecting the data.
2. Once collected, provisions should be made to protect the data so that only those employees within the organization who need access to it to perform their job duties have access to it.
3. Personal information should be released outside the organization collecting the data only when the person has agreed to its disclosure.
4. When information is collected about an individual, the individual should know that the data is being collected and have the opportunity to determine the accuracy of the data.

Read Ethics & Issues 5-3 to consider the legal issues surrounding your digital footprint.

Table 5-3 Major U.S. Government Laws Concerning Privacy

Law	Purpose
Children’s Internet Protection Act	Protects minors from inappropriate content when accessing the Internet in schools and libraries
Children’s Online Privacy Protection Act (COPPA) Computer Abuse Amendments Act	Requires websites to protect personal information of children under 13 years of age Outlaws transmission of harmful computer code such as viruses
Digital Millennium Copyright Act (DMCA)	Makes it illegal to circumvent antipiracy schemes in commercial software; outlaws sale of devices that copy software illegally
Electronic Communications Privacy Act (ECPA)	Provides the same right of privacy protection of the postal delivery service and phone companies to various forms of electronic communications, such as voice mail, email, and mobile phones
Financial Modernization Act	Protects consumers from disclosure of their personal financial information and requires institutions to alert customers of information disclosure policies
Freedom of Information Act (FOIA)	Enables public access to most government records
HIPAA (Health Insurance Portability and Accountability Act)	Protects individuals against the wrongful disclosure of their health information
PATRIOT (Provide Appropriate Tools Required to Intercept and Obstruct Terrorism)	Gives law enforcement the right to monitor people’s activities, including web and email habits
Privacy Act	Forbids federal agencies from allowing information to be used for a reason other than that for which it was collected

Discover More: Visit this chapter’s free resources to learn about more privacy laws.

 ETHICS & ISSUES 5-3**Do You Have the Right to Be Digitally Forgotten?**

Privacy experts, such as The Institute for Responsible Online and Cell-Phone Communication (IROC2), warn that “Your digital activity is public and permanent” and is available permanently to anyone using a search engine. Does it have to be? Do you have a “right to be forgotten” as was ruled by a court in the European Union recently?

In this case, the court ordered a popular search engine to remove links to information that was “inadequate, irrelevant, or no longer relevant.” The content in question included many factual articles published by a major news source. Examples included stories about a university student arrested for driving while intoxicated and a referee who

lied about a mistake. Free speech advocates criticize the law. They state that a government should not be able to deny access to accurate information. Others argue that a person should be able to request removal of information that is damaging to his or her reputation. Some are concerned that negative incidents may be necessary information for an employer to know about a job seeker, or for those considering a relationship with another person. You can never truly delete your digital footprint because everything you do online has the potential to be forwarded, captured as a screenshot, or archived in databases.

Among the debated issues is whether the rights of a private citizen should differ from those of a public figure. Many argue that different rules apply for celebrities, politicians,

and others who choose such professions. Some feel that the responsibility rests on search engines to provide methods that enable individuals to comment on, explain, or select what information is displayed when they are the subject of an Internet search. For example, Google developed the Google Inactive Account Manager, where you can specify what happens to your data after a period of inactivity.

Consider This: Does a government have a right to legislate search engine links? Why or why not? In what, if any, situations should individuals be able to request removal of digital content? Should search engines provide users with tools to control what information about them appears? Why or why not?

Employee Monitoring

Employee monitoring involves the use of computers, mobile devices, or cameras to observe, record, and review an employee’s use of a technology, including communications such as email messages, keyboard activity (used to measure productivity), and websites visited. Many programs exist that easily allow employers to monitor employees. Further, it is legal for employers to use these programs.

 **CONSIDER THIS****Do employers have the right to read employee email messages?**

Actual policies vary widely. Some organizations declare that they will review email messages regularly, and others state that email messages are private. In some states, if a company does not have a formal email policy, it can read email messages without employee notification.

Content Filtering

One of the more controversial issues that surround the Internet is its widespread availability of objectionable material, such as prejudiced literature, violence, and obscene photos. Some believe that such materials should be banned. Others believe that the materials should be filtered, that is, restricted.

Content filtering is the process of restricting access to certain material. Many businesses use content filtering to limit employees’ web access. These businesses argue that employees are unproductive when visiting inappropriate or objectionable websites. Some schools, libraries, and parents use content filtering to restrict access to minors. Content filtering opponents argue that banning any materials violates constitutional guarantees of free speech and personal rights. Read Ethics & Issues 5-4 to consider whether content filtering violates first amendment rights.

ETHICS & ISSUES 5-4

Does Content Filtering in a Public Library Violate First Amendment Rights?

Among the resources libraries offer are Internet-enabled computers. The use of content filtering software on library computers controls the type of information a patron can access. Free speech advocates argue that this violates the First Amendment because it restricts library patrons from viewing certain websites and content.

The Children's Internet Protection Act (CIPA) requires that schools and libraries use content filtering software in order to receive certain federal funds. The purpose of CIPA is to restrict access to objectionable material, protect children when communicating online,

prohibit children from sharing personal information, and restrict children's identities or accounts being hacked. Proponents of CIPA claim it is necessary to protect children. CIPA does allow libraries to turn off the filters, if an adult patron requests it. Some libraries use content filtering software on computers used only by children.

Critics of content filtering software argue that the programs do not always work as intended. They can overfilter content, blocking information or education websites based on a single word. Some websites and services that filtering software may block include online social networks, or software platforms, such as Google Drive, which students may need to access to submit assignments.

Conversely, they can underfilter content, which could result in access to webpages with inappropriate media. Others argue that it gives unequal access to students doing research who rely on library computers to do schoolwork and those who have unfiltered Internet access at home.

Libraries typically have a policy stating acceptable use of the Internet. Libraries' policies also should state whether they use content filtering software, so that the patrons are aware.

Consider This: Is it fair for a government to require that libraries use content filtering software? Why or why not? Do free speech laws cover content on the Internet? Why or why not?

Web filtering software is a program that restricts access to specified websites. Some also filter sites that use specific words (Figure 5-26). Others allow you to filter email messages, chat rooms, and programs. Many Internet security programs include a firewall, antivirus program, and filtering capabilities combined. Browsers also often include content filtering capabilities.

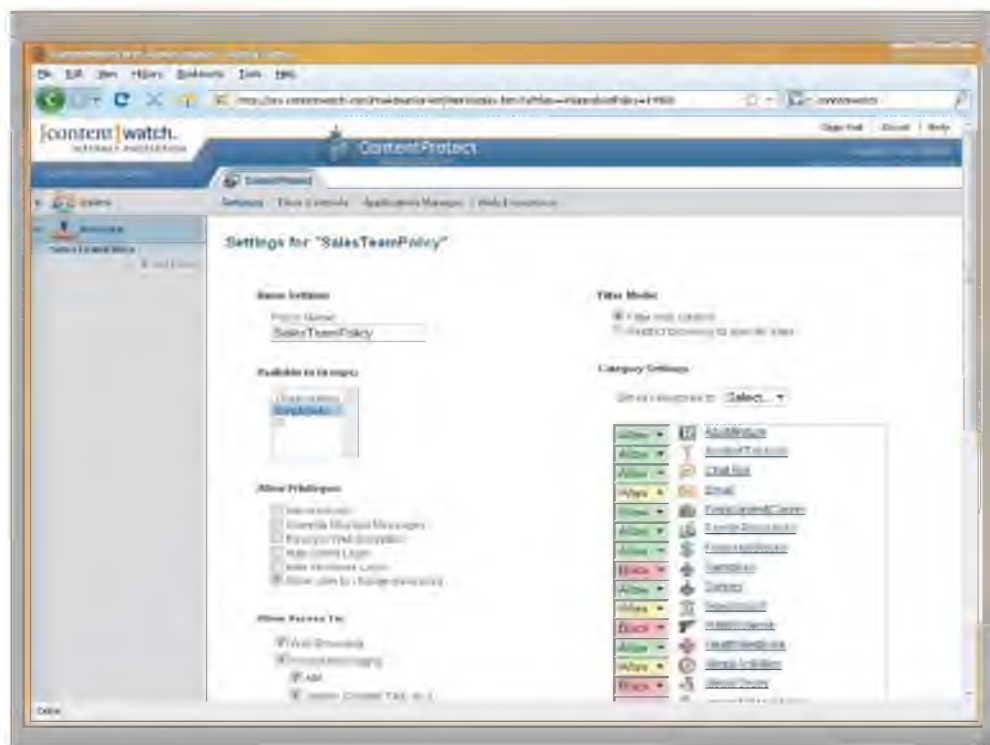


Figure 5-26 Web filtering software restricts access to specified websites.

Courtesy of ContentWatch, Inc.

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Ethics and Society and Information Privacy as it relates to the chapter objectives.

Now you should know ...


- What issues you might encounter with respect to information accuracy, intellectual property, codes of conduct, and green computing (Objective 9)
- How you can make your personal data more private (Objective 10)
- Why your computer might have a cookie (Objective 10)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter presented a variety of digital security risks. You learned about cybercrime and cybercriminals. The chapter discussed risks and safeguards associated with Internet and network attacks, unauthorized access and use, software theft, information theft, and hardware theft, vandalism, and failure. It presented various backup strategies and methods of securing wireless communications. You learned about ethical issues in society and various ways to protect the privacy of personal information.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: AVG, Intel Security, Symantec, and LoJack; Technology Trends: Uses of Face Recognition Technology and Cloud Security; and High-Tech Talks: Digital Forensics and Encryption Algorithms.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

National and Local Security

Since 2001, the federal government, local governments, businesses, and individuals have been implementing aggressive new security measures because of the increase in terrorist activity. A security threat can exist anywhere, and it is nearly impossible for humans alone to protect the country. As a result, technology now assists governments, law enforcement officials, business owners, and other individuals with monitoring and maintaining security.

Advancements in computer vision enable computers to monitor indoor and outdoor areas that might be subject to a high volume of criminal activity. For example, some cities are installing cameras in problematic areas. A program analyzes the output from the camera and can determine whether two or more people in close proximity to one another might be engaged in a physical confrontation. If the computer detects suspicious behavior, it automatically notifies local law enforcement.

Computers also use facial recognition to identify individuals who do not belong in a

particular area. For example, one theme park takes a picture of individuals they escort out of and ban from the park. As visitors walk from their cars to the park, surveillance cameras positioned in strategic locations scan visitors' faces and compare them with the database containing images of those who are banned from the park. If the computer finds a match, it alerts a security officer who then can investigate the situation. Thousands of people visit theme parks each day, and computers make it easier to perform the otherwise impossible task of identifying those who might be trespassing.

The federal government, particularly the Department of Homeland Security, uses a computerized No Fly List to track individuals who are not authorized to travel on commercial flights within the United States. When an individual makes a reservation, a computer compares his or her

name to the names on the No Fly List. If the computer finds a match, the individual must prove that he or she is not the person on the list before being allowed to board an aircraft.

Whether you are walking outside, visiting an attraction, or traveling, the chances are good that computers are, in some way, ensuring your safety.

-  **Consider This:** In what other ways do computers and technology play a role in national and local security?



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Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to **test your knowledge of digital content** associated with this chapter and **access the Study Guide resource** from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- Define the terms, digital security risk, computer crime, cybercrime, and crimeware.
- Differentiate among hackers, crackers, script kiddies, cyberextortionists, and cyberterrorists. Identify issues with punishing cybercriminals.
- List common types of malware. A(n) ____ is the destructive event or prank malware delivers.
- Identify risks and safety measures when gaming.
- Define these terms: botnet, zombie, and bot.
- Describe the damages caused by and possible motivations behind DoS and DDoS attacks.
- A(n) ____ allows users to bypass security controls when accessing a program, computer, or network.
- Define the term, spoofing. How can you tell if an email is spoofed?
- List ways to protect against Internet and network attacks.
- Describe the purpose of an online security service.
- Define the terms, firewall and proxy server. List steps to set up a personal firewall.
- Give examples of unauthorized access and use of a computer or network.
- Identify what an AUP should specify. Why might you disable file and printer sharing?
- Explain how an organization uses access controls and audit trails.
- Differentiate among user names, passwords, passphrases, and pass codes.
- List tips for using a password manager safely.
- What is a single sign on account? PIN stands for ____.
- Describe the purpose of a CAPTCHA.
- Define the terms, possessed objects and biometric devices.
- What is the purpose of a lock screen?
- Describe how companies use the following recognition, verification, or payment systems: fingerprint, face, hand, voice, signature, and iris. List disadvantages of biometric devices.
- Explain the two-step verification process.
- Define the term, digital forensics. Name areas in which digital forensics are used.
- Define the terms, software theft, keygen, and software piracy. Identify methods to prevent software theft.
- Explain the process of product activation.
- Describe the following license agreement types: single- or end-user, network, and site. List conditions provided in a license agreement.
- Give examples of information theft. How can you protect yourself from information theft?
- Describe the functions of an encryption algorithm and an encryption key. Differentiate between private and public key encryption.
- Unencrypted data is called ____; encrypted data is called ____.
- Describe the purpose of a VPN.
- Define these terms: digital signature, digital certificate, and secure site.
- List concerns and responsibilities regarding cloud data storage and privacy.
- Describe what occurs during hardware theft or vandalism.
- Define the terms, backup and restore.
- List six types of backups. Describe the three-generation backup policy.
- Identify the components of a disaster recovery plan.
- Describe security risks associated with wireless access. Identify ways to secure your wireless network.
- List guidelines to protect your mobile device data.
- Describe technology ethics, information accuracy, intellectual property rights, copyrights, and codes of conduct.
- Describe issues surrounding inaccurate data.
- List measures users can take to contribute to green computing.
- Explain how companies, websites, and employers might infringe on your right to information privacy.
- Describe how the following techniques are used to collect personal data: electronic profiles, cookies, phishing, clickjacking, spyware, adware, and malware.
- How can you protect against phishing scams?
- Identify methods to protect yourself from social engineering scams.
- List examples of privacy laws. Should you be able to remove personal information from the Internet? Why or why not?
- Describe what a company might track when monitoring employees.
- Define and identify issues surrounding content and web filtering.
- Describe uses of technology in the national and local security industry.

You should be able to define the Primary Terms and be familiar with the Secondary Terms listed below.

Key Terms

Discover More: Visit this chapter's premium content to **view definitions** for each term and to access the Flash Cards **resource** from your smartphone, tablet, laptop, or desktop.

Primary Terms (shown in bold-black characters in the chapter)

adware (244)	decrypt (229)	green computing (241)	restore (233)
back door (217)	denial of service attack (DoS attack) (217)	hacker (214)	script kiddie (214)
back up (233)	digital certificate (231)	information privacy (242)	secure site (231)
backup (233)	digital forensics (227)	information theft (229)	social engineering (245)
biometric device (224)	digital security risk (212)	license agreement (228)	software piracy (228)
botnet (216)	digital signature (231)	malware (215)	software theft (228)
code of conduct (241)	disaster recovery plan (234)	online security service (219)	spoofing (217)
computer crime (212)	employee monitoring (247)	password (222)	spyware (215)
content filtering (247)	encryption (229)	personal firewall (220)	technology ethics (238)
cookie (243)	fingerprint reader (224)	phishing (244)	two-step verification (226)
cracker (214)	firewall (219)	PIN (223)	user name (242)
cybercrime (212)		piracy (228)	web filtering software (248)
cyberextortionist (214)		product activation (228)	zombie (216)
cyberterrorist (214)			

Secondary Terms (shown in *italic* characters in the chapter)

<i>acceptable use policy (AUP) (231)</i>	<i>differential backup (234)</i>	<i>network license (229)</i>	<i>SSID (236)</i>
<i>access control (222)</i>	<i>digital rights management (240)</i>	<i>off-site (233)</i>	<i>symmetric key encryption (230)</i>
<i>adware (215)</i>	<i>distributed DoS attack (DDoS attack) (217)</i>	<i>parent (234)</i>	<i>trojan horse (215)</i>
<i>asymmetric key encryption (230)</i>	<i>email spoofing (217)</i>	<i>passcode (223)</i>	<i>two-factor verification (226)</i>
<i>audit trail (222)</i>	<i>encryption algorithm (230)</i>	<i>passphrase (223)</i>	<i>unauthorized access (221)</i>
<i>biometric payment (226)</i>	<i>encryption key (230)</i>	<i>password manager (223)</i>	<i>unauthorized use (221)</i>
<i>bot (216)</i>	<i>end-user license agreement (EULA) (228)</i>	<i>password organizer (223)</i>	<i>user ID (222)</i>
<i>Business Software Alliance (BSA) (228)</i>	<i>ENERGY STAR program (241)</i>	<i>payload (215)</i>	<i>virtual private network (VPN) (230)</i>
<i>CAPTCHA (224)</i>	<i>face recognition system (225)</i>	<i>phishing filter (244)</i>	<i>virus (215)</i>
<i>CERT/CC (219)</i>	<i>full backup (234)</i>	<i>plaintext (230)</i>	<i>voice verification system (225)</i>
<i>certificate authority (CA) (231)</i>	<i>grandparent (234)</i>	<i>power usage effectiveness (PUE) (241)</i>	<i>worm (215)</i>
<i>child (234)</i>	<i>hactivist (214)</i>	<i>private key encryption (230)</i>	<i>zombie army (216)</i>
<i>ciphertext (230)</i>	<i>hand geometry system (225)</i>	<i>proxy server (219)</i>	
<i>clickjacking (245)</i>	<i>incremental backup (234)</i>	<i>public key encryption (230)</i>	
<i>cloud backup (234)</i>	<i>intellectual property (IP) (240)</i>	<i>rootkit (215)</i>	
<i>Computer Emergency Response Team Coordination Center (219)</i>	<i>intellectual property rights (240)</i>	<i>selective backup (234)</i>	
<i>continuous data protection (CDP) (234)</i>	<i>IP spoofing (217)</i>	<i>session cookie (243)</i>	
<i>copyright (240)</i>	<i>keygen (228)</i>	<i>signature verification system (225)</i>	
<i>crimeware (212)</i>	<i>lock screen (225)</i>	<i>single sign on (222)</i>	
<i>cyberforensics (227)</i>	<i>MAC address (236)</i>	<i>single-user license agreement (228)</i>	
<i>cyberwarfare (214)</i>	<i>MAC address control (236)</i>	<i>site license (229)</i>	
<i>cypher (230)</i>	<i>malware (245)</i>	<i>spyware (215)</i>	
	<i>malicious software (215)</i>		



CAPTCHA (224)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises interactively**; complete the **self-assessment in the Test Prep resource** from on your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. Any illegal act involving the use of a computer or related devices generally is referred to as a crimeware. (212)
- _____ 2. A rootkit displays an online advertisement in a banner or pop-up window on webpages, email, or other Internet services. (215)
- _____ 3. Viruses, worms, and other malware can be hidden in downloaded game files and mobile apps. (216)
- _____ 4. An audit trail records in a file both successful and unsuccessful access attempts. (222)
- _____ 5. It is good practice to change your password frequently. (222)
- _____ 6. Intentionally erasing software would be considered software theft. (228)
- _____ 7. A typical license agreement allows you to rent or lease the software. (229)
- _____ 8. Unencrypted, readable data is called ciphertext. (230)
- _____ 9. Private key encryption also is called asymmetric key encryption. (230)
- _____ 10. VPNs encrypt data to help ensure that the data is safe from being intercepted by unauthorized people. (230)
- _____ 11. When data is traveling to or from a computer to a cloud service, it is subject to interception. (232)
- _____ 12. A good practice to secure your wireless network is to immediately broadcast the SSID. (236)

Multiple Choice

Select the best answer.

1. A _____ is someone who demands payment to stop an attack on an organization's technology infrastructure. (214)
 - a. cyberterrorist
 - b. script kiddie
 - c. cracker
 - d. cyberextortionist
2. _____ is a program that hides in a computer or mobile device and allows someone from a remote location to take full control of the computer or device. (215)
 - a. A rootkit
 - b. Spyware
 - c. A trojan horse
 - d. Adware
3. A _____ is a program or set of instructions in a program that allows users to bypass security controls when accessing a program, computer, or network. (217)
 - a. zombie
 - b. botnet
 - c. back door
 - d. session cookie
4. An employee using an organization's computer to send personal email messages might be an example of _____. (221)
 - a. cybercrime
 - b. hardware vandalism
 - c. intellectual property rights violation
 - d. unauthorized access and use
5. A _____ is a private combination of words, often up to 100 characters in length and containing mixed capitalization and punctuation, associated with a user name that allows access to certain computer resources. (223)
 - a. passphrase
 - b. private key
 - c. passcode
 - d. encryption algorithm
6. A(n) _____ is a set of characters that the originator of the data uses to encrypt the text and the recipient of the data uses to decrypt the text. (230)
 - a. cipher
 - b. plaintext
 - c. public key
 - d. encryption key
7. A(n) _____ backup method is the only real-time backup, providing very fast recovery of data. (234)
 - a. selective
 - b. full
 - c. incremental
 - d. continuous data protection
8. Online shopping websites generally use a _____ to keep track of items in a user's shopping cart. (243)
 - a. phishing filter
 - b. session cookie
 - c. location sharing algorithm
 - d. keygen

Checkpoint

Matching Match the terms with their definitions.

- | | |
|--|--|
| _____ 1. script kiddie (214) | a. compromised computer or device whose owner is unaware the computer or device is being controlled remotely by an outsider |
| _____ 2. zombie (216) | b. technique intruders use to make their network or Internet transmission appear legitimate to a victim computer or network |
| _____ 3. bot (216) | c. program that performs a repetitive task on a network |
| _____ 4. spoofing (217) | d. small text file that a web server stores on your computer |
| _____ 5. access control (222) | e. notice that guarantees a user or website is legitimate |
| _____ 6. keygen (228) | f. strategy designed to prevent illegal distribution of movies, music, and other digital content |
| _____ 7. digital certificate (231) | g. program that creates software registration numbers and sometimes activation codes |
| _____ 8. technology ethics (238) | h. hacker who does not have the technical skills and knowledge of a cracker |
| _____ 9. digital rights management (240) | i. security measure that defines who can access a computer, device, or network; when they can access it; and what actions they can take while accessing it |
| _____ 10. cookie (243) | j. moral guidelines that govern the use of computers, mobile devices, information systems, and related technologies |

**Consider This** Answer the following questions in the format specified by your instructor.

1. Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (214, 233, 246, 247), How To (218, 221, 236, 244), Mini Features (232, 235, 237), Secure IT (216, 219, 223, 240), and Technology @ Work (249).
2. What are some common digital security risks? (212)
3. How does a hacker differ from a cracker? (214)
4. What is cyberwarfare? (214)
5. What is a hacktivist? (214)
6. How does malware deliver its payload? (215)
7. What is a botnet? (216)
8. What practices should gamers follow to increase their security? (216)
9. What is the purpose of a DoS attack? (217)
10. Why would a programmer or computer repair technician build a back door? (217)
11. How is email spoofing commonly used? (217)
12. What are methods to protect computers, mobile devices, and networks from attacks? (218)
13. Who would an organization requiring assistance or information about Internet security breach contact? (219)
14. What screening techniques do proxy servers use? (219)
15. How does unauthorized access differ from unauthorized use? (221)
16. What is a single sign-on account? (222)
17. What is a password manager? (223)
18. Are passphrases more secure than passwords? Why or why not? (223)
19. How are fingerprint readers used with personal computers and mobile devices? (225)
20. What conditions are found in a typical single-user license agreement? (229)
21. Who issues digital certificates? (231)
22. What is meant by a three-generation backup policy? (234)
23. What should you include in a disaster recovery plan for natural disasters? What should you include for man-made disasters? (235)
24. What steps can you take to secure your wireless network? (236)
25. How can mobile security apps protect your mobile device data? (237)
26. What are some questions that arise surrounding fair use with respect to copyrighted material? (240)
27. What role does the ENERGY STAR program play in green computing? (241)
28. For what purposes do websites use cookies? (243)
29. What is clickjacking? (245)

Problem Solving

The **Problem Solving** exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, work, or with nonprofit organizations. The **Collaboration** exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. No Browsing History** While using the browser on your tablet, you realize that it is not keeping a history of websites you have visited. Why might this be happening, and what is the first step you will take to correct this problem?
- 2. Phishing Scam** You just received an email message from someone requesting personal identification information. Believing the message was legitimate, you provided the requested information to the original sender. You now realize, however, that you might have fallen victim to a phishing scam. What are your next steps?
- 3. Suspicious File Attachment** You receive an email message that appears to be from someone you know. When you try to open the attachment, nothing happens. You attempt to open the attachment two more times without any success. Several minutes later, your computer is running slower and you are having trouble running apps. What might be wrong?
- 4. Antivirus Software Outdated** After starting your computer and signing in to the operating system, a message is displayed stating that your virus definitions are out of date and need to be updated. What are your next steps?
- 5. Laptop's Physical Security** You plan to start taking your laptop to school so that you can record notes in class. You want to make sure, however, that your computer is safe if you ever step away from it for a brief period of time. What steps can you take to ensure the physical security of your laptop?



Figure 5-10: Phishing Email Example

Professional

- 6. Corporate Firewall Interference** You installed a new browser on your work computer because you no longer wish to use the default browser provided with the operating system. When you run the new browser, an error message appears stating that a user name and password are required to configure the firewall and allow this program to access the Internet. Why has this happened?
- 7. Problems with CAPTCHA** You are signing up for an account on a website and encounter a CAPTCHA. You attempt to type the characters you see on the screen, but an error message appears stating that you have entered the incorrect characters. You try two more times and get the same result. You are typing the characters to the best of your ability but think you still might be misreading at least one of the characters. What are your next steps?
- 8. Unclear Acceptable Use Policy** You read your company's acceptable use policy, but it is not clear about whether you are able to use the computer in your office to visit news websites on your lunch break. How can you determine whether this type of activity is allowed?
- 9. Two-Step Verification Problem** A website you are attempting to access requires two-step verification. In addition to entering your password, you also have to enter a code that it sends to you as a text message. You no longer have the same phone number, so you are unable to receive the text message. What are your next steps?
- 10. Issue with Virus Protection** You receive a notification that the antivirus program on your computer is not enabled. While attempting to enable the antivirus program, an error message is displayed stating that a problem has prevented the antivirus program from being enabled. What are your next steps?

Collaboration

- 11. Technology in National and Local Security** National and local security agencies often use technology to protect citizens. For example, computers are used to maintain a No Fly List, which contains a list of individuals not cleared to board a commercial aircraft. Form a team of three people to create a list of the various ways technology helps to keep the public safe. One team member should research how local agencies, such as police departments, use technology to ensure security. Another team member should research ways national security agencies use technology to protect the public from threats, and the last team member should research ways that private businesses use technology to enhance security. Compile these findings into a report and submit it to your instructor.

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn exercises**, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Evaluating Your Electronic Profile

When you make purchases online, tap or click advertisements, follow links, and complete online forms requesting information about yourself, you are adding to your electronic profile. While an electronic profile may help businesses guide you toward products and services that are of interest to you, some people view them as an invasion of privacy. The following steps guide you through the process of locating online information about yourself and taking steps to remove the information, if possible.

- a. Run a browser.
- b. Navigate to a search engine of your choice.
- c. Perform a search for your full name.
- d. In the search results, follow a link that you feel will display a webpage containing information about you. If the link's destination does not contain information about you, navigate back to the search results and follow another link.
- e. Evaluate the webpage that contains information about you. If you wish to try removing the information, locate a link that allows you to contact the site owner(s) or automatically request removal of the information.
- f. Request that your information be removed from the website. Some websites may not honor your request for removal. If you feel that the information must be removed, you may need to solicit legal advice.
- g. If the search results display information from an account you have on an online social network, such as Facebook or LinkedIn, you may need to adjust your privacy settings so that the information is not public. If the privacy settings do not allow you to hide your information, you may need to consider deleting the account.
- h. Repeat Steps d – g for the remaining search results. When you no longer see relevant search results for the search engine you used, search for other variations of your name (use your middle initial instead of your middle name, exclude your middle name, or consider

using commonly used nicknames instead of your first name).

- i. Use other search engines to search for different variations of your name. Some search engines uncover results that others do not.
- j. If you have an account on an online social network, navigate to the website's home page and, without signing in, search for your name. If information appears that you do not want to be public, you may need to adjust your privacy settings or remove your account.
- k. Follow up with requests you have made to remove your online information.

Exercises

1. What personal information have you uncovered online? Did you have any idea that the information was there?
2. What additional steps can you take to prevent people and businesses from storing information about you?
3. What steps might you be able to take if you are unsuccessful with your attempts to remove online information that identifies you?



How To: Your Turn

2 Update Virus Definitions

In addition to installing or activating an antivirus program on your computer or mobile device to keep it safe from viruses, it also is necessary to keep the virus definitions updated so that the antivirus program can search for and detect new viruses on your computer or mobile device. New virus definitions can be released as often as once per day, depending on the number of new viruses that are created. Antivirus programs either can search for and install new virus definitions automatically at specified intervals, or you can update the virus signatures manually. The following steps describe how to update the virus definitions for an antivirus program.

Update Virus Definitions Manually

- If necessary, establish an Internet connection so that you will be able to update the virus definitions.
- Run an antivirus program.
- Tap or click the button to check for updated virus definitions.
- If new virus definitions are available for the antivirus program, tap or click the link to download the definitions to the computer or mobile device.
- When the update is complete, tap or click the button to scan the computer or mobile device for viruses.

Configure Automatic Updates for Virus Definitions

- If necessary, establish an Internet connection so that you will be able to update the virus definitions.
- Run an antivirus program.
- Tap or click the option to update virus definitions automatically.
- Tap or click the option to display the virus definition update schedule.
- To provide the maximum protection from viruses, configure the antivirus program to update definitions as frequently as possible.
- After configuring the update schedule, tap or click the button to update virus definitions manually.
- When the update is complete, tap or click the button to scan the computer or mobile device for viruses.

Exercises

- What antivirus program, if any, currently is installed on your computer? Is it scheduled to update virus definitions automatically?
- In addition to downloading and installing virus definitions from within the antivirus program, are other ways available to obtain the latest virus definitions?
- In addition to keeping the antivirus program's virus definitions current, what other ways can you protect a computer or mobile device from viruses?



3 Determine Whether a Computer or Mobile Device Is Secured Properly

Several steps are required to secure a computer or mobile device properly. In addition to installing antivirus software and updating the virus definitions regularly, you also should install and configure a firewall, keep the operating system up to date, and be careful not to open suspicious email messages, visit unsecure webpages, or download untrusted files while using the Internet. The following steps guide you through the process of making sure your computer or mobile device is secured properly by verifying antivirus software is installed and running, a firewall is enabled and configured, and the operating system is up to date.

Verify Antivirus Software

- Use the search tool in the operating system or scan the programs on the computer or mobile device for antivirus software. Some operating systems include antivirus software.
- If you are unable to locate antivirus software on the computer or mobile device, obtain an antivirus program and install it.
- Run the antivirus program.
- Verify the virus definitions in the antivirus program are up to date.

Verify the Firewall

- Use the search tool in the operating system or scan the programs, apps, and settings on the computer or mobile device to access and configure the firewall.
- If you are unable to locate a firewall on the computer or mobile device, obtain a firewall program and install it.
- Run the firewall program.
- View the firewall settings and verify the firewall is turned on.
- View the list of programs, apps, and features allowed through the firewall. If you do not recognize or use one or more of the programs, apps, or features, remove them from the list of allowed programs, apps, and features.

How To: Your Turn

Verify Operating System Updates

- If necessary, establish an Internet connection.
- Navigate to the area of the operating system where you can access the button, link, or command to search for operating system updates. For example, in Microsoft Windows, you would display the settings for Windows Update.
- Tap or click the button, link, or command to check for updates.
- If no updates are available, your operating system is up to date. If the operating system locates additional updates, download and install the updates. **NOTE: If the computer or mobile device you are using does not belong to you, check with its owner before downloading and installing updates for the operating system.**



Exercises

- Before you began this exercise, was your computer or mobile device secured properly? How did you know your computer or mobile device was secured properly? If it was not, what actions did you need to perform to secure it?
- Which programs, apps, and features do you think are safe to allow through your firewall? Which programs, apps, and features do you feel are not safe to allow through your firewall?
- What additional ways can you properly secure your computer?

Clear Your Browsing History

A browser keeps track of the webpages that you have visited previously unless you have changed your settings. Although you can clear the browsing history on your computer or mobile device, your Internet service provider still may have logs that show a history of websites you have visited. The following steps guide you through the process of clearing your browsing history.

- Run the browser.
- Display the browser's settings.
- If necessary, navigate to the settings that configure the browser's security settings. These settings often are found in the Security, Safety, or Privacy category.

- Select the option to delete the browsing history. In addition to deleting the list of websites you have visited, you also may be able to clear passwords the browser has remembered, clear cookies and temporary internet files, clear data you entered in forms, and clear a history of downloads.
- When the browsing history has been deleted, run the browser again.
- Follow the above steps for each additional browser you have installed on your computer or mobile device.

Exercises

- What are some reasons why you might want to delete your browsing history?
- Can you configure your browser to automatically delete your browsing history? If so, how?
- What are the advantages of keeping your browsing history? If you do keep your browsing history, how long do you keep it?

5 Configure a Browser's Cookie Settings

As discussed in this chapter, cookies can be used for a variety of reasons. Websites can install cookies on your computer or mobile device that can store information on your computer or mobile device, or track your browsing habits. You can configure a browser's settings to disallow websites from storing and accessing cookies on your computer or mobile device. The following steps guide you through the process of configuring a browser's cookie settings.

- Run the browser.
- Display the browser's settings.
- Navigate to the settings that configure the browser's cookie settings. These settings often are found in the Security, Safety, or Privacy category.
- Configure how the browser handles first-party cookies and third-party cookies. Some users choose to reject all cookies. To function properly, however, some websites require that you accept their cookies.
- Save the changes to the settings.
- Run the browser again.

Exercises

- What is the difference between first-party cookies and third-party cookies?
- Configure the browser to deny all first-party and third-party cookies and then navigate to five websites you visit most frequently. Do the websites display any differently now that you are denying all cookies? Describe your browsing experience while the browser is configured to deny all cookies.
- What security risks are associated with cookies?

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to challenge yourself with additional Internet Research exercises, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web News, Weather, and Sports

Apps on tablets, smartphones, and other mobile devices are changing the delivery of the day's major news, weather, and sports stories. In one study, approximately one-half of American adults reported that they get some of their news on a tablet or mobile device. They view video and photos from eyewitnesses and fans, read analyses from investigators and coaches, and comment on stories. Men and college-educated people are the heaviest users of mobile news websites, and they are likely to read in-depth investigations and analyses. Online social networks also are a major source of information for many people.

Research This: (a) Visit two news websites or apps and locate one national event covered in both sources. Compare the coverage of the two stories. What information is provided in addition to the text, such as video, graphics, or links to related articles? Which story offers a better analysis? Which source is easier to navigate and read? Then, using another website or app, locate and read today's top international news story. What did you learn by reading the story? Were you aware of this event prior to reading the online story? Does the coverage include videos and photos to increase your comprehension?

(b) Visit a weather website or app and obtain the five-day forecast for your hometown. Include details about information that supplements the current and forecast conditions, such as a pollen or air quality index, storm tracking, travel advisories, or season summaries.



(c) Visit a sports website or app and read the first story reported. Describe the coverage of this event. Which sources are quoted in the story? Which links are included to other stories? Describe the features provided on this website, such as the ability to chat, customize the page for your favorite teams, or share the content with media sharing sites.

2 Social Media

Sharing photos on your social media sites of yesterday's visit to the ballpark might be at the top of today's to-do list, but these images might be just the clues cyberthieves need to access your account. Facebook, in particular, is one website that scammers and advertisers use to gather information regarding your whereabouts and your personal life. Their malicious attacks begin with a visit to your timeline or other record of your activities. Searching for keywords on your page, they send targeted messages appearing to originate from trusted friends. If you open their attachments or tap or click their links, you have given these unscrupulous individuals access to your account. In addition, you may think you have crafted a password no one could guess. With your page open for others to view, however, the thieves scour the contents in hopes of locating starting clues, such as children's names, anniversary dates, and pet breeds, which could be hints to cracking your password.

Research This: In the Help section of an online social network you use, search for information about changing your profile's security and privacy settings. What steps can you take to mitigate the chance of becoming the victim of a hack? For example, can you adjust the connection settings to restrict who can see stories, send friend requests and messages, or search for you by name or contact information? Can you hide certain posts or block people from posting on your page? Can you report posts if they violate the website's terms? What are other potential threats to someone accessing your account?

3 Search Skills Social Media Search

Search engines provide access to millions of search results by finding webpages, documents, images, or

Internet Research

other information that match the search text you provide. Recommendations from people who use social media to share what they have read can be a possible alternative to using a search engine. People who take the time to Tweet pin an article or image on Twitter or Pinterest often do so because they found it useful, and hope others will as well.

To search Twitter, type the search text, search twitter, in a search engine to find the web address for the Twitter Search website, or sign in to Twitter with your credentials. In the Search Twitter text box, type the search text. For example, type the text, best mapping app, to find recommendations of links to articles or websites about mapping apps. You also can search Twitter for hashtags (a keyword preceded by a # symbol) to find Tweets about current events or popular discussion topics.

To search Pinterest, sign in to your Pinterest account and then type the search text into the search box. For example, type the search text, information security, into the search box to view related pins from Pinterest users. Pinterest users often pin links to infographics, images, and websites.



Research This: Use Twitter and Pinterest to search for information about the following topics and then compare your results with those you would find using a search engine such as Bing, Google, or Yahoo!:

(1) green computing, (2) computer virus, (3) cyber-crime, and (4) malware. How are the results different? What type of information are you more likely to find on Twitter, on Pinterest, and using a search engine?

Security

Digital certificates and signatures detect a sender's identity and verify a document's authenticity. In this

chapter you learned that many e-commerce companies use them in an attempt to prevent digital eavesdroppers from intercepting confidential information. The online certificate authority (CA) vendors generate these certificates using a standard, called X.509, which is coordinated by the International Telecommunication Union and uses algorithms and encryption technology to identify the documents.

Research This: Visit websites of at least two companies that issue digital certificates. Compare products offered, prices, and certificate features. What length of time is needed to issue a certificate? What is a green address bar, and when is one issued? What business or organization validation is required? Then, visit websites of at least two companies that provide digital signatures. Compare signing and sending requirements, types of supported signatures, and available security features. Which documents are required to obtain a digital signature? When would a business need a Class 2 rather than a Class 3 digital signature?

Cloud Services

Cloud Security (SecaaS)

Antivirus software offers regular, automatic updates in order to protect a server, computer, or device from viruses, malware, or other attacks. Antivirus software is an example of cloud security, or security as a service (SecaaS), a service of cloud computing that delivers virus definitions and security software to users over the Internet as updates become available, with no intervention from users. Security as a service is a special case of software as a service, but is limited to security software solutions.

Individuals and enterprise users take advantage of antivirus software and security updates. Enterprise cloud users interact with cloud security solutions via a web interface to configure apps that provide protection to email servers, preventing spam before it arrives, keeping data secure, and watching for online threats and viruses. As the use of cloud-based resources continues, the market for security as a service solutions is expected to increase significantly in coming years.

Research This: (1) Use a search engine to find two different providers of security as a service solutions. Research the different solutions they provide, and report your findings. (2) How are enterprise security requirements different from those of individual users?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Online Gaming Safety

You and your friend frequently play a popular online role-playing game. Your friend's computer had a virus recently, which was traced back to a malware-infected website. Your friend tells you that she visited the website after following a link while playing the game. What risks are involved when playing online games?

Do This: Use the web to find articles about incidents of malware infections associated with online gaming. Research tips for increasing security when playing online games. Did you find other threats and security tips in addition to the ones mentioned in this chapter? Have you ever downloaded updates to a game? If so, how did you ensure the updates were safe? Locate a list of games that are known to cause malware infections. Share your findings and any online gaming security problems you have experienced with the class.

2. Ensuring Safety and Security Online

You work in the information technology department for a large enterprise. An increasing number of users are contacting the help desk complaining about slow computer performance. Help desk representatives frequently attribute the decreased performance to malware. Although the help desk has installed security software on each computer, users also must practice safe computing. Your manager asked you to prepare information that teaches employees how to guard against malware and other security threats.

Do This: Include information such as how to determine if a website is safe, how to identify email and other spoofing schemes, guidelines for downloading programs and apps, email attachment safety, and how to avoid phishing scams. Create a list of how organizations use common safeguards to protect other users on the network, such as firewalls, proxy servers, user names and passwords, access controls, and audit trails.

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The league's board of directors asked you to develop a disaster recovery plan for its main office. The main office consists of a small storefront with two back rooms: one room is the office, with all of the electronic equipment and paper files; the other is for storage of nonelectronic equipment. The staff members — you, an administrative assistant, and an information technology (IT) specialist — work in the office. The electronic equipment in the office includes two desktops, a laptop, an external hard drive for backups, a wireless router, and two printers. In addition, each staff member has a smartphone.

Do This: Choose either a natural or man-made disaster. Create a disaster recovery plan that outlines emergency strategies, backup procedures, recovery steps, and a test plan. Assign staff members roles for each phase of the disaster recovery plan.

Collaboration

4. Implementing Biometric Security You are the chief technology officer of a large company. You have been reading an article about computer security that discussed several examples of security breaches, including thieves breaking into an office and stealing expensive equipment, and a recently terminated employee gaining access to the office after hours and corrupting data. Because of these incidents, your company would like to start using biometric devices to increase its security.

Do This: Form a three-member team and research the use of biometric devices to protect equipment and data. Each member of your team should choose a different type of biometric device, such as fingerprint readers, face recognition systems, and hand geometry systems. Find products for each device type, and research costs and user reviews. Search for articles by industry experts. Would you recommend using the biometric device for security purposes? Why or why not? Meet with your team, discuss and compile your findings, and then share with the class.



Technology Timeline

1937 Dr. John V. Atanasoff and Clifford Berry design and build the first electronic digital computer. Their machine, the Atanasoff-Berry-Computer, or ABC, provides the foundation for advances in electronic digital computers.



Atanasoff-Berry Computer (ABC) at the University of Iowa. Photo: Collection of the University of Iowa.



1945 John von Neumann poses in front of the electronic computer built at the Institute for Advanced Study. This computer and its von Neumann architecture served as the prototype for subsequent stored program computers worldwide.



Photo: Alan Turing, Computer Architecture, from the National Archives and Records Administration. (1945)



1947 William Shockley, John Bardeen, and Walter Brattain invent the transfer resistance device, eventually called the transistor. The transistor would revolutionize computers, proving much more reliable than vacuum tubes.



1952 Dr. Grace Hopper considers the concept of reusable software in her paper, "The Education of a Computer." The paper describes how to program a computer with symbolic notation instead of detailed machine language.



Courtesy of the Computer History Museum.

1937

1943

1945

1946

1947

1951

1952

1953



Photo: The Turing Machine. The Turing Machine.



Photo: The Turing Machine. The Turing Machine.

1943 During World War II, British scientist Alan Turing designs the Colossus, an electronic computer created for the military to break German codes. The computer's existence is kept secret until the 1970s.



Photo: The ENIAC Computer. The ENIAC Computer.

1946 Dr. John W. Mauchly and J. Presper Eckert, Jr. complete work on the first large-scale electronic, general-purpose digital computer. The ENIAC (Electronic Numerical Integrator And Computer) weighs 30 tons, contains 18,000 vacuum tubes, occupies a 30 x 50 foot space, and consumes 160 kilowatts of power.



Photo: The UNIVAC I Computer. The UNIVAC I Computer.

1951 The first commercially available electronic digital computer, the UNIVAC I (UNIVersal Automatic Computer), is introduced by Remington Rand. Public awareness of computers increases when the UNIVAC I correctly predicts that Dwight D. Eisenhower will win the presidential election.



Photo: Core Memory. Core Memory.

1953 Core memory, developed in the early 1950s, provides much larger storage capacity than vacuum tube memory.

1953 The IBM model 650 is one of the first widely used computers. The computer is so successful that IBM manufactures more than 1,000. IBM will dominate the mainframe market for the next decade.

1957 The IBM 305 RAMAC computer is the first to use magnetic disk for external storage. The computer provides storage capacity similar to magnetic tape that previously was used but offers the advantage of semi-random access capability.



1959 More than 200 programming languages have been created.

1959 IBM introduces two smaller, desk-sized computers: the IBM 1401 for business and the IBM 1620 for scientists.



1965 Dr. John Kemeny of Dartmouth leads the development of the BASIC programming language.



1968 In a letter to the editor titled, "GO TO Statements Considered Harmful," Dr. Edsger Dijkstra introduces the concept of structured programming, developing standards for constructing computer programs.

1965 Digital Equipment Corporation (DEC) introduces the first microcomputer, the PDP-8. The machine is used extensively as an interface for time-sharing systems.



1968 Computer Science Corporation (CSC) becomes the first software company listed on the New York Stock Exchange.



1957 FORTRAN (FORmula TRANslation), an efficient, easy-to-use programming language, is introduced by John Backus.



1957

1958

1959

1960

1964

1965

1967

1968



1958 Jack Kilby of Texas Instruments invents the integrated circuit, which lays the foundation for high-speed computers and large-capacity memory. Computers built with transistors mark the beginning of the second generation of computer hardware.



1960 COBOL, a high-level business application language, is developed by a committee headed by Dr. Grace Hopper.



1967 Douglas Engelbart applies for a patent for his wooden mouse.

1964 The number of computers has grown to 18,000. Third-generation computers, with their controlling circuitry stored on chips, are introduced. The IBM System/360 computer is the first family of compatible machines, merging science and business lines.



1968 Alan Shugart at IBM demonstrates the first regular use of an 8-inch floppy disk.



1964 IBM introduces the term, word processing, for the first time with its Magnetic Tape/Selectric Typewriter (MT/ST). The MT/ST was the first reusable storage medium that allowed typed material to be edited without requiring that the document be retyped.

1969 Under pressure from the industry, IBM announces that some of its software will be priced separately from the computer hardware, allowing software firms to emerge in the industry.



1969 The ARPANET network is established, which eventually grows to become the Internet.



1975 MITS, Inc. advertises one of the first microcomputers, the Altair. The Altair is sold in kits for less than \$400, and within the first three months 4,000 orders are taken.



1975 Ethernet, the first local area network (LAN), is developed at Xerox PARC (Palo Alto Research Center) by Robert Metcalfe.



1976 Steve Jobs and Steve Wozniak build the first Apple computer. A subsequent version, the Apple II, is an immediate success. Adopted by elementary schools, high schools, and colleges, for many students, the Apple II is their first contact with the world of computers.



1980 IBM offers Microsoft Corporation cofounder, Bill Gates, the opportunity to develop the operating system for the soon-to-be announced IBM personal computer. With the development of MS-DOS, Microsoft achieves tremendous growth and success.

1980 Alan Shugart presents the Winchester hard disk, revolutionizing storage for personal computers.



1969

1970

1971

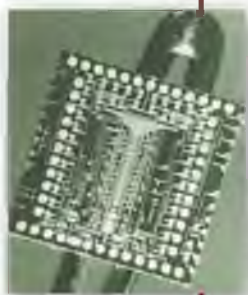
1975

1976

1979

1980

1981



1970 Fourth-generation computers, built with chips that use LSI (large-scale integration) arrive. While the chips used in 1965 contained up to 1,000 circuits, the LSI chip contains as many as 15,000.

1979 VisiCalc, a spreadsheet program written by Bob Frankston and Dan Bricklin, is introduced.

1979 The first public online information services, CompuServe and the Source, are founded.

1981 The IBM PC is introduced, signaling IBM's entrance into the personal computer marketplace. The IBM PC quickly garners the largest share of the personal computer market and becomes the personal computer of choice in business.



1981 The first computer virus, Elk Cloner, is spread via Apple II floppy disks, which contained the operating system. A short rhyme would appear on the screen when the user pressed the Reset button after the 50th boot of an infected disk.



1971 Dr. Ted Hoff of Intel Corporation develops a microprocessor, or microprogrammable computer chip, the Intel 4004.



© Eric V. Trovati/Alamy Ltd. Courtesy of Microsoft © Corporation

Microsoft

1986 Microsoft has public stock offering and raises approximately \$61 million.

1988 Microsoft surpasses Lotus Development Corporation to become the world's top software vendor.

1991 Kodak announces the first digital SLR (single-lens reflex) camera. The Kodak DCS 100 is developed mostly for photojournalism purposes and stores the photos and batteries in a separate unit.



© Kodak Company. Courtesy of Kodak

3.275 Million

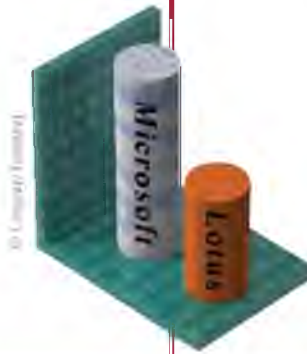
1982 3,275,000 personal computers are sold, almost 3,000,000 more than in 1981.

1982 Hayes introduces the 300 bps smart modem. The modem is an immediate success.

1982 Compaq, Inc. is founded to develop and market IBM-compatible PCs.



Courtesy of Hewlett-Packard Company



© CompuLink (Internet)

1991 World Wide Web Consortium releases standards that describe a framework for linking documents on different computers.



© Cengage Learning

1982 1983 1984 1986 1988 1989 1991

1983 Instead of choosing a person for its annual award, TIME magazine names the computer Machine of the Year for 1982, acknowledging the impact of computers on society.

Apple

1984 Apple introduces the Macintosh computer, which incorporates a unique, easy-to-learn, graphical user interface.

1989 Nintendo introduces the Game Boy, its first handheld game console.



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© Nintendo. All Rights Reserved.



1983 Lotus Development Corporation is founded. Its spreadsheet software, Lotus 1-2-3, which combines spreadsheet, graphics, and database programs in one package, becomes the best-selling program for IBM personal computers.



Courtesy of Hewlett-Packard Company

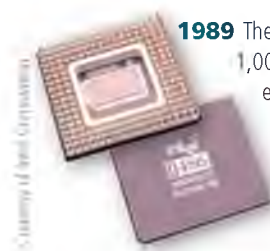
1984 Hewlett-Packard announces the first LaserJet printer for personal computers.



Courtesy of CERN

1989 While working at CERN, Switzerland, Tim Berners-Lee invents the World Wide Web.

1989 The Intel 486 becomes the world's first 1,000,000 transistor microprocessor. It executes 15,000,000 instructions per second — four times as fast as its predecessor, the 80386 chip.



Courtesy of Intel Corporation



1993 Microsoft releases Microsoft Office 3 Professional, the first version of Microsoft Office for the Windows operating system.

1993 Several companies introduce computers using the Pentium processor from Intel. The Pentium chip contains 3.1 million transistors and is capable of performing 112,000,000 instructions per second.



1994 Amazon is founded and later begins business as an online bookstore. Amazon eventually expands to sell products of all types and facilitates the buying and selling of new and used goods. Today, Amazon employs more than 88,400 people.



1994 Linus Torvalds creates the Linux kernel, a UNIX-like operating system that he releases free across the Internet for further enhancement by other programmers.

1995 eBay, an online auction website, is founded. Providing an online venue for people to buy and sell goods, it quickly becomes the world's largest online marketplace as it approaches 100 million active users worldwide.



Link and learn are required for blocks of blocks to analyze its ability. Other factors may be requirements of their respective systems.



1995 Sun Microsystems launches Java, an object-oriented programming language that allows users to write one program for a variety of computer platforms.

1995 Microsoft releases Windows 95, a major upgrade to its Windows operating system. Windows 95 consists of more than 10,000,000 lines of computer instructions developed by 300 person-years of effort.



1992



1992 Microsoft releases Windows 3.1, the latest version of its Windows operating system. Windows 3.1 offers improvements such as TrueType fonts, multimedia capability, and object linking and embedding (OLE). In two months, 3,000,000 copies of Windows 3.1 are sold.

1993

1993 The U.S. Air Force completes the Global Positioning System by launching its 24th Navstar satellite into orbit. Today, GPS receivers can be found in cars, laptops, and smartphones.



1993 The White House launches its website, which includes an interactive citizens' handbook and White House history and tours.

1994

1994 Jim Clark and Marc Andreessen found Netscape and launch Netscape Navigator 1.0, a browser.



1994 Apple introduces the first digital camera intended for consumers. The Apple QuickTake 100 is connected to home computers using a serial cable.

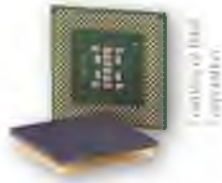


1995

1994 Yahoo!, a popular search engine and portal, is founded by two Stanford Ph.D. students as a way to keep track of their personal interests on the Internet. Currently, Yahoo! has approximately 11,500 employees in 25 countries, provinces, and territories.



1997 Intel introduces the Pentium II processor with 7.5 million transistors. The new processor, which incorporates MMX technology, processes video, audio, and graphics data more efficiently and supports programs such as movie editing, gaming, and more.



1999 Intel introduces the Pentium III processor. This processor succeeds the Pentium II and can process 3-D graphics more quickly. The Pentium III processor contains between 9.5 and 44 million transistors.

1999 Governments and businesses frantically work to make their computers Y2K (Year 2000) compliant, spending more than \$500 billion worldwide.



1997 Microsoft releases Internet Explorer 4.0 and seizes a key place in the Internet arena.



1999 Open source software, such as the Linux operating system and the Apache web server created by unpaid volunteers, begins to gain wide acceptance among computer users.

1996

1997

1998

1999

1996 U.S. Robotics introduces the PalmPilot, an inexpensive user-friendly personal digital assistant (PDA).



1996 Microsoft releases Windows NT 4.0, an operating system for client-server networks.



1998 Google files for incorporation and is now the most used search engine, capturing more than 60 percent of the market over other search engines.



1998 E-commerce booms. Companies such as Amazon.com, Dell, and E*TRADE spur online shopping, allowing buyers to obtain a variety of goods and services.



1998 Apple introduces the iMac, the next version of its popular Macintosh computer. The iMac wins customers with its futuristic design, see-through case, and easy setup.



2000 Shawn Fanning, 19, and his company, Napster, turn the music industry upside down by developing software that allows computer users to swap music files with one another without going through a centralized file server.



2000 E-commerce achieves mainstream acceptance. Annual e-commerce sales exceed \$100 billion, and Internet advertising expenditures reach more than \$5 billion.



2001 Intel unveils its Pentium 4 chip with clock speeds starting at 1.4 GHz. The Pentium 4 includes 42 million transistors.



2001 Wikipedia, a free online encyclopedia, is introduced. Additional wikis begin to appear on the Internet, enabling people to share information in their areas of expertise. Although some might rely on wikis for research purposes, the content is not always verified for accuracy.



2002 Digital video cameras, DVD burners, easy-to-use video editing software, and improvements in storage capabilities allow the average computer user to create Hollywood-like videos with introductions, conclusions, rearranged scenes, music, and voice-over.



2002 After several years of negligible sales, the Tablet PC is reintroduced to meet the needs of a more targeted audience.

2000

2001

2002



2000 Dot-com (Internet based) companies go out of business at a record pace — nearly one per day — as financial investors withhold funding due to the companies' unprofitability.



2002 Microsoft launches its .NET strategy, which is a new environment for developing and running software applications featuring ease of development of web-based services.

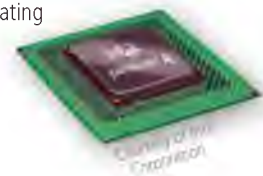


2002 DVD burners begin to replace CD burners (CD-RW). DVDs can store up to eight times as much data as CDs. Uses include storing home movies, music, photos, and backups.



2000 Telemedicine uses satellite technology and videoconferencing to broadcast consultations and to perform distant surgeries. Robots are used for complex and precise tasks.

2002 Intel ships its revamped Pentium 4 chip with the 0.13 micron processor and Hyper-Threading (HT) Technology, operating at speeds of 3.06 GHz. This new development eventually will enable processors with a billion transistors to operate at 20 GHz.



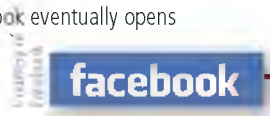
2004 Mozilla releases its first version of the Firefox browser. Firefox provides innovative features that enhance the browsing experience for users, including tabbed browsing and a Search box. Firefox quickly gains popularity and takes market share away from Microsoft's Internet Explorer.



2004 Companies such as RealNetworks, Microsoft, Sony, and Walmart stake out turf in the online music store business started by Apple.



2004 Facebook, an online social network originally available only to college students, is founded. Facebook eventually opens registration to all people and immediately grows to more than 110 million users.



2004 Flat-panel LCD monitors overtake bulky CRT monitors as the popular choice of computer users.

2004 Linux, an open source operating system, makes major inroads into the server market as a viable alternative to Microsoft Windows Server 2003, Sun's Solaris, and UNIX.



2004 Sony unveils the PlayStation Portable (PSP). This handheld game console is the first to use optical discs.



2004 106 million, or 53 percent, of the 200 million online population in America accesses the Internet via broadband.

2003



2003 In an attempt to maintain their current business model of selling songs, the Recording Industry Association of America (RIAA) files more than 250 lawsuits against individual computer users who offer copyrighted music over peer-to-peer networks.

2004 USB flash drives become a cost-effective way to transport data and information from one computer to another.



2004 Major retailers begin requiring suppliers to include radio frequency identification (RFID) tags or microchips with antennas, which can be as small as one-third of a millimeter across, in the goods they sell.



2003 Wireless computers and devices, such as keyboards, mouse devices, home networks, and wireless Internet access points become commonplace.



2004 The smartphone overtakes the PDA as the mobile device of choice.



2004 Apple introduces the sleek all-in-one iMac G5. The new computer's display device contains the system unit.



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2005 YouTube, an online community for video sharing, is founded. YouTube includes content such as home videos, movie previews, and clips from television shows. In November 2006, Google acquires YouTube.

Video iPod



2005 Apple releases the latest version of its popular pocket-sized iPod portable media player. First it played songs, then photos, then podcasts, and now, in addition, up to 150 hours of music videos and television shows on a 2.5" color display.



2006 Sony launches its PlayStation 3. New features include a Blu-ray Disc player, high-definition capabilities, and always-on online connectivity.

2006 Apple begins selling Macintosh computers with Intel microprocessors.



2006 Web 2.0, a term coined in 2004, becomes a household term with the increase in popularity of online social networks, wikis, and web applications.

2006 Nintendo releases the Nintendo DS Lite, a handheld game console with new features such as dual screens and improved graphics and sound.



2005

2006

**Spyware
Spam
Phishing**

2005 Spam, spyware, phishing, and pharming take center stage, along with viruses and other malware, as major nuisances to the 801 million computer users worldwide.

2005 Blogging and podcasting become mainstream methods for distributing information via the web.

**Blogging
Podcasting**



2005 Microsoft releases the Xbox 360, its latest game console. Features include the capability to play music, display photos, and communicate with computers and other Xbox gamers.



2006 Intel introduces its Core 2 Duo processor family. Boasting record-breaking performance while using less power, the family consists of five desktop computer processors and five mobile computer processors. The desktop processor includes 291 million transistors, yet uses 40 percent less power than the Pentium processor.



2006 IBM produces the fastest supercomputer, Blue Gene/L. It can perform approximately 28 trillion calculations in the time it takes you to blink your eye, or about one-tenth of a second.



2006 Nintendo Wii is introduced and immediately becomes a leader in game consoles. The Wii is being used in revolutionary ways, such as training surgeons.

2007 Intel introduces Core 2 Quad, a four-core processor made for dual-processor servers and desktop computers. The larger number of cores allows for more energy-efficient performance and optimizes battery performance in laptops.



© Intel Corporation

2007 VoIP (Voice over Internet Protocol) providers expand usage to include Wi-Fi phones. The phones enable high-quality service through a Wireless-G network and high-speed Internet connection.



© CenturyLink

2007 Apple releases its Mac OS X version 10.5 "Leopard" operating system, available in a desktop version and server version. The system includes a significantly revised desktop, with a semitransparent menu bar and an updated search tool that incorporates the same visual navigation interface as iTunes.



© Apple Inc.

2007 Apple introduces the iPhone and sells 270,000 phones in the first 2 days. iPhone uses iTouch technology that allows you to make a call simply by tapping a name or number in your address book. In addition, it stores and plays music like an iPod. Also, Apple sells its one billionth song on iTunes.



© Apple Inc.

2008 Smartphones become smarter. Smartphones introduced this year include enhanced features such as touch screens with multi-touch technology, mobile TV, tactile feedback, improved graphics, GPS receivers, and better cameras.



© Apple Inc.



© Microsoft

2008 Bill Gates retires from Microsoft. He continues as chairman and advisor on key development projects.

2008 Google releases its new browser. Google Chrome uses an entirely unique interface and offers other features such as dynamic tabs, crash control, and application shortcuts.



© Google

2007

2008

2007 Half of the world's population uses mobile phones. More and more people are using a mobile phone in lieu of a landline in their home.



© iStockphoto.com

2008 Netflix, an online movie rental company, and TiVo, a company manufacturing digital video recorders (DVRs), make Netflix movies and television episodes available on TiVo DVRs.



© TiVo Inc.

2007 Blu-ray Discs increase in popularity, overcoming and replacing HD DVD in less than one year. A Blu-ray Disc can store approximately 9 hours of high-definition (HD) video on a 50 GB disc or approximately 23 hours of standard-definition (SD) video.



© Blu-ray Disc Association



2007 Wi-Fi hot spots are popular in a variety of locations. People bring their computers to coffeehouses, fast food restaurants, or bookstores to access the Internet wirelessly, either free or for a small fee.

2008 Computer manufacturers begin to offer solid-state drives (SSDs) instead of hard disks, mostly in laptops. Although SSDs have a lower storage capacity, are more expensive, and slightly more susceptible to failure, they are significantly faster.



© iStockphoto.com



© iStockphoto.com

2008 WiMAX goes live! The advantage of this technology is the capability to access video, music, voice, and video calls wherever and whenever desired. Average download speeds are between 2 Mbps and 4 Mbps. By year's end, Sprint has approximately 100 million users on its network.

2009 Intel releases the Core i5 and Core i7 line of processors. These processors offer increased performance for some of the more demanding tasks. Intel also enhances its Core processor family by releasing multi-core processors, designed to increase the number of instructions that can be processed at a given time.



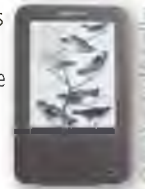
2009 Computers and mobile devices promote fitness by offering games and programs to help users exercise and track their progress. These games and programs also are used to assist with physical rehabilitation.



2011 Netbooks offer a smaller, lighter alternative to laptops. Netbooks have screens between seven and ten inches, and are used mostly for browsing the web and communicating online.



2011 E-books and e-book readers explode in popularity. Many novels, textbooks, and other publications now are available digitally and can be read on an e-book reader, computer, or mobile device.



2009 Online social networks revolutionize communications. Schools, radio stations, and other organizations develop pages on popular online social networks, such as Facebook, creating closer connections with their stakeholders.



2009 Web apps continue to increase in popularity. Web apps make it easier to perform tasks such as word processing, photo editing, and tax preparation without installing software on your computer.

2011 More than 200 types of mobile devices are using Google Android, an operating system originally designed for mobile devices.



2011 Steve Jobs, a cofounder of Apple, passes away after a long battle with cancer. Jobs is remembered for revolutionizing the computer and music industries.

2009 In June 2009, federal law requires that all full-power television stations broadcast only in digital format. Analog television owners are required to purchase a converter box to view over-the-air digital programming.



2011 A new generation of browsers is released to support HTML5, enabling webpages to contain more vivid, dynamic content.



2009

2010

2011



2010 AMD develops a 12-core processor, which contains two 6-core processors, each on an individual chip. Power consumption is similar to that of a 6-core processor but offers reduced clock speed.



2010 Hard disk capacity continues to increase at an exponential rate, with the largest hard disks storing more than 2.5 TB of data and information.



2011 Google introduces its Google+ online social network and integrates it across many of its products and services.

2010 Kinect for Xbox 360 changes the way people play video games. Game players now can interact with the game with a series of sensors, as well as a camera, tracking their movements in 3-D.



2010 Apple releases the iPad, a revolutionary mobile device with a 9.7-inch multi-touch screen. The iPad boasts up to 10 hours of battery life, connects wirelessly to the Internet, and is capable of running thousands of apps.



2011 Intel introduces Ultrabooks, which are powerful, lightweight alternatives to laptops. Ultrabooks normally weigh three pounds or less, have great performance and battery life, and are usually less than one inch thick.



2012 Microsoft announces the Surface, a tablet designed to compete with Apple's iPad. The Surface has a built-in stand, runs the Windows 8 operating system and its apps, and supports a cover that also can serve as a keyboard.



2012 Apple releases the iPhone 5. This newest iPhone has a four-inch screen, contains a new, smaller connector, and uses Apple's A6 processor.



2012 Microsoft releases Windows 8, its newest version of the Windows operating system. Windows 8 boasts a completely redesigned interface and supports touch input.

2013 Amazon announces it will use drones to deliver packages to its customers.



2013 Twitter users generate more than 500 million Tweets per day.



2013 Sony releases the PlayStation 4 (PS4) game console and Microsoft releases the Xbox One game console.

2013 Tablet sales grow at a faster rate than personal computer sales ever grew.



2012

2012 Google's Android surpasses Apple's iOS as the most popular operating system used on smartphones. Although the iPhone still is the bestselling smartphone, competing products are gaining market share quickly.



2013 Samsung releases the Galaxy Gear, a smartwatch that synchronizes with a Samsung Galaxy smartphone using Bluetooth technology.



2013 QR codes rapidly gain in popularity, giving mobile device users an easy way to access web content.



Source: qr-code-generator.com

2013 Windows 8.1, a significant update to Microsoft's Windows 8 operating system, is released.



2012 Microsoft releases Office 2013. Office 365, which uses the familiar Office 2013 interface, also is released, allowing users to use their Microsoft accounts to access Office apps from computers that do not have Office installed.

2012 Nintendo releases the Wii U game console.



2013 Apple releases the iPhone 5S, the first iPhone with TouchID. TouchID verifies a user's identity using an integrated fingerprint reader.

2013 Many consumers prefer tablets for their mobile computing needs. Tablets provide ultimate portability while still allowing users to access a vast array of apps, as well as access to the Internet and their email messages.



Green Computing



2014 Individuals and enterprises increase their focus on green computing. Computer manufacturers not only sell more energy-efficient hardware, they also provide easy ways in which customers can recycle their old computers and devices.

2014 Solid-state storage is becoming more popular, with storage capacities increasing and prices decreasing.



2014 Apple releases the Apple Watch, a wearable device that runs apps and can monitor various aspects of your health and fitness.



2014 Decreases in storage costs and increases in Internet connection speeds persuade more users to use cloud storage for their data. Cloud storage also provides users with the convenience of accessing their files from almost anywhere.



2015 3-D printing decreases in price and increases in popularity.



2015 Microsoft releases Windows 10, the latest version of its operating system. Windows 10 expands on many of the new features introduced in Windows 8, and also brings back popular features, such as the Start menu, from previous versions of Windows.



2015 Individuals and families are increasingly turning to streaming video on the Internet and abandoning their cable companies.

2014

2014 Bitcoin continues to grow as a digital currency and online payment system.



2014 Apple releases the iPhone 6 and iPhone 6 Plus. Both devices have significantly larger screens than its predecessors.



2014 Televisions with features such as curved screens and Ultra HD displays begin to increase in popularity.



2014 Google Glass goes on sale to the public in the United States.

2014 Amazon drops the price of its Fire Phone to \$0.99, possibly indicating that apps and services are valued more than the device.

2015



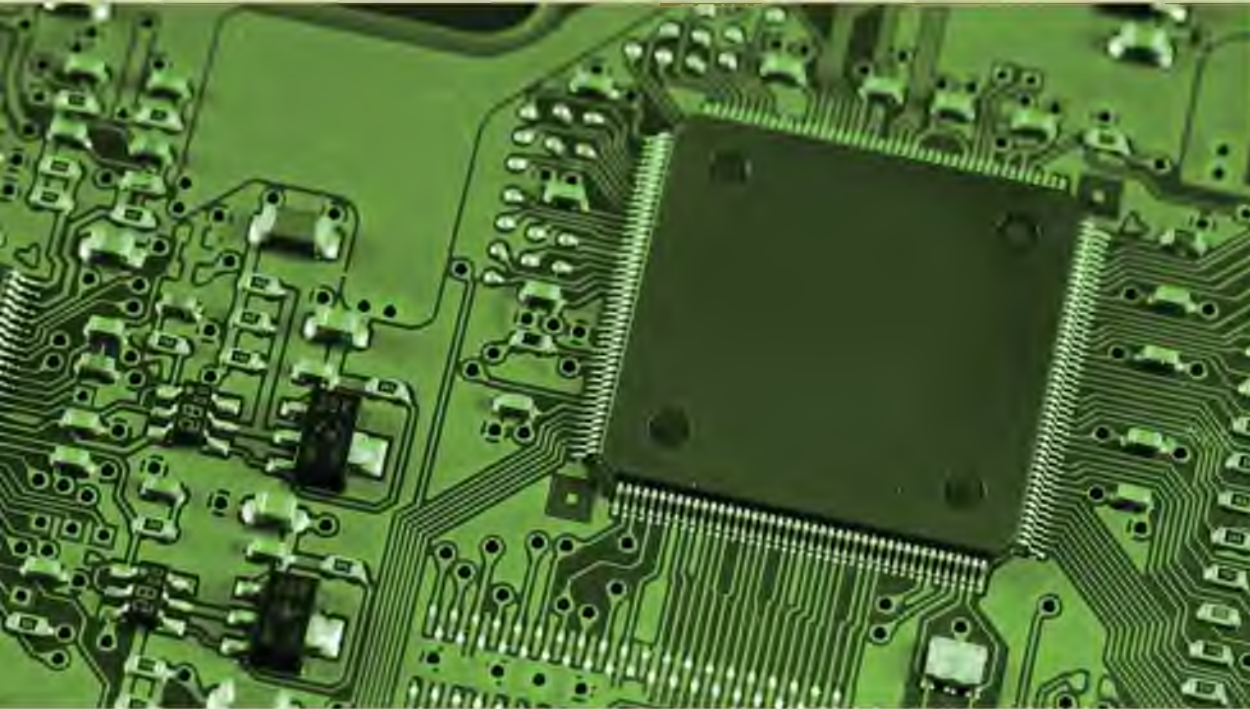
2015 Emerging protocols, such as LTE-A and Wi-Fi 802.11ac, ad, ah, and ah, increase performance on mobile and wireless networks.

2015 Approximately 91% of all Internet traffic is video, including HD and 3-D video.

Notes

COMPUTING COMPONENTS: Processors, Memory, the Cloud, and More

6



"I bought my laptop a couple of years ago, and it appears to be working well. Although at times it runs a little slow and generates a lot of heat, I really have not had problems with it. Why would I need to learn about hardware inside my laptop and other devices?"


While you may be familiar with some of the content in this chapter, do you know how to . . .

- Protect computers and mobile devices from theft?
- Select the right processor?
- Recognize the Internet of Things?
- Make use of cloud computing services?
- Prevent a computer from overheating?
- Determine memory requirements?
- Install memory?
- Erase your mobile phone's memory?
- Familiarize yourself with efforts related to technology products made with fair trade practices?
- Identify which ports you might need on a computer or mobile device?
- Clean a computer or mobile device?
- Conserve battery life on mobile computers and devices?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

Computers and mobile devices contain a variety of electronic components.





Objectives

After completing this chapter, you will be able to:

- 1 Describe the various computer and mobile device cases and the contents they protect
- 2 Describe multi-core processors, the components of a processor, and the four steps in a machine cycle
- 3 Identify characteristics of various personal computer processors on the market today, and describe the ways processors are cooled
- 4 Describe what is meant by the Internet of Things
- 5 Explain the advantages and services of cloud computing
- 6 Define a bit, and describe how a series of bits represents data
- 7 Explain how program and application instructions transfer in and out of memory
- 8 Differentiate among the various types of memory: RAM, cache, ROM, flash memory, and CMOS
- 9 Describe the purpose of adapter cards and USB adapters
- 10 Explain the function of a bus
- 11 Explain the purpose of a power supply and batteries
- 12 Describe how to care for computers and mobile devices

Inside the Case

Whether you are a home user or a business user, you most likely will purchase a new computer or mobile device, or upgrade an existing computer at some time in the future. Thus, you should understand the purpose of each component in a computer or mobile device. As Chapter 1 discussed, computers and mobile devices include components that are used for input, processing, output, storage, and communications. Many of these components are inside the case that contains and protects the electronics of the computer or mobile device from damage. These cases, which are made of metal or plastic, are available in a variety of shapes and sizes (Figure 6-1).

- Recall that the term, *system unit* (or *chassis*), refers to the case on a desktop that contains and protects the motherboard, hard drive, memory, and other electronic components. Some desktops have a tower system unit that is a device separate from the monitor. Others that house the display and the system unit in the same case are called an all-in-one. Peripheral devices normally occupy space outside the system unit and communicate with the system unit using wired or wireless technology.
- On most laptops, including ultrathin laptops, the keyboard and pointing device often occupy the area on top of the case, and the display attaches to the case by hinges.
- With a slate tablet, which typically does not include a physical keyboard, the case is behind the display. Keyboard options for slate tablets include an on-screen keyboard, a wireless keyboard, or a keyboard that attaches to the slate via a clip, magnets, or other mechanism. On a convertible tablet, by contrast, the case is positioned below a keyboard, providing functionality similar to a laptop. The difference is that the display attaches to the case with a swivel-type hinge, enabling the user to rotate the display and fold it down over the keyboard to look like a slate tablet.
- With game consoles, the input and output devices, such as controllers and a television, reside outside the case.
- Like a slate tablet, the case on a smartphone often is behind the display.
- The case on wearable devices, portable media players, digital cameras, and handheld game devices typically consumes the entire device and houses the display and input devices.



Figure 6-1 Cases for computers and mobile devices are available in a variety of shapes and sizes.

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Internet Research

Which laptops are the most popular?

Search for: laptop market share

At some point, you might have to open the case on a desktop or access panels on a laptop to replace or install a new electronic component, or hire a professional to assist with this task. For this reason, you should be familiar with the electronic components inside the case, some of which are shown in Figure 6-2 and discussed in this chapter. Read Secure IT 6-1 for tips related to protecting your computers and mobile devices from theft.

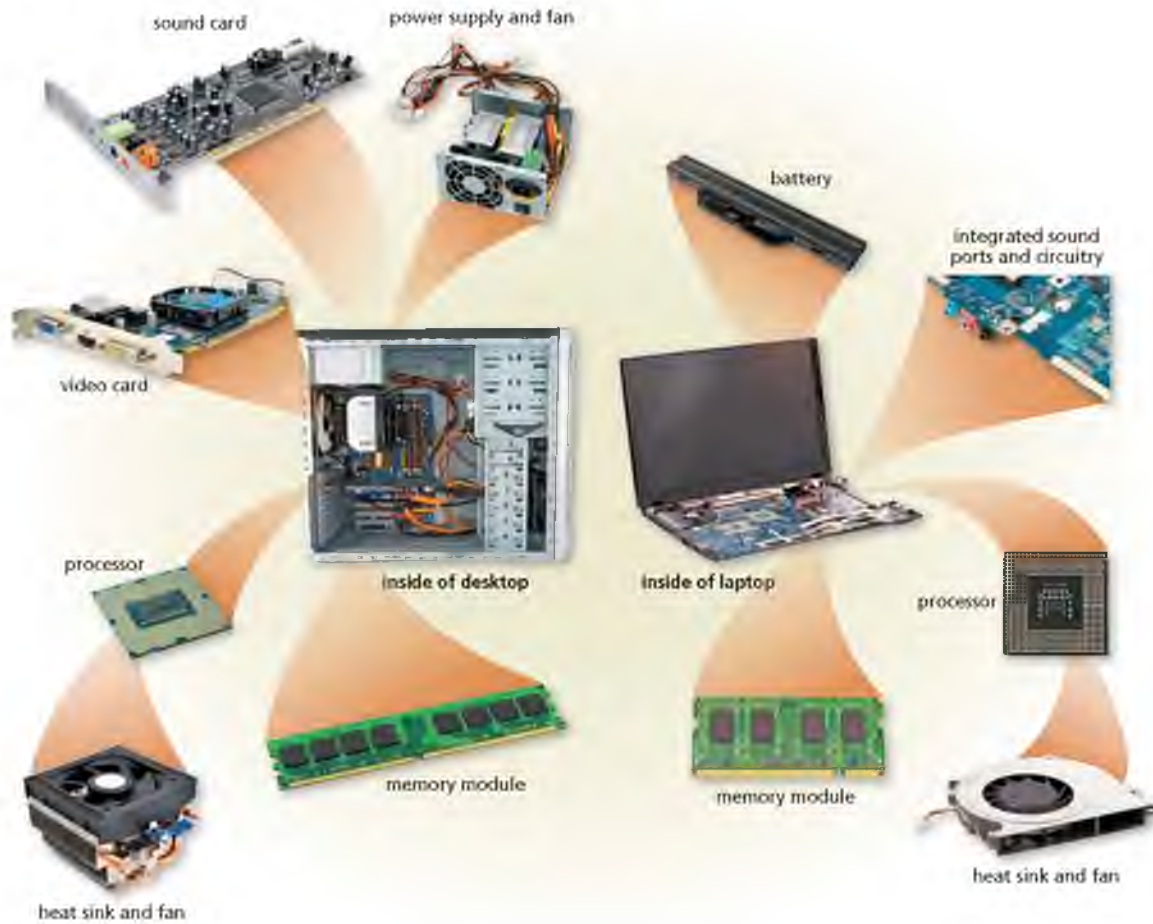


Figure 6-2 This figure shows typical components in a higher-end desktop and laptop. Many basic desktops have integrated video and sound capability, similar to the laptop image shown here.

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The Motherboard

The **motherboard**, sometimes called a *system board*, is the main circuit board of the computer. Many electronic components, such as the processor and memory, attach to the motherboard; others are built into it. Figure 6-3 shows photos of current desktop and laptop motherboards.

On personal computers, the circuitry for the processor, memory, and other components reside on a computer chip(s). A computer **chip** is a small piece of semiconducting material, usually silicon, on which integrated circuits are etched. An *integrated circuit* contains many microscopic pathways capable of carrying electrical current. Each integrated circuit can contain millions of elements such as resistors, capacitors, and transistors. A *transistor*, for example, can act as an electronic switch that opens or closes the circuit for electrical charges. Today's computer chips contain millions or billions of transistors.

Most chips are no bigger than one-half-inch square. Manufacturers package chips so that the chips can be attached to a circuit board, such as a motherboard.

SECURE IT 6-1

Securing Computers and Mobile Devices

Millions of smartphones, mobile devices, and computers are stolen in the United States every year, but only a small percent of these devices are recovered. Many devices can help deter potential thieves and also help trace and recover stolen goods. The following products may be useful in securing and tracking hardware.

- **Clamps, cables, and locks:** Lock kits include mounting plates, glue, cables, and padlocks to protect desktops, monitors, laptops, and peripheral devices.
- **Ultrasonic sensors:** Thieves do not need to remove a computer from an office building or school to commit their crimes; instead, they can open the case on a desktop or server on site and then remove a hard drive or other expensive component. To prevent such tampering, hardware manufacturers have developed an alarm system to install in the case. If the computer is moved or the case is opened,

an ear-piercing alarm sounds and a security company is alerted.

- **Tracking software:** Many smartphones and mobile devices have software that shows the approximate location of devices and computers. The owner can issue commands remotely to have the device play a sound, lock the screen, display a message, or erase all personal information.
- **Asset tags:** Metal security plates affixed to hardware contain unique bar codes that are registered to the owner and are stored in a security company's database. If a lost or stolen device is recovered, the finder can call the phone number on the tag, and the company will notify the owner.
- **Personal safes:** Protective cases that are approximately the size of a cereal box can store a smartphone, keys, tablet, and other valuables. The attached security cable

can be secured to a stationary object, such as a chair or table. Some personal safes have built-in electronic locks; others can be secured with a combination lock. The safe can be useful in a hotel room, at the gym, or on campus.

Consider This: Have you seen any of these security devices at school or at businesses? If so, where? Do you know someone whose computer or mobile device was lost or stolen? If so, was the hardware recovered? What other measures can organizations take to prevent security breaches?



Courtesy of SentrySafe

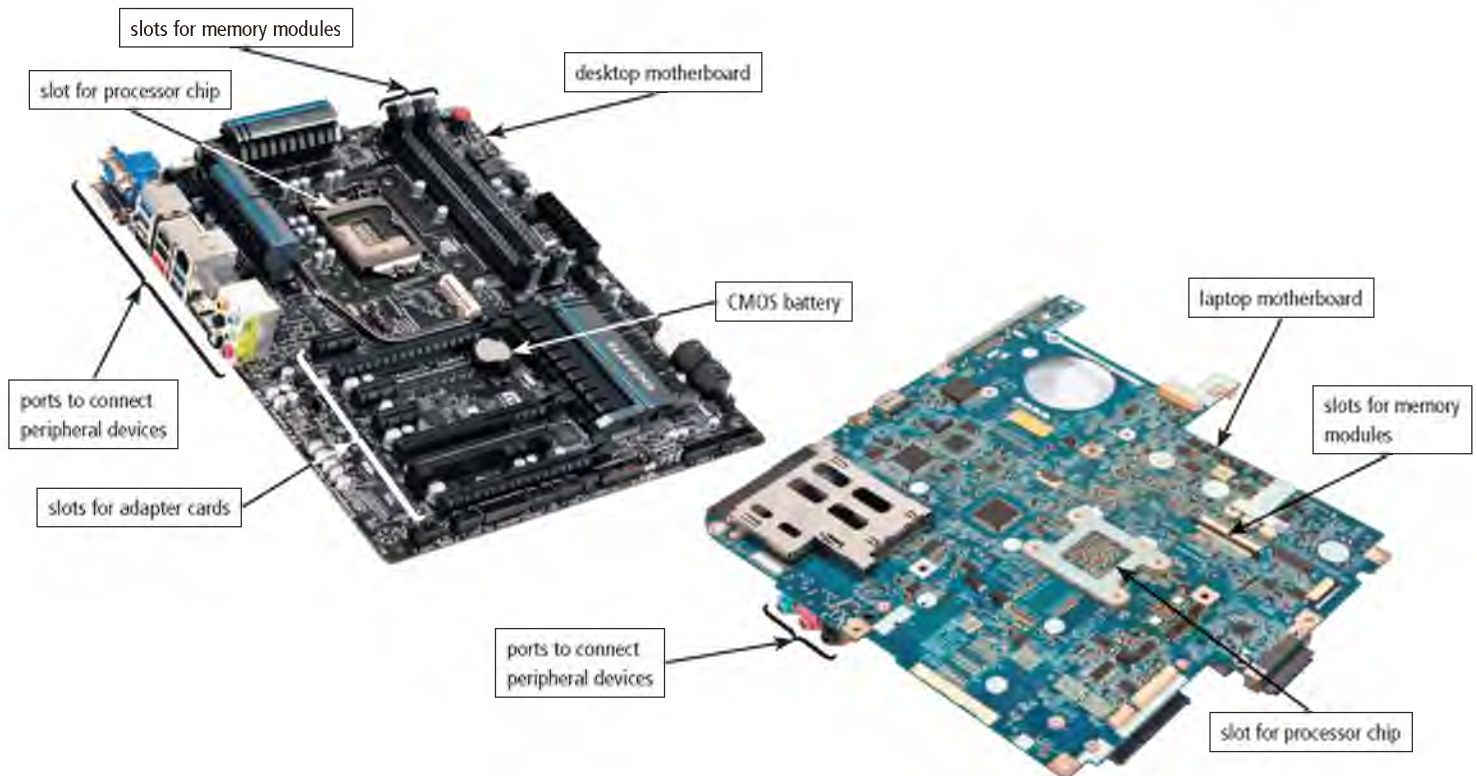


Figure 6-3 A desktop motherboard and a laptop motherboard.

Courtesy of GIGABYTE; © iStockphoto / RAW group

**Technology Trend**

Discover More: Visit this chapter's free resources to learn about medical robotics.

Processors

The **processor**, also called the **central processing unit (CPU)**, interprets and carries out the basic instructions that operate a computer. The processor significantly impacts overall computing power and manages most of a computer's operations. On larger computers, such as mainframes and supercomputers, the various functions performed by the processor extend over many separate chips and often multiple circuit boards. On a personal computer, all functions of the processor usually are on a single chip. Some computer and chip manufacturers use the term *microprocessor* to refer to a personal computer processor chip.

Most processor chip manufacturers now offer multi-core processors. A processor core, or simply core, contains the circuitry necessary to execute instructions. The operating system views each processor core as a separate processor. A **multi-core processor** is a single chip with two or more separate processor cores. Multi-core processors are used in all sizes of computers. Read Secure IT 6-2 to learn how chips can help to identify and secure animals.

**CONSIDER THIS****Are multi-core processors better than single-core processors?**

Each processor core on a multi-core processor generally runs at a slower speed than a single-core processor, but multi-core processors typically increase overall performance. For example, although a dual-core processor does not double the processing speed of a single-core processor, it can approach those speeds. The performance increase is especially noticeable when users are running multiple programs simultaneously, such as antivirus software, spyware remover, email program, Internet messaging, media player, and photo editing software. Multi-core processors also are more energy efficient than separate multiple processors, requiring lower levels of power consumption and emitting less heat inside the case.

SECURE IT 6-2**Chip Implants Secure Animals' Identity**

The search for lost dogs or cats can be traumatic for their owners. The animals' safe return home may be based on data stored on a chip that veterinarians have implanted under the skin, usually at the neck or shoulder blades.

The chip — sometimes called a microchip because it is so small (about the size of a grain of rice) — has a unique number that is registered to the owner's name and address. It contains an antenna and transponder encased in a glass tube. The antenna receives low-frequency radio waves when a scanning device passes over the chip, and the transponder sends a signal with the chip's number back to the scanner.

Shelters and animal control centers routinely scan runaway pets for chips in an attempt to reunite animals with their owners.

Most shelters require pets to have the implant before the animals are adopted or before a once-lost pet is returned to its owner. Some veterinarians also scan new pets for chips to ensure the animal does not belong to someone else.

Some pet owners are concerned that microchipping can cause health problems, particularly if the chip moves from its original injection site. Most humane societies and veterinarians, however, state that no long-term adverse health effects or discomfort occurs.

Microchips also are implanted or attached externally in other animals, including horses, elephants, cows, birds, fish, lizards, and snakes. Breeders, farmers, and animal associations implant the chips to deter thieves. Chips also can monitor an animal's temperature, so that a farmer can prevent the

spread of disease by identifying and removing an ill animal from a herd.

Researchers, including those at the U.S. Fish and Wildlife Service, also use this technology to track migration of wild animals, reptiles, and fish. They study how these species interact with their environment, and conservation authorities can identify endangered species, such as sea turtles, that have been confiscated from smugglers.



Consider This: Do you have or know anyone who has a pet that has been implanted with a chip? If so, why do you think they did it? Besides possible health problems, why might some people oppose mandatory animal chipping? Do you think people someday might choose to have a chip implanted to eliminate the need to carry identification? Why or why not?

Processors contain a control unit and an arithmetic logic unit (ALU). These two components work together to perform processing operations. Figure 6-4 illustrates how other devices connected to the computer communicate with the processor to carry out a task. When a user runs an application, for example, its instructions transfer from a storage device to memory. Data needed by programs and applications enters memory from either an input device or a storage device. The control unit interprets and executes instructions in memory, and the arithmetic logic unit performs calculations on the data in memory. Resulting information is stored in memory, from which it can be sent to an output device or a storage device for future access, as needed.

Discover More: Visit this chapter's free resources to learn more about processor chip manufacturers and multi-core processors.

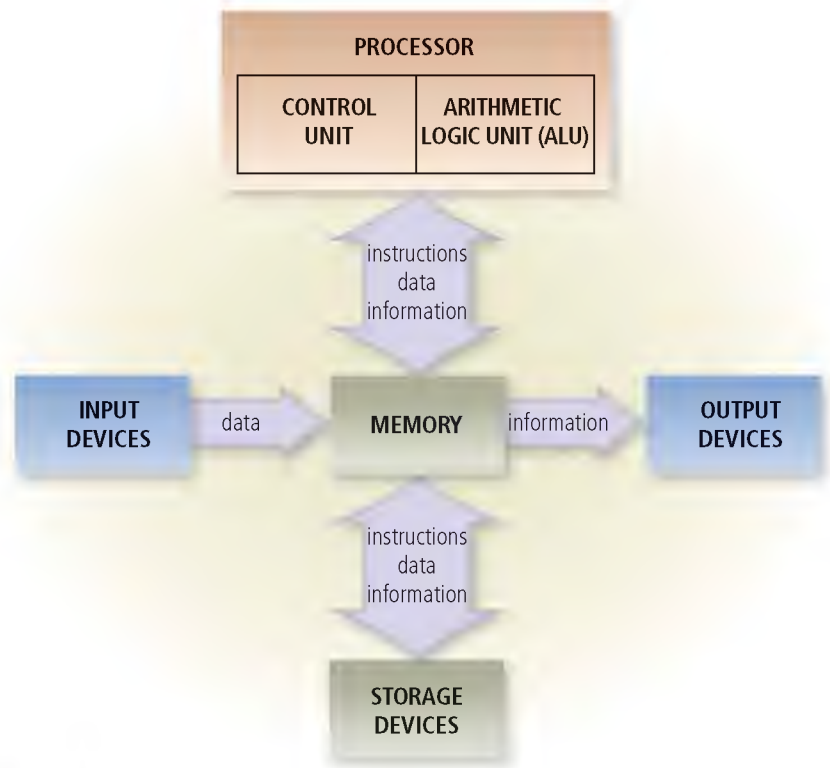


Figure 6-4 Most devices connected to the computer communicate with the processor to carry out a task.
© Cengage Learning

The Control Unit

The **control unit** is the component of the processor that directs and coordinates most of the operations in the computer. That is, it interprets each instruction issued by a program or an application and then initiates the appropriate action to carry out the instruction. Types of internal components that the control unit directs include the arithmetic logic unit, registers, and buses, each discussed in this chapter.

The Arithmetic Logic Unit

The **arithmetic logic unit (ALU)**, another component of the processor, performs arithmetic, comparison, and other operations.

Arithmetic operations include basic calculations, such as addition, subtraction, multiplication, and division. *Comparison operations* involve comparing one data item with another to determine whether the first item is greater than, equal to, or less than the other item. Depending on the result of the comparison, different actions may occur. For example, to determine if an employee should receive overtime pay, software instructs the ALU to compare the number of hours an employee worked during the week with the regular time hours allowed (e.g., 40 hours). If the hours worked exceed 40, for example, software instructs the ALU to perform calculations that compute the overtime wage.

Machine Cycle

For every instruction, a processor repeats a set of four basic operations, which comprise a *machine cycle*: (1) fetching, (2) decoding, (3) executing, and, if necessary, (4) storing.

- *Fetching* is the process of obtaining a program or an application instruction or data item from memory.
- *Decoding* refers to the process of translating the instruction into signals the computer can execute.
- *Executing* is the process of carrying out the commands.
- *Storing*, in this context, means writing the result to memory (not to a storage medium).

Internet Research
What is Moore's Law?
Search for: moores law

Internet Research
What is Wolfram|Alpha?
Search for: wolfram alpha

Figure 6-5 illustrates the steps in a machine cycle. In some computers, the processor fetches, decodes, executes, and stores only one instruction at a time. With others, the processor fetches a second instruction before the first instruction completes its machine cycle, resulting in faster processing. Some use multiple processors simultaneously to increase processing times.

Discover More: Visit this chapter's free resources to learn about two additional ways to increase processing times, pipelining and parallel processing.

The Steps in a Machine Cycle

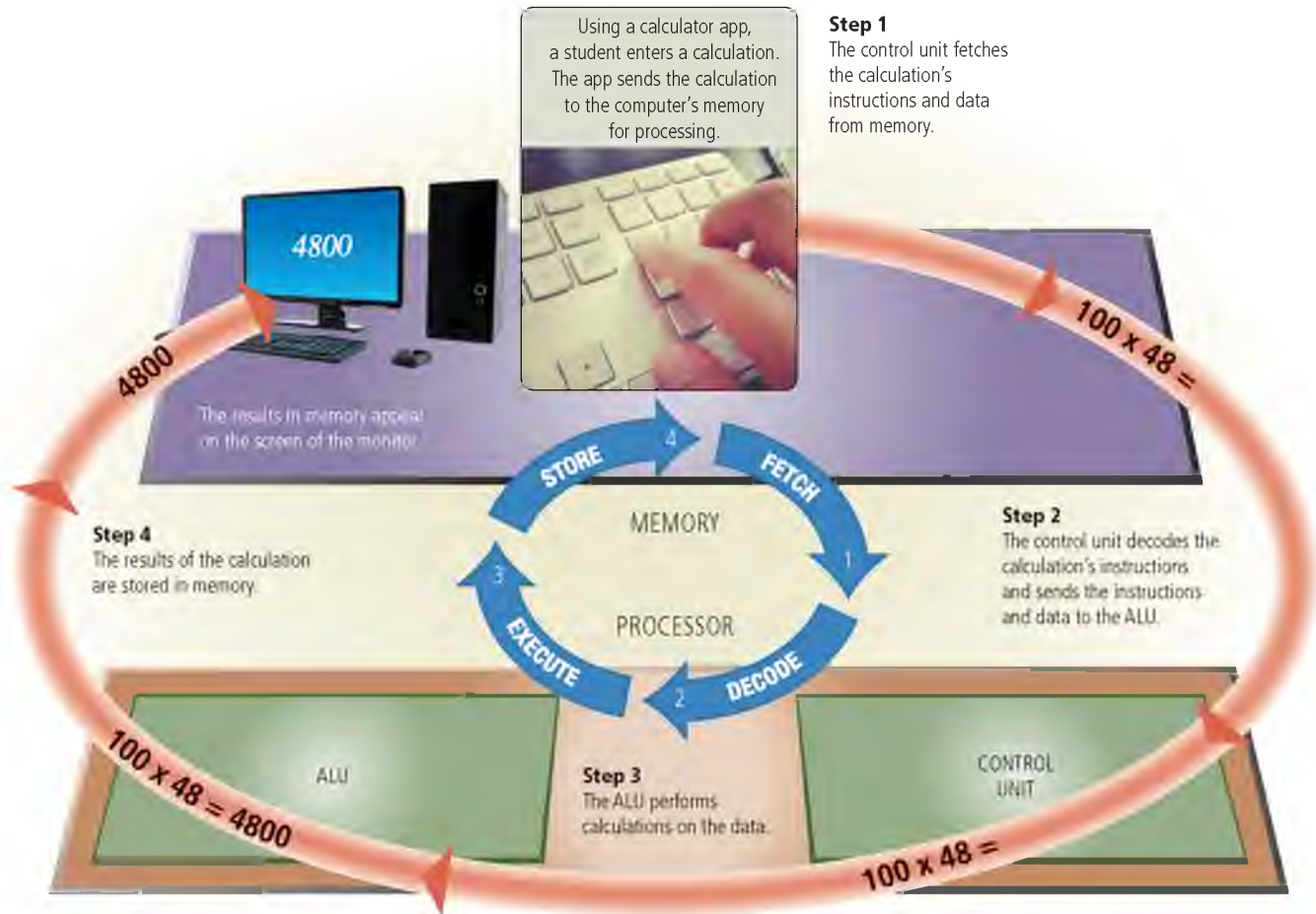


Figure 6-5 This figure shows the steps in a machine cycle.
© iStockphoto / sweetym; © slavchovr / Shutterstock.com; © Cengage Learning

Registers

A processor contains small, high-speed storage locations, called *registers*, that temporarily hold data and instructions. Registers are part of the processor, not part of memory or a permanent storage device. Processors have many different types of registers, each with a specific storage function. Register functions include storing the location from where an instruction was fetched, storing an instruction while the control unit decodes it, storing data while the ALU calculates it, and storing the results of a calculation.



System Clock and Peripheral Devices

The speed of the system clock has no effect on peripheral devices such as a printer or hard drive.

The System Clock

The processor relies on a small quartz crystal circuit called the **system clock** to control the timing of all computer operations. Just as your heart beats at a regular rate to keep your body functioning, the system clock generates regular electronic pulses, or ticks, that set the operating pace of components of the system unit.

Each tick equates to a *clock cycle*. Processors today typically are *superscalar*, which means they can execute more than one instruction per clock cycle.

The pace of the system clock, called the **clock speed**, is measured by the number of ticks per second. Current personal computer processors have clock speeds in the gigahertz range. Giga is a prefix that stands for billion, and a *hertz* is one cycle per second. Thus, one **gigahertz (GHz)** equals one billion ticks of the system clock per second. A computer that operates at 3 GHz has 3 billion (giga) clock cycles in one second (hertz).

The faster the clock speed, the more instructions the processor can execute per second. The speed of the system clock is just one factor that influences a computer's performance. Other factors, such as the type of processor chip, amount of cache, memory access time, bus width, and bus clock speed, are discussed later in this chapter.

CONSIDER THIS

Does the system clock also keep track of the current date and time?

No, a separate battery-backed chip, called the *real-time clock*, keeps track of the date and time in a computer. The battery continues to run the real-time clock even when the computer is off.

Personal Computer and Mobile Device Processors

The leading manufacturers of personal computer processor chips are Intel and AMD. AMD manufactures *Intel-compatible processors*, which have an internal design similar to Intel processors, perform the same functions, and can be as powerful, but often are less expensive. These manufacturers often identify their processor chips by a model name or model number. Read How To 6-1 for items to consider when selecting a processor for a computer.

In the past, chip manufacturers listed a processor's clock speed in marketing literature and advertisements. As previously mentioned, though, clock speed is only one factor that impacts processing speed in today's computers. To help consumers evaluate various processors, manufacturers such as Intel and AMD now use a numbering scheme that more accurately reflects the processing speed of their chips.

Internet Research

What are the fastest processor clock speeds?

Search for: fastest processor

BTW

Technology Innovators

Discover More: Visit this chapter's free resources to learn about Intel, Gordon Moore, and AMD.

HOW TO 6-1

Select the Right Processor


When you are shopping for a new computer, it is important to select one with a processor that will meet your needs. For example, some processors are designed for home users, some are designed for power users, and others are designed for mobile users. Performing basic research before you shop for a new computer can help you select the most appropriate processor. The following steps describe how to select the right processor.

1. Determine your needs. Think about how you will use your computer and the programs and applications you plan to run. If you will be using your computer for basic tasks, such as web browsing or checking email, you may require a less expensive processor than a user who will be running many programs and applications simultaneously.

2. Determine your current processor. If you are replacing your existing computer with a new computer, determine the processor in your existing computer so that you can make sure the new processor is better and faster than the one in use currently.

3. Research processor models. While shopping for computers in your price range, pay attention to the types of processors they include. Visit the processor manufacturer's website and verify that the processor will meet your computing needs adequately. Reviewing the minimum system requirements on the programs and apps you wish to run may help you determine the processor you need. Choose a processor that exceeds the minimum system requirements of the programs and apps you wish to run, but remember that it is not

always necessary to purchase the most expensive computer with the fastest processor.

 **Consider This:** What type of processor is in your current computer? If you were to upgrade your processor, which one would you choose? Why?



Courtesy of Intel

**Technology Innovator**

Discover More: Visit this chapter's free resources to learn about Nvidia, maker of high-performance graphics processors.

Processor chips include technologies to improve processing performance (for example, to improve performance of media and 3-D graphics). Some also include technology to track computer hardware and software, diagnose and resolve computer problems, and secure computers from outside threats. Processors for mobile computers also include technology to optimize and extend battery life and integrate wireless capabilities. Smaller mobile devices often use more compact processors that consume less power, yet offer high performance.

Discover More: Visit this chapter's free resources to learn more about processor chips.

**CONSIDER THIS****Can you upgrade an existing computer's processor?**

You might be able to upgrade a processor to increase the computer's performance. Be certain the processor you buy is compatible with your computer's motherboard; otherwise, you will have to replace the motherboard, too.

**Mobile Device Cooling**

Mobile devices often use low-voltage processors, which have such low power demands that they do not require additional cooling.

Processor Cooling

Processor chips for laptops, desktops, and servers can generate quite a bit of heat, which could cause the chip to malfunction or fail. Although the power supply on some computers contains a main fan to generate airflow, today's personal computer processors often require additional cooling.

Some computer cases locate additional fans near certain components, such as a processor, to provide additional cooling. Heat sinks, liquid cooling technologies, and cooling mats often are used to help further dissipate processor heat.

A *heat sink* is a small ceramic or metal component with fins on its surface that absorbs and disperses heat produced by electrical components, such as a processor. Many heat sinks have fans to help distribute air dissipated by the heat sink. Some heat sinks are packaged as part of a processor chip. Others are installed on the top or the side of the chip (Figure 6-6).

Some computers use liquid cooling technology to reduce the temperature of a processor. *Liquid cooling technology* uses a continuous flow of fluid(s), such as water and glycol, in a process that transfers the heated fluid away from the processor to a radiator-type grill, which cools the liquid, and then returns the cooled fluid to the processor.

Laptop users often use a cooling pad to help further reduce the heat generated by their computer. A *cooling pad* rests below a laptop and protects the computer from overheating and also the user's lap from excessive heat (Figure 6-7). Some cooling pads contain a small fan to transfer heat away from the laptop. These types of cooling pads often draw power from a USB port. Instead of using power, other pads absorb heat through a conductive material inside the pad.



Figure 6-6 This photo shows a heat sink being attached to the top of a processor to prevent the chip from overheating.

© Claudio Bravo / Shutterstock.com



Figure 6-7 A laptop cooling pad helps reduce heat generated by a laptop.

Courtesy of Targus Group International, Inc; Courtesy of Targus Group International, Inc.

Mini Feature 6-1: The Internet of Things

The *Internet of Things (IoT)* describes a computing environment where everyday objects, or things, are connected to the Internet. Sensors connected to these objects may gather, share, transmit, and receive data about the objects with other devices or servers online. Users can

access the data or control individual objects using web or mobile apps. Read Mini Feature 6-1 to learn about types of devices used as things and technologies used to enable the IoT. Read Ethics & Issues 6-1 to consider whether the IoT discriminates, and read Secure IT 6-3 for privacy issues related to the IoT.



Technology Trend
Discover More: Visit this chapter's free resources to learn about self-driving cars.

MINI FEATURE 6-1

The Internet of Things

Analysts predict that the IoT will be a multitrillion-dollar business as the number of “smart” devices and things connected to the Internet continues to increase. As watches, thermostats, fitness trackers, appliances, clothing, and other “things” become equipped with sensors that can transmit data to and from the Internet, keeping every “thing” connected could become one of the world's largest industries.

From Devices to Things

Computers and mobile devices are not the only things that connect to the Internet. You can buy a thermostat, such as the one from Nest Labs shown in the figure, that



Source: Nest Labs

allows you to adjust the temperature of your home from anywhere using an app on your smartphone. The thermostat contains a temperature sensor that can send and receive data. A wireless chip attached to your medicine bottle can send text messages to remind you to take your medication and then contact your pharmacy to refill the prescription when it is due for a refill. Smart trash cans in public places have sensors that monitor the amount of trash deposited and then send a message notifying owners when the containers need to be emptied. This saves garbage collectors from checking the containers every day; instead, they can empty the containers only when receiving a message that they are full.

Wearable technology, such as smartwatches and wristbands, can track your pulse and heart rate, as well as accept calls and display notifications from a smartphone. Many public buses and subways have GPS sensors that report their locations so that travelers can track them with mobile apps. Retailers can use beacons, which are devices that send low-energy Bluetooth signals to nearby smartphones, to notify customers who use a payment app such as Paypal, of personalized offers in their stores.


Washers and dryers in many college dormitory laundry rooms are connected to sensors that report the availability of an individual machine. Students can visit a website, use a mobile app, or request text message alerts to locate available machines before carrying their laundry to the laundry room.

Technologies Enable the IoT

The IoT brings together several recent technology developments. Communications technologies, such as Bluetooth, RFID tags, near-field communications (NFC) tags, and sensors tracking heat (temperature), light, weight, or location have become readily available. Sensors and tags can transmit messages to a server on the Internet over a wireless network at frequent intervals for analysis and storage. Developments in Big Data have made it possible to access, store, and process all of this data reported by sensors efficiently. (To learn more about Big Data, read Mini Feature 11-1 in Chapter 11.) Mobile service providers offer connectivity to a variety of devices at broadband speeds, so transmitting and retrieving data can take place quickly. The size and cost of wireless radios has decreased, enabling more things to have embedded sensors, tags, and transmitters.

The capability of computers, devices, and everyday objects to communicate with one another over the Internet has opened new possibilities for both consumers and the enterprise to be more productive, efficient, and informed.

Discover More: Visit this chapter's free resources to learn more about the Internet of Things.

 **Consider This:** Research one of the smart products described in the “From Devices to Things” section of this mini feature. Who manufactures or uses it? How does it work? What are the benefits to such a smart product? What object or thing do you wish was connected to the Internet? What data would you like it to send or capture? How might an app help you to control this object or access information about it? How would this improve your life?



Source: Mac-Gray Corporation

ETHICS & ISSUES 6-1



Does the Internet of Things Discriminate?

Technology experts expect that the advantages brought by the expansion of the Internet of Things (IoT) will enhance the comfort, safety, and efficiency of a large population across the globe. Where does that leave people who are struggling to make ends meet? What about those who live in developing countries?

Among the IoT technologies that exist or are in development include the following examples. Students can find accurate information quickly and use cloud-based apps to store data so that it is accessible. The coordination of traffic lights based on GPS data will lead to a lessening of commute times. Wearable and implanted devices can collect and communicate health-related

data. Sensors that monitor temperature, air and water quality and usage, and more, will reduce home ownership costs and security risks. Agricultural devices can monitor, track, and provide assessment of livestock and crops to lower costs and improve access to food.

Individuals or countries that cannot afford these and other IoT-related technologies may feel a negative impact as others take advantage of the effects brought by these technologies. Students without access to these technologies could be at a disadvantage. Workers with shorter travel times may enjoy a better quality of life. Those who cannot afford health-related devices may be at higher risk for illnesses or medical complications. Homeowners without

IoT-enabled homes may be more prone to dangers, such as fires. Countries involved in agricultural exporting may lose business as others are able to reduce costs.

As costs of these technologies decrease, it is likely that the divide between the more and less fortunate will decrease. Awareness of the impact of the inequalities also may give rise to nonprofits or organizations that focus on providing IoT technologies to a larger population.

Consider This: In what other ways will IoT affect individuals and countries who cannot afford these technologies? What responsibility exists to make IoT technologies available to all?

SECURE IT 6-3



Does the Internet of Things Encroach on Privacy?

Being digitally observed in the connected world is inescapable. Every day, smart electric meters, wearable technology, and vehicles' black boxes submit data about us as part of the Internet of Things (IoT). Researchers predict billions of devices will be part of the IoT by the end of this decade. With all these devices in nearly every facet of our daily lives, data is being accumulated and sold to health care providers, home security businesses, utility companies, and researchers.

Savvy consumers can take some steps to attempt to limit exposure to data collection.

They can enable privacy settings, for example, but that does not guarantee that data is not being gathered, transmitted, and compiled. The report of Smart TVs secretly collecting data about audiences' viewing habits sparked privacy and security concerns. Consumers need to urge companies to design products with built-in privacy protections. These devices could have default settings that prevent the sharing of data until obtaining the consumer's consent. Companies should explain what data is being collected and whether it will be used to help people live more productive lives or to create personal profiles that predict behavior. In addition, companies bear the responsibility

of ensuring sensitive data being collected is kept secure and confidential.

Privacy and security concerns abound with the Internet of Things, but most consumers and technology experts believe that the security, health, and productivity benefits of this technology outweigh the potential risks.

Consider This: Should companies inform consumers about the data being collected in homes, vehicles, schools, and workplaces? What role should governmental agencies, such as the Federal Trade Commission, play in overseeing companies' secure products and commercial data collection techniques?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Inside the Case and Processors as it relates to the chapter objectives.

Now you should know . . .

- Why you should protect the contents of computers and mobile devices (Objective 1)
- How processors in computers and mobile devices operate (Objective 2)
- Which processors might be best suited to your needs, and how to keep processors and other components from overheating (Objective 3)
- How you might interact with the Internet of Things (Objective 4)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Cloud Computing

Recall that cloud computing refers to an environment of servers that house and provide access to resources users access via the Internet. Home and business users choose cloud computing for a variety of reasons:

- **Accessibility:** Data and/or applications are available worldwide from any computer or device with an Internet connection.
- **Cost savings:** The expense of software and high-end hardware, such as fast processors and high-capacity memory and storage devices, shifts away from the user.
- **Space savings:** Floor space required for servers, storage devices, and other hardware shifts away from the user.
- **Scalability:** Provides the flexibility to increase or decrease computing requirements as needed.

Cloud computing consists of a front end and a back end, connected to each other through a network. The front end includes the hardware and software with which a user interacts to access the cloud. For example, a user might access a resource on the cloud through a browser on a laptop. The back end consists of the servers and storage devices that manage and store the resources accessed by users.

Mini Feature 6-2: Cloud Computing Services

Cloud computing allows companies to outsource, or contract to third-party providers, elements of their information technology infrastructure. They pay only for the computing power, storage, bandwidth, and access to applications that they actually use. As a result, companies need not make large investments in equipment, or the staff to support it. Read Mini Feature 6-2 to learn about available types of cloud computing services.



BTW

Technology Innovator

Discover More: Visit this chapter's free resources to learn about VMware, a provider of virtualization software and cloud computing services.



Internet Research

Which companies offer cloud computing services?

Search for: cloud computing providers

MINI FEATURE 6-2

Cloud Computing Services

Consumers and organizations rely on cloud computing services to manage IT infrastructure (infrastructure as a service), provide applications (software as a service), access online data (data as a service), and create, test, and deploy applications using web-based development tools (platform as a service).

Infrastructure as a Service

IaaS (infrastructure as a service) uses software to emulate hardware capabilities, enabling companies to scale, or adjust up or down, storage, processing power, or bandwidth as needed. For example, retailers may need to increase these capabilities to accommodate additional traffic to their websites during busy holiday shopping seasons. When the season ends, retailers easily can reduce these settings.

Two specific instances of IaaS are storage as a service and desktop as a service:

- **Storage as a Service:** Cloud storage providers offer file management services such as storing files online, system backup, and archiving earlier versions

of files. Cloud storage is especially useful to tablet and smartphone users, because it enables them to access their files from all of their devices.

- **Desktop as a Service:** Some companies specify the applications, security settings, and computing resources available to employees on their desktop computers. These images, or configurations, provide a common desktop work environment available to employees across an entire organization. Because the desktop and its applications appear to be installed on the user's own computer, desktop as a service also is known as a *virtual desktop*.

Software as a Service

SaaS (software as a service) describes a computing environment where an Internet server hosts and deploys applications. Editing documents or photos, sending email messages, and managing finances are common consumer tasks of SaaS applications. A pioneering provider of SaaS applications for companies is Salesforce (shown in the figure in this mini feature), which offers customer relationship management (CRM) software. Salesforce users subscribe to modules to handle tasks such as sales and marketing campaigns and customer services.

(continued)



Source: Courtesy Salesforce.com

Data as a Service

Government agencies, companies, and social media sites make data available for developers to incorporate in applications or to use when making business decisions and plans. *DaaS (data as a service)* allows users and applications to access a company's data. *Mashups*

are applications that incorporate data from multiple providers into a new application. Displaying homes or crime statistics on a map are examples of mashups that require data from real estate, police records, and mapping providers.

Platform as a Service





Application developers need to maintain computers running specific hardware, operating systems, development tools, databases, and other software. *PaaS (platform as a service)* allows developers to create, test, and run their solutions on a cloud platform without having to purchase or configure the underlying hardware and software.

Discover More: Visit this chapter's free resources to learn more about the various cloud services described in this mini feature.

Consider This: Cloud computing services are based on a "pay as you go" model. How are cloud services different from desktop or mobile applications? What services are customers paying for from an SaaS provider? Under what circumstances might it be advantageous to purchase an external hard drive to store your files, rather than storing them on a third-party server on the cloud?

Data Representation

To understand how a computer processes data, you should know how a computer represents data. People communicate through speech by combining words into sentences. Human speech is **analog** because it uses continuous (wave form) signals that vary in strength and quality. Most computers are **digital**. They recognize only two discrete states: on and off. This is because computers are electronic devices powered by electricity, which also has only two states: on and off.

Binary Digit (bit)	Electronic Charge	Electronic State
		ON
		OFF

Bits and Bytes

The two digits, 0 and 1, easily can represent these two states (Figure 6-8). The digit 0 represents the electronic state of off (absence of an electronic charge). The digit 1 represents the electronic state of on (presence of an electronic charge).

When people count, they use the 10 digits in the decimal system (0 through 9). The computer, by contrast, uses a binary system because it recognizes only two states. The **binary system** is a number system that has just two unique digits, 0 and 1, called bits. A **bit** (short for *binary digit*) is the smallest unit of data the computer can process. By itself, a bit is not very informative.

When 8 bits are grouped together as a unit, they form a **byte**. A byte provides enough different combinations of 0s and 1s to represent 256 different characters. These characters include numbers, uppercase and lowercase letters of the alphabet, punctuation marks, and other keyboard symbols, such as an asterisk (*), ampersand (&), and dollar sign (\$).

Figure 6-8 The circuitry in a computer or mobile device represents the on or the off states electronically by the presence or absence of an electronic charge.

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Coding Schemes

The combinations of 0s and 1s that represent uppercase and lowercase letters, numbers, and special symbols are defined by patterns called a coding scheme. Coding schemes map a set of *alphanumeric characters* (letters and numbers) and special symbols to a sequence of numeric values that a computer can process. *ASCII* (pronounced ASK-ee), which stands for American Standard Code for Information Interchange, is the most widely used coding scheme to represent a set of characters. In the ASCII coding scheme, for example, the alphabetic character E is represented as 01000101; the symbolic character * is represented as 00101010; the numeric character 6 is represented as 00110110 (Figure 6-9).

When you press a key on a keyboard, a chip in the keyboard converts the key's electronic signal into a special code, called a scan code, that is sent to the electronic circuitry in the computer. Then, the electronic circuitry in the computer converts the scan code into its ASCII binary form and stores it as a byte value in its memory for processing. When processing is finished, the computer converts the byte into a human-recognizable number, letter of the alphabet, or special character that is displayed on a screen or is printed (Figure 6-10). All of these conversions take place so quickly that you do not realize they are occurring.

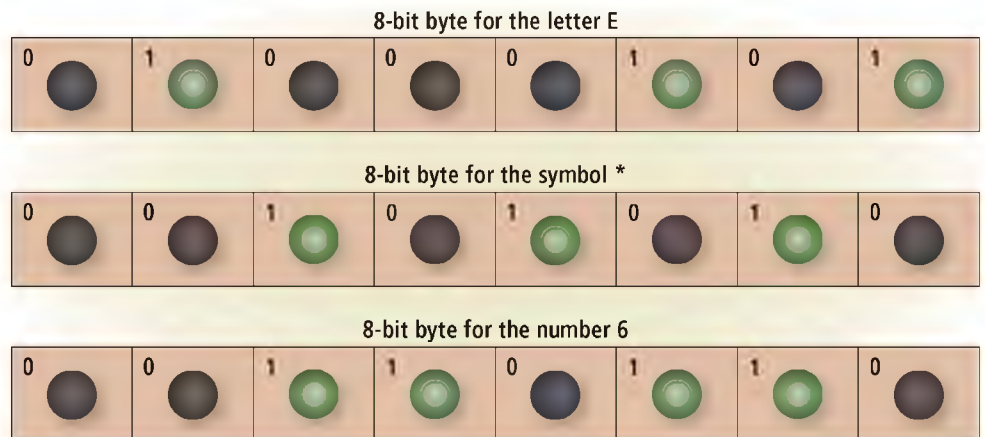


Figure 6-9 Eight bits grouped together as a unit are called a byte. A byte represents a single character in the computer or mobile device.

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High-Tech Talk

Discover More: Visit this chapter's free resources to learn more about coding schemes and number systems.

How a Letter Is Converted to Binary Form and Back

Step 1

A user presses the capital letter **T** (SHIFT+T keys) on the keyboard, which in turn creates a special code, called a scan code, for the capital letter **T**.



Step 2

The scan code for the capital letter **T** is sent to the electronic circuitry in the computer.



Step 4

After processing, the binary code for the capital letter **T** is converted to an image and displayed on the output device.



Step 3

The electronic circuitry in the computer converts the scan code for the capital letter **T** to its ASCII binary code (01010100) and stores it in memory for processing.



Figure 6-10 This figure shows how a letter is converted to binary form and back.

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CONSIDER THIS

Why are coding schemes necessary?

Computers rely on logic circuits, which are controlled by electronic switches whose state can be either on or off. Each switch's on/off state is represented by one bit, whose value is either 0 or 1. Coding schemes translate real-world data into a form that computers can process easily.

Memory

Memory consists of electronic components that store instructions waiting to be executed by the processor, data needed by those instructions, and the results of processing the data (information). Memory usually consists of one or more chips on the motherboard or some other circuit board in the computer. Memory stores three basic categories of items:

1. The operating system and other programs that control or maintain the computer and its devices
2. Applications that carry out a specific task, such as word processing
3. The data being processed by the applications and the resulting information

This role of memory to store both data and programs is known as the *stored program concept*.

Bytes and Addressable Memory

A byte (character) is the basic storage unit in memory. When an application's instructions and data are transferred to memory from storage devices, the instructions and data exist as bytes. Each byte resides temporarily in a location in memory that has an address. Simply put, an *address* is a unique number that identifies the location of a byte in memory. To access data or instructions in

memory, the computer references the addresses that contain bytes of data. The photo in Figure 6-11 shows how seats in a stadium are similar to addresses in memory:

(1) a seat, which is identified by a unique seat number, holds one person at a time, and a location in memory, which is identified by a unique address, holds a single byte; and (2) both a seat, identified by a seat number, and a byte, identified by an address, can be empty.

Manufacturers state the size of memory in terms of the number of bytes it has available for storage. Common sizes for memory are in the gigabyte and terabyte range. A *gigabyte (GB)* equals approximately 1 billion bytes. A *terabyte (TB)* is equal to approximately 1 trillion bytes.

Types of Memory

Computers and mobile devices contain two types of memory: volatile and nonvolatile. When the computer's power is turned off, *volatile memory* loses its contents. *Nonvolatile memory*, by contrast, does not lose its contents when power is removed from the computer. Thus,

volatile memory is temporary and nonvolatile memory is permanent. RAM is the most common type of volatile memory. Examples of nonvolatile memory include ROM, flash memory, and CMOS. The following sections discuss these types of memory.

RAM

Users typically are referring to RAM when discussing computer and mobile device memory. **RAM** (*random access memory*), also called *main memory*, consists of memory chips that can be read from and written to by the processor and other devices. When you turn on power to a computer or mobile device, certain operating system files (such as the files that determine how the desktop

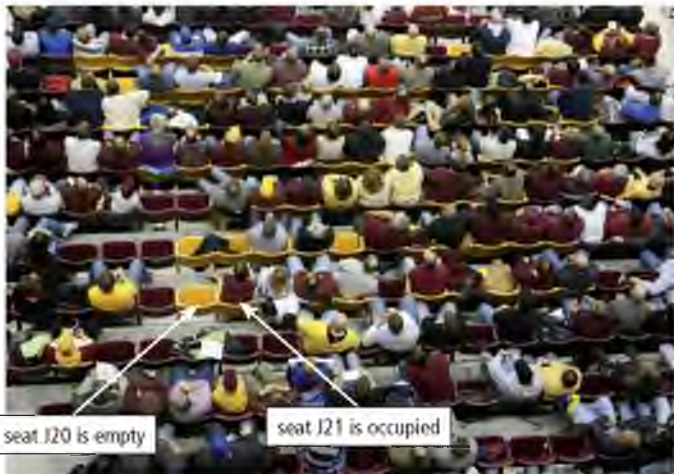


Figure 6-11 Seats in a stadium are similar to addresses in memory: a seat holds one person at a time, and a location in memory holds a single byte; and both a seat and a byte can be empty.

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or home screen appears) load into RAM from a storage device such as a hard drive. These files remain in RAM as long as the computer or mobile device has continuous power. As additional applications and data are requested, they also load into RAM from storage.

The processor interprets and executes a program or application's instructions while the program or application is in RAM. During this time, the contents of RAM may change (Figure 6-12). RAM can accommodate multiple programs and applications simultaneously.

Most RAM is volatile, which means it loses its contents when the power is removed from the computer. For this reason, you must save any data, instructions, and information you may need in the future. Saving is the process of copying data, instructions, and information from RAM to a storage device such as a hard drive.

How Program Instructions Transfer in and out of RAM

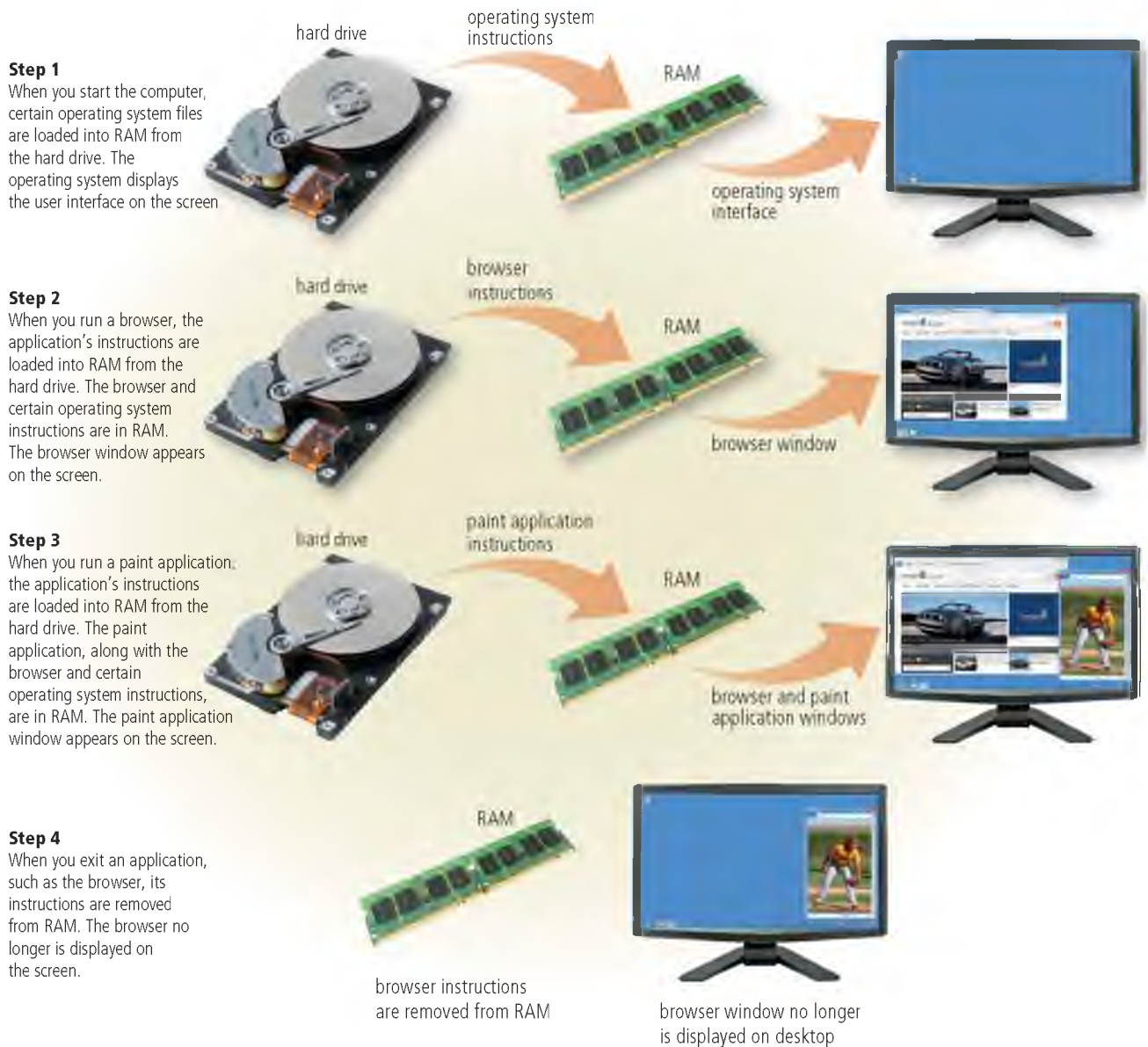


Figure 6-12 This figure shows how program and application instructions transfer in and out of RAM.

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Types of RAM Two common types of RAM are dynamic RAM and static RAM:

- *Dynamic RAM (DRAM* pronounced DEE-ram) chips must be reenergized constantly or they lose their contents. Many variations of DRAM chips exist, most of which are faster than the basic DRAM (Table 6-1).
- *Static RAM (SRAM* pronounced ESS-ram) chips are faster and more reliable than any variation of DRAM chips. These chips do not have to be reenergized as often as DRAM chips; hence, the term, static. SRAM chips, however, are much more expensive than DRAM chips. Special applications, such as cache, use SRAM chips. A later section in this chapter discusses cache.

Read How To 6-2 for instructions about determining memory requirements.

 **Table 6-1 Common DRAM Variations**

Name	Comments
SDRAM (Synchronous DRAM)	<ul style="list-style-type: none"> • Synchronized to the system clock • Much faster than DRAM
DDR SDRAM (Double Data Rate SDRAM)	<ul style="list-style-type: none"> • Transfers data twice, instead of once, for each clock cycle • Faster than SDRAM
DDR2	<ul style="list-style-type: none"> • Second generation of DDR • Faster than DDR
DDR3	<ul style="list-style-type: none"> • Third generation of DDR • Designed for computers with multi-core processors • Faster than DDR2
DDR4	<ul style="list-style-type: none"> • Fourth generation of DDR • Faster than DDR3
RDRAM (Rambus DRAM)	<ul style="list-style-type: none"> • Much faster than SDRAM

Discover More: Visit this chapter's free resources to learn about additional DRAM variations.

HOW TO 6-2



Determine Memory Requirements


If you are shopping for a new computer or looking to upgrade your existing computer, be sure that it will have sufficient memory. When a computer has insufficient memory, its performance can slow significantly. On the other hand, it would be an unnecessary expense to purchase a computer with more memory than you will ever use. The following steps describe how to determine memory requirements.

1. If you are upgrading the memory in your existing computer, determine the following:
 - a. Amount of memory currently installed
 - b. Amount of memory the computer can support
 - c. Type of memory modules currently installed
 - d. Whether memory modules must be installed in pairs
 - e. Number of available slots for memory modules

2. Determine the amount of memory your computer requires by checking the memory requirements for the operating system and programs and applications you plan to run. You can find the system requirements, which will specify the memory requirements, on product packaging or on a software manufacturer's website. If you are planning to upgrade your computer and the amount of memory you require exceeds the amount of memory your computer currently can support, you may need to purchase a new computer. If you are purchasing a new computer, view the computer's specifications to make sure it has sufficient memory. Some online vendors offer a web app that will check the configuration on your computer to determine the memory modules that are compatible and offer options to you for purchase.
3. Once you have determined your memory requirements, you are ready to purchase the memory modules. Memory modules are

available for purchase in many computer and electronic stores, directly from computer manufacturers, and on various websites. When you are purchasing memory modules, keep the following in mind:

- a. Many types of memory modules are available. Purchase a type, size, and speed that is compatible with your computer.
- b. If your computer requires that you install memory in pairs, be sure to purchase two memory modules that are the same type, size, and speed.
- c. Do not purchase more memory modules than you have slots available. You may need to remove existing memory modules to make room for new memory modules.

 **Consider This:** How much memory would be appropriate for your computer based on your current computing needs?

Memory Modules RAM chips usually reside on a memory module, which is a small circuit board. Memory slots on the motherboard hold memory modules.

Two types of memory modules are SIMMs and DIMMs (Figure 6-13). A *SIMM* (single inline memory module) has pins on opposite sides of the circuit board that connect together to form a single set of contacts. With a *DIMM* (dual inline memory module), by contrast, the pins on opposite sides of the circuit board do not connect and, thus, form two sets of contacts. Read How To 6-3 for instructions about installing memory modules.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn how data is written to RAM.

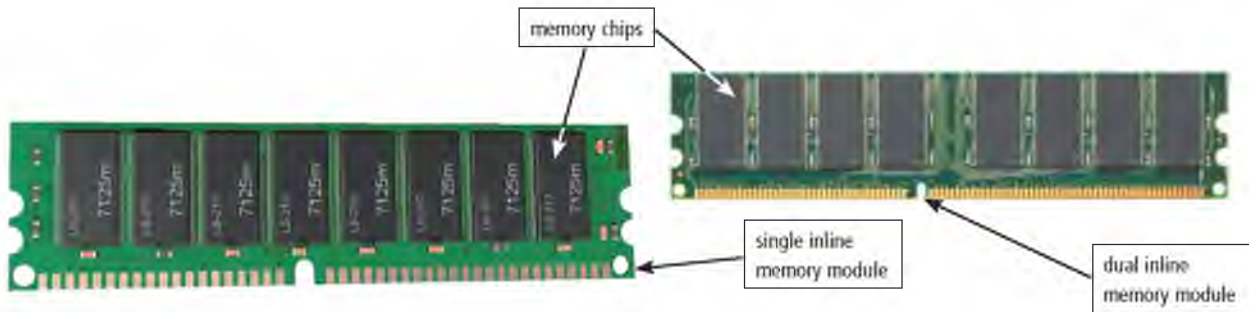


Figure 6-13 Memory modules contain memory chips.

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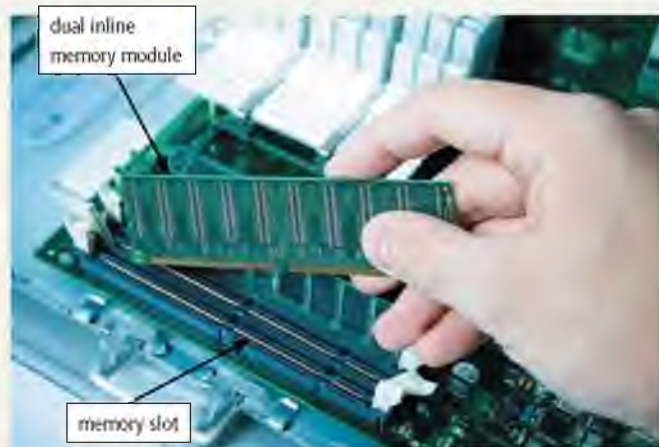
HOW TO 6-3

Install Memory Modules

Installing additional memory modules in a desktop or laptop can be a relatively easy process. The following steps describe how to install new memory modules.

1. Turn off and unplug your computer from the power source. If you are using a laptop, remove its battery.
2. Wear an antistatic wristband to protect the computer from static electricity.
3. Remove or open the computer case. If you are upgrading a laptop, you may be able to locate the slots for the memory modules through an access panel.
4. If necessary, remove any existing memory modules you no longer need. If clips are holding the memory module in place, you may need to pull the clips away from the memory module before removing it. Remove the memory modules by lifting them out by the side edges.
5. Remove the new memory modules from the packaging.
6. Slowly and carefully insert the memory modules into the slots on your computer's motherboard. Be sure they are facing the correct way as you insert them. The memory modules should "click" in place once they are inserted completely.
7. Close the computer case or any access panel you have opened.
8. Plug in the computer and turn it on.
9. Check the system information in the operating system to make sure it is recognizing the new amount of memory installed.

Consider This: Why might it not be possible to install memory modules in some types of computers?



Cache

Most of today's computers improve their processing times with **cache** (pronounced cash), which is a temporary storage area. Two common types of cache are memory cache and disk cache. This chapter discusses memory cache. Chapter 8 discusses disk cache.

BTW
L2 Cache

When discussing cache, most users are referring to L2 cache.

Memory cache helps speed the processes of the computer because it stores frequently used instructions and data. Most personal computers today have two types of memory cache: Level 1 (L1) cache and Level 2 (L2) cache. Some also have Level 3 (L3) cache.

- *L1 cache* is built directly on the processor chip. L1 cache usually has a very small capacity.
- *L2 cache* is slightly slower than L1 cache but has a much larger capacity. Current processors include *advanced transfer cache (ATC)*, a type of L2 cache built directly on the processor chip. Processors that use ATC perform at much faster rates than those that do not use it.
- *L3 cache* is a cache on the motherboard that is separate from the processor chip. L3 cache exists only on computers that use L2 advanced transfer cache.

When the processor needs an instruction or data, it searches memory in this order: L1 cache, then L2 cache, then L3 cache (if it exists), then RAM — with a greater delay in processing for each level of memory it must search (Figure 6-14). If the instruction or data is not found in memory, then it must search a slower speed storage medium, such as a hard drive or optical disc.

Discover More: Visit this chapter's free resources to learn more about memory cache.

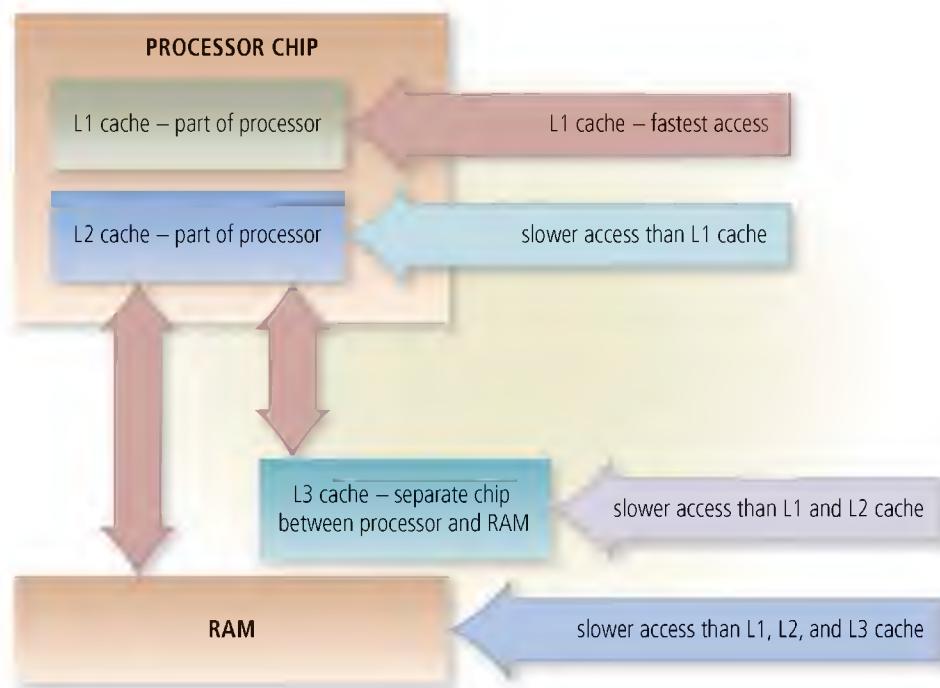


Figure 6-14 Memory cache helps speed processing times when the processor requests data, instructions, or information.

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ROM

Read-only memory (ROM pronounced rahm) refers to memory chips storing permanent data and instructions. The data on most ROM chips cannot be modified — hence, the name read-only. ROM is nonvolatile, which means its contents are not lost when power is removed from the computer. In addition to computers and mobile devices, many peripheral devices contain ROM chips. For example, ROM chips in printers contain data for fonts.

Manufacturers of ROM chips often record data, instructions, or information on the chips when they manufacture the chips. These ROM chips, called **firmware**, contain permanently written data, instructions, or information, such as a computer or mobile device's start-up instructions. Read Ethics & Issues 6-2 to consider issues related to the manufacture of computer and mobile device components.

ETHICS & ISSUES 6-2

Should Companies Reveal Which Products They Manufacture Using Fair Trade Practices?

Despite the increased cost, many coffee and tea drinkers gladly purchase fair trade products. Fair trade labels indicate that the workers who pick the coffee beans or tea leaves work in humane conditions and receive fair pay for their labor.

With respect to technology, several cases of unfair labor practices exist. Some technology manufacturers use products or components made in areas of extreme poverty. In these cases, factory owners coerce workers, including children, to work long hours in unsafe or unsanitary conditions for little pay and without breaks. In another example, mining for the raw materials needed to manufacture technology

components may occur in areas where military conflict exists. Those involved in the military conflict may use the revenue from mining this material, sometimes called conflict minerals, to fund the soldiers and continue the discord.

Under a rule recently adopted by the U.S. Securities and Exchange Committee (SEC), manufacturers must review their supply sources and file a form disclosing any materials mined in areas of conflict. Failure to disclose may have legal consequences, as well as attract the attention of human rights and environmental activists. Critics of this rule state that it does not address methods to ease situations of conflict, and may take jobs away from the workers. In addition, the rule applies only to manufacturers, not to retailers or distributors.

The Fair Labor Association (FLA) provides workplace standards for the environment and treatment of workers at all stages of product development. Many technology companies are making efforts to comply with the SEC ruling, as well as FLA guidelines. Providing a living wage, ensuring worker safety, and mandating that workers receive breaks are some of the guidelines.

Consider This: Would you pay more for a fair trade smartphone or laptop? Why or why not? Are retailers responsible for the source of the materials used in products they sell? Why or why not? Should the government require companies to comply with fair trade policies? Why or why not?

Flash Memory

Flash memory is a type of nonvolatile memory that can be erased electronically and rewritten. Most computers use flash memory to hold their start-up instructions because it allows the computer to update its contents easily. For example, when the computer changes from standard time to daylight savings time, the contents of a flash memory chip (and the real-time clock chip) change to reflect the new time.

Flash memory chips also store data and programs on many mobile devices and peripheral devices, such as smartphones, portable media players, printers, digital cameras, automotive devices, and digital voice recorders. When you enter names and addresses in a smartphone, for example, a flash memory chip stores the data. Some portable media players store music on flash memory chips; others store music on tiny hard drives or memory cards. Memory cards contain flash memory on a removable device instead of a chip. Read *Secure IT 6-4* for tips about deleting data on a smartphone.

SECURE IT 6-4

Wiping Mobile Phone Memory

If you ever have lent your smartphone to someone, left it sitting on your desk at school or work, or placed it in your car's center console at valet parking, you might have provided someone access without your consent to all your personal data stored on that device. A thief can plug a small device, called a *Cellular Seizure Investigation (CSI) stick*, into the phone and then download sensitive data in seconds.

While this unscrupulous activity seems alarming, a similar action occurs every day when smartphone users recycle or sell their devices without wiping all their personal records from memory. A person buying or acquiring the phone then can access the sensitive data left in memory. Some recyclers

claim that 95 percent of the mobile phones they receive are not completely cleaned.

A kill switch allows smartphone owners to delete all data or to disable their devices remotely in the event of theft or loss. Since 2015, all smartphones sold in California must include this device, and federal and other state lawmakers have proposed requiring all manufacturers to include this switch in their products.

Deleting all data from a mobile phone's memory is a relatively simple process, but it is not a universal procedure. Each device has its own set of steps described in the owner's manual or online. In general, users must locate their device's settings area on a menu and then look for a reset command. Most electronics manufacturers post instructions for this process on their websites. Mobile phone retailers often

can offer help in clearing personal data; if you resort to this measure, be certain to watch the sales associate perform this action. If your mobile phone has a SIM or memory card, remove and destroy it if you are not going to transfer it to another phone. Employees who use their phone to access email messages on corporate servers sometimes are required to enter a passcode on the phone so that if it is lost or stolen, the data can be wiped remotely.

Consider This: Have you ever wiped the memory of your mobile phone? What action would you take if you received or bought a used mobile phone and then discovered the previous owner's personal information stored in memory? Should lawmakers require smartphone manufacturers to include a kill switch in their products? Why or why not?

CMOS

Some RAM chips, flash memory chips, and other memory chips use complementary metal-oxide semiconductor (*CMOS* pronounced SEE-moss) technology because it provides high speeds and consumes little power. CMOS technology uses battery power to retain information even when the power to the computer is off. Battery-backed CMOS memory chips, for example, can keep the calendar, date, and time current even when the computer is off. The flash memory chips that store a computer's start-up information often use CMOS technology.



Figure 6-15 It takes about one-tenth of a second to blink your eye, in which time a computer can perform some operations 10 million times.

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Memory Access Times

Access time is the amount of time it takes the processor to read data, instructions, and information from memory. A computer's access time directly affects how fast the computer processes data. For example, accessing data in memory can be more than 200,000 times faster than accessing data on a hard disk because of the mechanical motion of the hard disk.

Today's manufacturers use a variety of terminology to state access times (Table 6-2). Some use fractions of a second, which for memory occurs in nanoseconds. A *nanosecond* (abbreviated *ns*) is one billionth of a second. A nanosecond is extremely fast (Figure 6-15). In fact, electricity travels about one foot in a nanosecond.

Table 6-2 Access Time Terminology

Term	Abbreviation	Speed
Millisecond	ms	One-thousandth of a second
Microsecond	μs	One-millionth of a second
Nanosecond	ns	One-billionth of a second
Picosecond	ps	One-trillionth of a second



CONSIDER THIS

What if a manufacturer states access times in megahertz instead of fractions of a second?

Some manufacturers state access times in MHz; for example, 800 MHz DDR2 SDRAM. If a manufacturer states access time in megahertz, you can convert it to nanoseconds by dividing 1 billion ns by the megahertz number. For example, 800 MHz equals approximately 1.25 ns (1,000,000,000/800,000,000). The higher the megahertz, the faster the access time; conversely, the lower the nanoseconds, the faster the access time.

While access times of memory greatly affect overall computer performance, manufacturers and retailers often list a computer's memory in terms of its size, not its access time. For example, an advertisement might describe a computer as having 8 GB of RAM.



NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Cloud Computing, Data Representation, and Memory, as it relates to the chapter objectives.

Now you should know . . .

- Which cloud computing service is best suited to your needs (Objective 5)
- How your computers and mobile devices represent data (Objective 6)
- How memory on your computer or mobile device works with your programs and applications (Objective 7)
- When you are using RAM, cache, ROM, flash memory, and CMOS (Objective 8)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Adapters

Although the circuitry in many of today's computers integrates all the necessary functionality, some require additional capabilities in the form of adapters. Desktops and servers use adapter cards; mobile computers use USB adapters. Read How To 6-4 to learn about ports you might consider including in a computer or mobile device that can eliminate the need for adapters.

HOW TO 6-4

Determine Which Ports You Need on a Computer or Mobile Device

When purchasing a computer or mobile device, it is important to make sure it has the correct ports so that you can connect your peripheral devices. The following list will help identify the ports you need on a computer or mobile device.

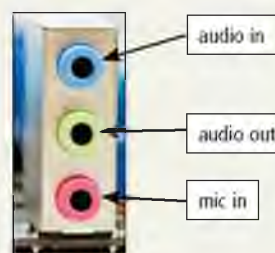
- **Displays:** If you plan to connect your computer or mobile device to a display such as a monitor or projector, make sure your computer or mobile device has a port that is compatible with the display. For example, if you plan to connect a laptop to a monitor that has an HDMI port, your computer or mobile device should have a port capable of HDMI output.



- **Networking:** If you plan to connect your computer or mobile device to a wired computer network, it should have an Ethernet port to which you can connect network cables.



- **Audio:** If you plan to connect your computer or mobile device to an audio output device, such as speakers, headphones, or earbuds, your computer or mobile device should have a port for audio output. If you are connecting an external microphone or other device that provides audio, your computer or mobile device should have a port for audio input.



cable that connects this device to the computer, and make sure your computer has a port that will accept the connector on the cable. In many cases, these devices will connect to your computer using a USB connection. Make sure your computer has a sufficient number of USB ports to support the devices you want to connect. If you are unable to connect a computer with enough USB ports, you can purchase a USB hub.



If your computer or mobile device does not have the ports you need, you may be able to purchase an adapter that converts an existing port to one that can connect to the desired device.

- **Consider This:** In addition to the devices discussed in this box, what other devices might you connect to your computer or mobile device?

- **Other Input, Output, and Storage Devices:** If you plan to connect other devices, such as a keyboard, mouse, external hard drive, or printer, look at the

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Adapter Cards

An **adapter card**, sometimes called an *expansion card* or *adapter board*, is a circuit board that enhances the functions of a component of a desktop or server system unit and/or provides connections to peripheral devices. An **expansion slot** is a socket on a desktop or server motherboard that can hold an adapter card. Figure 6-16 shows some adapter cards in expansion slots on a desktop motherboard.

Two popular adapter cards are sound cards and video cards. A *sound card* enhances the sound-generating capabilities of a personal computer by allowing sound to be input through a

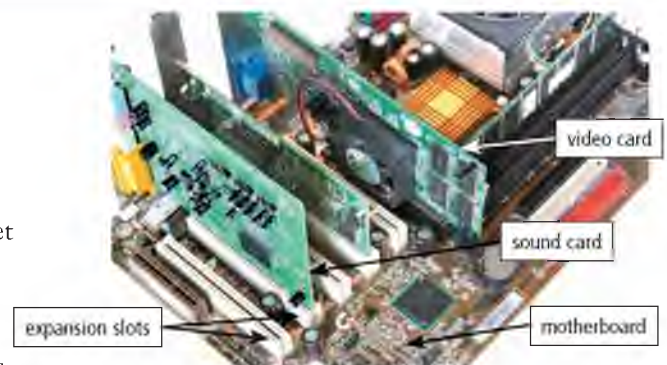


Figure 6-16 Cards inserted in expansion slots on a desktop motherboard.

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microphone and output through external speakers or headphones. A *video card*, also called a *graphics card*, converts computer output into a video signal that travels through a cable to the monitor, which displays an image on the screen. Table 6-3 identifies the purpose of some adapter cards. Sometimes, all functionality is built in the adapter card. With others, a cable connects the adapter card to a device, such as a digital video camera, outside the computer.

Today's computers support **Plug and Play** technology, which means the computer automatically can recognize peripheral devices as you install them. Plug and Play support means you can plug in a device and then immediately begin using it. Read Secure IT 6-5 for issues related to Plug and Play technology.

 **Table 6-3 Adapter Cards**

Type	Purpose
Bluetooth	Enables Bluetooth connectivity
MIDI	Connects to musical instruments
Modem	Connects to transmission media, such as cable television lines or phone lines
Network	Provides network connections, such as to an Ethernet port
Sound	Connects to speakers or a microphone
TV tuner	Allows viewing of digital television broadcasts on a monitor
USB	Connects to high-speed USB ports
Video	Provides enhanced graphics capabilities, such as accelerated processing or the ability to connect a second monitor
Video capture	Connects to a video camera

SECURE IT 6-5




Plug and Play Security Flaws

Plug and Play technology allows your computer to recognize peripheral devices and begin using them immediately after they are installed. This support permits computers to connect and communicate with devices easily, but it also creates security flaws that allow hackers to take control of security systems, routers, Smart TVs, printers,

webcams, and other devices connected to the Internet.

According to Rapid7, a security firm that uncovered these defects, between 40 and 50 million devices are susceptible to remote attacks. Rapid7 has developed a scanner tool to check vulnerabilities and identify affected hardware. Security experts recommend turning off or disabling any Plug and Play device not

being used on a network that accesses the Internet.

 **Consider This:** Would you consider checking your home network to discover Plug and Play security weaknesses or disabling devices? What steps can manufacturers take to minimize these vulnerabilities?

USB Adapters

Because of their smaller size, mobile computers typically do not have expansion slots. Instead, users can purchase a **USB adapter**, which is a dongle that plugs into a USB port, enhances functions of a mobile computer, and/or provides connections to peripheral devices (Figure 6-17). USB adapters can be used to add memory, communications, multimedia, security, and storage capabilities to mobile computers. A USB flash drive is a common USB adapter that provides computers and mobile devices with additional storage capability as long as it is plugged in. Read Ethics & Issues 6-3 to consider whether manufacturers should eliminate proprietary connectors.

Unlike adapter cards that require you to open the system unit and install the card on the motherboard, you can change a removable flash memory device without having to open the system unit or restart the computer. This feature, called *hot plugging*, allows you to insert and remove a device while the computer is running (be sure, though, to stop or eject the device before removing it).

ETHICS & ISSUES 6-3

Should Manufacturers Eliminate Proprietary Connectors?

If you need to replace the cable that connects your mobile device to a USB port, you might have a choice of many makes, models, and prices. Some devices, however, require the use of proprietary connectors, limiting your options to those manufacturers who make connectors that match the port on your mobile device.

When Apple released the iPhone 5 in 2012, for example, it required the use of a proprietary connector that was incompatible with connectors used with prior iPhone models and other Apple devices. Apple developed the connector, called Lightning,

in part to eliminate problems caused by attempts to attach the cord the wrong way. With Lightning, users can attach the cord in either direction without causing damage to the port or device. Critics argue that requiring customers to purchase proprietary connectors increases the cost of purchasing or upgrading a mobile device.

The International Electronics Commission (IEC) is working with major technology providers to make micro USB the universal connector standard used to charge mobile devices. This type of universal standard has several advantages. It will save customers money because they will not have to purchase a new connector with their new

device, even if it is a different brand. A universal standard connector also will enable users with different device models to share connectors. The environment will benefit because fewer outdated or incompatible cords will find their way into landfills. Further, the manufacturing process will generate less waste because fewer cords will be required.

Consider This: Should customers pressure manufacturers to use a universal connector standard? Why or why not? Would you consider the connector type when purchasing a new phone? Why or why not?



Figure 6-17 A USB adapter inserts into a USB port on a computer or mobile device.

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Buses

As explained earlier in this chapter, a computer processes and stores data as a series of electronic bits. These bits transfer internally within the circuitry of the computer along electrical channels. Each channel, called a **bus**, allows the various devices both inside and attached to the system unit to communicate with one another. Just as vehicles travel on a highway to move from one destination to another, bits travel on a bus (Figure 6-18).

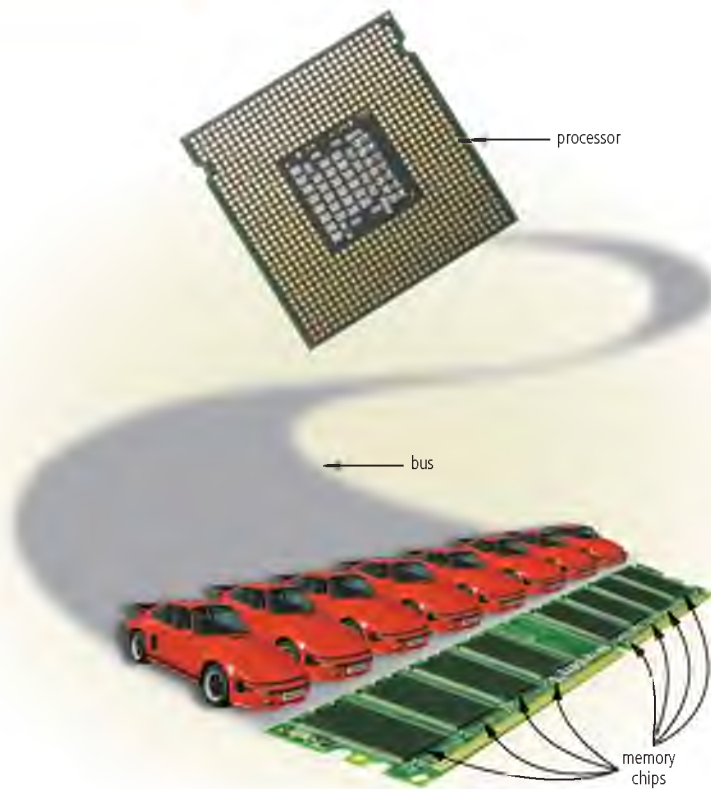


Figure 6-18 Just as vehicles travel on a highway, bits travel on a bus. Buses are used to transfer bits from input devices to memory, from memory to the processor, from the processor to memory, and from memory to output or storage devices.

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Buses are used to transfer bits from input devices to memory, from memory to the processor, from the processor to memory, and from memory to output or storage devices. Buses consist of a data bus and an address bus. The *data bus* is used to transfer actual data, and the *address bus* is used to transfer information about where the data should reside in memory.

Bus Width

The size of a bus, called the *bus width*, determines the number of bits that the computer can transmit at one time. For example, a 32-bit bus can transmit 32 bits (4 bytes) at a time. On a 64-bit bus, bits transmit from one location to another 64 bits (8 bytes) at a time. The larger the number of bits handled by the bus, the faster the computer transfers data. Using the highway analogy again, assume that one lane on a highway can carry one bit. A 32-bit bus is like a 32-lane highway. A 64-bit bus is like a 64-lane highway.

If a number in memory occupies 8 bytes, or 64 bits, the computer must transmit it in two separate steps when using a 32-bit bus: once for the first 32 bits and once for the second 32 bits.

Using a 64-bit bus, the computer can transmit the number in a single step, transferring all 64 bits at once. The wider the bus, the fewer number of transfer steps required and the faster the transfer of data. Most personal computers today use a 64-bit bus.

In conjunction with the bus width, many computer professionals refer to a computer's word size. **Word size** is the number of bits the processor can interpret and execute at a given time. That is, a 64-bit processor can manipulate 64 bits at a time. Computers with a larger word size can process more data in the same amount of time than computers with a smaller word size. In most computers, the word size is the same as the bus width.



CONSIDER THIS

How is bus speed measured?

Every bus also has a clock speed. Just like the processor, manufacturers state the clock speed for a bus in hertz. The higher the bus clock speed, the faster the transmission of data, which results in programs running faster.

Types of Buses

A computer has a system bus, possibly a backside bus, and an expansion bus.

- A *system bus*, also called the *front side bus (FSB)*, is part of the motherboard and connects the processor to main memory.
- A *backside bus (BSB)* connects the processor to cache.
- An *expansion bus* allows the processor to communicate with peripheral devices.

When computer professionals use the term, bus, by itself, they usually are referring to the system bus.

Power Supply and Batteries

Many personal computers plug in standard wall outlets, which supply an alternating current (AC) of 115 to 120 volts. This type of power is unsuitable for use with a computer or mobile device, which requires a direct current (DC) ranging from 5 to more than 15 volts. The **power supply** or laptop AC adapter converts the wall outlet AC power into DC power (Figure 6-19). Different motherboards and computers require different wattages on the power supply. If a power supply is not providing the necessary power, the computer will not function properly.



Figure 6-19 Examples of desktop power supply and laptop AC adapter.

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Built into the power supply is a fan that keeps the power supply cool. Some have variable speed fans that change speed or stop running, depending on temperature in the case. Many newer computers have additional fans near certain components in the system unit, such as the processor, hard drive, and ports. Some users install more fans to help dissipate heat generated by the components of the computer.

CONSIDER THIS

How many fans are in a desktop case?

Most have at least three fans: one in the power supply, one in the case, and one on the processor heat sink. In addition, you also might find a fan on a video card or other adapter card. While some computers contain fans that are designed to be quiet or operate in quiet mode, others allow you to turn off noisy fans until they are needed. You also can purchase programs that slow or stop the fan until the temperature reaches a certain level.

Some external peripheral devices, such as a cable modem, speakers, or a printer, have an AC adapter, which is an external power supply. One end of the AC adapter plugs in the wall outlet and the other end attaches to the peripheral. The AC adapter converts the AC power into the DC power that the peripheral requires, and also often charges the battery in a mobile computer or device.

Mobile computers and devices can run using either a power supply or batteries. The batteries typically are rechargeable lithium-ion batteries (Figure 6-20). Some mobile devices and computers, such as some ultrathin laptops, do not have removable batteries.

Internet Research

How effective are solar chargers?

Search for: portable solar charger reviews



Figure 6-20 Rechargeable batteries for mobile computers and devices.

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CONSIDER THIS

How often do batteries for mobile computers and devices need to be replaced?

Battery life depends on usage. While some may last several years, you may need to replace a battery much sooner than that. When the battery no longer can hold a charge, you should replace it with a battery made by, or recommended by, the manufacturer of the computer or device. Read Ethics & Issues 6-4 to consider issues surrounding mobile phone policies.

ETHICS & ISSUES 6-4



Should Businesses Be Allowed to Make Policies Regarding Customer Mobile Phone Use?

Diners who use mobile devices while at a restaurant or moviegoers whose devices make noise or light up an otherwise dark theater can cause distractions and frustrations for employees and other patrons. One deli counter posted a sign that said it would not serve customers until they put away their phone. Another similar business said it would levy an additional charge to anyone using a phone while ordering, stating that “It’s rude.”

Restaurant owners who want to ban mobile phones insist that “distracted dining” adds considerably to the time a customer spends occupying a table, which results in more time elapsing before the restaurant can

seat new customers. Food service may be slower because customers are not promptly reading the menu and deciding on their order. This has prompted many owners to adopt a zero tolerance policy for mobile phone use. One movie theater escorted a patron from the theater for refusing to turn off her phone. The theater argued that the purchase of a ticket, which states that it can refuse service without a refund for anyone causing disturbances, is a contract.

You can expect to see more and more restaurants, movie theaters, and other businesses posting or stating guidelines for use of mobile devices beyond asking customers to silence their devices. Some businesses institute rules that state acceptable use for mobile phones, rather than an outright ban. Many businesses

designate mobile phone areas. Others give a discount for patrons who leave devices with the host or front desk. Still others allow use of photography, as long as no flash is involved. One etiquette blogger suggested that patrons dining in a group stack their phones in the middle of the table. Whoever first reaches for his or her phone must pay the entire bill.

Consider This: Do businesses have a right to refuse service or otherwise restrict phone usage by customers? Why or why not? Is it ever acceptable to use a mobile phone in a restaurant or theater? Under what circumstances? Have you ever been negatively affected by another person’s inappropriate use of a mobile phone? How did you resolve the problem?

Mini Feature 6-3: Proper Care for Computers and Mobile Devices

Taking proper care of computers and mobile devices not only will help prolong their life, but also will keep them running optimally. Read Mini Feature 6-3 to learn about properly caring for computers and mobile devices.

MINI FEATURE 6-3

Proper Care for Computers and Mobile Devices

Caring for a computer or mobile device requires keeping hardware in good condition and maintaining programs and apps.

Hardware Maintenance

Before performing any of the following steps to care for your computer or mobile device, turn off and unplug the device from its power source. If the computer or mobile device has a removable battery, you also should remove the battery. All hardware maintenance should be performed in an area that is clean and free from clutter.

- Use a damp cloth to clean the screen gently. Do not use any special cleaners to clean the display, as they may damage the display. Water is sufficient to remove dust and most dirt. Read How To 6-5 for additional ways to protect screens and replace them if necessary.
- If the computer or mobile device has a keyboard, use a can of compressed air to free the keyboard from any dirt and debris that might interfere with the operation of the keys or pose a risk of getting inside the computer or mobile device. When using compressed air, hold the can upright, and not at an angle, when dispensing the air. Holding the can at an angle can cause the can to dispense a very cold liquid instead of air, which can damage components in your computer or mobile device.
- If you are transporting a laptop, be sure to store it in a case with plenty of padding. If you are using a mobile device, protect it with a case. A case will protect the device better in the event you drop it and may make it easier for you to grip the device while using it.
- If the computer or mobile device has an air vent where a fan removes heat, make sure the vent is free of dust and debris. A blocked vent can prohibit heat from escaping, which ultimately can cause the computer or mobile device to overheat. If the air vent is dirty, contact a trained professional to have it cleaned properly. Improperly cleaning an air vent can result in more debris entering the computer or mobile device.



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- When you insert media such as an optical disc, be sure the media is clean. Inserting dirty media can damage a computer or mobile device's internal components.

Software Maintenance

Maintaining the software on your computers and mobile devices can help them run optimally. While no specific recommendation exists for the frequency with which you should perform the following actions, you should do so if you begin to notice a decline in your computer or mobile device's performance.

- Uninstall programs and remove apps you no longer need on your computer or mobile device. These programs and apps may consume a significant amount of space on your storage medium and decrease the performance of your computer or mobile device. More information about uninstalling programs and removing apps can be found in How To 4-4 in Chapter 4.
- If you are using a desktop or laptop, defragment the computer's hard disk if you notice a decline in the computer's performance. More information about defragmenting can be found in the Disk Defragmenter section in Chapter 4.
- Install programs and apps only from reputable software manufacturers. In addition, make sure you are installing the program or app from the original installation media, the software manufacturer's website, or from your mobile device's app store or marketplace. You also should read reviews for programs and apps before you download and/or install them to make sure the program or app will meet your needs.

Discover More: Visit this chapter's free resources to learn about additional ways to care for your hardware.

-  **Consider This:** In addition to the methods mentioned in this mini feature, what other ways can you care for your computer or mobile device?



CONSIDER THIS

How does an antistatic wristband work?

When working with electronic components, such as a motherboard, you should wear an antistatic wristband. An *antistatic wristband* is a bracelet designed to protect electronics from an electrostatic discharge by preventing a buildup of static electricity on a user. The wristband has an attached clip that you connect to any bare metal surface, which acts as a ground.



HOW TO 6-5



Protect and Replace Screens

One way to protect the screen on your mobile device is to use a screen protector. A *screen protector* is a thin plastic film that adheres to the screen of your device. While screen protectors may not protect the screen if you drop your device or an object impacts it with excessive force, it will protect the screen from minor scratches obtained through normal use. Screen protectors often can be purchased from the same place you bought your mobile device and also are available online. If you cannot find a screen protector that is the exact same size as the screen on your mobile device, you can purchase a larger one and then trim it to fit your screen.

In the event the screen on your mobile device breaks, the following steps will guide you through the process of replacing it. Even if your device continues to work with a broken screen, you still should replace it as soon as possible to avoid injury. **NOTE: Screen replacement should be attempted only by advanced users. If you are**

uncomfortable following these steps, seek help from a trained professional. In addition, the exact steps to replace a broken screen can vary with each device. If the steps for your device vary from the steps listed below, follow the instructions from your device's manufacturer.

1. Back up the data on your mobile device before starting a screen replacement. While a successful screen replacement should not threaten the data, it is a good idea to keep a backup in case a problem arises unexpectedly.
2. Turn off the mobile device and disconnect it from all power sources. If the device uses a removable battery, remove it.
3. Protect your hands and eyes before beginning glass replacement.
4. If possible, carefully remove all pieces of broken glass. Consider using compressed air to remove any dust.
5. Remove the display assembly. Refer to your device's documentation for information about removing the display. You may

need a small, nonmagnetic screwdriver and/or metal or plastic tool to remove the assembly. If the display assembly is connected to the mobile device with a cable, carefully disconnect the cable.

6. Unpack the new screen and connect it to the mobile device, connecting any necessary cables.
7. Reassemble the mobile device, reconnect the power source and/or the battery, and turn on the device.

Consider This: Why might you replace a cracked screen instead of replacing the entire mobile device?



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NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Adapters, Buses, and Power Supply and Batteries, as it relates to the chapter objectives.

Now you should know . . .

- When you would use an adapter card and a USB adapter (Objective 9)
- How your computer uses buses (Objective 10)
- Why your computers and mobile devices need power supplies or batteries (Objective 11)
- How to care for your computers and mobile devices (Objective 12)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter presented the various components inside computers and mobile devices. It discussed types of processors, steps in a machine cycle, and processor cooling methods. You learned about advantages and services of cloud computing. The chapter discussed how memory stores data and described various types of memory. You learned about adapters, buses, power supplies and batteries, and ways to care for computers and mobile devices.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Intel and Gordon Moore, AMD, Nvidia, and VMware; Technology Trends: Medical Robotics and Self-Driving Cars; and High-Tech Talks: How Data is Written to RAM and Coding Schemes and Number Systems.

- Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Publishing

Today, virtually any printed material that you read exists additionally in electronic form. In publishing's early years, and before computers existed, authors and writers recorded content using a typewriter, which then would be duplicated and bound into a publication. When word processors were introduced, writers not only could type their work, but also were able to apply basic formatting and check their spelling. While typewriters and word processors performed their tasks adequately, they pale in comparison to the extent to which today's computers and mobile devices have improved the publishing process.

Before computers and other related technological advances, publishing a book would be a very long process. After the authors wrote a manuscript, it was converted into a form that was ready to print; the printing process then could take several weeks to complete. Today, authors can use programs and apps to write material in a format that will require minimal, if any, conversion before it is ready to print.

Many book, magazine, and newspaper publishers are turning away from the print medium and encouraging consumers to read content electronically. In fact, some publishers are turning exclusively to publishing in electronic form and abandoning the print medium altogether. As mentioned previously in this book, you can read book content or magazine and newspaper articles either on the web or using an e-book reader. Content on the web usually is available free or for a fee. For

example, some newspapers allow people to read articles for free, while others may charge a digital subscription fee. If you are using an e-book reader, you often have to pay to download and read content, although some items are available for free.

Programs and apps, including web apps, also are enabling individuals to publish content themselves. Individuals easily can publish content to a blog on the web, or they can use an app to create and publish an e-book for others to purchase and download.

Many libraries also are taking advantage of advances in technology by enabling users to check out books electronically. Similar to a print book, library patrons can reserve an e-book on their computer or mobile device. When the e-book is available, it will download to the user's computer or mobile device automatically. When the e-book is due or when the user decides to return the book, it will remove itself from the user's computer or mobile device. While many people believe that libraries can check out unlimited copies of the same e-book simultaneously, this is not true. Libraries are able to check out simultaneously only the

number of copies, or licenses, of the e-book they purchase. For example, if a library purchases two licenses of an e-book, only two copies of that e-book can be checked out simultaneously. If a third user wants to check out this e-book, he or she must wait for one copy to be returned.

Technology has greatly improved the publishing industry. Not only is content published more quickly and in an easily accessible form, but it also now is less prone to errors because the development process is much more streamlined.

-  **Consider This:** In what other ways do computers and technology play a role in the publishing industry?



Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to **test your knowledge of digital content** associated with this chapter and **access the Study Guide resource** from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- Describe the hardware referred to by the terms, system unit and chassis.
- Name the typical location of the case for a laptop, slate tablet, convertible tablet, smartphone, game console, wearable device, portable media player, digital camera, and handheld game device.
- List products for securing and tracking hardware and how each is used.
- Define the terms, motherboard, chip, integrated circuit, and transistor.
- Describe the purpose of the processor and how multi- and single-core processors differ.
- Describe how a chip can be used to locate a lost animal.
- Explain the role of the control unit and ALU in performing computer operations.
- Describe what happens during each step in the machine cycle.
- Define these terms: registers, system clock, and superscalar. Describe how clock speed is measured.
- List two leading manufacturers of personal computer processor chips. List considerations when choosing a processor.
- List technologies that processor chips often include.
- List options for cooling a processor, and describe how each works.
- Define the term, Internet of Things (IoT). List IoT-enabled devices and technologies.
- Describe issues related to access and privacy regarding IoT.
- Explain why a home or business user might choose cloud computing. Describe services offered with cloud computing.
- Human speech is ___ because it uses continuous (wave form) signals that vary in strength and quality. Most computers are ___, meaning that they recognize only two discrete states: on and off.
- Define the terms, bit and byte. Describe the binary system and the ASCII coding scheme.
- List categories of items stored in memory. Explain how manufacturers state memory size.
- Differentiate between volatile and nonvolatile memory. List an example of each.
- Describe how RAM works. List two types of RAM.
- Explain how to determine memory requirements.
- Describe the function of a memory module. List two types of memory modules.
- List the steps to install memory modules.
- Describe how a computer uses cache. Differentiate among L1, L2, and L3 cache.
- Describe what is stored in ROM. ___ are ROM chips that contain permanently written data, instructions, or information.
- Explain if a company is responsible for using components manufactured using fair trade practices.
- Identify uses for flash memory.
- List methods to wipe the memory of a mobile device when recycling or selling.
- Describe CMOS technology and its possible uses.
- Define the term, access time. List different methods used to state access time.
- Identify the port options for computers and mobile devices. Explain the function of each type.
- Describe the purpose of an adapter card and the role of an expansion slot. List types of adapter cards.
- Explain Plug and Play technology.
- List security concerns regarding Plug and Play technology.
- Describe the functions of USB adapters.
- Explain the advantages of using a universal standard connector.
- Define the term, hot plugging.
- Identify the role of a bus. Differentiate between a data bus and an address bus.
- Describe how bus width and word size affect and are used to measure computer speed.
- List types of buses and describe the purpose of each.
- Explain how a power supply converts AC current into DC current.
- Explain the purpose of and roles of fans in power supplies.
- Describe issues surrounding use of mobile devices in restaurants or movie theatres.
- Explain how to maintain hardware and software on your computer or mobile device.
- A(n) ___ wristband is a bracelet designed to protect electronics from an electrostatic discharge by preventing a buildup of static electricity on a user.
- List steps and precautions to take when replacing the screen on a mobile device.
- Identify how technology is used in the publishing industry.

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

Discover More: Visit this chapter's premium content to **view definitions for each term** and to **access the Flash Cards resource** from your smartphone, tablet, laptop, or desktop.

Key Terms

Primary Terms (shown in **bold-black** characters in the chapter)

access time (296)	cache (293)	firmware (294)	power supply (301)
adapter card (297)	central processing unit (CPU) (280)	flash memory (295)	processor (280)
analog (288)	chip (278)	gigahertz (GHz) (283)	RAM (290)
arithmetic logic unit (281)	clock speed (283)	memory (290)	read-only memory (ROM) (294)
binary system (288)	control unit (281)	memory cache (294)	system clock (282)
bit (288)	digital (283)	motherboard (278)	USB adapter (298)
bus (299)	eCycling (297)	multi-core processor (280)	word size (300)
byte (288)	expansion slot (297)	Plug and Play (298)	

Secondary Terms (shown in *italic* characters in the chapter)

<i>adapter board (297)</i>	<i>data bus (300)</i>	<i>IaaS (infrastructure as a service) (287)</i>	<i>screen protector (304)</i>
<i>address (290)</i>	<i>DDR SDRAM (292)</i>	<i>integrated circuit (278)</i>	<i>SDRAM (292)</i>
<i>address bus (300)</i>	<i>DDR2 (292)</i>	<i>Intel-compatible processors (283)</i>	<i>SIMM (single inline memory module) (293)</i>
<i>advanced transfer cache (ATC) (294)</i>	<i>DDR3 (292)</i>	<i>Internet of Things (IoT) (284)</i>	<i>software as a service (SaaS) (287)</i>
<i>alphanumeric characters (289)</i>	<i>DDR4 (292)</i>	<i>L1 cache (294)</i>	<i>sound card (297)</i>
<i>ALU (281)</i>	<i>decoding (281)</i>	<i>L2 cache (294)</i>	<i>static RAM (SRAM) (292)</i>
<i>antistatic wristband (304)</i>	<i>DIMM (dual inline memory module) (293)</i>	<i>L3 cache (294)</i>	<i>stored program concept (290)</i>
<i>arithmetic operations (281)</i>	<i>dynamic RAM (DRAM) (292)</i>	<i>liquid cooling technology (284)</i>	<i>storing (281)</i>
<i>ASCII (289)</i>	<i>executing (281)</i>	<i>machine cycle (281)</i>	<i>superscalar (283)</i>
<i>backside bus (BSB) (300)</i>	<i>expansion bus (300)</i>	<i>main memory (290)</i>	<i>system board (278)</i>
<i>binary digit (288)</i>	<i>expansion card (297)</i>	<i>marshups (288)</i>	<i>system bus (300)</i>
<i>bus width (300)</i>	<i>fetching (281)</i>	<i>microprocessor (280)</i>	<i>system unit (276)</i>
<i>Cellular Seizure Investigation (CSI) stick (295)</i>	<i>front side bus (FSB) (300)</i>	<i>nanosecond (ns) (296)</i>	<i>teabyte (TB) (290)</i>
<i>chassis (276)</i>	<i>gigabyte (GB) (290)</i>	<i>nonvolatile memory (290)</i>	<i>transistor (278)</i>
<i>clock cycle (283)</i>	<i>graphics card (298)</i>	<i>PaaS (platform as a service) (288)</i>	<i>video card (298)</i>
<i>CMOS (296)</i>	<i>heat sink (284)</i>	<i>random access memory (290)</i>	<i>virtual desktop (287)</i>
<i>comparison operations (281)</i>	<i>hertz (283)</i>	<i>RDRAM (292)</i>	<i>volatile memory (290)</i>
<i>cooling pad (284)</i>	<i>hot plugging (298)</i>	<i>real-time clock (283)</i>	
<i>DaaS (data as a service) (288)</i>		<i>registers (282)</i>	



power supply (301)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

True/False Mark T for True and F for False.

- _____ 1. The motherboard also is called a system board. (278)
- _____ 2. On a personal computer, all functions of the processor usually are on a single chip. (280)
- _____ 3. A dual-core processor doubles the processing speed of a single-core processor. (280)
- _____ 4. In general, multi-core processors are less energy efficient than separate multiple processors. (280)
- _____ 5. The system clock keeps track of the date and time in a computer. (283)
- _____ 6. In cloud computing, the back end consists of the servers and storage devices that manage and store the resources accessed by users. (287)
- _____ 7. In the binary system, the digit 1 represents the absence of an electronic charge. (288)
- _____ 8. Most RAM is nonvolatile. (291)
- _____ 9. The processor interprets and executes a program or application's instructions while the program or application is in nonvolatile memory. (291)
- _____ 10. ROM chips also are called firmware. (294)
- _____ 11. As with processors, manufacturers state the clock speed for a bus in hertz. (300)
- _____ 12. The power supply converts the wall outlet AC power into DC power. (301)

Multiple Choice


Select the best answer.

1. The _____ is the main circuit board of the computer. (278)
 - a. ALU
 - b. CPU
 - c. motherboard
 - d. system chassis
2. A _____ is a single chip with two or more separate processor cores. (280)
 - a. transistor
 - b. multi-core processor
 - c. resistor
 - d. capacitor
3. _____ include basic calculations such as addition, subtraction, multiplication, and division. (281)
 - a. Arithmetic operations
 - b. Comparison operations
 - c. Machine cycles
 - d. Transistors
4. In the machine cycle, the _____ operation obtains a program or application instruction or data item from memory. (281)
 - a. fetching
 - b. decoding
 - c. executing
 - d. storing
5. The term, _____, describes a computing environment where everyday objects are connected to the Internet. (284)
 - a. IoT
 - b. DaaS
 - c. IaaS
 - d. ASCII
6. An aspect of cloud computing that allows developers to create, test, and run their solutions on a cloud platform without having to purchase or configure the underlying hardware and software is known as _____. (288)
 - a. DaaS
 - b. IaaS
 - c. SaaS
 - d. PaaS
7. _____ are applications that incorporate data from multiple providers into a new application. (288)
 - a. Plug and Play apps
 - b. Firmware
 - c. Mashups
 - d. DDR2s
8. A(n) _____ is a circuit board that enhances the functions of a component of a desktop or server system unit and/or provides connections to peripheral devices. (297)
 - a. expansion slot
 - b. USB adapter
 - c. front side bus
 - d. adapter card

Checkpoint

Matching Match the terms with their definitions.

- | | |
|-----------------------------|---|
| _____ 1. motherboard (278) | a. small, high-speed storage locations contained in a processor |
| _____ 2. chip (278) | b. component of the computer that directs and coordinates most of the operations in the computer |
| _____ 3. transistor (278) | c. widely used coding scheme to represent a set of characters |
| _____ 4. control unit (281) | d. the main circuit board of the computer |
| _____ 5. registers (282) | e. integrated circuit component that acts as an electronic switch that opens or closes the circuit for electrical charges |
| _____ 6. IaaS (287) | f. ROM chips that contain permanently written data, instructions, or information |
| _____ 7. ASCII (289) | g. determines the number of bits that the computer can transmit at one time |
| _____ 8. firmware (294) | h. the use of software to emulate hardware capabilities, enabling computers to scale, or adjust up or down, storage, processing power, or bandwidth as needed |
| _____ 9. bus width (300) | i. small piece of semiconducting materials, usually silicon, on which integrated circuits are etched |
| _____ 10. word size (300) | j. number of bits the processor can interpret and execute at a given time |

 **Consider This** Answer the following questions in the format specified by your instructor.

- Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (286, 295, 299, 302), How To (283, 292, 293, 297, 304), Mini Features (285, 287, 303), Secure IT (279, 280, 286, 295, 298), and Technology @ Work (305).
- Where is the typical location of the case on a laptop, tablet, smartphone, game console, wearable device, portable media player, digital camera, and handheld game device? (276)
- How does tracking software help secure hardware? (279)
- What is meant by the term, microprocessor? (280)
- What are the two components contained in the processor? (281)
- How do arithmetic operations and comparison operations differ? (281)
- What are the four operations performed during the machine cycle? (281)
- What are registers? (282)
- In addition to the clock speed, what other factors influence the computer's performance? (283)
- What does the term superscalar mean, with regard to the clock cycle? (283)
- What is clock speed? (283)
- What is a heat sink? (284)
- How does a cooling pad reduce the heat generated by a computer? (284)
- How might the Internet of Things (IoT) invade privacy? (286)
- In reference to cloud computing, what do the front end and back end include, respectively? (287)
- What is the binary system? (289)
- How do volatile and nonvolatile memory differ? (290)
- Which type of memory is RAM? (291)
- How do DRAM and SRAM chips differ? (292)
- What are the two types of memory modules? (293)
- How do L1, L2, and L3 cache differ? (294)
- What is the function of an adapter card? (297)
- What does Plug and Play allow you to do? (298)
- Should a universal connector standard be adopted? Why or why not? (299)
- How does bus width measure a computer's processing speed? (300)
- How does the data bus differ from the address bus? (300)
- What are three types of buses? (300)

Problem Solving

The Problem Solving exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, work, or with nonprofit organizations. The Collaboration exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. No Matching Port** Your uncle has given you a new monitor for your computer. When you attempt to connect it, you notice that none of the ports on the back of your computer is able to accept the connector at the end of the monitor's cable. What are your next steps?
- 2. Incompatible Power Adapter** While using your laptop, you notice the battery life is running low. When you plug in the AC adapter that was included with the laptop, an error message is displayed stating that the AC adapter is incompatible. You unplug the AC adapter and plug it back in, but the same message keeps appearing. Why might this be happening?
- 3. Nonworking Fan** Each time you turn on your computer, you hear the noise generated by the fans in the system unit. Recently, however, you turned on the computer and noticed that the noise was not as loud and that the fan in the back of the system unit was not spinning. What are your next steps?
- 4. Missing Smartphone** You have just returned from the mall and seem to have forgotten your smartphone. You checked all over your house and your car, and it is nowhere to be found. What are your next steps?
- 5. Low Battery Life** You have had your laptop for more than one year and notice that your battery is losing its charge more quickly than normal. What are some ways you can conserve battery life so that your smartphone does not lose its charge as quickly?



Photo courtesy of iStock.com

Professional

- 6. Determining Memory Requirements** Your computer has been running slowly and you suspect it is because it is low on memory. You review the computer's hardware configuration and find that the computer has only 4 GB of RAM. How can you determine how much memory your computer should have to run properly?
- 7. Selecting the Right Processor** Your boss has given you permission to purchase a new processor for your aging desktop computer, but many models are available. What steps will you take to make sure you purchase the processor that is best for you?
- 8. Plug and Play Error** You have connected an external hard drive to your computer so that you can back up your important files, but the computer is not recognizing the external hard drive when it is connected. What might be wrong?
- 9. Internet Access Unavailable** You are using a cloud storage provider to save files you want to use both at work and at home, so that you do not have to carry a USB flash drive back and forth with your files. When you arrive at work, you notice that your Internet connection is unavailable and you are unable to access the files stored on the cloud. What steps can you take to prevent this in the future?
- 10. System Password** You started working at a company to replace someone who has just been terminated. When you turn on your computer, which previously was used by the terminated employee, the computer immediately asks for a system password. You do not know the password but need to access the computer so that you can start working. What are your next steps?

Collaboration

- 11. Technology in Publishing** You have been hired to select employees for the IT (information technology) department in a start-up publishing company. Before you can begin hiring employees, you must familiarize yourself with the technology requirements in the publishing industry. Form a team of three people to compose a plan for creating the IT department. One team member should research the hardware requirements for people working in the publishing industry. Another team member should research the types of software used in this industry, and the third team member should compile a list of interview questions to ask each candidate.

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn exercises**, such as App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Conserve Battery Life of Mobile Computers and Devices

As consumers rely on mobile computers and devices more and more every day, it is increasingly important for the battery life on these devices to support high usage demands. Unfortunately, battery life on these devices often is not sufficient for many users to make it throughout the day with moderate activity on their devices. For this reason, it is important to conserve battery life so that a mobile computer or device can remain functional until it is possible to connect it to a battery charger. The following steps guide you through the process of conserving battery life on mobile computers and devices:

- a. When you first obtain a new mobile computer or device or purchase a new battery for your computer or mobile device, charge the battery completely. Most new mobile computers and devices will indicate how long to charge the battery before its first use. Refrain from using the device before the battery is fully charged.
- b. Charge the battery only when it is drained completely. Many batteries on computers and mobile devices can be charged only a certain number of times before they fail completely. For this reason, you should charge batteries only when absolutely necessary.
- c. When you charge your mobile computer or device, try not to unplug the battery charger until the battery is charged completely.
- d. Use the battery charger supplied with the mobile computer or device. Connecting inexpensive battery chargers from other vendors may damage the battery.
- e. If you want to use the mobile computer or device while it is plugged in to an external power source, remove the battery, if possible, if it is fully charged. Leaving the mobile computer or device connected to an external power source while the battery has a full charge can shorten the life of the battery.
- f. If you are using a laptop or tablet, disable Wi-Fi and Bluetooth unless you are using them.
- g. Adjust the display's brightness. Brighter displays consume more battery life, so keep the display as dim as you can without having to strain your eyes.
- h. Download and install an app that will inform you which other apps are running and consuming battery life. If an app does not need to run, you should exit it so that the app does not consume your battery.
- i. Avoid turning your mobile computer or device on and off multiple times per day. The power-saving features on mobile computers and devices often require less power than turning on your computer or mobile device from a powered-off state.
- j. Turn off automatic app update capabilities on your phone or mobile device, so that your device is not constantly checking for new apps and downloading them to your device.

Exercises

1. What other ways can you think of to conserve the battery life on your mobile computer or device?
2. Approximately how long do batteries on your mobile computers and devices last before they no longer are able to hold a charge?
3. What else can shorten the battery life on a mobile computer or device?



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2 Locate a Lost Mobile Computer or Device

Mobile computers and devices sometimes contain a feature that can help you locate it in the event you lose it. If the device does not contain this feature, you may be able to download and install an app that can help you track its location. The following steps guide you through the process of locating a lost mobile computer or device.

How To: Your Turn

How To: Your Turn

- Before you lose or misplace a mobile computer or device, enable the feature that allows you to track its location remotely.
- Make sure the GPS feature on your device is enabled. If GPS is not enabled, the device might be more difficult to locate.
- If you lose your smartphone, try calling it to see if someone answers. He or she may have located your misplaced phone. If nobody answers, send it a text message inquiring about the phone's location.
- If you lose a device, you can run an app or navigate to a website that will enable you to track the device's location. The device's location typically will be displayed on a map and include the approximate address.
- If the device is in an unfamiliar location, use a service such as Google Maps to obtain driving directions to the location.
- If the device is in a location other than where you originally lost it, exercise extreme caution while trying to retrieve your device. You might consider contacting a local law enforcement agency to accompany you while trying to retrieve your device.
- If you are unable to track your device using the above suggestions, consider contacting your mobile service provider to see if they have a way to locate the device.



Exercises

- What privacy concerns might arise as a result of keeping the GPS feature on a device enabled?
- What are names of some apps that can help you track your device's location in the event it is lost or stolen?
- In addition to GPS, what other ways might you be able to determine your device's location?

Run Diagnostic Tools and Check for Computer Hardware Errors

If your computer is not functioning properly and you believe the problem is related to the computer's hardware, you can run diagnostic tools to check for hardware errors. If the diagnostic tool identifies a hardware error, you then can communicate information about the error to technical support personnel so that they either can correct the problem or suggest replacing the problematic hardware. The following

steps guide you through the process of running diagnostic tools and checking for hardware errors.

Obtain Diagnostic Tools

Your computer may have included diagnostic tools you can use to check for hardware errors. If it did not include diagnostic tools, follow these steps to download diagnostic tools from the computer manufacturer's website:

- Navigate to the computer manufacturer's website.
- Tap or click the necessary links to display information about the computer.
- Tap or click the link to display a page containing drivers and/or downloads for the computer's model.
- Browse for a diagnostic tool that you can download to your computer.
- Some diagnostic tools can run within the operating system, and some require that you copy them to an optical disc or USB flash drive so that you can start the computer from this media and run the diagnostic tools. If necessary, copy the diagnostic tools to an optical disc or USB flash drive.

Run Diagnostic Tools

- Run the program containing the diagnostic tools. If you copied the diagnostic tools to an optical disc or USB flash drive, restart the computer with the optical disc or USB flash drive inserted, and be sure to select the option to boot (start) from that device.
- Select the option to scan all computer hardware for errors.
- Begin the scan. Please note that because the program is scanning all hardware, it may take some time to complete. Some specific tests during the scan will require input from you, so watch the computer closely while the scan is in progress.
- When the scan is complete, note any errors and, if desired, report them to the computer manufacturer's technical support team.
- When the scan is complete, if necessary, restart the computer.

Exercises

- What might cause you to use diagnostic tools to scan a computer for hardware errors?
- After scanning your computer for hardware errors, were any found?
- In addition to downloading drivers from the computer manufacturer's website, are there any other websites offering tools to help you diagnose your computer hardware problems? If so, what are some?

How To: Your Turn

4 Determine How Much Memory Is Being Used on Your Computer or Mobile Device

If your computer or mobile device is running slowly, it could be running low on memory. A number of factors can contribute to the slow performance, but checking the memory usage is fast and easy. If the computer or mobile device's memory is almost all used, you may be able to determine which programs and apps are using the most memory. Exiting these programs and apps may make more memory available and increase a computer or mobile device's performance. The following steps guide you through the process of determining how much memory is being used on a computer or mobile device.

- Restart the computer or mobile device.
- If necessary, sign in to the operating system.
- Navigate to the window or screen showing a list of running tasks. On a computer, you may be able to search for the Task Manager or Activity Monitor. On a mobile device, a list of running processes may be found in the system settings.
- Tap or click the option to show the list of running processes. This list will show you how much memory each process is using. This list also includes the

programs and apps currently running. If you notice that a program or app is consuming a high amount of memory, consider exiting the program or app to make the memory available.

- When you are finished, return to the desktop or home screen.



Source: Microsoft

Exercises

- How much memory is installed on your computer or mobile device? How much currently is being used?
- Which three processes are using the largest amount of memory on your computer or mobile device?
- If the programs and apps you run consume nearly all available memory on your computer or mobile device, what additional steps might you be able to take?

5 Check Your Computer's Hardware Configuration

If you are experiencing a problem with a hardware component on your computer, you can check the computer's hardware configuration to determine

the manufacturer's name and model number for the hardware in question. With this information, you then can search for ways to correct the problem. Alternatively, if you reinstall the operating system on the computer, you may check the computer's hardware configuration to make sure the operating system is recognizing correctly all hardware connected to the computer. The following steps guide you through the process of checking a computer's hardware configuration.

- If you are using a Mac, display the Apple menu and then select the option to display information about the computer. If you are running Windows, display the Control Panel.
- Navigate to the area that displays information about the hardware and devices currently connected to the computer. (*Hint:* In Windows, display the Device Manager. On a Mac, display the System Report.)
- Tap or click the categories of hardware devices to see details related to those types of devices.
- If you are familiar with the hardware devices on the computer, verify that the operating system is recognizing these devices correctly.
- If you notice a problem with the operating system detecting any of these devices, you might need to run the installation software and/or install the drivers for the hardware device so that the operating system can communicate with the device. If necessary, contact the computer manufacturer's technical support for assistance.

Exercises

- List at least three hardware devices listed in the System Report or in the Device Manager.
- In addition to the reasons mentioned above, what are some other reasons why you might want to check the hardware configuration on a computer?
- What steps can you take if one or more hardware devices are not identified by your computer?



Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to **challenge yourself with additional Internet Research exercises**, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

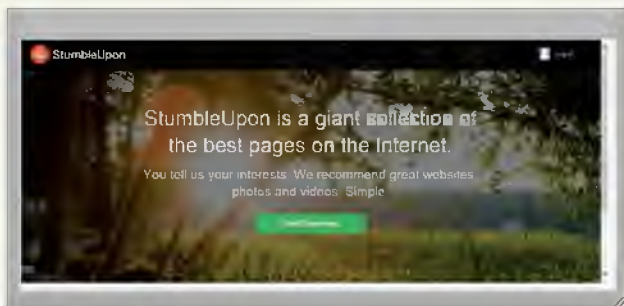
Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Content Aggregation and Curation

Locating valuable information to read on particular topics or to share with your online social network may take some effort. To help find material, you may want to use content aggregation, an automated process that uses keywords to gather and filter materials someone else has written or produced on the Internet. Another option is content curation, which is a manual process of acquiring this information and then expanding the content into original and useful material to post. A good content curator can edit the content to share, add annotations and notes, give attributions to the original source, and provide additional viewpoints. As a starting point, Twitter and blog feeds, bookmarking tools such as StumbleUpon, and services that provide email notifications, such as Google Alerts, provide the opportunity to view webpages, photos, videos, and additional material about celebrities, sports, politics, businesses, and other people and subjects.

Research This: (a) Visit StumbleUpon and two other bookmarking services. If necessary, sign in to these services and compare the features. How do users select the categories to view? What information is required to create a profile? What opportunities for feedback are provided? What procedure would users follow to delete their profiles and terminate their accounts?

(b) Visit Google Alerts and two other email alerting services. If necessary, create an alert for at least two words for which you would want to receive email notifications. What options are available to customize these alerts? For example, can you specify the frequency of the alerts, the types of websites to search, the geographical region, or the number of messages sent?



Source: StumbleUpon

2 Social Media

Companies review the conversations, comments, complaints, and feedback written on online social networks to obtain valuable information that ultimately enhances developing or improving products and services. In some cases, companies have asked consumers to view videos of product demonstrations, Tweet their immediate impressions, and suggest improvements. Small companies with limited marketing and advertising budgets, in particular, increasingly view social media as an inexpensive means of building relationships with and among customers. Social media users interact with others who have similar interests and exchange information about their experiences. In general, companies have found that customers are eager to provide feedback and recommend improvements.

Research This: View at least two automotive websites and describe the social media that are featured. Choose one of the websites and review the content. What topics are being discussed? In which ways is the company encouraging participation, such as by sponsoring contests or providing opportunities for consumers to upload photos and videos? Can consumers create an account to share advice, rate and review vehicles, and discuss mechanical issues?

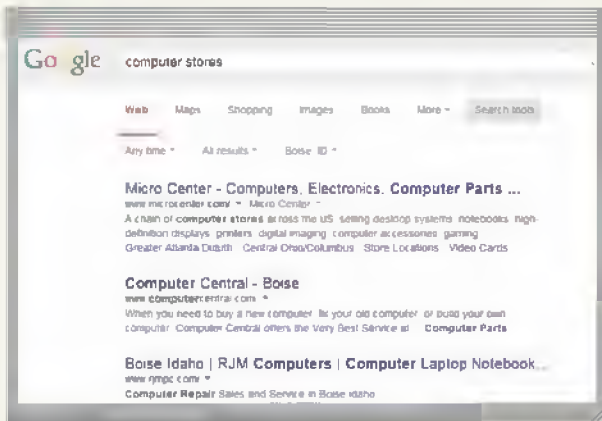
3 Search Skills Limiting Search Results by Website, Date, and Location

You can instruct a search engine to look for results on a specific website that match your search text. To do so, in your search text include the operator `site:` followed by a domain name you would like to search, with no spaces between the colon and the domain name. For example, to read articles from the Cnet website about solid state drives, type the search text, `site:cnet.com "solid state drives"`.

Some search engines provide additional search tools to specify a date range such as the past day, week, or month, to limit your results. Limiting search results by date can help you to find current information because the search engine will return results published during

Internet Research

a specified period. Providing a location or ZIP code as search options (beneath the search box) will limit search results to the geographic area you specify. Location search can help you find results for a specific area, such as computer stores in Boise, Idaho.



Source: Google

Research This: Create search text using the techniques described above or in previous Search Skills exercises, and type it in a search engine to answer these questions. (1) Find information on Intel’s website about core I7 processors that was posted within the past month. (2) Where in your local area can you recycle used computer equipment and electronics? (3) Find reviews of digital cameras posted within the past week. (4) Which laptops reviewed during the past six months have the longest battery life?

Security

More than 3 million smartphones are stolen each year, according to a *Consumer Reports* survey. In addition, 1.4 million smartphone users never have recovered a lost phone. Secure IT 6-1 in this chapter describes categories of products that can help secure and track hardware that has been stolen or lost.

Research This: Which apps are available for your smartphone to erase data remotely? Which location-tracking apps allow you to take a photo of the thief and then send an email message that contains the image to you automatically? If your device is lost and you file a police report, you will need the device’s serial number. Locate that number now and write it on a piece of paper. Also, locate the phone’s 15-digit International Mobile Equipment Identity

(IMEI) number and record that number. Store the document with these two numbers in a secure location. In addition, research the efforts by the U.S. Federal Communications Commission (FCC) and the Cellular Telecommunications Industry Association (CTIA) to create a centralized database of lost and stolen mobile phones. What is the status of this database? What legislation has been proposed or passed that requires wireless carriers and phone manufacturers to develop technological solutions that can curb the growing problem of violent smartphone theft?

Cloud Services Public, Private, Hybrid, and Personal Clouds (IaaS)

When deciding how to host data and apps on the cloud, companies often choose between sharing a server on the cloud with other organizations, configuring a dedicated server on the cloud, or using both options. Companies must consider the type of data involved and the level of security required to keep it safe. Public, private, and hybrid clouds are examples of IaaS (infrastructure as a service), a service of cloud computing that uses a provider’s hardware to manage, store and access files and apps over the Internet. On a public cloud, several companies store data or apps on the same physical server on the cloud. On a private cloud, a company has its own servers in the cloud to host its apps and data. On a hybrid cloud, organizations may host confidential data on a private cloud and rely on a public cloud for information that does not require such a high degree of security.

Individual users may set up a personal cloud by purchasing a networked hard drive. A networked hard drive connects directly to a router, providing access to its files over the Internet. This is a useful solution for having access to files from several devices.

Research This: (1) Use a search engine to find IaaS providers that offer public, private, and hybrid cloud solutions. Summarize the different solutions they provide. (2) Under what circumstances might an individual or enterprise set up a public, private, or hybrid cloud? (3) Research networked hard drive models from different manufacturers. Compare their costs, storage sizes, and additional features to consider when creating a personal cloud. (4) When might you create a personal cloud instead of using a cloud storage provider?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Cloud Storage

The owner of the motorcycle repair shop where you work as a part-time office manager is seeking alternatives to using a network server to store and back up files. She asks you to investigate the feasibility of using cloud storage, rather than purchasing additional storage media for the company's computers, mobile devices, and network servers.

Do This: Analyze the advantages and disadvantages of using cloud storage. Include in your discussion security concerns, costs, and a comparison between two different cloud storage offerings. Which company offers the better arrangement? Why? Explore one other area of cloud computing, such as SaaS (software as a service), and determine how the service might benefit the shop. Find three providers of the cloud service and compare prices, user reviews, and features. List the risks and benefits of using the cloud for storage and other services.

2. Upgrading Memory

You are an IT consultant at a bank. An analyst at the bank is complaining that her laptop is performing slowly. You determine that the laptop's memory is insufficient for the complex calculations and reports the analyst is running.

Do This: Search the web to learn more about current memory modules available to increase memory capacity. Evaluate the differences among various options, including type, size, speed, and price. Find articles from industry experts that list methods and recommendations for upgrading a laptop's memory. Also determine how to add memory to a laptop, obtaining answers to the following questions: How can you determine the type and correct amount of memory to add? Why should you not purchase more memory than

your computer can support? How do you determine the available slots for memory modules? What safety measures should you take when upgrading memory? Is it better to upgrade the memory or purchase a new laptop?

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. You recently purchased replacement smartphones for yourself and another employee, along with an upgraded tablet that the staff can use. Because you are discarding the outdated devices, the league's board of directors is concerned about how to secure and protect data when selling, donating, or recycling the devices. The board asked you to prepare information it can use in a press release to educate the league's customers about keeping data secure when discarding a device.

Do This: Determine the possible steps needed to wipe the memory and storage media in the devices. What kind of data is important to delete? Why? What are the risks of not wiping the memory and storage media in a device before you discard it? What responsibility does the league have to protect members' personal data? Why? Does choosing whether to sell, donate, or recycle the devices change your approach and need to wipe the devices' memory? Why or why not?



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Collaboration

4. Mobile Device Batteries You work in the IT department for a large publishing company that just purchased new tablets for all employees. The department manager asked you to prepare information about how to conserve the battery life of the tablets.

Do This: Form a three-member team. Each member of your team should choose a different type of tablet. Find information about the battery life for each device type, including recommendations for use by the manufacturer and user reviews of the device and its chargers. Research apps that track battery life. Search for articles by industry experts that give tips on conserving the battery life of a tablet. Meet with your team, and discuss and compile your findings. Which tablet would you recommend? Why? How does the charger affect the battery life? What did you learn about battery conservation? Which apps would you recommend? Why?

INPUT AND OUTPUT: Extending Capabilities of Computers and Mobile Devices

7



Users interact with a variety of input and output devices every day.

“After work or school, I video chat with my friends and discuss our gaming strategies. I print photos from my digital camera on my ink-jet printer. I have a wireless speaker system that works with my laptop and phone. What more should I know about input and output?”

While you may be familiar with some of the content in this chapter, do you know how to . . .

- Decide if you should take notes electronically or by hand?
- Use motion and gestures for input?
- Use touch input on various devices?
- Use DV technology?
- Set up and use a webcam or integrated DV camera?
- Prevent unauthorized use of a webcam?
- Improve the quality of scanned documents?
- Scan QR codes safely?
- Prevent electronic pickpockets from obtaining information stored on your credit cards and other personal documents?
- Protect yourself from hardware radiation?
- Show media on a Smart TV from a computer or tablet?
- Print from a smartphone or tablet?
- Acquire assistive technologies for input and output?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

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✓ Objectives

After completing this chapter, you will be able to:

- 1 Differentiate among various types of keyboards: standard, compact, on-screen, virtual, ergonomic, gaming, and wireless
- 2 Describe characteristics of various pointing devices: mouse, touchpad, and trackball
- 3 Describe various uses of touch screens
- 4 Describe various types of pen input: stylus, digital pen, and graphics tablet
- 5 Describe various uses of motion input, voice input, and video input
- 6 Differentiate among various scanners and reading devices: optical scanners, optical readers, bar code readers, RFID readers, magstripe readers, MICR readers, and data collection devices
- 7 Identify the types of output
- 8 Explain the characteristics of various displays
- 9 Summarize the various types of printers: ink-jet printers, photo printers, laser printers, all-in-one printers, thermal printers, mobile printers, label printers, plotters and large-format printers, and impact printers
- 10 Identify the purpose and features of speakers, headphones and earbuds, data projectors, interactive whiteboards, and force-feedback game controllers and tactile output
- 11 Identify various assistive technology input and output methods

What Is Input?

Input is any data and instructions entered into the memory of a computer. As shown in Figure 7-1, people have a variety of options for entering data and instructions into a computer.

As discussed in Chapter 1, *data* is a collection of unprocessed items, including text, numbers, images, audio, and video. Once data is in memory, a computer or mobile device interprets and executes instructions to process the data into information. Instructions that a computer or mobile device processes can be in the form of software (programs and apps), commands, and user responses.

- *Software* is a series of related instructions, organized for a common purpose, that tells a computer or mobile device what tasks to perform and how to perform them. When software developers write programs or apps, they usually enter the instructions into the computer or mobile device by using a keyboard, mouse, or other input method. The software developer then stores the program in a file that a user can execute (run). When a user runs a program or app, the computer or mobile device loads the program or app from a storage medium into memory. Thus, a program or app is entered into a computer's or mobile device's memory.
- A *command* is an instruction that causes a program or app to perform a specific action. Programs and apps respond to commands that a user issues. Users issue commands by touching an area on a screen, pressing keys on the keyboard, clicking a mouse button to control a pointer on the screen, or speaking into a microphone.
- A *user response* is an instruction a user issues by responding to a message displayed by a program or app. A response to the message instructs the program or app to perform certain actions. For example, when a program or app asks the question, 'Do you want to save the changes made to this file?', and you respond with the instruction of 'Yes', the program will save the file with the changes you made. If you respond with the instruction of 'No', the program will not save your changes before exiting.

Commonly used input methods include the keyboard, pointing devices, touch screens, pen input, motion input, voice input, video input, and scanners and reading devices. This chapter discusses each of these input methods.



Figure 7-1 Users can enter data and instructions into computers and mobile devices in a variety of ways.

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Keyboards

Most computers and mobile devices include a keyboard or keyboarding capabilities. As discussed in previous chapters, a **keyboard** is an input device that contains keys you press to enter data and instructions into a computer or mobile device. Nearly all keyboards have a typing area, function keys, toggle keys, and navigation keys (Figure 7-2). Many also include media control buttons, Internet control buttons, and other special keys. Others may include a fingerprint reader or a pointing device.

- The typing area includes letters of the alphabet, numbers, punctuation marks, and other basic keys. Read Secure IT 7-1 to learn about software that can track your keystrokes.
- *Function keys*, which are labeled with the letter F followed by a number, are special keys programmed to issue commands to a computer. The command associated with a function key may vary, depending on the program you are using.
- A *toggle key* is a key that switches between two states each time a user presses the key. CAPS LOCK and NUM LOCK are examples of toggle keys. Many mobile devices have keys that toggle the display of alphabetic, numeric, and symbols on touch keyboards in order to display more characters and symbols on a keyboard with fewer keys.
- Users can press the navigation keys, such as arrow keys and PAGE UP/PAGE DOWN and PAGE UP/PAGE DOWN on the keyboard, to move the insertion point in an application left, right, up, or down.
- A *keyboard shortcut* is one or more keyboard keys that you press to perform an operating system or application-related task. Some keyboard shortcuts are unique to a particular application or operating system.
- Media control buttons allow you to control a media player program, access the computer's optical disc drive, and adjust speaker volume.
- Internet control buttons allow you to run an email application, run a browser, and search the web.



BTW

Insertion Point

The *insertion point*, also known as a *cursor* in some applications, is a symbol on the screen, usually a blinking vertical bar, that indicates where the next character you type will appear.

Discover More: Visit this chapter's free resources to learn more about function key commands, toggle keys, and keyboard shortcuts.

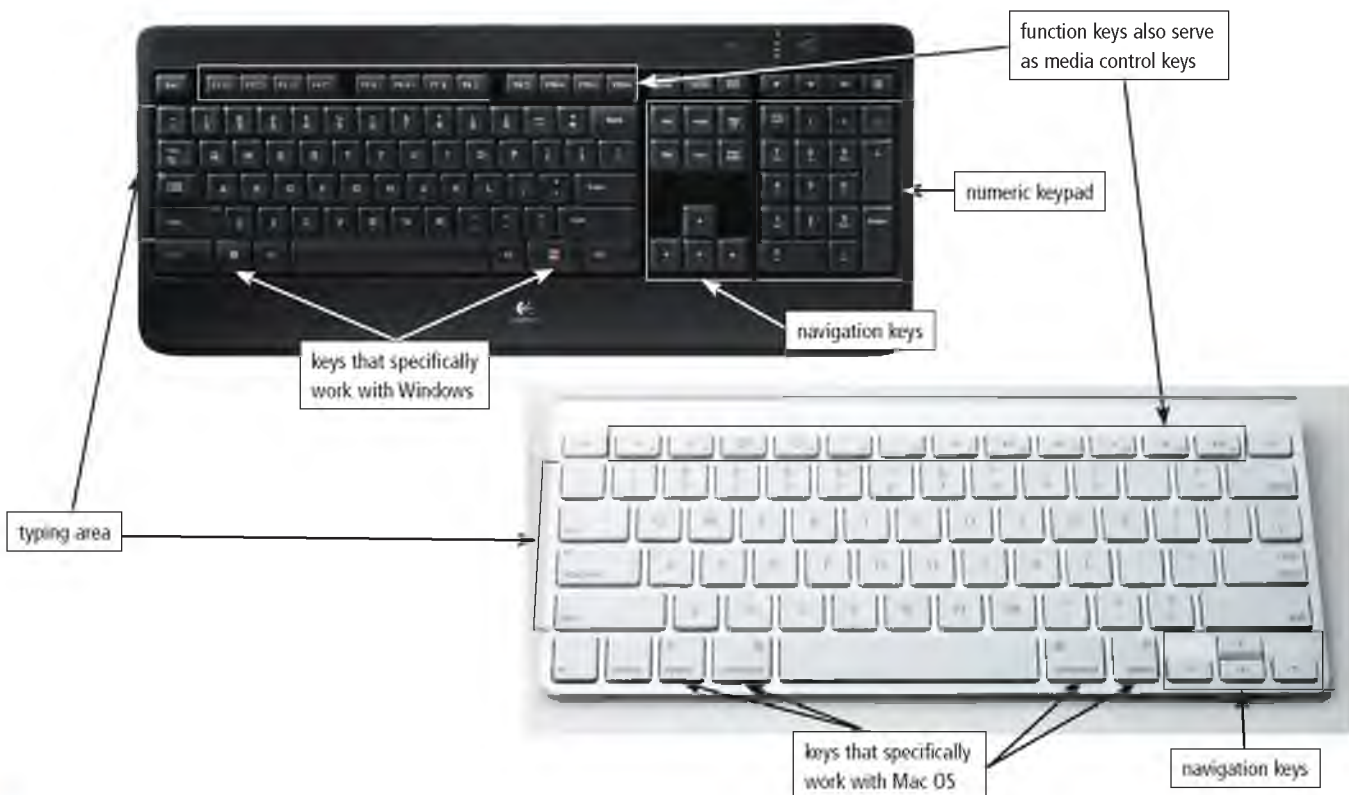


Figure 7-2 On a standard keyboard, you type using keys in the typing area and on the numeric keypad. Some of the keys on standard keyboards differ, depending on the operating system with which they are designed to work.

Courtesy of Logitech; © iStockphoto / Jill Fromer

SECURE IT 7-1

Keyboard Monitoring

Some employers and parents want to monitor everything that has been entered into a computer to ensure that employees and children are using the computer for appropriate purposes. They may use *keyboard monitoring software*, also called *keylogging software*, to accomplish this task. This software runs undetected and stores every keystroke in a file for later retrieval.

These programs have both criminal and beneficial purposes. When used in a positive fashion, employers can measure the efficiency of data entry personnel. This software also can verify that employees are not releasing company secrets, are not viewing personal or inappropriate content on work computers, and are not engaging in activities that could subject the company to harassment, hacking, or other similar charges. Employers sometimes use the software to troubleshoot technical problems and to back up their networks. Parents, likewise, can verify their children are using the home computer safely and are not visiting inappropriate websites. Educators and

researchers can capture students' input to analyze how well they are learning a second language or improving their typing skills. This software also can monitor activity in chat rooms and other similar locations.

When used for malicious purposes, criminals use the programs on both public and private computers to capture user names, passwords, credit card numbers, and other sensitive data and then use this data to access financial accounts and private networks.

Many keylogging programs are available, and they perform a variety of functions. Some simply record keystrokes in a hidden file stored on the hard drive that can be accessed by supplying the correct password. More sophisticated programs record software used, websites visited, and periodic screenshots and then transmit this data to a remote computer.

It can be difficult to locate keylogging software on a computer, but taking these steps may help detect the programs:

- **Run detection software regularly.** Several antivirus and spyware detection programs check for known keylogging programs.
- **Review hard drive files.** Regularly look at the most recent files and note any that are updated continually. These files might be the keylogging software's logs.
- **Check running programs.** Periodically examine which software is loaded from the computer's hard drive into memory when you start the computer and which are running while you are using the computer. If you are uncertain of any program names, perform a search to learn the software's function and if it is a known keylogging program.

Consider This: Do you know anyone who has installed keylogging software or who has found keylogging software installed on his or her computer? Is keylogging software an invasion of privacy? Should employers inform employees if the software is installed? Why or why not?

Types of Keyboards

Desktops include a standard keyboard. Standard keyboards typically have from 101 to 105 keys, which include function keys along the top and a numeric keypad on the right (shown in the top keyboard in Figure 7-2).

As discussed in previous chapters, you have a variety of keyboard options for mobile computers and devices (Figure 7-3). These devices often use a *compact keyboard*, which is smaller than a standard keyboard and usually does not include the numeric keypad or navigation keys. Typically, the keys on a compact keyboard serve two or three purposes in order to provide the same functionality as standard keyboards. Some compact keyboards are built into the computer or mobile device and/or are permanently attached with hinges, a sliding mechanism, or some other technique. Other compact keyboards are separate devices that communicate wirelessly or attach to the computer or device with a magnet, clip, or other mechanism. Some users prefer to work with on-screen or virtual keyboards instead of a physical keyboard. Others, however, prefer to use a standard keyboard with their mobile devices because these keyboards provide added functionality and tactile comfort.



Figure 7-3 Users have a variety of keyboard options for mobile computers and devices.

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CONSIDER THIS

What is the rationale for the arrangement of keys in the typing area?

The keys originally were arranged on old mechanical typewriters to separate frequently used keys, which caused typists to slow down. This arrangement, called a QWERTY keyboard because the six first letters on the top row of letter keys spell QWERTY, reduced the frequency with which the mechanical levers jammed.



Figure 7-4 An ergonomic keyboard.
© Dmitry Melnikov / Shutterstock.com

An *ergonomic keyboard* has a design that reduces the chance of repetitive strain injuries (RSIs) of wrist and hand (Figure 7-4). Recall that the goal of ergonomics is to incorporate comfort, efficiency, and safety in the design of the workplace. Even keyboards that are not ergonomically designed attempt to offer a user more comfort by including a wrist rest.

A *gaming keyboard* is a keyboard designed specifically for users who enjoy playing games on the computer. Gaming keyboards typically include programmable keys so that gamers can customize the keyboard to the game being played.

The keys on gaming keyboards light up so that the keys are visible in all lighting conditions. Some have small displays that show important game statistics, such as time or targets remaining.

Internet Research

How prevalent are RSIs?

Search for: rsi statistics

CONSIDER THIS

Why use a wireless keyboard?

Although some keyboards connect via a cable to a USB port on the computer, some users choose a wireless keyboard to eliminate the clutter of a cord and/or to free USB ports for other uses. A *wireless keyboard* is a battery-powered device that transmits data to the computer or mobile device using wireless technology. For example, Bluetooth keyboards are especially popular with tablets because they do not require a USB port and are easy to pair with computers and devices. Many vendors offer tablet cases with a built-in Bluetooth keyboard so that you easily can transport a keyboard with the tablet.

BTW

Technology Innovator

Discover More: Visit this chapter's free resources to learn about Logitech, a global company that makes a variety of input and output devices.

Pointing Devices

In a graphical user interface, a **pointer** is a small symbol on the screen whose location and shape change as a user moves a pointing device. A pointing device can enable you to select text, graphics, and other objects, such as buttons, icons, links, and menu commands. The following pages discuss a variety of pointing devices.

Mouse

A **mouse** is a pointing device that fits under the palm of your hand comfortably. As you move a mouse, the pointer on the screen also moves. The bottom of a mouse is flat and contains a mechanism that detects movement of the mouse. Desktop users have an optical mouse or a touch mouse, both of which can be placed on nearly all types of flat surfaces (Figure 7-5).

An *optical mouse* uses optical sensors that emit and sense light to detect the mouse's movement. Similarly, a *laser mouse* uses laser sensors that emit and sense light to detect the mouse's movement. Some mouse devices use a combination of both technologies. The top and sides of an optical or laser mouse may have one to four buttons; some may also have a small wheel. Some are more sensitive than others for users requiring more precision, such as graphic artists, engineers, or game players.

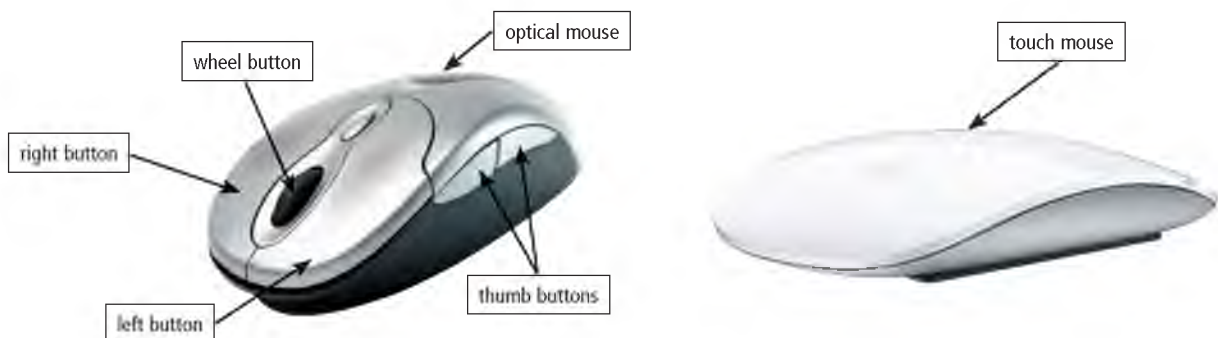


Figure 7-5 An optical mouse has buttons. A touch mouse often has no buttons.

© Anton Derevschuk / Shutterstock.com; Courtesy of Apple, Inc.

A *touch mouse* is a touch-sensitive mouse that recognizes touch gestures, in addition to detecting movement of the mouse and traditional click and scroll operations. For example, you press a location on a touch mouse to simulate a click, sweep your thumb on the mouse to scroll pages, or slide multiple fingers across the mouse to zoom.

As with keyboards, you can purchase an ergonomic mouse to help reduce the chance of RSIs or to reduce pain and discomfort associated with RSIs.

CONSIDER THIS

Why use a wireless mouse?

As with keyboards, some users choose a wireless mouse to eliminate the clutter of a cord. A *wireless mouse* is a battery-powered device that transmits data using wireless technology. A wireless mouse typically transmits data to a receiver that plugs in a USB port or uses Bluetooth technology to pair with the device.

Touchpad

A **touchpad** is a small, flat, rectangular pointing device that is sensitive to pressure and motion (Figure 7-6). Touchpads are found most often on laptops and convertible tablets. Desktop users who prefer the convenience of a touchpad can purchase a separate touchpad, which usually communicates wirelessly with the computer.

To move the pointer using a touchpad, slide your fingertip across the surface of the pad. Some touchpads have one or more buttons around the edge of the pad that work like mouse buttons; others have no buttons. On most touchpads, you also can tap the pad's surface to imitate mouse operations, such as clicking. Some touchpads also recognize touch gestures, such as swipe, pinch, and stretch motions.



Trackpad

Apple uses the term, *trackpad*, to refer to the touchpad on its laptops.



Figure 7-6 Laptop users often use the touchpad to control movement of the pointer. You also can purchase an external wireless touchpad for use with desktops and tablets.

© Andrew Donehue / Shutterstock.com; © iStockPhoto / Goldmund

CONSIDER THIS

What is a pointing stick?

Some mobile computer keyboards contain a pointing stick, which is a pressure-sensitive pointing device shaped like a pencil eraser positioned between its keys. To move the pointer using a pointing stick, you push the pointing stick with a finger.

Trackball

A **trackball** is a stationary pointing device with a ball on its top or side. The ball in most trackballs is about the size of a Ping-Pong ball. Some devices, called a trackball mouse, combine the functionality of both a trackball and a mouse (Figure 7-7).

To move the pointer using a trackball, you rotate the ball with your thumb, fingers, or the palm of your hand. In addition to the ball, a trackball usually has one or more buttons that work like mouse buttons.



CONSIDER THIS

Why use a trackball instead of a mouse?

For users who have limited desk space, a trackball is a good alternative to a mouse because the device is stationary. Keep in mind, however, that a trackball requires frequent cleaning because it picks up oils from fingers and dust from the environment.



Figure 7-7 Shown here is a trackball mouse, which is a single device that provides the functionality of both a trackball and a mouse.

© iStockphoto / peng wu

Touch Screens

A **touch screen** is a touch-sensitive display. Touch screens are convenient because they do not require a separate device for input. Smartphones and tablets, and many laptops and all-in-ones offer touch screens.

You can interact with a touch screen by touching areas of the screen with your finger or a stylus to make selections or to begin typing. Many touch screens also respond to gestures.

A *gesture* is a motion you make on a touch screen with the tip of one or more fingers or your hand. For example, you can slide your finger to drag an object or pinch your fingers to zoom out. (Read How To 1-1 in Chapter 1 for a description of widely used touch screen gestures.)

Touch screens that recognize multiple points of contact at the same time are known as *multi-touch*. Because gestures often require the use of multiple fingers (points of contact), touch screens that support gestures are multi-touch.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn about biometric input.

Mini Feature 7-1: Touch Input

Many new computers and devices are using touch as a primary method of input. In fact, newer operating systems are optimizing their user interfaces for touch input. Read Mini Feature 7-1 to learn about various devices that use touch input.

MINI FEATURE 7-1

Touch Input

Devices that utilize touch input include monitors for desktops and screens on laptops and tablets, smartphones, wearable devices, portable media players, digital cameras, tablets, kiosks, and navigation systems.

Desktop Monitors and Screens on Laptops and Tablets

An increasing number of desktop monitors and screens on laptops and tablets support touch input. These touch-enabled monitors and screens allow users to interact with the operating system without a keyboard or pointing device. Instead of using a mouse to click an object on the screen, users simply can tap or double-tap the item they otherwise would have clicked. For example, users can tap or double-tap an icon to run a program or an application, slide their finger to scroll, or use their finger to drag items across the screen.



Smartphones

Smartphones are becoming more functional, lighter weight, and now often do not include a physical keyboard. Touch input can help smartphone manufacturers achieve all these goals. The gestures you might perform on a smartphone that supports touch input include tapping to run an app, sliding or swiping to scroll, and pinching and stretching to zoom. The absence of a physical keyboard makes it more difficult to type without looking at the screen, so it is not advisable to use a smartphone when performing actions that require undivided attention, such as driving a car or walking.

Wearable Devices

Wearable devices, such as smartwatches, do not have room for a physical keyboard, so they mainly rely on touch input. The gestures you might perform on a wearable device include tapping to make a selection, and sliding or swiping to scroll through the various screens.

Portable Media Players

Portable media players widely use touch as the primary method of input so that the size of the screen on the device is maximized. That is, space on the device does not have to be dedicated to other controls, such as buttons or click wheels. Users slide and swipe to browse their music libraries on their portable media players and then tap to select the song they want to play. While songs are playing, users can tap the screen to display controls so that they can pause or stop the song, navigate to another song, or adjust the volume.

Digital Cameras

As digital cameras start to include built-in features to browse through and edit photos without requiring a computer, touch input helps digital camera users perform these functions with greater accuracy. For example, you can perform gestures such as swiping left and right on the screen to browse your photos, tapping the screen to identify the area on which you wish to focus when taking a picture, pinching and stretching to zoom while viewing photos, tapping areas of photos to remove red-eye, and dragging borders of photos to crop them.

Kiosks

Touch input also is used on devices where a keyboard and pointing device might not endure its high volume of use. Kiosks, such as those at an airport allowing you to check in for a flight, can be used by hundreds of people per day. Because kiosks are designed to help you perform a specific function as quickly as possible, touch input is ideal for their user-friendly interfaces. Users typically interact with kiosks by tapping various areas of the screen to select options (as discussed in Chapter 3). If typing is required, an on-screen keyboard is displayed so that users can enter information, such as their name or a confirmation number. Kiosks requiring sensitive or a significant amount of input also might include a separate keyboard and pointing device. For example, ATMs with touch screens often have a separate keypad to enter your PIN so that others are not able to see what you are typing.

Navigation Systems

Navigation systems in cars and other vehicles use touch input because typing on a separate keyboard is not wise while in a vehicle. Navigation system users can perform actions such as tapping to enter a destination address, dragging to display different areas of the map, or pinching and stretching to zoom. Operating a navigation system with touch input requires you to take your eyes off the road to interact with the device, so you should operate a navigation system only while your vehicle is parked or stopped. To reduce the chances of driver distraction, some built-in navigation systems reduce functionality while the vehicle is in motion. Read Ethics & Issues 7-1 to consider issues associated with using navigation and other mobile devices while driving.

Discover More: Visit this chapter's free resources to learn more about operating systems, monitors, smartphones, portable media players, and navigation systems that use touch input.

Consider This: Do you find it is easier to use touch input instead of using a keyboard or mouse? Does your answer depend on the type of device you are using or the task you are trying to accomplish? Why?



ETHICS & ISSUES 7-1

Should a Vehicle Be Able to Prevent User Input on a Mobile Device while the Vehicle is in Motion?

As you are driving, you receive a text message from a friend. Is it safe to read the text message? Is it legal? Should you respond to it? Millions of Americans acknowledge that they use mobile phones while driving. Today's newer vehicles include sophisticated hands-free systems that use Bluetooth and other technologies to connect mobile devices to the vehicle's sound system.

Other technologies restrict or block usage while a vehicle is moving. Motion sensors can detect if the car is in motion. A phone's camera can tell whether the user is the driver or a passenger by the angle of the scenery in the

background. Some cars will not start unless the mobile device is plugged into a socket that blocks all signals and can send a message to a parent if the device is removed. Parents can install apps on their children's smartphones that use GPS, cameras, and motion sensors to track or restrict teens' usage.

The debate about mobile phone safety while driving elicits different points of view from vehicle insurance companies, consumer safety groups, and the telecommunications industry. The U.S. Department of Transportation says that users who text while driving have a crash risk 23 times higher than those who refrain. In some states, it is illegal to send, read, or respond to text messages while driving. Other states have outlawed the use of mobile phones or they

require drivers to use hands-free devices while driving. Many states have different laws for teens or new drivers.

A recent study stated that talking on a phone while driving affects drivers' response times as much as if they had consumed alcohol. Critics of hands-free and signal blocking technology claim that drivers can be just as easily distracted if they are discussing business or emotional matters.

Consider This: Would you use technology that limited your device usage while driving? Why or why not? Do you think laws that target teens or new drivers are fair? Why or why not? Do you believe hands-free devices are safe? Why or why not?

CONSIDER THIS

What is the purpose of a touch-sensitive pad?

Portable media players that do not have touch screens typically have a touch-sensitive pad. A *touch-sensitive pad* is an input device that contains buttons and/or wheels you operate with a thumb or other finger. Using the touch-sensitive pad, you can scroll through and play music; view photos; watch videos or movies; navigate through song, photo, or movie lists; display a menu; adjust volume; customize settings; and perform other actions. For example, users can rotate a portable media player's touch-sensitive pad to browse through the device's playlists and press the pad's buttons to play or pause media (Figure 7-8).



Figure 7-8 You use your thumb or finger to rotate or press buttons on a touch-sensitive pad, which commonly is found on portable media players.

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Pen Input

Some displays and mobile devices support pen input. With **pen input**, you touch a stylus or digital pen on a flat surface to write, draw, or make selections.

Stylus

A **stylus** is a small metal or plastic device that looks like a tiny ink pen but uses pressure instead of ink (Figure 7-9). Nearly all tablets and mobile devices, some laptop screens, and a few desktop monitors have touch screens that support pen input, in addition to touch input. These computers and devices may include a stylus. Some stylus designs include buttons you can press to simulate clicking a mouse.

To capture a handwritten signature, a user writes his or her name on a **signature capture pad** with a stylus that is attached to the device. Software then transmits the signature to a central computer, where the signature is stored. Retailers use signature capture pads to record purchasers' signatures. Signature capture pads often work with POS terminals and include a magnetic stripe card reader, discussed later in the chapter.



Some manufacturers refer to a stylus as a pen.



Figure 7-9 You use a stylus to write, draw, or make selections on a touch screen that supports pen input.

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Digital Pen

A **digital pen**, which is slightly larger than a stylus, is an input device that captures and converts a user's handwriting or drawings into a digital format, which users can upload (transfer) to a computer or mobile device. Some require the user to write or draw on special paper or a tablet; others can write or draw on any surface (Figure 7-10).

Once uploaded, *handwriting recognition software* on the computer or mobile device translates the handwritten letters and symbols created on the screen into typed text or objects that the computer or device can process. For this reason, digital pens most often are used for taking notes. Some are battery operated or USB powered; others use wireless technology, such as Bluetooth. Read Ethics & Issues 7-2 to consider whether you should take notes electronically or by hand.

Discover More: Visit this chapter's free resources to learn more about digital pens.



Figure 7-10 Users take notes with a digital pen and then upload the notes to a computer or mobile device, where software translates the notes to typed text.

Courtesy of LiveScribe

Internet Research

Which digital pens are the most accurate?

Search for: digital pen reviews

ETHICS & ISSUES 7-2

Is It More Efficient to Take Notes by Hand or with a Digital Device?

When an instructor starts a lecture, he or she looks out at the classroom to see some students bent over a tablet, others frantically typing on a laptop, and still others using pen and paper to take notes. Which method is most effective for retaining knowledge?

A recent study concluded that students who used traditional pen and paper to take notes in class and while studying had better understanding and recall of information. The study concluded that when taking notes on a laptop, students tended to write down the speaker's exact words. Taking notes longhand required students to process the information, use their own words, and select

what information is important enough to write down. Tablet users tended to have a mix of both transcribed and selected content. Regardless of the note-taking method, students performed equally when asked to recall factual information. Laptop users, however, were less able to answer conceptual or interpretive questions than those who took notes longhand.

Another concern when using laptops and mobile devices in a classroom is distractibility. Students may receive notifications about activity on an online social network, or use Internet messaging or text messaging to communicate with others about unrelated topics. Research shows that laptop users have unrelated programs or apps on their screen up to 40 percent of class time. Many instructors

encourage students to use their computers and mobile devices for class related purposes. For example, some encourage students to Tweet answers to questions or research articles to support a fact or opinion. Others provide access to online forums in order for students to communicate with one another during or after class.

Consider This: Should instructors inform students about the benefits of longhand note taking? Why or why not? Should students be required to take notes longhand? Why or why not? How else might you use your computer or mobile device during class time to further your own learning?

Graphics Tablet

To use pen input on a computer that does not have a touch screen, you can attach a graphics tablet to the computer. A **graphics tablet**, also called a *digitizer*, is an electronic plastic board that detects and converts movements of a stylus or digital pen into digital signals that are sent to the computer (Figure 7-11). Each location on the graphics tablet corresponds to a specific location on the screen. Architects, mapmakers, designers, and artists, for example, use graphics tablets to create images, sketches, or designs.



Figure 7-11 Architects use a graphics tablet to create blueprints.
© iStockphoto / small_frog

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled What is Input?, Keyboards, Pointing Devices, Touch Screens, and Pen Input, as it relates to the chapter objectives.

Now you should know . . .

- What types of keyboards are available for computer and mobile devices, and which are best suited your needs (Objective 1)
- When you would use a mouse, touchpad, and trackball (Objective 2)
- What devices use touch screens (Objective 3)
- When you might use a stylus, digital pen, and graphics tablet (Objective 4)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Motion, Voice, and Video Input

Many of today's computers, mobile devices, and game devices support motion, voice, and video input. The following sections discuss each of these input methods.

Mini Feature 7-2: Motion Input

With *motion input*, sometimes called *gesture recognition*, users can guide on-screen elements using air gestures. *Air gestures* involve moving your body or a handheld input device through the air. With motion input, a device containing a camera detects your gesture and then converts it to a digital signal that is sent to a computer, mobile, or game device. For example, gamers can swing their arm or a controller to simulate rolling a bowling ball down a lane toward the pins. Read Mini Feature 7-2 to learn how a variety of fields use motion input.

Internet Research

What are other uses of gesture recognition?

Search for: gesture recognition uses

MINI FEATURE 7-2

Motion Input

Until a few years ago, the idea of controlling a computer by waving your hands was seen only in Hollywood science fiction movies. Today, the entertainment industry (such as for gaming and animating movies), the military, athletics, and the medical field have found uses for motion input.

Motion-sensing devices communicate with a game console or a personal computer using wired or wireless technology. The console or computer translates a player's natural gestures, facial movements, and full-body motion into input. Although these devices originally were intended for gaming, developers are working on adapting them or using similar technology outside of the gaming and entertainment industries.

Entertainment

Motion-sensing game controllers enable a user to guide on-screen elements by moving a handheld input device through the air. Examples include handheld devices that enable gamers to use sweeping arm movements to simulate sports activities, such as a golf swing (shown in the figure below), balance boards that judge stability and motion when holding yoga poses, and remote control attachments, such as a steering wheel used to guide a car along a race course.

Some controllers track peripheral motion within a specific area. With these devices, users can move their finger to draw or move their whole body to dance or exercise. Some use a device that can track small finger gestures, enabling users to be more precise in their movements.

Facial motion capture converts people's facial movements into a digital format while they talk, smile,

and more. Animators, for example, use the digital data to simulate facial movements to create realistic gaming avatars, or computer-generated characters in movies. Facial movements, however, are more subtle and difficult to detect. Thus, the technology used for capturing facial motions requires more precision and a higher resolution than that required by gaming devices.

Military

Military uses of motion input include training, such as flight simulation or weapon usage. To ensure safety, trainees maneuver a helicopter or other device using motion input from a remote location. Motion input also aids in physical rehabilitation for wounded soldiers by providing a method for conducting physical therapy exercises outside of a military hospital. Another use of motion input is to assist in recovery from post-traumatic stress disorder. Sufferers of this ailment can use avatars and simulators to work through scenarios in a comfortable environment.

Athletics

Coaches and sports trainers use motion input to improve athletes' performance and to correct inefficient or injury-causing motions. Analyzing the arc of a pitcher's arm, and factoring the speed of the motion and the trajectory of the ball, can help improve a pitcher's accuracy and speed. Combining the athlete's motion input with complex algorithms can pinpoint areas in which the athlete can improve.

Medical Field

The medical field also uses motion input for training. For example, surgeons can practice new technologies in a simulated environment. Using motion input that enhances movements, surgeons also can operate less invasively. Surgeons even operate remotely, enabling experts to manipulate surgical devices and share their expertise to save lives around the world. Sports medicine specialists use motion input to assess injuries, determine treatment, and assist in physical therapy.

Discover More: Visit this chapter's free resources to learn more about motion-sensing devices and controllers, controllers that track peripheral motion, and other uses of motion input.

Consider This: Have you used a motion-sensing device or game controller? What were your impressions? What security issues surround military use of motion input? What issues might the medical field encounter when using motion input?



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Figure 7-12 With Siri, you can speak instructions and commands to the smartphone and its apps. As shown here, the user asks Siri about the weather, to which Siri replies by speaking a message and displaying the forecast.

© iStockphoto / alexander kirch

Internet Research

How accurate is voice recognition?

Search for: voice recognition accuracy

Voice and Audio Input

Voice input is the process of entering input by speaking into a microphone. The microphone may be built in the computer or device, in a headset, or an external peripheral device that sits on top of a desk or other surface. Some external microphones have a cable that attaches to a port on a computer; others communicate using wireless technology, such as Bluetooth.

Uses of voice input include Internet messaging that supports voice conversations, chat rooms that support voice chats, video calls, videoconferencing, VoIP, and voice recognition. Recall that VoIP enables users to speak to other users via their Internet connection. **Voice recognition**, also called *speech recognition*, is the computer or mobile device's capability of distinguishing spoken words. Some computers and mobile devices make use of built-in and third-party voice recognition applications, which have a natural language interface (Figure 7-12). A *voice recognition application* allows users to dictate text and enter instructions by speaking into a microphone.

On mobile devices, these applications allow users to speak simple, task-based instructions to the device, such as setting an alarm, entering a calendar appointment, or making a call. Some mobile devices have a *speech-to-text* feature, which recognizes a user's spoken words and enters them into email messages, text messages, or other applications that support typed text entry.

Discover More: To learn how voice recognition works, visit the free resources in Chapter 3 and read the High-Tech Talk article on this topic.

Audio Input Voice input is part of a larger category of input called audio input. *Audio input* is the process of entering any sound into the computer, such as speech, music, and sound effects. To enter high-quality sound into computer, the computer uses a sound card or integrated sound capability. Users enter sound into computers and mobile devices via devices such as microphones, CD/DVD/Blu-ray Disc players, or radios, each of which plugs in a port on the computer or device.

Some users also record live music and other sound effects into a computer by connecting external music devices, such as an electronic keyboard (Figure 7-13), guitar, drums, harmonica, and microphones, to a computer. Music production software allows users to record, compose, mix, and edit music and sounds. For example, music production software enables you to change the speed, add notes, or rearrange the score to produce an entirely new arrangement.

Discover More: Visit this chapter's free resources to learn more about voice recognition applications and music production software.



Figure 7-13 This sound engineer uses a computer to mix music.

© iStockphoto / Chris Schmidt

CONSIDER THIS

How do external music devices connect to a computer?

External music devices typically connect to USB and MIDI ports. When purchasing a music device, check its specifications for the type(s) of ports to which it connects.

Mini Feature 7-3: Digital Video Technology

Video input is the process of capturing full-motion images and storing them on a computer or mobile device's storage medium, such as a hard disk or optical disc. A **digital video (DV) camera** records video as digital signals, which you can transfer directly to a computer or mobile device with the appropriate connection. Read Mini Feature 7-3 to learn the steps involved in using DV technology.



Technology Trend

Discover More: Visit this chapter's free resources to learn about the use of drones with technology.

MINI FEATURE 7-3

Digital Video Technology

Everywhere you look, people are capturing videos using DV (digital video) cameras and mobile devices with built-in digital cameras. Using **DV technology**, you can input, edit, manage, publish, and share your videos. You can enhance digital videos by adding scrolling titles and transitions, cutting out or adding scenes, and adding background music and voice-over narration. The following sections outline the steps involved in the process of using DV technology.

Step 1: Select a DV Camera

DV cameras range from inexpensive consumer versions to high-end DV camera models that support Blu-ray or HDV standards. Many mobile devices allow you to record digital video that you later can transmit to your computer or email from the device. When selecting a DV camera, consider features such as zoom, sound quality, editing capabilities, and resolution.

Step 2: Record a Video

With most DV cameras, you have a choice of recording programs that include different combinations of camera settings. These programs enable you to adjust the exposure and other functions to match the recording environment. You also have the ability to select special digital effects, such as fade, wipe, and black and white.

Step 3: Transfer and Manage Videos

You can connect most video cameras and mobile devices to a computer using a USB port. With many devices, you can transfer the videos to a media sharing or an online social network. Before doing this, however, consider the frame rate and video file format. The *frame rate* of a video refers to the number of frames per second (fps). A smaller frame rate results in a smaller file size for the video, but playback of the video will not be as smooth as one recorded with a higher frame rate. A video file format holds the video information in a manner specified by a vendor.

Step 4: Edit a Video

When editing, you first split the video into smaller pieces, or scenes, that you can manipulate easily. Most video editing software automatically splits the video into scenes at locations that you specify. After splitting, you should delete, or prune, unwanted scenes or portions of scenes. You can crop (or resize) scenes, and add logos, special

effects, or titles. Special effects include warping, changing from color to black and white, morphing, or zoom motion. *Morphing* transforms one video image into another image over the course of several frames of video.

The next step is to add audio effects, including voice-over narration and background music. Using many video editing programs, you can add more tracks, or layers, of sound to a video in addition to the sound that the video camera or mobile device recorded. Adding audio tracks enables you to set a mood by providing background music or sounds. In the final step, you use video editing software to combine the scenes into a complete video by ordering scenes and adding transition effects. Transition effect options include fades, wipes, blurs, bursts, ruptures, and erosions.

Step 5: Distribute a Video

Some mobile devices allow you to upload video directly to video sharing and online social networks, as well as to send a video message. You can save digital video to media such as a DVD or Blu-ray Disc and package it for individual distribution or sale.

Discover More: Visit this chapter's free resources to learn more about DV cameras, Blu-ray and HDV standards, special digital effects, transferring videos to a computer or online site, video file formats, video editing software, and adding logos.


 **Consider This:** If your computer or mobile device is capable of recording video, how often and for what purposes do you generally record videos? What settings can you adjust to improve the quality of the video? Which file format does your mobile device use to save video files?





Figure 7-14 During a video call, users see one another as they communicate.

© iStockphoto / Anatoliy Babiy

Webcams and Integrated DV Cameras

A **webcam** is a type of DV camera that enables you to capture video and still images, and usually audio input, for viewing or manipulation on a computer or mobile device. Some webcams are separate peripheral devices, which usually attach to the top of a desktop monitor. Many laptops, tablets, and smartphones have built-in webcams. Smartphones and other mobile devices have built-in integrated DV cameras. Read How To 7-1 for instructions about setting up and using a webcam or integrated DV camera.

Using a webcam or integrated DV camera, you can send email messages with video attachments, broadcast live images or video over the Internet, conduct videoconferences, and make video calls. During a **video call**, all parties see one another as they communicate over the Internet (Figure 7-14).

HOW TO 7-1

Set Up and Use Webcams and Integrated DV Cameras

As mentioned, webcams and DV cameras are used to record and/or send live video to others. Before you can record and send video to others, you must have a webcam or integrated DV camera on your computer or mobile device. Some computers and mobile devices have integrated DV cameras; others require you to set up a separate webcam. The following steps describe how to set up a webcam, and use a webcam or integrated DV camera:

Setting Up a Webcam

1. If the webcam included software, install the software on your computer before connecting the webcam.
2. Connect the webcam to your computer or mobile device either when the software prompts you or after you have installed the necessary software. If no software accompanied your webcam, connect the webcam to the computer or mobile device.
3. When the computer or mobile device acknowledges that a webcam has been connected, you are ready to begin using it.



Using a Webcam or Integrated DV Camera

1. Run the app that will use the webcam or integrated DV camera.
2. Display the app's settings and make sure the app recognizes the webcam or integrated DV camera.
3. If you are using the camera to record a video, record a short clip and then replay it to make sure the camera properly captured audio and video. If you are using the camera for a videoconference, place a call to somebody using the videoconferencing app and make sure he or she is able to see and hear you.

4. If you experience problems with the camera capturing audio or video, try the following:
 - a. Run the program that came with the camera and see if a troubleshooter can identify and correct the problem you are experiencing.
 - b. If you are using a webcam, disconnect the webcam from the computer, restart the computer or mobile device, and then reconnect the webcam.
 - c. If you are using a webcam, disconnect the webcam, uninstall the program(s) included with the webcam, restart the computer or mobile device, and then follow the previous steps to set up and use the webcam.
 - d. If you continue experiencing problems after attempting these steps, contact the technical support team for the camera's manufacturer.

Consider This: What are some reasons why you might use a webcam or integrated DV camera on your computer or mobile device?

CONSIDER THIS

What is the purpose of a videoconference versus a video call?

Where video calls usually are for personal use, videoconferences typically are for business use. A **videoconference** is a meeting between two or more geographically separated people who use a network or the Internet to transmit audio and video data (Figure 7-15). To participate in a videoconference using a computer, you need videoconferencing software or access to a videoconferencing web app, along with a microphone, speakers, and a video camera attached to or built into a computer. As you speak, members of the meeting hear your voice on their speakers. Any image in front of the video camera, such as a person's face, appears in a window on each participant's screen.



Figure 7-15 To save on travel expenses, many large businesses use videoconferencing.

Idprod / Fotolia

Discover More: Visit this chapter's free resources to learn more about videoconference software.

You can configure some webcams to display the images they capture remotely on a webpage, or via an app on a mobile device. This use of a webcam attracts website visitors by showing images that change regularly. Home or small business users might use webcams to show a work in progress, weather and traffic information, or employees at work; they also might use it as a security system. Some websites have live webcams that display still pictures and update the displayed image at a specified time or time intervals, such as every 15 seconds. A *streaming cam* has the illusion of moving images because it sends a continual stream of still images. Read Secure IT 7-2 to learn about security issues related to using webcams.

SECURE IT 7-2

Digital Video Security

Sales of home security systems are on the rise due to their low costs and easy setup. These systems use cameras and sensors to monitor activity, and most send a message via mobile phone to alert a user of movement and entrance or exit into the dwelling and send the webcam's live feed of the scene.

This use of webcams serves a practical use in a private setting. Similarly, webcams in public areas, such as shopping malls, parking lots, and school cafeterias, help with surveillance measures and record everyday activity.

Webcam use, however, is criticized when the live feeds are used in a manner without the recorded parties' consent. Ethics and Issues 3-1 in Chapter 3 discusses the appropriate punishment for webcam spying, citing examples of criminals who hacked into home computers and streamed live video feeds, school administrators who took 66,000

pictures and screen captures of students using school-distributed laptops at home, and rent-to-own stores that rented laptops with spyware that captured photos of customers in their homes. Digital video recorders also are hidden in products resembling remote car keys, wall and desk clocks, sunglasses, smoke detectors, and electrical boxes.

If you have a webcam, follow these measures to prevent its unauthorized use:

- **Unplug the webcam.** This obvious suggestion offers the most secure solution. If the webcam is not connected to the computer, it cannot reveal what is occurring in front of the lens.
- **Cover the lens and plug the microphone.** Place a piece of black electrical tape over the lens, and insert a dummy plug in the microphone port. This solution is ideal for tablets and laptops equipped with cameras.

- **Register the hardware.** Hardware manufacturers continually update their firmware to fix issues. If you register your product, the companies can notify you of known security holes and offer updates to download.
- **Use a strong password.** When connecting a webcam to a network, you may need to configure the device for features such as sending an email or text message when motion is detected. If you are prompted to create a password, be certain it can resist hackers and malicious software. Read Secure IT 1-3 in Chapter 1 for tips about creating strong passwords.

Consider This: If you have a webcam, what actions will you take to protect your privacy? Should you be warned of webcam use when you are in a public area? If so, how can these warnings be given? Would you consider buying a digital video recorder for surveillance purposes?

Scanners and Reading Devices

Some input devices save users time by capturing data directly from a *source document*, which is the original form of the data. Examples of source documents include time cards, order forms, invoices, paychecks, advertisements, brochures, photos, inventory tags, or any other document that contains data to be processed.

Devices that can capture data directly from a source document include optical scanners, optical readers, bar code readers, RFID (radio frequency identification) readers, magnetic stripe card readers, and MICR (magnetic-ink character recognition) readers.

Optical Scanners

An optical scanner, usually called a **scanner**, is a light-sensing input device that reads printed text and graphics and then translates the results into a form the computer can process. A flatbed scanner works in a manner similar to a copy machine except it creates a file of the document in memory instead of a paper copy (Figure 7-16). Once you scan a picture or document, you can display the scanned object on the screen, modify its appearance, store it on a storage medium, print it, attach it to an email message, include it in another document, or post it on a website or photo community for everyone to see.

The quality of a scanner is measured by its resolution, that is, the number of bits it stores in a pixel and the number of pixels per inch. The higher each number, the better the quality, but the more expensive the scanner.

Many scanners include *OCR* (optical character recognition) *software*, which can read and convert text documents into electronic files. OCR software converts a scanned image into a text file that can be edited, for example, with a word processing application.



CONSIDER THIS

How can you improve the quality of scanned documents?

Place a blank sheet of paper behind translucent papers, newspapers, and other transparent types of paper. If the original is crooked, draw a line on the back at the bottom of the image. Use that mark to align the original on the scanner. Use photo editing software to fix imperfections in images.

How a Flatbed Scanner Works

Step 1

Place the document to be scanned face down on the glass window. Using buttons on the scanner or the scanner program, start the scanning process.



Step 2

The scanner converts the document content to digital information, which is transmitted through the cable to the computer's memory and saved on the computer's hard drive.



Step 3

Once in the computer, users can display the image, print it, send it in an email message, include it in a document, or place it on a webpage.



Figure 7-16 This figure shows how a flatbed scanner works.

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Optical Readers

An optical reader is a device that uses a light source to read characters, marks, and codes and then converts them into digital data that a computer can process. Two technologies used by optical readers are optical character recognition (OCR) and optical mark recognition (OMR).

- Most **OCR devices** include a small optical scanner for reading characters and sophisticated software to analyze what is read. OCR devices range from large machines that can read thousands of documents per minute to handheld wands that read one document at a time. OCR devices read printed characters in a special font.
- **OMR devices** read hand-drawn marks, such as small circles or rectangles. A person places these marks on a form, such as a test, survey, or questionnaire answer sheet (shown in Figure 7-1 at the beginning of this chapter).

Bar Code Readers

A **bar code reader**, also called a *bar code scanner*, is an optical reader that uses laser beams to read bar codes (Figure 7-17). A **bar code** is an identification code that consists of either a set of vertical lines and spaces of different widths or a two-dimensional pattern of dots, squares, and other images. The bar code represents data that identifies the manufacturer and the item.

Manufacturers print a bar code either on a product's package or on a label that is affixed to a product, such as groceries, books, clothing, vehicles, mail, and packages. Each industry uses its own type of bar code. The United States Postal Service (USPS) uses a POSTNET bar code. Retail and grocery stores use the *UPC (Universal Product Code)* bar code.

A **QR code** (quick response code) is known as a 2-D bar code because it stores information in both a vertical and horizontal direction (Figure 7-18). The information it stores can correspond to a web address or other content, such as contacts or phone numbers. QR codes can be read with a QR bar code reader or a QR code reader app on a smartphone or other mobile device. All types of material, from posters to textbooks to merchandise, include QR codes that consumers scan to obtain additional information, which may be in the form of a website or may display text for the user to read. For information about safely scanning QR codes, read Secure IT 7-3.

Discover More: Visit this chapter's free resources to learn more about QR code reader apps.



Figure 7-17 A bar code reader uses laser beams to read bar codes on products such as clothing, shown here.

© iStockPhoto / klaptoman



Figure 7-18 This customer pays her bills by scanning an on-screen QR code.

© iStockPhoto / gpointstudio



Technology Innovators

Discover More: Visit this chapter's free resources to learn about Masahiro Hara and Denso Wave, QR code inventors.



What are current uses of QR codes?

Search for: qr code uses

SECURE IT 7-3

Safely Scanning QR Codes

QR codes have come a long way since their first use, which was in tracking parts used to manufacture Japanese cars. Now they are used to market, educate, and entertain. Every industry has found some benefit of using innovative and creative QR technology to benefit workers and the public. They have become a necessary method of providing additional information about exhibits, downloading apps, displaying videos, advertising items, and performing thousands of other functions.

As with most computer applications, however, users must be cautious by scrutinizing the QR codes they see, in an attempt to thwart malicious attacks. Follow these guidelines to use QR codes safely:

- **Scan trustworthy sources.** In general, QR codes in books, magazines, and newspapers are safe. Posters on the street or on leaflets handed out on street corners, however, may not be as secure. Verify the source of the codes before scanning them.
- **Verify the web address.** Most QR code reader apps show the address of the website that will be displayed. If you do not recognize the domain name or the web address looks suspicious, do not grant permission.
- **Choose a reputable QR scanner.** Visit trustworthy Android marketplaces and the iTunes Store for safe QR apps. Look for safety features that will check the authenticity of destination websites, issue warnings for malicious QR codes, display a preview of each code, and block unsafe websites.
- **Do not supply personal information.** If the QR code directs you to a website displaying a form, do not enter personal or financial data unless you are certain that the website is safe, secure, and authentic.
- **Check for tampering.** Verify the QR code is original. Unscrupulous people may place a fraudulent sticker over the printed code.

Consider This: Where have you seen QR codes? Have you scanned any? If so, what information have you obtained? Have you followed any of the security precautions listed above? If not, which will you now follow?

RFID Readers

RFID (radio frequency identification) is a technology that uses radio signals to communicate with a tag placed in or attached to an object, an animal, or a person. RFID tags, which contain a memory chip and an antenna, are available in many shapes and sizes. An **RFID reader** reads information on the tag via radio waves. RFID readers can be handheld devices or mounted in a stationary object, such as a doorway.



Figure 7-19 This electronic key system locks and unlocks doors using RFID technology.

© iStockPhoto / iggy1965

Many retailers see RFID as an alternative to bar code identification because it does not require direct contact or line-of-site transmission. Each product in a store would contain a tag that identifies the product. As consumers remove products from the store shelves and walk through a checkout area, an RFID reader reads the tag(s) and communicates with a computer that calculates the amount due and updates inventory.

Other uses of RFID include tracking times of runners in a marathon; tracking location of people, airline baggage, and misplaced or stolen goods; checking lift tickets of skiers; managing inventory; gauging temperature and pressure of tires on a vehicle; checking out library books; providing access to rooms or buildings (Figure 7-19); managing purchases; and tracking payment as vehicles pass through booths on tollway systems.

Magstripe Readers

A **magstripe reader**, short for *magnetic stripe card reader*, reads the magnetic stripe on the back of credit cards, entertainment cards, bank cards, identification cards, and other similar cards (Figure 7-20). The stripe contains information identifying you and the card issuer. Some information stored in the stripe may include your name, account number, the card's expiration date, and a country code.

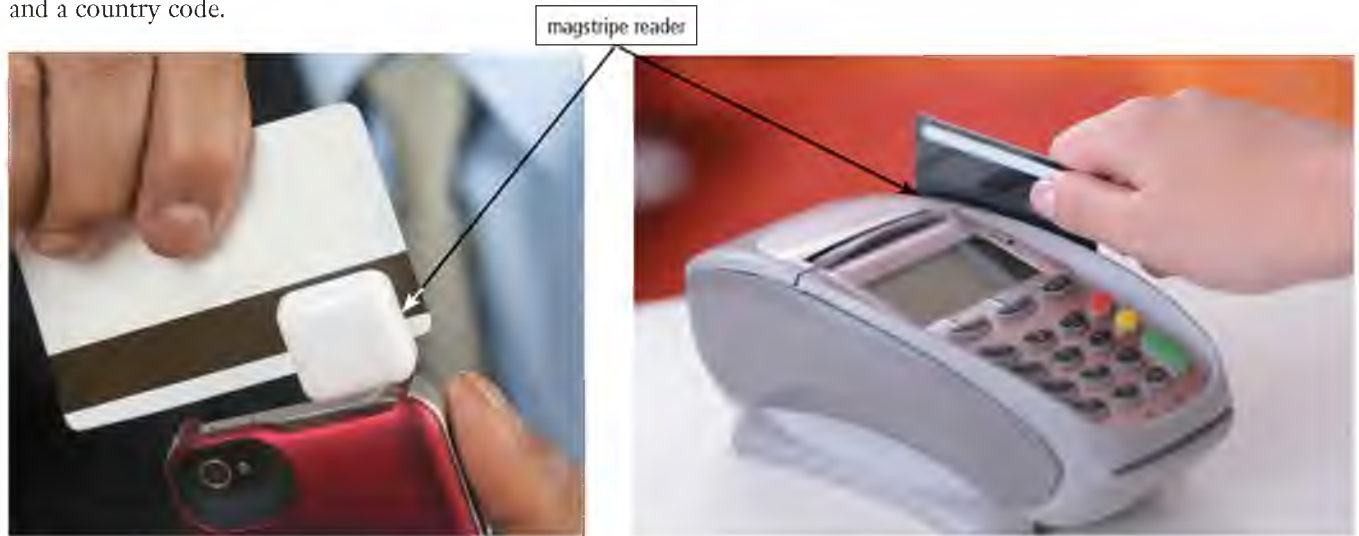


Figure 7-20 A magstripe reader reads information encoded on the stripe on the back of a credit card.

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Most magstripe readers are separate devices that communicate with a POS (point-of-sale) terminal, such as those in retail stores. Home or small business users, however, may attach a small plastic magstripe reader to a smartphone or tablet so that they can accept payments using a mobile app. When a credit card is swiped through a magstripe reader, it reads the information stored on the magnetic stripe on the card. Read *Secure IT 7-4* for tips about how to protect credit cards from scanning devices.

Internet Research

What types of mobile magstripe readers are available?

Search for: mobile magstripe readers

SECURE IT 7-4

Protecting Credit Cards from Scanning Devices

One-third of the 775 million credit and debit cards issued in the United States are likely targets for high-tech thieves who can steal the account information quickly and silently. RFID technology embedded in these cards transmits signals with the coded account information to scanners, which thieves place in their coat pockets, purses, and other nonmetallic containers. Some signals have a range as far as 30 feet, so that the electronic pickpockets simply walk among crowds in search of obtaining these radio waves.

The RFID technology embedded in the credit cards is approximately the size of a postage stamp. It consists of a coil of wire connected to an electronic circuit that generates a pattern of electrical pulses with coded account information

unique to a specific card. An antenna transmits these radio waves to a scanner.

The radio waves do not penetrate metal or water easily. You, consequently, can protect these cards and documents by wrapping them in aluminum foil or placing them near water bottles. Security experts also recommend stacking several credit cards in an attempt to scramble the signals. Place the cards in your wallet with the magnetic strip facing inside. RFID-blocking wallets also are manufactured to prevent scanners from obtaining the emitted signals.

To determine if your credit or debit card has this RFID technology, look for the words, PayPass, PayWave, Blink, or a radio wave symbol, as shown in the figure. If you do not see this information, call customer service or search the company's website. This technology

also is found in passports, driver's licenses, hotel room keys, and university and employee identification cards, so you may need to protect these documents and cards from electronic pickpockets, too.



Consider This: Are any of your credit or debit cards or personal documents embedded with RFID technology? If so, what precautions will you take to block the signals from scanners?

CONSIDER THIS

Why are some magnetic stripes not readable by a magstripe reader?

If the magstripe reader rejects the card, it is possible that the magnetic stripe is scratched, dirty, or erased. Exposure to a magnet or magnetic field can erase the contents of a card's magnetic stripe.

CONSIDER THIS

What is a smart card?

A smart card stores data on an integrated circuit embedded in a card, such as a credit card. Chapter 8 discusses smart cards in more depth.

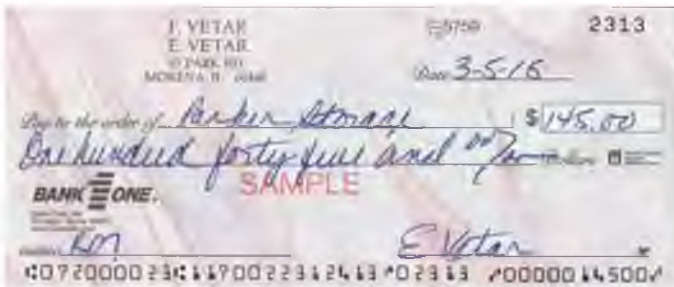


Figure 7-21 The MICR characters preprinted on the check represent the bank routing number, customer account number, and check number. The amount of the check in the lower-right corner is added after the check is cashed.

© Cengage Learning



Figure 7-22 An employee in a warehouse uses this data collection device to scan items, which wirelessly transmits information about the scanned item to the store's inventory system.

© endostock / Fotolia

MICR Readers

MICR (magnetic-ink character recognition) *devices* read text printed with magnetized ink. An MICR reader converts MICR characters into a form the computer can process. The banking industry almost exclusively uses MICR for check processing. Each check in your checkbook has precoded MICR characters beginning at the lower-left edge (Figure 7-21).

When a bank receives a check for payment, it uses an MICR inscriber to print the amount of the check in MICR characters in the lower-right corner. Each check is inserted in an MICR reader, which sends the check information — including the amount of the check — to a computer for processing.

Data Collection Devices

Instead of reading or scanning data from a source document, a *data collection device* obtains data directly at the location where the transaction or event takes place. For example, employees use bar code readers, handheld computers, or other mobile devices to collect data wirelessly (Figure 7-22). These types of data collection devices are used in restaurants, grocery stores, factories, warehouses, the outdoors, or other locations where heat, humidity, and cleanliness are not easy to control. For example, factories and retail stores use data collection devices to take inventory and order products.

Data collection devices and many mobile computers and devices have the capability of wirelessly transmitting data over a network or the Internet. Increasingly more users today send data wirelessly to central office computers using these devices.

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Motion, Voice, and Video Input, and Scanners and Reading Devices, as it relates to the chapter objectives.

Now you should know...

- Which type of motion, voice, and video input are best suited to your needs (Objective 5)
- Why you would use optical scanners and readers, bar code readers, RFID readers, magstripe readers, MICR readers, and data collection devices (Objective 6)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

What Is Output?

Output is data that has been processed into a useful form. Recall that computers process data (input) into information (output). The form of output varies, depending on the hardware and software being used and the requirements of the user. Users view or watch output on a screen, print it, or hear it through speakers, headphones, or earbuds. While working with a computer or mobile device, a user encounters four basic types of output: text, graphics, audio, and video (Figure 7-23). Very often, a single form of output, such as a webpage, includes more than one of these types of output.



Figure 7-23 Four types of output are text, graphics, audio, and video.

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- **Text:** Examples of output that primarily contain text are text messages, Internet messages, memos, letters, press releases, reports, classified advertisements, envelopes, and mailing labels. On the web, users read blogs, news and magazine articles, books, television show transcripts, stock quotes, speeches, and lectures.
- **Graphics:** Many forms of output include graphics to enhance visual appeal and convey information. Business letters have logos. Reports include charts. Newsletters use drawings, clip art, and photos. Users print high-quality photos taken with a digital camera. Many websites use animation.
- **Audio:** Users download their favorite songs and listen to the music. Software, such as games, encyclopedias, and simulations, often include musical accompaniments and audio clips, such as narrations and speeches. On the web, users listen to radio broadcasts, audio clips, podcasts, sporting events, news, music, and concerts. They also use VoIP.
- **Video:** As with audio, software and websites often include video clips and video blogs. Users watch news reports, movies, sporting events, weather conditions, and live performances on a computer or mobile device. They attach a video camera to a computer or mobile device to watch video or programs.



Technology Innovator
Discover More: Visit this chapter's free resources to learn about Ursula Burns, who has served as chair and CEO of Xerox.

CONSIDER THIS

Are storage devices categorized as input or output devices?

When storage devices write on storage media, they are creating output. Similarly, when storage devices read from storage media, they function as a source of input. Nevertheless, they are categorized as storage devices, not as input or output devices.

Common methods of output include displays, printers, speakers, headphones and earbuds, data projectors, interactive whiteboards, and force-feedback game controllers and tactile output. The following sections discuss each of these output devices.

Displays

A *display device*, or simply **display**, is an output device that visually conveys text, graphics, and video information. Sometimes called *soft copy*, information on a display exists electronically and appears

for a temporary period. Displays consist of a screen and the components that produce the information on the screen. Most current displays are a type of *flat-panel display*, which means they have a shallow depth and a flat screen. Figure 7-24 shows displays for a variety of computers and mobile devices.

Desktops often use a monitor as their display. A **monitor** is a display that is packaged as a separate peripheral device. Some monitors have a tilt-and-swivel base, which allows you to adjust the angle of the screen to minimize neck strain and reduce glare from overhead lighting. With some, you also can rotate the screen. Adjustable monitor stands allow you to



Figure 7-24 A variety of displays.

© cobalt88 / Shutterstock.com; © Pawel Gaul / Photos.com; © Maxx-Studio / Shutterstock.com; © iStockphoto / BarisSimsek; © bloomua / Fotolia

adjust the height of the monitor. Monitor controls enable you to adjust the brightness, contrast, positioning, height, and width of images. Some have touch screens, integrated speakers, and/or a built-in webcam. Today's monitors have a small footprint; that is, they do not take up much desk space. For additional space savings, some monitors are wall mountable.

Most mobile computers and devices integrate the display and other components into the case. Size of these displays varies depending on the mobile computer or device. Some mobile computers and many mobile devices have touch screens. Traditional laptops have a display that attaches with a hinge to the case. (Read How To 7-2 to learn how to connect a laptop to an external display.) Tablets are available with two types of displays: one that attaches with a hinge and one built into the top of the case. Some smartphone and digital camera displays also attach with a hinge to the device. On other smartphones and most portable media players, digital cameras, and handheld game consoles, the display is built into the case. Newer vehicles integrate a display in the dashboard, enabling drivers to control audio, video, navigation, temperature, and other settings.

Discover More: Visit this chapter's free resources to learn more about monitor and display sizes and manufacturers.



Measuring Displays

You measure the screen on a monitor, laptop, tablet, smartphone, or other mobile device the same way you measure a television; that is, you measure diagonally from one corner to the other.

HOW TO 7-2

Connect a Laptop to an External Display

When you are using a laptop, you may need to connect it to an external display for a variety of reasons. If you are giving a presentation, connecting a laptop to a projector or television will allow attendees to view presentation slides or other media content. If you use your laptop at a desk, you might want to connect it to a larger display so that you can more easily see the content without straining your eyes, or you may want to work with two open programs simultaneously with one displaying on the laptop screen and the other on the external display. The following steps describe how to connect a laptop to an external display.

1. Verify that your laptop is compatible with the external display.
2. Make sure that you have a cable that can connect from a port on your laptop to a port or cable connected to the external display. If not, you may need to purchase an adapter.
3. Verify that your laptop supports a screen resolution that the external display also supports.

4. Use the cable to connect your laptop's video port to the video input port for the external display.
5. External displays often have multiple video input ports; make sure the external display is configured to display the content from the port to which your laptop is connected.
6. If necessary, configure the laptop to display content on the external display. This often can be done by pressing a

key on the keyboard or accessing the operating system's display settings.

7. If necessary, change the screen resolution on the laptop so that the contents display properly on the external display.

Consider This: What are some other reasons why you might want to connect your laptop to an external display?



Display Technologies

Many desktop monitors, along with the screens on mobile computers and devices, use some type of LCD technology. A *liquid crystal display (LCD)* sandwiches a liquid compound between two sheets of material that presents sharp, flicker-free images on a screen when illuminated. The light source, called the *backlight*, often uses either CCFL (cold cathode fluorescent lamp) or LED (light-emitting diode) technology.



Internet Research

What is in-plane switching (IPS)?

Search for: ips display

A display that uses LED for the backlight often is called an *LED display* or an LED LCD display. LED displays consume less power, last longer, and are thinner, lighter, and brighter than a display that uses CCFL technology, but they also may be more expensive. Screens in laptops and mobile devices often use LED backlight technology.

LCD displays typically produce color using *active-matrix*, or *TFT* (thin-film transistor), technology, which uses a separate transistor to apply charges to each liquid crystal cell and, thus, displays high-quality color that is viewable from all angles. Several types of active matrix displays, or panels, are available, with some providing higher quality than others.

Instead of LCD or traditional LED, some displays use OLED technology. *OLED* (organic LED) uses organic molecules that are self-illuminating and, thus, do not require a backlight. OLED displays consume less power and produce an even brighter, easier-to-read display than LCD or LED displays, but they can have a shorter life span. OLEDs also can be fabricated on thin, flexible surfaces.

Many mobile computers and devices use either AMOLED or Retina Display technology. An *AMOLED* (active-matrix OLED) screen uses both active-matrix and OLED technologies, combining the benefits of high-quality viewing from all angles with lower power consumption. Variations of AMOLED provide different levels of viewing quality. *Retina Display*, developed by Apple, produces vibrant colors and supports viewing from all angles because the LCD technology is built into the screen instead of behind it and contains more pixels per inch of display. Recall that a *pixel* (short for picture element) is a single point in an electronic image.

Discover More: Visit this chapter's free resources to learn more about active-matrix displays.

Display Quality

The quality of a display depends primarily on its resolution, response time, brightness, dot pitch, and contrast ratio.

- **Resolution** is the number of horizontal and vertical pixels in a display. For example, a monitor or screen that has a 1600×900 resolution displays up to 1600 pixels per horizontal row and 900 pixels per vertical row, for a total of 1,440,000 pixels to create a screen image. A higher resolution uses a greater number of pixels and, thus, provides a smoother, sharper, and clearer image. As the resolution increases, however, some items on the screen appear smaller.

Displays are optimized for a specific resolution, called the *native resolution*. Although you can change the resolution to any setting, for best results, use the monitor or screen's native resolution setting.

- *Response time* of a display refers to the time in milliseconds (ms) that it takes to turn a pixel on or off. Response times of displays range from 2 to 16 ms. The lower the number, the faster the response time.
- Brightness of a display is measured in nits. A *nit* is a unit of visible light intensity equal to one candela (formerly called candlepower) per square meter. The *candela* is the standard unit of luminous intensity. Displays today range from 250 to 550 nits. The higher the nits, the brighter the images.
- *Dot pitch*, sometimes called *pixel pitch*, is the distance in millimeters between pixels on a display. Text created with a smaller dot pitch is easier to read. Advertisements normally specify a display's dot pitch or pixel pitch. Average dot pitch on a display should be .30 mm or lower. The lower the number, the sharper the image.
- *Contrast ratio* describes the difference in light intensity between the brightest white and darkest black that can be produced on a display. Contrast ratios today range from 500:1 to 2000:1. Higher contrast ratios represent colors better.

Graphics Chips, Ports, and Flat-Panel Monitors A cable on a monitor plugs in a port on the computer, which enables communications from a graphics chip. This chip, called the *graphics processing unit* (GPU), controls the manipulation and display of graphics on a display device. The GPU either is integrated on the motherboard or resides on a video card in a slot on the motherboard.

Today's monitors use a digital signal to produce a picture. To display the highest quality images, the monitor should plug in a DVI port, an HDMI port, or a DisplayPort.

- A *DVI (Digital Video Interface) port* enables digital signals to transmit directly to a monitor.
- An *HDMI (High-Definition Media Interface) port* combines DVI with high-definition (HD) television, audio, and video. Some ultrathin laptops have mini-HDMI ports that require the use of an adapter (or dongle) when connecting to a standard-size HDMI display.
- A *DisplayPort* is an alternative to DVI that also supports high-definition audio and video.

Over the years, several video standards have been developed to define the resolution, aspect ratio, number of colors, and other display properties. The *aspect ratio* defines a display's width relative to its height. A 2:1 aspect ratio, for example, means the display is twice as wide as it is tall. The aspect ratio for a *widescreen monitor* is 16:9 or 16:10. Some displays support multiple video standards. For a display to show images as defined by a video standard, both the display and GPU must support the same video standard.

Discover More: Visit this chapter's free resources to learn more about video standards.

DTVs and Smart TVs

Home users sometimes use a digital television (DTV) as a display. Gamers also use a television as their output device. They plug one end of a cable in the game console and the other end in the video port on the television.

HDTV (high-definition television) is the most advanced form of digital television, working with digital broadcast signals, transmitting digital sound, supporting wide screens, and providing high resolutions. A *Smart TV* is an Internet-enabled HDTV from which you can browse the web, stream video from online media services, listen to Internet radio, communicate with others on online social media, play online games, and more — all while watching a television show (Figure 7-25). Using a Smart TV, you can stream content from the TV to other Internet-enabled devices, such as a tablet or smartphone, and use cloud storage services to share content. Read How To 7-3 to learn how to show media on a Smart TV from your computer or device.



Figure 7-25 Smart TVs enable you to connect to the Internet and/or watch television shows.

Courtesy of LG Electronics USA Inc.

HOW TO 7-3

Show Media on a Smart TV from Your Computer or Device

Smart TVs can connect to the network in your home using a wired or wireless connection. Compatible computers and devices connected to the same network can display content on the Smart TV. For example if you connect your smartphone to the same network as the Smart TV, you can display pictures from the phone on the Smart TV. The following steps describe how to show media on a Smart TV from a computer or device.

1. Verify that your computer or device is capable of displaying content on the Smart TV.
2. Make sure that the computer or device is connected to the same network as the Smart TV.
3. Navigate to the settings on the computer or device and specify that you want to mirror the display on the Smart TV.
4. Navigate to the settings on the Smart TV, if necessary, and enable the setting that allows content from computers and devices to be displayed.
5. Continue to use the computer or device when the video from your computer or device is displayed on the Smart TV.
6. When you no longer wish to display the content from your computer or device on

the Smart TV, change the setting on your computer or mobile device to disable this feature.

Consider This: What type of media might you display on your Smart TV? Why?



© iStockPhoto / chargin8

DTVs often use LCD, LED, or plasma technology. A *plasma display* uses gas plasma technology, which sandwiches a layer of gas between two glass plates. When voltage is applied, the gas releases ultraviolet (UV) light. This UV light causes the pixels on the screen to glow and form an image. Read Ethics & Issues 7-3 to consider the effects of radiation from monitors and other devices.

ETHICS & ISSUES 7-3



Should We Be Concerned with Hardware Radiation?

When you work on a computer or talk on a mobile phone, could you be at risk from harmful radiation? Every electronic device emits some level of radiation. While the amounts for computers and mobile devices may not be harmful in low doses, some critics argue that constant exposure, such as sitting in an office all day or wearing a Bluetooth headset for several hours at a time, can cause levels of radiation that, over time, may cause cancer or other health concerns. In addition to the computer itself, peripheral devices, such as printers, along with the wireless or cordless methods to connect the devices, emit radiation.

Research is inconclusive about safe levels and long-term risks. Most agree that it is not the level from any one device, but rather the cumulative effect from long-term exposure (several hours a day over many years) to multiple devices simultaneously that causes harm.

You can protect yourself and minimize your risks. Replace older equipment, such as CRT (cathode-ray tube) monitors, with devices such as LCD monitors, which meet current emission standards. Sit back from your monitor as far as possible, and place a barrier between your computer and your lap. Move other electronic sources, such as hard drives and printers, as far away as possible. Minimize your wireless connections, such

as a wireless keyboard or a wireless mouse. Remove your Bluetooth headset when not in use, and frequently switch the headset from one ear to the other. Turn off devices when not in use. Recycle or donate older, unused devices to eliminate any radiation exposure from older devices, even when they are not in use.

Consider This: Do you consider computers and mobile devices to be harmful to your health? Why or why not? Would you change your electronic device usage, change your habits, or rearrange your computer work area to minimize your risk? Why or why not? What modifications can you make?

Internet Research

What are popular television streaming media services?

Search for: television streaming media



CONSIDER THIS

Can you view the output from your display remotely?

With a television streaming media device, you can view and control a home DVR or TV from a remote computer or mobile device.



NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled What is Output? and Displays, as it relates to the chapter objectives.

Now you should know...

- What types of output you may encounter (Objective 7)
- What to consider when purchasing computers and devices with various displays (Objective 8)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Printers

A **printer** is an output device that produces text and graphics on a physical medium, such as paper. Printed information (hard copy) exists physically and is a more permanent form of output than that presented on a display (soft copy).

A hard copy, also called a *printout*, is either in portrait or landscape orientation. A printout in *portrait orientation* is taller than it is wide, with information printed across the shorter width of the paper. A printout in *landscape orientation* is wider than it is tall, with information printed across the widest part of the paper. Letters, reports, and books typically use portrait orientation. Spreadsheets, slide shows, and graphics often use landscape orientation.

CONSIDER THIS

Can you print documents and photos from a mobile computer and device without physically connecting to the printer with a cable?

Yes. Many printers contain memory card slots, so that you can remove the memory card from a camera, insert it in the printer, and print photos directly from the card. You also can connect a printer to a wireless network so that devices with a Wi-Fi connection can print wirelessly. With *Bluetooth printing*, a computer or other device transmits output to a printer via radio waves. The computer or other device and the printer do not have to be aligned with each other; rather, they need to be within an approximate 30-foot range.



Technology Innovator
Discover More: Visit this chapter's free resources to learn about HP, a multinational technology company.

To meet the range of printing needs from home users to enterprise users, many different types and styles of printers exist with varying speeds, capabilities, and printing methods. Figure 7-26 presents a list of questions to help you determine the printer best suited to your needs.

Nonimpact Printers

A **nonimpact printer** forms characters and graphics on a piece of paper without actually contacting the paper. Some spray ink, while others use heat or pressure to create images.

Commonly used nonimpact printers are ink-jet printers, photo printers, laser printers, all-in-one printers, thermal printers, mobile printers, label printers, plotters, and large-format printers.

Ink-Jet Printers

An **ink-jet printer** is a type of nonimpact printer that forms characters and graphics by spraying tiny drops of liquid ink onto a piece of paper. Ink-jet printers have become a popular type of color printer for use in the home.

Ink-jet printers produce text and graphics in both black-and-white and color on a variety of paper types and sizes (Figure 7-27). These printers normally use individual sheets of paper stored in one or two removable or stationary trays. Most ink-jet printers can print lab-quality photos. Ink-jet printers also print on other materials, such as envelopes, labels, index cards, greeting card paper (card stock), transparencies, and iron-on T-shirt transfers. Many ink-jet printers include software for creating greeting cards, banners, business cards, and letterhead.

The speed of an ink-jet printer is measured by the number of pages per minute (ppm) it can print. Graphics and colors print at a slower rate than text.

Discover More: Visit this chapter's free resources to learn more about ink-jet printers.

1. What is my budget?
2. How fast must my printer print?
3. Do I need a color printer?
4. What is the cost per page for printing?
5. Do I need multiple copies of documents?
6. Will I print graphics?
7. Do I want to print photos?
8. Do I want to print directly from a memory card?
9. What types of paper does the printer use?
10. What sizes of paper does the printer accept?
11. Do I want to print on both sides of the paper?
12. How much paper can the printer tray hold?
13. Will the printer work with my computer and software?
14. How much do supplies such as ink, toner, and paper cost?
15. Can the printer print on envelopes?
16. How many envelopes can the printer print at a time?
17. How much do I print now, and how much will I be printing in a year or two?
18. Will the printer be connected to a network?
19. Do I want wireless printing capability?

Figure 7-26 Questions to consider before purchasing a printer.

© Cengage Learning



Figure 7-27 Ink-jet printers are a popular type of color printer used at home and in the office.

© iStockphoto / Greg Nicholas; JurgaR / iStockphoto; Courtesy of Xerox Corporation; JurgaR / iStockphoto; Courtesy of Xerox Corporation



CONSIDER THIS

How does resolution affect print quality?

As with many other input and output devices, one factor that determines the quality of an ink-jet printer is its resolution. Printer resolution is measured by the number of *dots per inch (dpi)* a printer can print. With an ink-jet printer, a dot is a drop of ink. A higher dpi means the print quality is higher because the drops of ink are smaller and more drops fit in an area.

The difference in quality becomes noticeable when the size of the printed image increases. That is, a wallet-sized image printed at 1200 dpi may look similar in quality to one printed at 2400 dpi. When you increase the size of the image, to 8 × 10 for example, the printout of the 1200 dpi resolution may look grainier than the one printed using a 2400 dpi resolution.

Internet Research

How much do ink cartridges cost?

Search for: ink cartridge cost comparison

Ink Cartridges The printhead mechanism in an ink-jet printer contains ink-filled cartridges. Each cartridge has fifty to several hundred small ink holes, or nozzles. The steps in Figure 7-28 illustrate how a drop of ink appears on a page. The ink propels through any combination of the nozzles to form a character or image on the paper.

When the cartridge runs out of ink, you simply replace the cartridge. Most ink-jet printers use two or more ink cartridges, one containing black ink and the other(s) containing colors. Some color cartridges contain a variety of ink colors; others contain only a single color. Consider the number of ink cartridges a printer requires, along with the cost of the cartridges, when purchasing a printer. To reduce the expense of purchasing cartridges, some users opt to purchase refilled cartridges or have empty cartridges refilled by a third-party vendor.

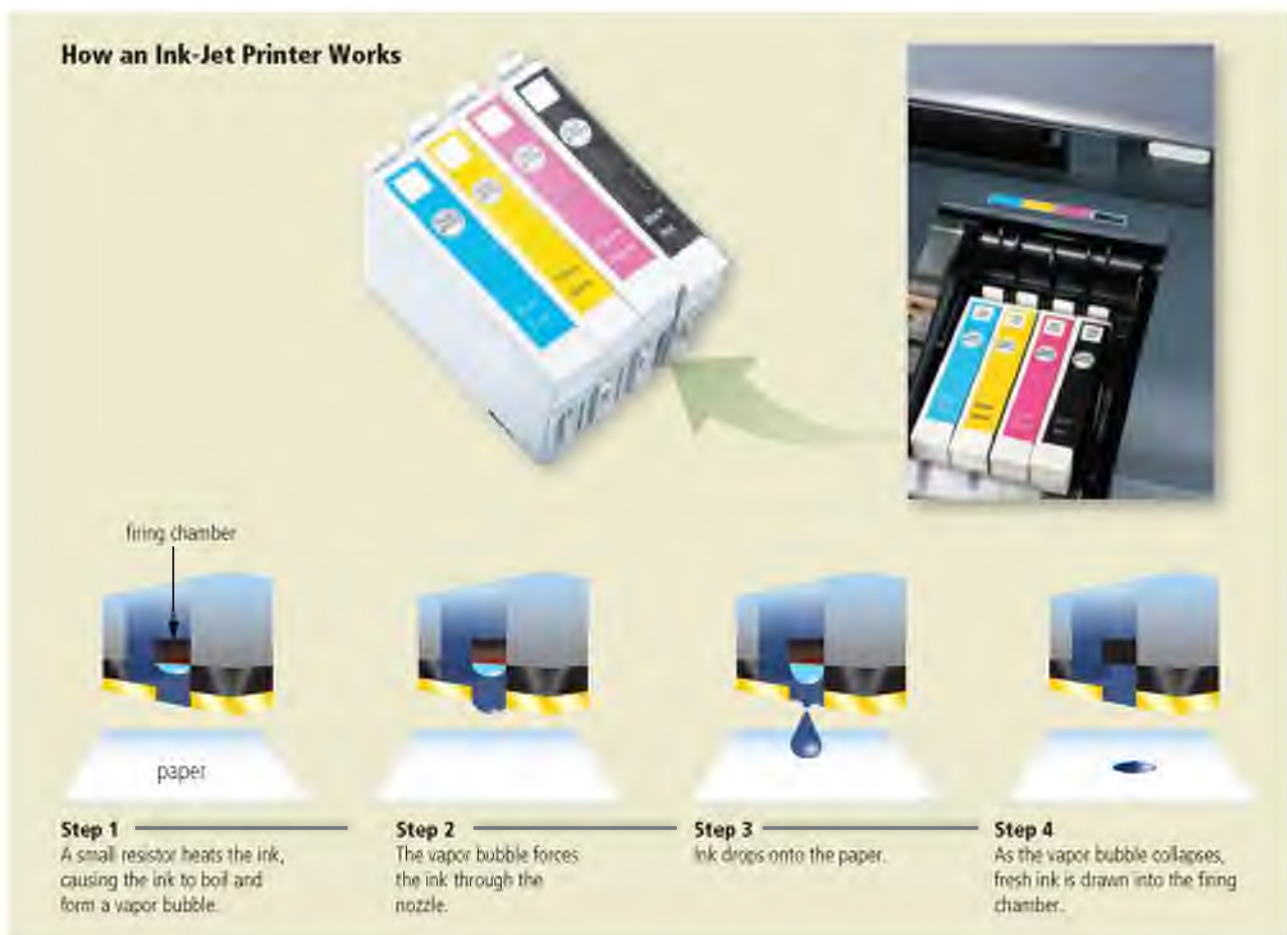


Figure 7-28 This figure shows how an ink-jet printer works

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Photo Printers

A **photo printer** is a color printer that produces lab-quality photos (Figure 7-29). Some photo printers print just one or two sizes of photos, for example, 3×5 inches and 4×6 inches. Others print up to 8×10 or even larger. Some even print panoramic photos. Generally, the more sizes the printer prints, the more expensive the printer.

Many photo printers use ink-jet technology. With models that can print letter-sized documents, users connect the photo printer to their computer and use it for all their printing needs. For a few hundred dollars, this type of photo printer is ideal for the home or small business user.

Most photo printers are PictBridge enabled, so that you can print photos without a computer. *PictBridge* is a standard technology that allows you to print photos directly from a digital camera by connecting a cable from the digital camera to a USB port on the printer. Photo printers also usually have a built-in card slot(s) so that the printer can print digital photos directly from a memory card. Read *How To 7-4* for instructions about printing from a smartphone or tablet.

Discover More: Visit this chapter's free resources to learn more about photo printers.



Figure 7-29 A photo printer.
© iStockphoto / Tamas Ambrits

HOW TO 7-4

Print from a Smartphone or Tablet

As smartphones and tablets become more widely used and packed with features, you may need to print items stored on these devices. For example, you may capture a great photo while spending time with your family and want to print the photo to place on your desk, or you may take notes on your tablet and want to print a hard copy. You have several options available to print from a smartphone or tablet. The method you use will depend primarily on the type of mobile device and printer you are using, and the printer must support printing from a mobile device. The following steps describe how to print from a smartphone or tablet:

1. Verify your mobile device or tablet is connected to the same network as the printer.
2. If necessary, download and install an app on your device or tablet to enable you to print. The printer's documentation will inform you if you need an app and, if so, where to obtain it.

3. When you are viewing the item that you want to print on your smartphone or tablet, select the option to print on your printer and then retrieve the printout.

In addition to using an app or built-in features on your mobile device or computer to print, you may be able to configure your printer so that you can attach files and send them to a specified email address. The following steps describe how to use this feature on supported printers:

1. Access your printer's settings and make sure the printer is connected to your network.
2. Configure the option to set up an email address for receiving print jobs and write down that email address.
3. On your computer or mobile device, send the file you want to print as an attachment to an email message addressed to the email address determined in Step 2.
4. When the printer receives the email message with the file attachment, it will print the file.

If your mobile device or printer does not support wireless printing, you also can print

by transferring the file from your smartphone or tablet to your laptop, desktop, or printer. The following steps describe how to print from a smartphone or tablet when wireless printing is not supported:

1. Remove the memory card from your smartphone or tablet and insert it into your laptop, desktop, or printer. *Note:* If your smartphone or tablet does not have a removable memory card, you can connect the smartphone or tablet to a desktop, laptop, or printer using the USB cable included with your device.
2. On the laptop, desktop, or printer, navigate to and select the file you want to print, and then select the option to print the file.
3. When the printer stops, safely remove the memory card from the laptop, desktop, or printer and insert it in your smartphone or tablet.

Consider This: What are some other reasons why you might want to print from a smartphone or tablet?



Figure 7-30 A laser printer.
Courtesy of Xerox Corporation

Laser Printers

A **laser printer** is a high-speed, high-quality nonimpact printer (Figure 7-30). Laser printers are available in both black-and-white and color models. A laser printer for personal computers ordinarily uses individual 8 1/2 × 11-inch sheets of paper stored in one or more removable trays that slide in the printer case.

Laser printers print text and graphics in high-quality resolutions. While laser printers usually cost more than ink-jet printers, many models are available at affordable prices for the home user. Laser printers usually print at faster speeds than ink-jet printers.

Depending on the quality, speed, and type of laser printer, the cost ranges from a few hundred to a few thousand dollars for the home and small office user, and several hundred thousand dollars for the enterprise user.

When printing a document, laser printers process and store the entire page before they actually print it. For this reason, laser printers sometimes are called page printers. Storing a page before printing requires that the laser printer has a certain amount of memory in the device. The more memory in the printer, the faster it usually can print.

Operating in a manner similar to a copy machine, a laser printer creates images using a laser beam and powdered ink, called *toner*. The laser beam produces an image on a drum inside the printer. The light of the laser alters the electrical charge on the drum wherever it hits. When this occurs, the toner sticks to the drum and then transfers to the paper through a combination of pressure and heat (Figure 7-31). When the toner runs out, you replace the toner cartridge.

Internet Research
How much does toner for a laser printer cost?
Search for: laser printer toner cost comparison

How a Black-and-White Laser Printer Works

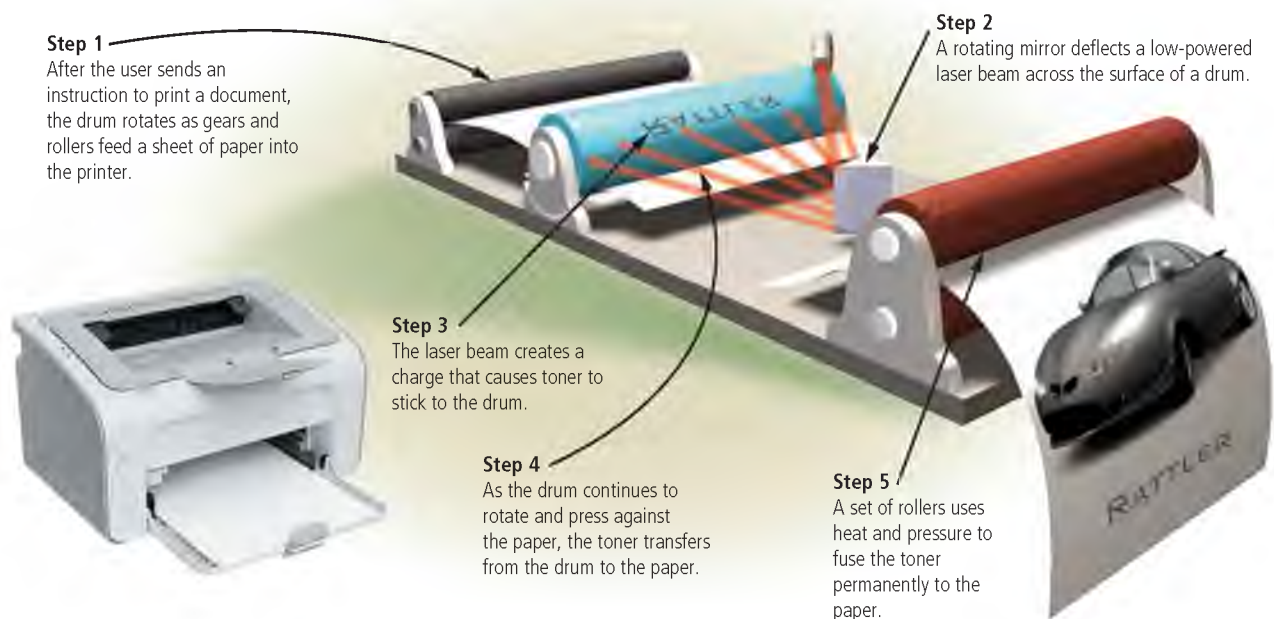


Figure 7-31 This figure shows how a black-and-white laser printer works.
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All-in-One Printers

An **all-in-one printer**, also called a *multifunction printer* (MFP), is a single device that looks like a printer or a copy machine but provides the functionality of a printer, scanner, copy machine, and perhaps a fax machine (Figure 7-32). Some use color ink-jet printer technology, while others use laser technology.



Figure 7-32 An all-in-one printer.
Courtesy of Epson America, Inc.



CONSIDER THIS

Who uses all-in-one printers?

Small/home office users have all-in-one printers because these devices require less space than having a separate printer, scanner, copy machine, and fax machine. Another advantage of these devices is they are significantly less expensive than if you purchase each device separately. If the device breaks down, however, you lose all four functions, which is the primary disadvantage.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn how 3-D printers work.

3-D Printers

A **3-D printer** uses a process called additive manufacturing to create an object by adding material to a three-dimensional object, one horizontal layer at a time. 3-D printers can print solid objects, such as clothing, prosthetics, eyewear, implants, toys, parts, prototypes, and more (Figure 7-33).

Using a digital model created with CAD (computer-aided design) software, 3-D printers begin creating an object at the bottom and add layers of material to the object until it is complete. Depending on the type of printer, the layers are built with liquid polymer, gel, or resin.

In the past, 3-D printers were quite expensive and used only by large corporations. Today, home and small business users work with more affordable desktop 3-D printers.



Figure 7-33 A 3-D printer.
© dreamnikon / Fotolia

Thermal Printers

A **thermal printer** generates images by pushing electrically heated pins against heat-sensitive paper. Basic thermal printers are inexpensive, but the print quality is low, the images tend to fade over time, and thermal paper can be expensive. Self-service gas pumps often print gas receipts using a built-in, lower-quality thermal printer. Many point-of-sale terminals in retail and grocery stores also print purchase receipts on thermal paper.

Some thermal printers have high print quality and can print at much faster rates than ink-jet and laser printers. A *dye-sublimation printer*, sometimes called a *digital photo printer*, uses heat to transfer colored dye to specially coated paper. Photography studios, medical labs, security identification systems, and other professional applications requiring high image quality use dye-sublimation printers that can cost thousands of dollars (Figure 7-34). Dye-sublimation printers for the home or small business user, by contrast, typically are much slower and less expensive than their professional counterparts. Some are small enough for the mobile user to carry in a briefcase.



Figure 7-34 A dye-sublimation printer.
Courtesy of Mitsubishi Electric Visual Solutions America, Inc.

Mobile Printers

A **mobile printer** is a small, lightweight, battery-powered printer that allows a mobile user to print from a laptop, smartphone, or other mobile device while traveling (Figure 7-35). Barely wider than the paper on which they print, mobile printers fit easily in a briefcase alongside a laptop.

Mobile printers mainly use ink-jet or thermal technology. Many connect to a USB port. Others have a built-in wireless port through which they communicate with the computer.



Figure 7-35 A mobile printer is small enough to fit in a backpack.

Courtesy of Brother International Corporation

Label Printers

A **label printer** is a small printer that prints on an adhesive-type material that can be placed on a variety of items, such as envelopes, packages, optical discs, photos, and file folders (Figure 7-36).

Most label printers also print bar codes. Label printers typically use thermal technology.



Figure 7-36 A label printer.

© iStockphoto.com/2ang14

Plotters and Large-Format Printers

Plotters are sophisticated printers used to produce high-quality drawings, such as blueprints, maps, and circuit diagrams. These printers are used in specialized fields such as engineering and drafting and usually are very costly. Current plotters use a row of charged wires (called styli) to draw an electrostatic pattern on specially coated paper and then fuse toner to the pattern. The printed image consists of a series of very small dots, which provides high-quality output.

Using ink-jet printer technology, but on a much larger scale, a **large-format printer** creates photo-realistic-quality color prints. Graphic artists use these high-cost, high-performance printers for signs, posters, and other professional quality displays (Figure 7-37).



Figure 7-37 Graphic artists use large-format printers to print signs, posters, and other professional quality displays.

Courtesy of Xerox Corporation

Impact Printers

An **impact printer** forms characters and graphics on a piece of paper by striking a mechanism against an inked ribbon that physically contacts the paper. Impact printers characteristically are noisy because of this striking activity (Figure 7-38). Impact printers are ideal for printing multipart forms because they print through many layers of paper easily. Factories, warehouses, and retail counters may use impact printers because these printers withstand dusty environments, vibrations, and extreme temperatures.

Discover More: Visit this chapter's free resources to learn more about impact printers.

Other Output Devices

In addition to displays and printers, other output devices are available for specific uses and applications. These include speakers, headphones and earbuds, data projectors, interactive whiteboards, and force-feedback game controllers and tactile output.

Speakers

Most personal computers and mobile devices have a small internal speaker that usually emits only low-quality sound. Thus, many users attach surround sound **speakers** or speaker systems to their computers, game consoles, and mobile devices to generate higher-quality sounds for playing games, interacting with multimedia presentations, listening to music, and viewing movies (Figure 7-39).

Most surround sound computer speaker systems include one or two center speakers and two or more *satellite speakers* that are positioned so that sound emits from all directions. Speakers typically have tone and volume controls, allowing users to adjust settings. To boost the low bass sounds, surround sound speaker systems also include a *subwoofer*.

In some configurations, a cable connects the speakers or the subwoofer to a port on the computer or device. With wireless speakers, however, a transmitter connects to a port on the computer, which wirelessly communicates with the speakers.

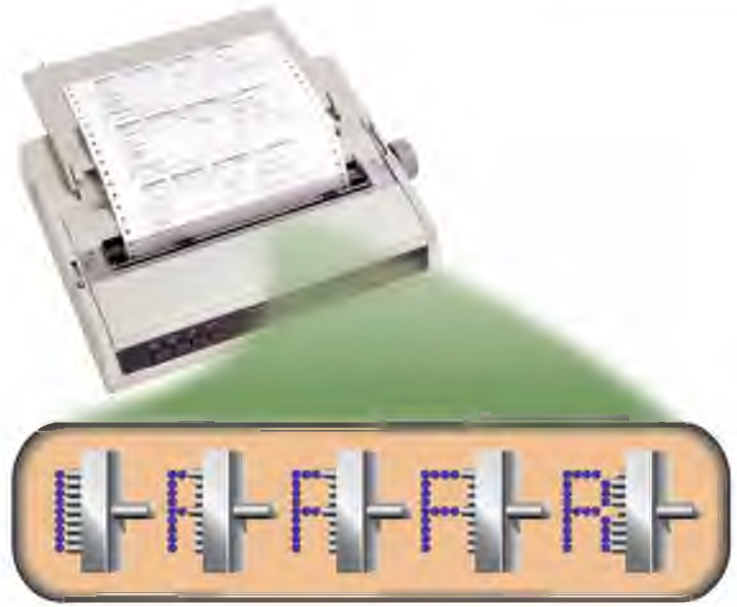


Figure 7-38 An impact printer produces printed images when tiny pins strike an inked ribbon.

Courtesy of Oki Data Americas, Inc.; © Cengage Learning



Figure 7-39 Users often attach high-quality surround sound speaker systems to their computers, game consoles, and mobile devices.

Courtesy of Logitech



CONSIDER THIS

What do the numbers mean in surround sound configurations?

The first number refers to the number of speakers, and the second number refers to the number of subwoofers. For example, a 2.1 speaker system contains two speakers and one subwoofer. A 5.1 speaker system has five speakers (i.e., four satellite speakers, one center speaker) and one subwoofer. A 7.2 speaker system has seven speakers (i.e., four satellite speakers, two side speakers, one center speaker) and two subwoofers.



Internet Research

Which wireless speakers are the best?

Search for: wireless speaker reviews



Figure 7-40 In a crowded environment where speakers are not practical, users can wear headphones to hear audio output.

© Terrie L. Zeller / Shutterstock.com

Internet Research

Which Bluetooth headset is best?

Search for: bluetooth headset reviews

As an alternative to headphones, earbuds, or headsets, you can listen to audio from mobile devices, such as a portable media player or smartphone, through speakers in a vehicle or on a stereo system at home or work. Or, you can purchase speakers specifically designed to play audio from the device.

Data Projectors

A **data projector** is a device that projects the text and images displaying on a computer or mobile device screen on a larger screen so that an audience can see the image clearly (Figure 7-41). For example, many classrooms use data projectors so that all students easily can see an instructor's presentation on the screen.



Figure 7-41 A data projector projects an image from a computer or mobile device screen on a larger screen so that an audience easily can see the image.

©iStockphoto / poba; © iStockphoto / Michal Szwedlo

Headphones and Earbuds

When using speakers, anyone in listening distance can hear the output. In a computer laboratory or other crowded environment, speakers might not be practical. Instead, users can listen through headphones or earbuds so that only the individual wearing the headphones or earbuds hears the sound from the computer. The difference is that **headphones** cover or are placed outside of the ear (Figure 7-40), whereas **earbuds** (shown with the audio output devices in Figure 7-23 earlier in the chapter) rest inside the ear canal. Both headphones and earbuds usually include noise-cancelling technology to reduce the interference of sounds from the surrounding environment.

A **headset** is a device that functions as both headphones and a microphone (shown in Figure 7-1 at the beginning of the chapter). Computer and smartphone users wear a headset to free their hands for typing and other activities while talking or listening to audio output. Many headsets communicate wirelessly with the computer or mobile device.

Some data projectors are large devices that attach to a ceiling or wall in an auditorium. Others, designed for the mobile user, are small portable devices that can be transported easily. Two types of smaller, lower-cost units are LCD projectors and DLP projectors.

- An *LCD projector*, which uses liquid crystal display technology, attaches directly to a computer or mobile device and uses its own light source to display the information shown on the computer screen. Because LCD projectors tend to produce lower-quality images, users often prefer DLP projectors for their sharper, brighter images.
- A *digital light processing (DLP) projector* uses tiny mirrors to reflect light, which produces crisp, bright, colorful images that remain in focus and can be seen clearly, even in a well-lit room. Some newer televisions use DLP instead of LCD or plasma technology.

Interactive Whiteboards

An **interactive whiteboard** is a touch-sensitive device, resembling a dry-erase board, that displays the image on a connected computer screen, usually via a projector. A presenter controls the program by clicking a remote control, touching the whiteboard, drawing on or erasing the whiteboard with a special digital pen and eraser, or writing on a special tablet. Notes written on the interactive whiteboard can be saved directly on the computer and/or printed. Interactive whiteboards are used frequently in classrooms as a teaching tool (Figure 7-42), during meetings as a collaboration tool, and to enhance delivery of presentations.

Force-Feedback Game Controllers and Tactile Output

Joysticks, wheels, gamepads, and motion-sensing game controllers are input devices used to control movements and actions of a player or object in computer games, simulations, and video games. These devices also function as output devices when they include *force feedback*, which is a technology that sends resistance to the device in response to actions of the user (Figure 7-43). For example, as you use the simulation software to drive from a smooth road onto a gravel alley, the steering wheel trembles or vibrates, making the driving experience as realistic as possible. These devices also are used in practical training applications, such as in the military and aviation.

Some input devices, such as a mouse, and mobile devices, such as a smartphone, include *tactile output* that provides the user with a physical response from the device. For example, users may sense a bumping feeling on their hand while scrolling through a smartphone's contact list.



Figure 7-42 Teachers and students can write directly on an interactive whiteboard, or they can write on a slate that communicates wirelessly with the whiteboard.

Courtesy of SMART Technologies



Figure 7-43 Gaming devices often use force feedback, giving the user a realistic experience.

© Vetkit / Dreamstime.com; © shutswis / Shutterstock.com; © Robseguin / Dreamstime.com

Assistive Technology Input and Output

The ever-increasing presence of computers in everyone's lives has generated an awareness of the need to address computing requirements for those who have or may develop physical limitations. **The Americans with Disabilities Act (ADA)** requires any company with 15 or more employees to make reasonable attempts to accommodate the needs of physically challenged workers. Read Ethics & Issues 7-4 to consider who should pay for assistive technologies.



Technology Trend

Discover More: Visit this chapter's free resources to learn more about assistive technologies.

ETHICS & ISSUES 7-4

Who Should Pay for Assistive Technologies?

Public institutions, such as schools and libraries, are required to accommodate visitors or students who require wheelchairs or other devices to enter and move about the building. These institutions install wide doors and ramps and modify restroom facilities to ensure accessibility. Should the same accommodations be available for those who need assistive technologies?

Assistive technologies include devices you can operate with your foot; one example is a mouse. Braille keyboards, printers, and display devices exist for visually impaired

users. Several sources are available to fund assistive technologies. Health insurance covers many assistive technologies. Government programs, such as Medicare, Medicaid, or Social Security, offer some funding. In addition, private or nonprofit groups may provide grants or donations.

Many libraries offer digital versions of books, including digital Braille and audio, for those with visual impairments or dyslexia. Patrons must submit a request that includes recommendations from a doctor. The Individuals with Disabilities Education Act (IDEA) requires that public schools provide free and appropriate education for

all students. Technology increasingly is an important part of a student's education. Thus, schools are required to purchase or acquire funding for adaptive technologies for students who need them. If a student's parents provide an assistive technology that a student uses at school, the school must pay to repair and service the device.

Consider This: Should parents of children who need assistive technology devices be required to provide funding or partial funding? Why or why not? What resources should public libraries provide to patrons with disabilities?



Figure 7-44 A camera/receiver mounted on the monitor tracks the position of the head-mounted pointer, which is the reflective material on the brim of the hat. As the user moves her head, the pointer on the screen also moves.

Courtesy of NaturalPoint, Inc.

Besides voice recognition, which is ideal for blind or visually impaired users, several other input options are available. Users with limited hand mobility who want to use a keyboard can use an on-screen keyboard or a keyboard with larger keys. Users with limited hand movement can use a head-mounted pointer to control the pointer or insertion point (Figure 7-44). To simulate the functions of a mouse button, a user works with switches that control the pointer. The switch might be a hand pad, a foot pedal, a receptor that detects facial motions, or a pneumatic instrument controlled by puffs of air.

For users with mobility, hearing, or vision disabilities, many different types of output options

are available. Hearing-impaired users, for example, can instruct programs to display words instead of sounds. Visually impaired users can change screen settings, such as increasing the size or changing the color of the text to make the words easier to read. Instead of using a monitor, blind users can work with voice output. That is, the computer speaks out loud the information that appears on the screen. Another alternative is a Braille printer, which prints information on paper in Braille (Figure 7-45).



Figure 7-45 A Braille printer.

Courtesy of Enabling Technologies; © Don Farrall / Getty Images

Internet Research

What are new developments related to assistive technologies?

Search for: assistive technology devices

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections Printers, Other Output Devices, and Assistive Technology Input and Output, as it relates to the chapter objectives.

Now you should know...


- Which type of printer might be suited to your needs (Objective 9)
- When you would use speakers, headphones, earbuds, data projectors, interactive whiteboards, and game controllers (Objective 10)
- Which types of assistive technology options are available (Objective 11)

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Chapter Summary

This chapter presented a variety of options for input and output. Input options included the keyboard, mouse and other pointing devices, touch screens, pen input, motion input, voice input, video input, and scanners and reading devices. Output options included displays, printers, speakers, headphones and earbuds, data projectors, interactive whiteboards, and force-feedback game controllers and tactile output. The chapter also presented several assistive technology options for input and output.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: HP, Logitech, Masahiro Hara and Denso Wave, and Ursula Burns; Technology Trends: Drones and Assistive Technology; and High-Tech Talks: Biometric Input and How 3-D Printers Work.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK



Finance


Watching the television, you notice a ticker at the bottom of the screen showing how various stocks currently are performing. You realize that the price of a stock you own has risen significantly, most likely the result of a recent press release about a new product they plan to release. A notification on your smartphone also alerts you of the sharp rise, and you decide to keep a closer eye on the price for the rest of the day in case you wish to sell some shares. You then use the app on your smartphone to check the balances in your accounts.

Because timely decisions often are important in the financial industry, technology helps provide important information to all who participate in various financial transactions. In the stock market, large displays on the trading floors of various exchanges help provide timely information to those buying and selling shares of stock. With the advancements in technology, stock traders now can see up-to-the-minute stock information on their computers and mobile

devices using various finance programs and apps. Users can configure these programs and apps to display notifications when a certain stock's price reaches a certain value so that they can decide whether they want to buy or sell shares. The program or app then can facilitate the sale or purchase of stock shares, all within seconds. Technology also enables users to buy or sell stock shares automatically when they reach a certain price, all without additional user intervention.

In addition to technology playing a role in the stock market, it also helps with banking for individuals and businesses. In fact, technology makes it possible to perform the majority of banking transactions, all without having to visit a bank teller. ATMs allow people the flexibility to deposit and withdraw funds from many locations around the globe. Web and mobile apps also are available and provide users with the ability to access account information, transfer funds between accounts, pay bills electronically, apply for loans, and complete the necessary

information to open new accounts. Some financial institutions allow their users to use a mobile app on their smartphone to deposit checks by taking a picture of the front and back of an endorsed check. The next time you are able to perform a financial transaction easily with little or no human intervention, think about all the ways technology has made this possible.

 **Consider This:** How else might computers and technology be used in the finance industry?



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Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to **test your knowledge of digital content** associated with this chapter and **access the Study Guide resource** from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- ___ is any data and instructions entered into the memory of a computer.
- Define these terms: data, software, and command. Give an example of a user response.
- List features that are common to most keyboards. Describe how to use a keyboard shortcut.
- Explain the criminal and beneficial purposes of keyboard monitoring software.
- Differentiate among compact, ergonomic, gaming, and wireless keyboards.
- Define the term, pointer. Name objects a pointing device can select.
- List different mouse types.
- Describe the following input devices: touchpad, pointing stick, and trackball.
- Explain how to interact with a touch screen.
- Describe how desktop monitors, laptop and mobile device screens, smartphones, wearable devices, portable media players, digital cameras, kiosks, and navigation systems use touch input.
- Explain technologies and laws aimed to prevent use of mobile devices while driving.
- List methods and devices for using pen input. Define the term, digitizer.
- Explain how hand-writing notes during class could impact your knowledge retention.
- Define the term, motion input. Describe how the entertainment industry, the military, athletes, and the medical field use motion input.
- Name hardware and devices used for voice and audio input.
- Outline steps involved in using DV technology.
- List steps for setting up and using a webcam.
- Explain what occurs during a videoconference and the technology needed.
- Outline steps to secure your privacy when using a device with a webcam.
- Describe types of scanners and reading devices.
- A(n) ___ code stores information that can correspond to a web address or other content.
- List guidelines for safely scanning QR codes.
- Explain why a retailer would use RFID technology, and list uses for magstripe readers.
- List guidelines to protect your credit card from scanning devices.
- Describe how a bank uses MICR technology.
- Give examples of data collection devices and describe how they are used.
- Define the term, output. List types and methods of output.
- Define the terms, display and monitor. Describe different types of monitors.
- List steps to connect a laptop to an external display.
- Differentiate among LCD, CCF, LED, TFT, OLED, and AMOLED technologies.
- Describe how display quality is determined. Define these terms: resolution, response time, nit, candela, dot pitch, and contrast ratio.
- Explain the purpose of the GPU. List and describe port types for monitors.
- Describe the technologies used by HDTV. Explain the capabilities of a Smart TV.
- List steps to show media on a Smart TV from a computer or mobile device.
- Explain safety issues surrounding hardware radiation.
- Describe orientation options for printouts. Explain what is needed to print using Bluetooth.
- Explain how an ink-jet printer works, and describe the mechanics of the ink cartridge.
- Explain how resolution affects printer quality.
- Explain how a photo printer uses PictBridge.
- Outline steps for printing from a smartphone or tablet.
- Compare the price and quality of laser printers to ink-jet printers.
- Describe the following printer types: all-in-one, 3-D, thermal, mobile, label, plotter, and impact.
- Explain how computers and mobile devices use speakers, such as satellite speakers, to emit sound.
- Differentiate among headphones, earbuds, and headsets.
- Define the term, data projector. Differentiate between LCD and DLP projector technology.
- Describe uses of interactive whiteboards and force-feedback game controllers. Define the term, tactile output.
- List types of assistive technologies for input and output.
- Explain issues surrounding payment for assistive technologies.
- Explain how the finance field uses technology.

Key Terms

You should be able to define the Primary Terms and be familiar with the Secondary Terms listed below.

Discover More: Visit this chapter’s premium content to view definitions for each term and to access the Flash Cards resource from your smartphone, tablet, laptop, or desktop.

Primary Terms (shown in bold-black characters in the chapter)

- 3-D printer (349)
- all-in-one printer (349)
- Americans with Disabilities Act (ADA) (353)
- bar code (335)
- bar code reader (335)
- data projector (352)
- digital pen (327)
- digital video (DV) camera (330)
- display (340)
- DV technology (331)
- earbuds (352)
- graphics tablet (328)
- HDTV (343)
- headphones (352)
- impact printer (351)
- ink-jet printer (345)
- input (318)
- interactive whiteboard (353)
- keyboard (320)
- label printer (350)
- large-format printer (350)
- laser printer (348)
- LCD (341)
- magstripe reader (339)
- mobile printer (350)
- monitor (340)
- mouse (322)
- nonimpact printer (345)
- OCR devices (335)
- OMR devices (335)
- output (339)
- pen input (326)
- photo printer (347)
- plotters (350)
- pointer (322)
- printer (344)
- QR code (335)
- resolution (342)
- RFID (336)
- RFID reader (336)
- scanner (334)
- signature capture pad (326)
- speakers (351)
- stylus (326)
- thermal printer (349)
- touch screen (324)
- touchpad (323)
- trackball (324)
- video call (332)
- videoconference (333)
- voice recognition (330)
- webcam (332)

Secondary Terms (shown in italic characters in the chapter)

- active-matrix (342)*
- air gestures (328)*
- AMOLED (342)*
- aspect ratio (343)*
- audio input (330)*
- backlight (341)*
- bar code scanner (335)*
- Bluetooth printing (345)*
- candela (342)*
- command (318)*
- compact keyboard (321)*
- contrast ratio (342)*
- cursor (320)*
- data (318)*
- data collection device (338)*
- digital light processing (DLP) projector (352)*
- digital photo printer (349)*
- digitizer (328)*
- display device (340)*
- DisplayPort (343)*
- dot pitch (342)*
- dots per inch (dpi) (346)*
- DVI (Digital Video Interface) port (343)*
- dye-sublimation printer (349)*
- ergonomic keyboard (322)*
- flat-panel display (340)*
- force feedback (353)*
- frame rate (331)*
- function keys (320)*
- gaming keyboard (322)*
- gesture (324)*
- gesture recognition (328)*
- graphics processing unit (342)*
- handwriting recognition software (327)*
- HDMI (High-Definition Media Interface) port (343)*
- headset (352)*
- high-definition television (343)*
- insertion point (320)*
- keyboard monitoring software (321)*
- keyboard shortcut (320)*
- keylogging software (321)*
- landscape orientation (344)*
- laser mouse (322)*
- LCD projector (352)*
- LED (341)*
- LED display (342)*
- liquid crystal display (341)*
- magnetic stripe card reader (337)*
- MICR devices (338)*
- morphing (331)*
- motion input (328)*
- multifunction printer (348)*
- multi-touch (324)*
- native resolution (342)*
- nit (342)*
- OCR software (334)*
- OLED (342)*
- optical mouse (322)*
- PictBridge (347)*
- pixel (342)*
- pixel pitch (342)*
- plasma display (344)*
- portrait orientation (344)*
- printout (344)*
- response time (342)*
- Retina Display (342)*
- satellite speakers (351)*
- Smart TV (343)*
- soft copy (340)*
- software (318)*
- source document (334)*
- speech recognition (330)*
- speech-to-text (330)*
- streaming cam (333)*
- subwoofer (351)*
- tactile output (353)*
- TFT (342)*
- toggle key (320)*
- toner (348)*
- touch mouse (323)*
- touch-sensitive pad (326)*
- trackpad (323)*
- UPC (Universal Product Code) (335)*
- user response (318)*
- voice input (330)*
- voice recognition application (330)*
- widescreen monitor (343)*
- wireless keyboard (322)*
- wireless mouse (323)*



QR code (335)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. CAPS LOCK and NUM LOCK are two examples of toggle keys. (320)
- _____ 2. Keylogging software runs undetected and stores every keystroke in a file for later retrieval. (321)
- _____ 3. Wearable devices mainly rely upon touch input. (325)
- _____ 4. A smaller frame rate results in a smaller file size for a video, as well as a smoother playback. (331)
- _____ 5. Optical character recognition (OCR) and optical mark recognition (OMR) are two technologies used by QR code readers. (335)
- _____ 6. Many retailers do not believe RFID is an alternative to bar code identification because it requires line-of-sight transmission. (336)
- _____ 7. A data collection device reads and scans data from a source document. (338)
- _____ 8. In terms of response time, the lower the number, the faster the response time. (342)
- _____ 9. Contrast ratio defines a display's width relative to its height. (342)
- _____ 10. Every electronic device emits some level of radiation. (344)
- _____ 11. Printer resolution is measured by the number of pixels per inch a printer can print. (346)
- _____ 12. A dye-sublimation printer uses heat to transfer colored dye to specially coated paper. (349)

Multiple Choice

Select the best answer.

1. A _____ is an instruction a user issues by responding to a message displayed by a program or app. (318)
 - a. command
 - b. user response
 - c. keyboard shortcut
 - d. function
2. Which of the following is not an example of a pointing device? (324)
 - a. touchpad
 - b. trackball
 - c. touch screen
 - d. pointing stick
3. A(n) _____ is an input device that contains buttons and/or wheels you operate with a thumb or finger. (326)
 - a. digitizer
 - b. interactive whiteboard
 - c. touch-sensitive pad
 - d. OCR device
4. _____ read hand-drawn marks, such as small circles or rectangles. (335)
 - a. MICR readers
 - b. Digitizers
 - c. OMR devices
 - d. OCR devices
5. LCD displays typically produce color using _____ technology, which uses a separate transistor to supply charges to each liquid crystal cell. (342)
 - a. passive-matrix
 - b. OLED
 - c. Retina Display
 - d. active-matrix
6. _____ displays use organic molecules that are self-illuminating and, thus, do not require a backlight. (342)
 - a. OLED
 - b. TFT
 - c. LED
 - d. CCFL
7. _____ orientation refers to a printout that is wider than it is tall. (344)
 - a. Cinematic
 - b. Portrait
 - c. Landscape
 - d. Widescreen
8. How many subwoofers would a 7.2 speaker system contain? (351)

a. 1	c. 7
b. 2	d. 9

Checkpoint

Matching Match the terms with their definitions.

- | | |
|---|--|
| _____ 1. command (318) | a. a type of 2-D bar code that stores information in both horizontal and vertical directions |
| _____ 2. keyboard shortcut (320) | b. small, flat, rectangular pointing device that is sensitive to pressure and motion |
| _____ 3. touchpad (323) | c. touch screen capability of recognizing more than one point of contact at the same time |
| _____ 4. multi-touch (324) | d. device that functions as both headphones and a microphone |
| _____ 5. voice recognition (330) | e. touch-sensitive device that displays the image on a connected computer screen, usually via projector |
| _____ 6. scanner (334) | f. chip that controls the manipulation and display of graphics on a display device |
| _____ 7. QR code (335) | g. instruction that causes a program or app to perform a specific action |
| _____ 8. graphics processing unit (342) | h. computer or mobile device's capability of distinguishing spoken words |
| _____ 9. headset (352) | i. light-sensing input device that reads printed text and graphics and then translates the result into a form the computer can process |
| _____ 10. interactive whiteboard (353) | j. one or more keyboard keys that you press to perform an operating system or application-related task |

Consider This Answer the following questions in the format specified by your instructor.

1. Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (326, 327, 344, 354), How To (332, 341, 343, 347), Mini Features (325, 329, 331), Secure IT (321, 333, 336, 337), and Technology @ Work (355).
2. What are some examples of data? (318)
3. What are some commonly used input methods? (319)
4. What happens when you press a toggle key? (320)
5. What steps can you take to detect keyboard monitoring software? (321)
6. What are some types of keyboards? (321)
7. How does an optical mouse differ from a touch mouse? (322)
8. How does a stylus differ from a digital pen? (326)
9. Who might use a graphics tablet? (328)
10. What are some disciplines in which motion input is being used? (329)
11. What is meant by the term, morphing? (331)
12. How does a video call differ from a videoconference? (333)
13. What steps should you take to secure a webcam? (333)
14. How do OCR and OMR devices differ? (335)
15. What do bar codes represent? (335)
16. What guidelines should you follow to use a QR code safely? (336)
17. What are some uses of RFID? (336)
18. What is contained in an RFID tag? (336)
19. Why might some magstripes become unreadable? (338)
20. What are the four basic types of output? (340)
21. What are some advantages and a disadvantage of OLED technology? (342)
22. On today's displays, what is the range for nits? (342)
23. What are commonly used nonimpact printers? (345)
24. If your mobile device does not support wireless printing, how can you print photos from it? (347)
25. What types of businesses use a dye-sublimation printer? (349)
26. Why might a user prefer a DLP projector over an LCD projector? (352)
27. What does the Americans with Disabilities Act (ADA) require? (353)
28. Should schools and companies be required to pay for assistive technologies? Why or why not? (354)

Problem Solving

The **Problem Solving** exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The **Collaboration** exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Assistive Technologies** You have just purchased a new computer and, because of a visual impairment, you are having trouble reading the information on the screen. What are your next steps?
- 2. Smart TV Issues** You are watching a movie on your Smart TV using a streaming media service.



© Courtesy of LG Electronics USA Inc.

Every few minutes, a message is displayed on the TV stating that the movie is buffering. Why might this be happening, and what can you do to resolve this issue?

- 3. Touch Gestures Not Working** You are using the stretch touch gesture to zoom on your mobile device. Each time you perform the gesture, however, instead of zooming, one of your fingers appears to be dragging an item around the screen. What might be the problem?
- 4. Dim Screen** While using your laptop, the screen suddenly becomes dim. You set the brightness to its highest setting before it dimmed and wonder why it suddenly changed. After resetting the brightness to its highest setting, you continue working. What might have caused the screen to dim?
- 5. Malfunctioning Earbud** While listening to music on your portable media player, one side of the earbuds suddenly stops working. What might have caused this?

Professional

- 6. Printer Problem** You are attempting to print on a wireless printer from your laptop, but each time you tap or click the Print button, you receive an error message that the printer is not connected. What are your next steps?
- 7. Projector Resolution Issue** You are preparing for a meeting in your company's conference room and have connected your laptop to the projector. When the projector displays the information from your laptop screen, the resolution drops significantly and not everything fits on the screen. What steps can you take to correct this problem?
- 8. Fingerprints Not Recognized** To increase security, your company now requires employees to sign in to their computer accounts using a fingerprint reader instead of entering a user name and password. This past weekend, you cut the finger you use to sign in, and your computer now does not recognize your fingerprint. As a result, you are unable to access your computer. What are your next steps?
- 9. Access Denied** Your company uses security badges with embedded RFID tags to authenticate the rooms to which employees have access. This badge also grants employees access to the company's parking lot. When arriving at work one morning, you wave your badge in front of the RFID reader, but the gate that allows access to the parking lot does not open. In addition, a red light blinks on the RFID reader. What are your next steps?
- 10. Monitors Reversed** You have two monitors on your desk at work: the monitor on the left is your primary monitor and displays the taskbar and the applications you are currently using, and you typically use the monitor on the right to display an email program. When you arrive at work and sign in to your Windows account, you realize that the monitor on the right is now the primary monitor. What might have happened?

Collaboration

- 11. Technology in Finance** Technology enables individuals and businesses to conduct transactions in the finance industry with great convenience and speed; however, many individuals do not realize the extent to which technology impacts the industry. Form a team of three people to learn more about the important role that technology plays in today's finance industry. One team member should research the different ways that technology impacts and improves personal financial transactions, such as home banking. Another team member should research how large businesses use technology to manage their finances, and the other team member should research the different ways technology has helped improve the stock market. Write a brief report summarizing your findings.

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

How To: Your Turn

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn exercises**, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Work with QR Codes

QR codes initially were used in the automotive industry to track vehicles during the production process. Today, QR codes often are used in publications and advertisements to convey information, direct users to a website, suggest users download a file, or direct users to an app store or marketplace to download an app. Exercise caution when scanning QR codes, because they may direct your mobile computer or device to a malicious website or file. For example, it probably is wise to avoid scanning QR codes appearing on homemade flyers and other similar sources.

Scanning QR Codes

When you encounter a QR code that you want to scan, you should use an app capable of reading QR codes. The following steps guide you through the process of scanning QR codes.

- Download and install an app that can read QR codes.
- When you see a QR code you want to scan, run the app on your mobile computer or device. If necessary, select the option to scan a QR code.
- Hold the device still and point its camera toward the QR code to scan it.
- Once your device scans the QR code, it will display the associated information. If the QR code represents a web address, the app will run a browser and navigate to that address.

Generating QR Codes

If you want to generate a QR code to make it easier for others to navigate to a particular location or perform an action, you should use a QR code generator. The following steps describe how to generate QR codes:

- Use a search engine to locate a website that contains a QR code generator and then navigate to it.
- Enter the information, such as a web address, phone number, word, or short phrase, that you want the QR code to contain, and then tap or click the button to generate the QR code.
- Copy the generated QR code image and then paste it in the desired location.
- Scan the QR code to make sure it displays the results you expect.

Exercises

- Compare and contrast at least three apps that can scan QR codes. Which one is your favorite? Why?
- Compare and contrast at least three websites or apps that can generate QR codes. Which app would you use to generate QR codes? Why?
- List at least three places you remember seeing QR codes. Did you scan them? Why or why not?



2 Record and Edit a Video

Once you have finished recording a video, you may want to edit it before sharing it with others. For example, you might want to remove portions of the video, add special effects, or play an audio track instead of the audio recorded with the video. The following steps guide you through the process of recording and editing a video.

Record a Video

- Verify your camera's battery is charged and that the device has sufficient space available to store the video you are about to record.
- If you plan to record the video from one location, consider placing the camera on a stable surface so that it does not move.
- If you intend to record outside where it is windy, shield the camera from the wind.
- Start the recording.

How To: Your Turn

- e. If you plan to move the camera during recording, do so with slow, smooth movements.
- f. Stop the recording.

Edit a Video

- a. If you are using video editing software on your computer, transfer the video to the computer. If you are using video editing capabilities on your mobile device, run the video editing app.
- b. Make a copy of the video so that you can revert to the original if you make a mistake.
- c. Run a video editing program on your computer and open the video.
- d. To trim a video — that is, remove portions from the beginning and/or end of the video — tap or click the command to trim the video. Select the new starting and ending position for the video.
- e. To add a special effect to the video, select the location in the video where you want to add the special effect, and then tap or click the command corresponding to the special effect you want to add.
- f. To add music that will play while the video is playing, tap or click the command to add a separate audio track to the video. Next, navigate to and select the music file you want to add. Finally, select the starting and ending locations in the video for the music.
- g. Preview the video.
- h. Save your changes.
- i. Exit the video editing program.

Exercises

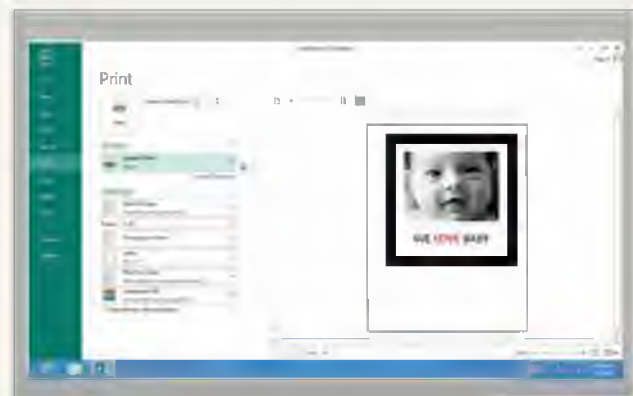
1. What reasons might you have for wanting to trim a video?
2. What type of device do you use to record videos? Why?
3. Compare and contrast at least three programs or apps that can be used to edit videos. Which one do you prefer? Why?

Save as or Print to a PDF File

In an effort to conserve paper, people today think twice before printing a hard copy of a document. Instead of printing a hard copy of a document, many applications have a built-in feature enabling you to print soft copies in various formats, such as PDF. You can print to a PDF file from many apps, including Microsoft Office. When you save as or print to a PDF file (both saving as or printing to PDF produce the

same results), anyone with an app capable of reading PDF files will be able to view the file without necessarily having to open it in the same program from which it was created. Several free apps you can use to view PDF files are available. The following steps guide you through the process of printing to a PDF file.

- a. Verify the app from which you want to print has a built-in feature to save files in or print files to PDF format. If this feature is not available, search for and install an app that enables you to save files to or print files in PDF format.
- b. Open the file you want to save in or print to PDF format.
- c. If you want to save the file as a PDF format, display the app's Save As dialog box and check if PDF is one of the available file types.
- d. If you want to print the file to a PDF, display the screen to print the file and select the appropriate printer to print the file to PDF.



Source: Microsoft

- e. Tap or click the button to save or print the file.
- f. Specify a file name and save location for the PDF file.

Exercises

1. What are some applications you can use to view PDF files?
2. In addition to saving paper, what are some other reasons why you might save or print to a PDF?

Take Screenshots

Many computer and mobile device operating systems allow you to take screenshots, which are snapshots of the screen that are saved as an image. In addition, third-party programs and apps also allow you to take screenshots. The following steps guide you through the process of taking a screenshot on your computer or mobile device.

How To: Your Turn

- If you wish to use a third-party app to take a screenshot, search for, download, and install the desired app. Next, run the app and review the required steps to take the screenshot.
- Display the desired programs, apps, or windows on the screen of which you want to take a screenshot.
- Issue the desired command to take the screenshot. On computers, you may need to press a specific key combinations (such as CTRL+PRINT SCREEN). On mobile devices, you may need to press specific buttons at the same time (such as the Home button and the Power button) or perform a specific hand gesture (such as swiping your hand across the screen).
- Locate the screenshot. If you used a third-party app, it may be displayed immediately upon taking the screenshot. If you used an operating system such as Windows or Mac OS, you may need to run another app (such as Microsoft Word) and paste the image into the document. If you took the screenshot on a mobile device, you may be able to locate the screenshot in the image gallery.

Exercises

- What are at least three reasons why you may need to take a screenshot?
- Why might you want to use a third-party program or app to take a screenshot instead of using the built-in function in your computer or device's operating system?
- If you take a screenshot of an entire screen but require information in only one window on the screen, what steps can you take to manipulate the screenshot so that it shows only the portions of the screen you desire?

Share a Photo or Video from Your Mobile Device with an Online Social Network

If you take a photo or record a video on your mobile device and want to share it with your friends, you might consider uploading it to an online social network. You can share a photo or video from your mobile device with an online social network in several ways, depending upon the online social network and how your mobile device is configured. This exercise describes two common ways to share a photo or video from your mobile device to an online social network.

Share Button

You may be able to share photos or videos with an online social network easily by using the Share

button. To use the Share button, you must have the online social network account to which you want to share properly configured on your mobile device. The following steps guide you through the process of sharing a photo or video from your mobile device with an online social network using the Share button.

- Locate and display the photo or video on your mobile device that you want to share with the online social network.
- Tap the Share button.
- Tap the desired online social network with which you want to share the photo or video.
- If desired, type a caption or message to share with the photo or video.
- Tap the necessary button to share the photo or video.

Uploading Photos or Videos Manually

If you are unable to share your photo or video using the Share button, you can sign in to the online social network and upload it manually. The following steps guide you through the process of sharing a photo or video on an online social network by uploading it manually to your online social network account.

- If necessary, take a photo or record a video you want to share.
- Using an app installed on your mobile device or the online social network's website, sign in to your account on the online social network on which you want to share the photo or video.
- Tap the appropriate button to post or share a photo or video.
- Navigate to and select the photo or video you want to share.
- If desired, type a caption or message to share with the photo or video.
- Tap the necessary button to share the photo or video.

Exercises

- What types of photos or videos do you share with online social networks?
- Research the potential privacy risks associated with uploading photos or videos of yourself or your family. Are you comfortable sharing photos or videos on online social networks? Why or why not?
- Why might individuals want to share photos and videos on online social networks instead of using other methods such as sending them as attachments to email messages?

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to challenge yourself with additional Internet Research exercises, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Health and Fitness

More than 70 percent of Internet users search online for health information, and their most commonly researched topics are specific diseases or conditions, treatments and procedures, and doctors or other health professionals. One-half of these online diagnosticians say that the information they found for themselves or someone else led them to seek medical attention.

Fitness websites and apps can provide guidance and motivation for all fitness levels and lifestyles. Expert advice is offered for designing customized workout routines, maintaining a nutritious diet, and buying equipment. Other features include downloadable MP3 workouts, videos demonstrating correct exercise techniques, and the ability to locate a virtual supportive workout buddy. Users often can set goals and then track their performance and overall progress with logs and detailed graphs.

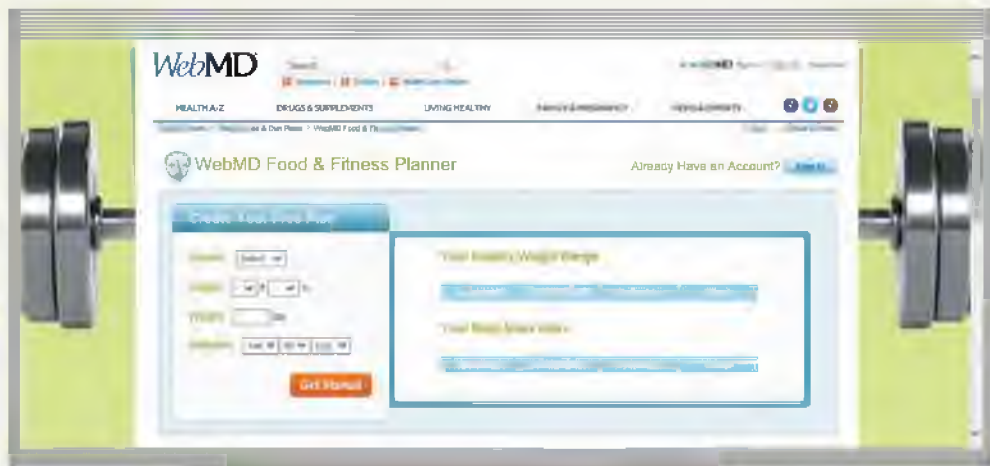
Research This: (a) Visit WebMD and two other health websites and describe the features of each. Which of the three is the most user-friendly? Why? Search for the difference between the flu and a cold. Describe the symptoms of each and the recommended foods to eat when you are suffering from either ailment.

(b) Visit WebMD and two fitness websites. What similar features do these websites have, such as fitness tools, effective exercises, and food planners? Which website is the easiest to navigate? Why? Which articles, planners, and tools would you use to start or continue your fitness routines?

2 Social Media

Aspiring musicians have turned to online social networks to break into the music business and to promote their material. Musical artists are urged to develop accounts on YouTube, Facebook, OurStage, MP3.com, Ourwave, Twitter, Myspace, Last.fm, PureVolume, and other online social networks to interact and stay connected with their fans. They can post information about concerts and album releases and sell concert tickets. They also can add music that fans can listen to, download at no charge, or purchase. Some online social networks sponsor contests for bands to showcase their talents and vie for fans' votes to play live at a local venue. Others are crowd-funding websites where bands can ask fans to pledge a specific amount of money to support the artists' creative efforts.

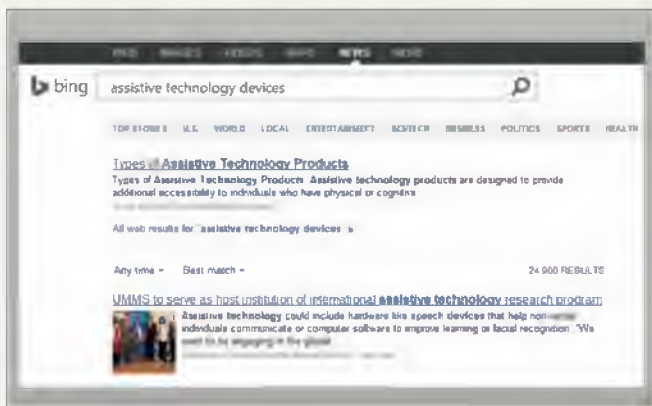
Research This: View at least two websites that allow listeners to recommend music and share playlists. What similarities and differences do these websites have? Locate one of your favorite artists on an online social network and describe the content displayed. For example, are concerts and new releases being promoted? Then, search for and then view at least two musician websites. What types of music are available? Which new artists and songs did you hear?



Internet Research

Search Skills News Search

Performing a news search using a search engine will limit search results to news stories that appeared recently or in the past in newspapers and magazines, news websites, and other electronic media news sources. To search for news articles about assistive technology devices, for example, type the search text, assistive technology devices, in the search engine's search box and then tap or click the News link on the search page. You may narrow the results by specifying a date range or location. Tap or click the search button to see the results.



Source: Microsoft

Research This: Create search text using the techniques described above or in previous Search Skills exercises, and type it into a search engine to answer these questions. Present a summary of your findings. (1) Find news articles about the enterprise uses of 3-D printing. (2) Find news articles suggesting capabilities to be included in the next iPhone. (3) Find a news story published within the past week describing how any company uses QR codes. (4) Select a technology company and then find news stories about its financial earnings during the past three months.

Security

The Office of Cyber and Infrastructure Analysis (OCIA), a division of the U.S. Department of Homeland Security, strives to thwart and respond to physical or cyberthreats and hazards. Part of the office's role is to implement two policies: (1) Presidential Policy Directive 21 - Critical Infrastructure Security and Resilience, and (2) Executive Order 13636 - Improving Critical Infrastructure Cybersecurity. These two policies are designed to strengthen and secure the country's critical physical assets and services, such as air traffic control, natural gas supplies, water treatment, power plants, and finance, which are likely targets of cyberattacks. Federal

agencies must comply with and routinely assess privacy standards and civil liberties protections. The government must share information regarding the cyberthreats, such as malicious code found on networks, but not contents of personal email messages. The private companies are urged to adopt the security incentives and increase their security systems, but participation is voluntary.

Research This: Locate Presidential Policy Directive 21 - Critical Infrastructure Security and Resilience and Executive Order 13636 - Improving Critical Infrastructure Cybersecurity and read their contents. Then, research news articles describing lawmakers' and businesses' support and criticism of these orders. What components are proposed to increase the nation's cybersecurity? What positions do the Internet Security Alliance and The Internet Association take on this matter? What efforts has Congress made to pass legislation addressing computer security?

Cloud Services Virtualization (IaaS)

An online business's website receives higher traffic during peak holiday shopping times. Purchasing and configuring additional servers to meet this demand for the short term can be an expensive task for companies managing complex computing environments. To minimize cost and maximize performance, companies often use virtualization software rather than purchasing and installing additional memory, storage, or processing power. Virtualization software allows one physical machine to emulate the capabilities of one or more servers. Virtualization is an example of infrastructure as a service (IaaS), a service of cloud computing that allows users to configure a computing environment's hardware, devices, storage, and operating systems using software. Amazon Web Services and Microsoft Azure are two cloud providers of virtualization services. (To learn more about virtualization, visit Chapter 9's free resources and read the High-Tech Talk article on this topic.)

Research This: (1) Use a search engine to find current articles, websites, or reviews of the virtualization offerings of Microsoft Azure and Amazon Web Services. (2) Find a case study about a company using Microsoft Azure or Amazon's virtualization services, summarize the problem the company was trying to solve, and describe how virtualization played a part in solving it. (3) Refer to the Chapter 6 Internet Research activity on private, public, and hybrid clouds. Why is running a private cloud in a virtualized environment a popular cloud computing solution?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Bar Codes versus RFID

You work as an efficiency analyst at one of the largest retail companies in the world, with multiple stores in every state, as well as in many other countries. For the past 25 years, the company has used bar code readers at checkout counters that scan the bar code on products to determine from a database the price to charge customers and to keep a record of inventory. The company is considering replacing the bar codes and bar code readers with RFID.

Do This: Analyze and discuss the impact such a change would have on the company, its suppliers, and its customers. Include in your discussion any security risks. Find two examples of RFID readers and compare prices, user reviews, and features. Are handheld options for RFID readers available for store clerks to use on the store floor or for customer checkout? Compile your findings. List advantages and disadvantages of implementing RFID. Include information about reliability and costs.

2. Carpal Tunnel Syndrome

While attending college for the past two years, you have worked part-time as a data entry clerk. Recently, you began to feel a pain in your right wrist. Your doctor diagnosed the problem as carpal tunnel syndrome, which is the most well-known of a series of musculoskeletal disorders that fall under the umbrella of repetitive strain injuries (RSIs). Your doctor made several recommendations to relieve the pain. You want to learn more about this debilitating injury.

Do This: Use the web to investigate carpal tunnel syndrome. Research the carpal tunnel syndrome warning signs and risk factors. Find suggestions about proper workstation ergonomics to avoid carpal tunnel

syndrome. Evaluate the differences among various treatment options. Does insurance typically cover treatment? Include in your discussion the average length of time of recovery. How should you change your workspace to help heal and prevent further damage? Should the company's insurance pay for changes to your workspace? Why or why not?

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. You recently hired a part-time employee who is visually impaired. The league's board of directors has asked you to assess your current input and output devices and make recommendations for assistive technologies. The new employee will need to enter data and review on-screen and printed information to ensure accuracy and identify trends.

Do This: Use the web to find information about assistive input devices, such as voice recognition and larger keyboards. Research output devices, such as large-screen monitors and Braille printers. In addition to devices, research assistive software that you can install on existing computers and devices shared by others. Find reviews from users of these assistive devices. Research costs for implementation, and find information about any grants your company can apply for as a nonprofit to ease the costs. Compile your findings.



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Collaboration

4. Printer Comparison You work for a local real estate agency as an IT consultant. The agency needs a new, networked printer it can use to print high-quality, custom color brochures for the homes it is showing. Each brochure is printed double-sided on glossy paper, and the agency prints an average of 200 per week.

Do This: Form a three-member team. Refer to Figure 7-26 in this chapter, which lists several questions to consider when choosing a printer, and divide the questions among your team. Each team member should answer each question according to what the employer needs. Then, each team member should use the web to research at least two printers that meet the requirements. Meet with your team, and discuss and compile your findings. Share information about the printers you researched, describe their features, and evaluate their advantages and disadvantages. Identify any additional questions you might have for the employer, such as needs for wireless printing and printing from mobile devices. Which printer you would recommend? Why?

DIGITAL STORAGE: Preserving Content Locally and on the Cloud

8



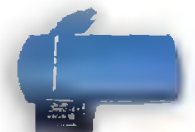
Users have a variety of storage options available.

“I use cloud storage for all my homework files. I transfer my digital photos from an SD card to my laptop’s hard drive, which has plenty of extra space for my music. Weekly, I back up files from my computer to an external hard drive. What more do I need to know about storage?”

While you may be familiar with some of the content in this chapter, do you know how to . . .

- Share media?
- Defragment a hard disk?
- Decide between a hard disk and an SSD?
- Transfer files from one internal hard drive to another?
- Encrypt data and files?
- Safely remove a portable flash memory storage device?
- Evaluate cloud storage providers?
- Fix a scratch on a CD or DVD?
- Use your own device to access company data responsibly?
- Protect your credit card?
- Limit data breaches when using NFC technology?
- Create a backup plan?
- Determine how much data a company should keep?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.





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Objectives

After completing this chapter, you will be able to:

- 1 Differentiate between storage and memory
- 2 Describe the characteristics of internal hard disks
- 3 Describe the benefits of solid-state drives
- 4 Identify uses of external hard drives and RAID
- 5 Differentiate among various types of memory cards and USB flash drives
- 6 Discuss the benefits and uses of cloud storage
- 7 Describe characteristics of and differentiate among types of optical discs
- 8 Explain types of enterprise storage: RAID, NAS, SAN, and tape
- 9 Identify uses of magnetic stripe cards, smart cards, RFID tags, and NFC tags

Storage

A storage medium, also called *secondary storage*, is the physical material on which a computer keeps data, information, programs, and applications. Examples of storage media include hard disks, solid-state drives (both of which can be internal or external), memory cards, USB flash drives, optical discs, network attached storage devices, magnetic stripe cards, smart cards, RFID tags, and NFC tags. Another storage option is cloud storage, which keeps information on servers on the Internet. Because the user accesses files on cloud storage through a browser using an app from the storage provider, the actual media on which the files are stored are transparent to the user. Figure 8-1 shows a variety of storage options.

In addition to programs and apps, users store a variety of data and information on storage media in their computers and mobile devices or on cloud storage. For example, many users store digital photos, appointments, schedules, contacts, email messages, and tax records. A home user also might store budgets, bank statements, a household inventory, stock purchase records, homework assignments, recipes, music, and videos. In addition or instead, a business user stores reports, financial records, travel records, customer orders and invoices, vendor payments, payroll records, inventory records, presentations, quotations, and contracts. Business and power users store diagrams, drawings, blueprints, designs, marketing literature, corporate newsletters, and product catalogs.

A **storage device** is the hardware that records and/or retrieves items to and from storage media. **Writing** is the process of transferring data, instructions, and information from memory to a storage medium. **Reading** is the process of transferring these items from a storage medium into memory. When storage devices write on storage media, they are creating output. Similarly, when storage devices read from storage media, they function as a source of input. Nevertheless, they are categorized as storage devices, not as input or output devices.



CONSIDER THIS

Does the amount of storage on a computer or mobile device affect the speed at which it operates?

Although the amount of storage does not directly affect the speed of a processor in a computer or mobile device, storage capacity (discussed next) could indirectly affect the overall performance. For example, a computer or mobile device with extra available storage may perform faster because the unused space can be used to hold temporary files while you browse the web and for virtual memory, discussed later in this chapter. Storage access times are discussed in more depth later in this chapter.



Figure 8-1 A variety of storage options.

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Storage Capacity

Capacity is the number of bytes (characters) a storage medium can hold. Table 8-1 identifies the terms manufacturers may use to define the capacity of storage media. For example, a storage medium with a capacity of 750 GB can hold approximately 750 billion bytes.

Storage requirements among users vary greatly. Home users, small/home office users, and mobile users typically have much smaller storage requirements than enterprise users. For example, home users may need 1 to 2 TB (terabytes, or trillions of bytes) of storage for all of their digital content, while enterprises may require 20 to 40 PB (petabytes, or quadrillions of bytes) of storage.



Table 8-1 Terms Used to Define Storage

Storage Term	Approximate Number of Bytes	Exact Number of Bytes
<i>Kilobyte (KB)</i>	1 thousand	2^{10} or 1,024
<i>Megabyte (MB)</i>	1 million	2^{20} or 1,048,576
<i>Gigabyte (GB)</i>	1 billion	2^{30} or 1,073,741,824
<i>Terabyte (TB)</i>	1 trillion	2^{40} or 1,099,511,627,776
<i>Petabyte (PB)</i>	1 quadrillion	2^{50} or 1,125,899,906,842,624
<i>Exabyte (EB)</i>	1 quintillion	2^{60} or 1,152,921,504,606,846,976
<i>Zettabyte (ZB)</i>	1 sextillion	2^{70} or 1,180,591,620,717,411,303,424
<i>Yottabyte (YB)</i>	1 septillion	2^{80} or 1,208,925,819,614,629,174,706,176



CONSIDER THIS

What can a gigabyte store?

The total number of items that can be stored in a gigabyte will vary, depending on file size, quality of media, and a variety of other factors. As a general guide, though, a gigabyte can hold approximately 500,000 pages of text, 600 medium-resolution photos, 250 songs (2 to 3 minutes each), 4 hours of low-resolution video, or 15 minutes of high-definition video.

Storage versus Memory

Items on a storage medium remain intact even when you turn off a computer or mobile device. Thus, a storage medium is nonvolatile. Most memory (i.e., RAM), by contrast, holds data and instructions temporarily and, thus, is volatile. Figure 8-2 illustrates this concept of volatility.



CONSIDER THIS

How do storage and memory interact?

When you turn on a computer or mobile device, it locates the operating system on its storage medium and loads the operating system into its memory (specifically, RAM). When you issue a command to run an application, such as a browser, the operating system locates the application on a storage medium and loads it into memory (RAM). When you are finished using the application, the operating system removes it from RAM, but the application remains on the storage medium.

A storage medium is similar to a filing cabinet that holds file folders, and memory is similar to the top of your desk. When you want to work with a file, you remove it from the filing cabinet (storage medium) and place it on your desk (memory). When you are finished with the file, you remove it from your desk (memory) and return it to the filing cabinet (storage medium).

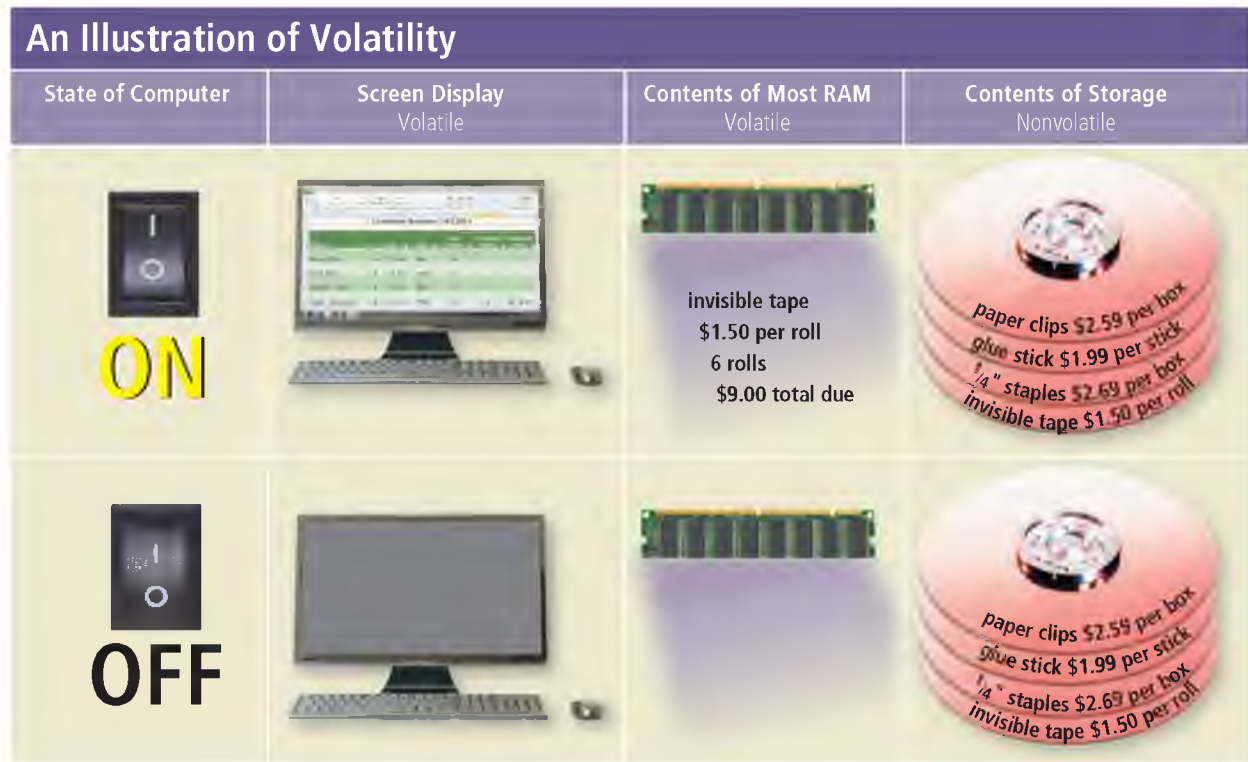


Figure 8-2 A screen display is considered volatile because its contents disappear when power is removed. Likewise, most RAM is volatile. That is, its contents are erased when power is removed from a computer or mobile device. Storage, by contrast, is nonvolatile. Its contents remain when power is off.

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Storage Access Times

The speed of storage devices and memory is defined by access time. **Access time** measures (1) the amount of time it takes a storage device to locate an item on a storage medium or (2) the time required to deliver an item from memory to the processor. The access time of storage devices is slow, compared with the access time of memory. Memory (chips) accesses items in billionths of a second (nanoseconds). Storage devices, by contrast, access items in thousandths of a second (milliseconds) or millionths of a second (microseconds).

Instead of, or in addition to, access time, some manufacturers state a storage device’s transfer rate because it affects access time. *Transfer rate* is the speed with which data, instructions, and information transfer to and from a device. Transfer rates for storage are stated in *KBps* (kilobytes per second), *MBps* (megabytes per second), and *GBps* (gigabytes per second).

Numerous types of storage media and storage devices exist to meet a variety of users’ needs. Figure 8-3 shows how different types of storage media and memory compare in terms of transfer rates and uses. This chapter discusses these and other storage media.

Mini Feature 8-1: Media Sharing

Users often want to share photos, videos, and music they have stored on computers and mobile devices with others using social media. Read Mini Feature 8-1 to learn about sharing media.

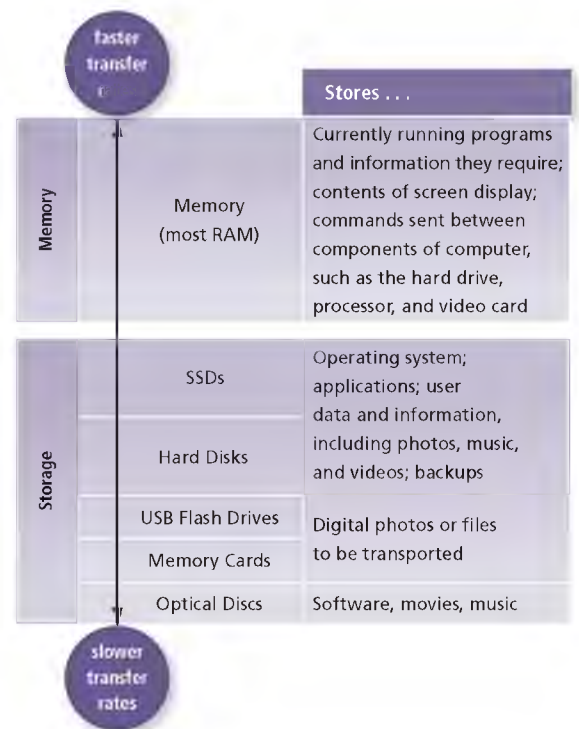


Figure 8-3 A comparison of different types of storage media and memory in terms of relative speed and uses. Memory is faster than storage but is expensive and not practical for all storage requirements. Storage is less expensive but is slower than memory.

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MINI FEATURE 8-1

Media Sharing

Online services offer a host of tools for sharing photos, video, and music with friends and family. When researching locations to share media files, ask yourself the following questions:

- **Where do my original files need to reside?** Can I upload from my computer, mobile device, or camera? Can I send via text message or email?
- **What is the cost?** Is the service free, or must I pay a monthly or annual fee? What happens to my files if I miss a payment or cancel my account?
- **How do I access and share the files safely?** Is the service password protected? Can I use Facebook, Twitter, blogs, and email to share the files?
- **What privacy rights are available?** Can I determine who can access the files and see my profile? Can I use a *geotag*, which is geographical data that can pinpoint where a photo was taken?
- **Can I annotate my media?** Does the service allow me to add notes, tags, and locations?
- **Are online reviews of the services available?** What experiences have other people had using the websites? Are they generally pleased or displeased with the service's reliability and ease of use?
- **What help and website support are available?** Does the service have an extensive Help section? Are FAQs, tutorials, and user forums posted?

Photos

Some photo sharing sites have millions of images to view and possibly download. When deciding which websites to use, consider the following factors:

- **Services:** Many services allow users to print the images. They also offer photo-customizing products.
- **Tools:** Owners can create webpages and keep photos organized by using albums, titles, and tags. They also can join forums to share experiences.
- **Features:** It is efficient if you can upload many files simultaneously in one batch. Many websites allow visitors to write comments on uploaded photos.
- **Storage space:** Some services offer unlimited storage, while others may limit members to a maximum number of stored photos or limit the total storage space.

Video

With video recording available on most smartphones and cameras, virtually anyone who owns these devices can produce videos to distribute. The following features are found on popular video sharing sites:

- **Video creation:** Editing tools allow special effects, editing, titles, and descriptions.

- **Audience interaction:** On-screen and keyboard controls allow viewers to play, pause, fast-forward, and stop the videos. Audience members can rate the videos and browse specific categories.
- **Features:** Most services accept files saved in a variety of file formats, but the maximum file size may be restricted or limited.
- **Genre:** Some websites accept a wide variety of content, while others require original work.



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Music

Online social networks and personal radio stations are popular sources of music. Some of these services are for listening only, while others sell songs to download. The following features are found on music sharing sites:

- **Playlists:** Musicians and listeners can organize the songs and albums into specific categories, such as by artist or genre. In a playlist, each song can be played sequentially or shuffled to play in random order.
- **Compatibility:** Some file types will not play on specific mobile devices, so check permissible formats before attempting to upload or download songs.
- **Features:** Services show the album cover, list artist information, and provide song previews.
- **Titles:** Musicians use music hosting websites as a convenient method of distributing their works.



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Protecting Your Rights to Files You Share

When you post your files on many media sharing sites, you can give permission to people who want to use or republish your photos, documents, or other digital content for a variety of purposes. *Creative Commons* is a nonprofit organization that provides standard licensing options that owners of creative works may specify when granting permission for others to use their digital content. When posting and downloading media files, ensure you are not infringing on copyright protection. Creative Commons simplifies the process of asking for permission to reuse online content.

Discover More: Visit this chapter's free resources to learn more about photo, video, and music sharing sites, Creative Commons, and copyright protection.

- **Consider This:** Have you used photo, video, or music sharing sites? If so, which ones? How did you decide the services to use? If not, would you like to try uploading or viewing one of these websites?



BTW

Technology Innovators

Discover More: Visit this chapter's free resources to learn about the bookmarking site Pinterest and its founder, Ben Silbermann.



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Hard Drives

The term, **hard drive**, refers collectively to hard disks and SSDs. Hard drives can be internal or external. That is, they can reside inside a computer or mobile device, or they can be an external device that connects to a computer or some mobile devices. The following sections discuss the characteristics of internal and external hard disks and SSDs.

Hard Disk

A **hard disk**, also called a **hard disk drive (HDD)**, is a storage device that contains one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information. Depending on how the magnetic particles are aligned, they represent either a 0 bit or a 1 bit. Recall from Chapter 7 that a bit (binary digit) is the smallest unit of data a computer can process. Thus, the alignment of the magnetic particles represents the data.

Desktops and laptops often contain at least one hard disk. The entire hard disk is enclosed in an airtight, sealed case to protect it from contamination (Figure 8-4). Read Ethics & Issues 8-1 to consider whether governments should be able to confiscate computers and mobile devices to search the content of hard drives and other media.



Technology Innovators
Discover More: Visit this chapter's free resources to learn about the storage solutions company, Seagate, and storage pioneer, Al Shugart.

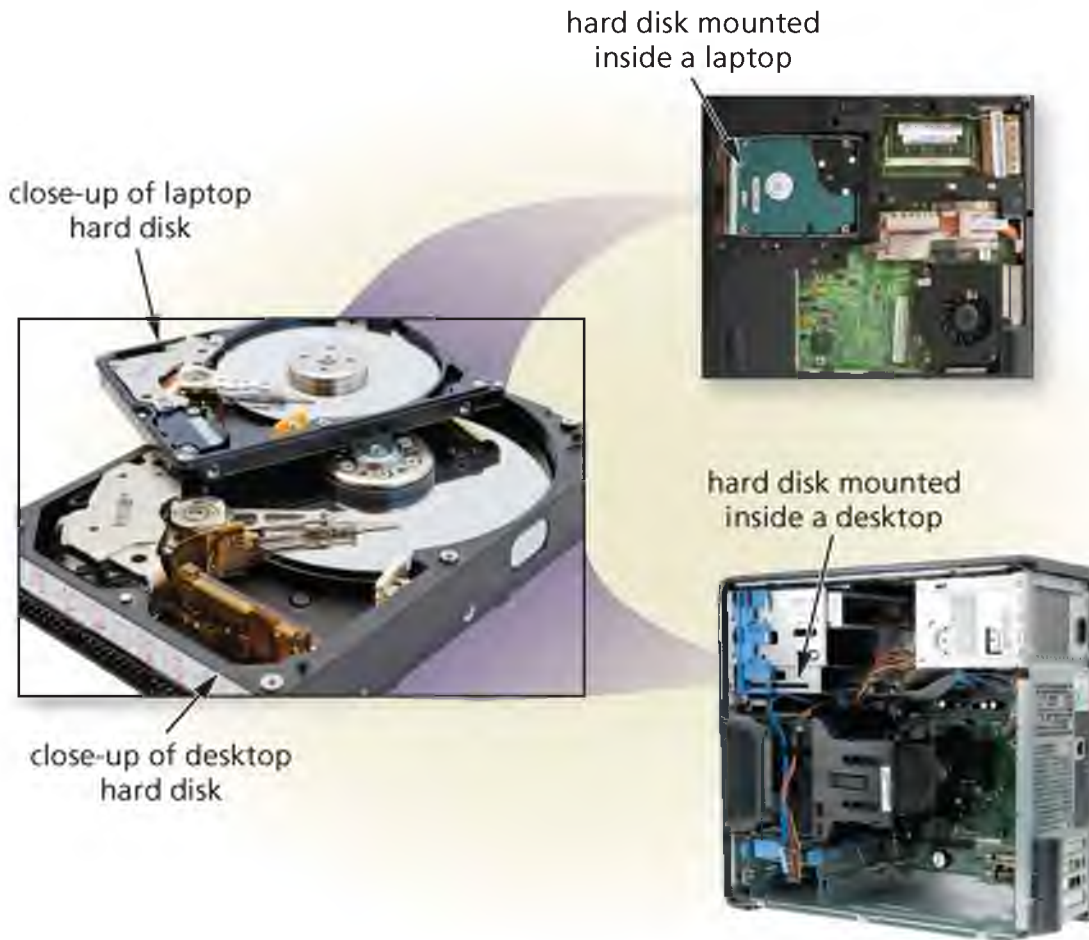


Figure 8-4 The hard disk in a personal computer is enclosed inside an airtight, sealed case. In these photos of the desktop and laptop hard disks, the top plate is removed for illustration purposes. The laptop hard disk is much smaller than the desktop hard disk.

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ETHICS & ISSUES 8-1

Is Government Search and Seizure of Computers Ethical?

In the interest of national security, the Department of Homeland Security may search and seize any computer or mobile device belonging to anyone arriving in the United States. Authorities can conduct the sometimes random searches without a warrant or even a reason. Additionally, the government has taken computers from schools and libraries in a similar manner. Authorities who confiscate computers and mobile devices for an off-site inspection may hold them for any amount of time.

The Fourth Amendment protects against unreasonable search and seizure. Yet sometimes, authorities do not return the devices and provide little or no reason for the seizure. At airports and other points

of entry to the country, the government considers computers and mobile devices to be containers, just as a piece of luggage is a container. Authorities, therefore, can search and seize computers and mobile devices without reasonable suspicion, just as they can with luggage.

Opponents claim that users may be unaware of some of the contents of a hard drive, such as with a shared or repurposed computer or device. Users also may not realize that the media on the computer or mobile device contains Internet search history, access to cloud storage, online social network activity, deleted email messages and documents, and drafts of email messages or documents that they never sent or saved. Opponents also claim that the government should be able to inspect the hardware but

not the contents of memory or a hard drive. Librarians and school administrators have stated that the government is invading the privacy of patrons and students. Privacy experts warn that, even without physically inspecting a computer or device, the government may still be able to access digital content you save, search for, or post.

Consider This: Is government search and seizure of computers without a warrant ethical? Why or why not? Do you believe a government employee should have the power to inspect the data on your mobile computer or device? Why or why not? If memories or thoughts someday are decipherable by a computer at a security checkpoint, should it be legal for the government to scan them? Why or why not?

Internet Research

What is the largest storage capacity available today for hard disks?

Search for: largest hard disk

The storage capacity of hard disks varies and is determined by the number of platters the hard disk contains, the composition of the magnetic coating on the platters, whether it uses longitudinal or perpendicular recording, and its density.

- A *platter* is made of aluminum, glass, or ceramic and has a thin coating of alloy material that allows items to be recorded magnetically on its surface.
- *Longitudinal recording* aligns the magnetic particles horizontally around the surface of the disk. With *perpendicular recording*, by contrast, hard disks align the magnetic particles vertically, or perpendicular to the disk's surface, making much greater storage capacities possible.
- *Density* is the number of bits in an area on a storage medium. A higher density means more storage capacity.

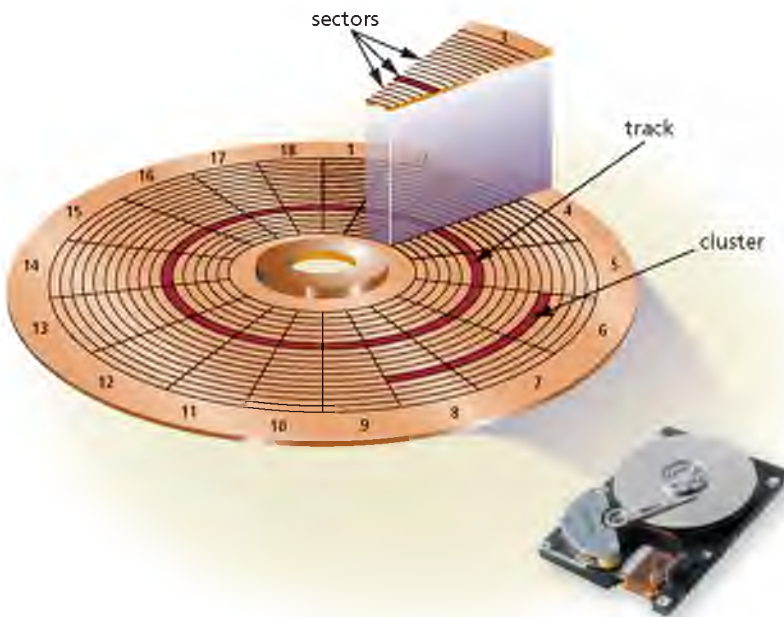


Figure 8-5 Tracks form circles on the surface of a hard disk. The disk's storage locations are divided into wedge-shaped sections, which break the tracks into small arcs called sectors. Several sectors form a cluster.

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Hard disks are read/write storage media. That is, you can read from and write on a hard disk any number of times. Before any data can be read from or written on a hard disk, however, the disk must be formatted. *Formatting* is the process of dividing the disk into tracks and sectors (Figure 8-5) so that the operating system can store and locate data and information on the disk. A *track* is a narrow recording band that forms a full circle on the surface of the disk. The disk's storage locations consist of wedge-shaped sections, which break the tracks into small arcs called *sectors*. On a hard disk, a sector typically stores up to 512 bytes of data. Sometimes, a sector has a flaw and cannot store data. When you format a disk, the operating system marks these bad sectors as unusable.

On desktops, the platters most often have a form factor (size) of approximately 3.5 inches in diameter. On laptops, mobile devices, and some servers, the form factor is 2.5 inches or less. A typical hard disk has multiple platters stacked on top of one another. Each platter has two read/write heads, one for each side. A **read/write head** is the mechanism that reads items and writes items in the drive as it barely touches the disk's recording surface. A head actuator on the hard disk attaches to arms that move the read/write heads to the proper location on the platter (Figure 8-6).

While the computer is running, the platters in the hard disk rotate at a high rate of speed. This spinning, which usually is 5,400 to 15,000 *revolutions per minute (rpm)*, allows nearly instant access to all tracks and sectors on the platters. The platters may continue to spin until power is removed from the computer, or more commonly today, the platters stop spinning or slow down after a specified time to save power. The spinning motion creates a cushion of air between the platter and its read/write head. This cushion ensures that the read/write head floats above the platter instead of making direct contact with the platter surface. The distance between the read/write head and the platter is about two-millionths of one inch.

How a Hard Disk Works

Step 1

The circuit board controls the movement of the head actuator and a small motor.

Step 2

A small motor spins the platters while the computer is running.

Step 3

When software requests disk access, the read/write heads determine the current or new location of the data.

Step 4

The head actuator positions the read/write head arms over the correct location on the platters to read or write data.

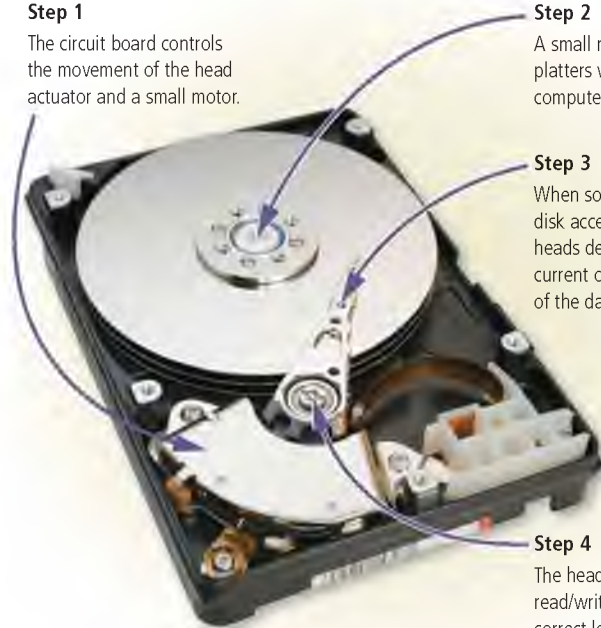


Figure 8-6 This figure shows how a hard disk works.
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CONSIDER THIS

What happens if dust touches the surface of a platter on a hard disk?

Because of the close clearance between the read/write head and the platter on a hard disk, dust, dirt, hair, smoke, or any other contaminant could cause a disk to crash (Figure 8-7). A *head crash* occurs when a read/write head touches the surface of a platter, usually resulting in a loss of data or sometimes loss of the entire disk.

Although current internal hard disks are built to withstand shocks and are sealed tightly to keep out contaminants, head crashes occasionally still do occur. Thus, it is crucial that you back up a hard disk regularly.

Internet Research

Can you recover data after a disk crash?

Search for: disk crash recovery

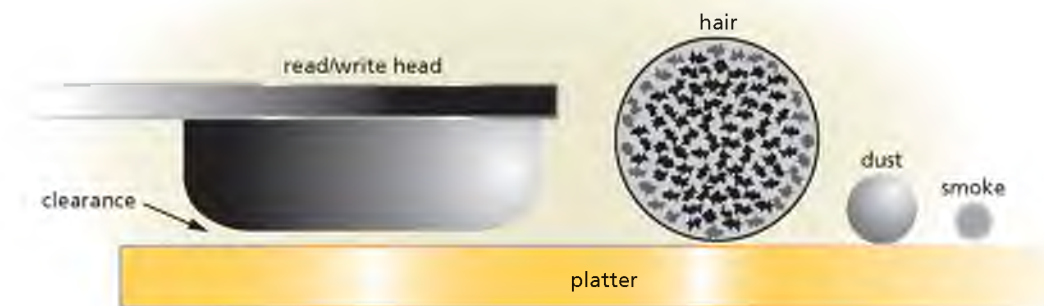


Figure 8-7 The clearance between a hard disk read/write head and the platter is about two-millionths of an inch. Any contaminant could render the disk unusable.

© Cengage Learning

**High-Tech Talk**

Discover More: Visit this chapter's free resources to learn how data is recovered.

Most manufacturers guarantee their hard disks to last approximately three to five years. Many last much longer with proper care. To prevent the loss of items stored on a hard disk, you regularly should perform preventive maintenance such as defragmenting or scanning the disk for errors. Read How To 8-1 for instructions about defragmenting a hard disk.

Discover More: Visit this chapter's free resources to learn more about adding a second hard drive to a computer, hard disk storage capacity, sectors, read/write heads, and disk cache.

HOW TO 8-1**Defragment a Hard Disk**

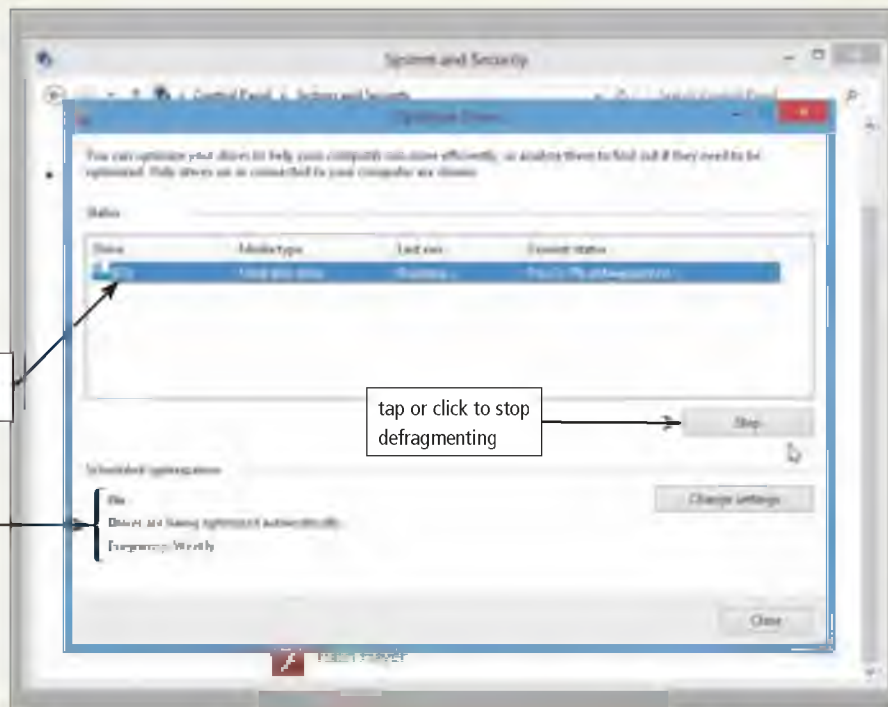
As discussed in Chapter 4, defragmenting a hard disk can improve your computer's performance by storing all related files for a particular program together. This can reduce the amount of time it takes the hard disk to locate and access the files necessary for programs to run. Windows has a built-in tool to defragment a computer's hard disk. Because the Mac OS defragments files automatically and writes smaller files closer together, Mac users generally do not have to defragment their hard

disks. The following steps describe how to defragment a hard disk using the Windows operating system.

1. Open the Control Panel window.
2. Tap or click the Control Panel link on the Settings menu to display the Control Panel.
3. Tap or click the 'System and Security' link.
4. If necessary, scroll to display the 'Defragment and optimize your drives' link.
5. Tap or click the 'Defragment and optimize your drives' link.

6. Tap or click the hard disk you wish to defragment.
7. Tap or click the Optimize button to begin defragmenting the selected hard disk. This process may take from several minutes to more than one hour.

Consider This: What other tools can help optimize the performance of your computer?

**Internet Research**

What is the largest storage capacity available today for SSDs?

Search for: largest ssd

SSDs

An **SSD (solid-state drive)** is a flash memory storage device that contains its own processor to manage its storage (Figure 8-8). As discussed in Chapter 6, flash memory is a type of non-volatile memory that can be erased electronically and rewritten. Flash memory chips are a type of *solid-state media*, which means they consist entirely of electronic components, such as integrated circuits, and contain no moving parts. The lack of moving parts makes flash memory

storage more durable and shock resistant than other types of media, such as magnetic hard disks or optical discs.

SSDs may be in the form of flash memory chips installed directly on a motherboard or an adapter card. They also may be housed in a separate casing that attaches to the motherboard, as shown in Figure 8-8, which are available in a variety of form factors including 3.5 inches, 2.5 inches, and 1.8 inches. SSDs are used in all types of computers, including servers, desktops, laptops, tablets, and a variety of mobile devices, such as portable media players and DV cameras. Some computers have both a hard disk and an SSD. Read How To 8-2 for instructions about transferring files from one internal hard drive to another.

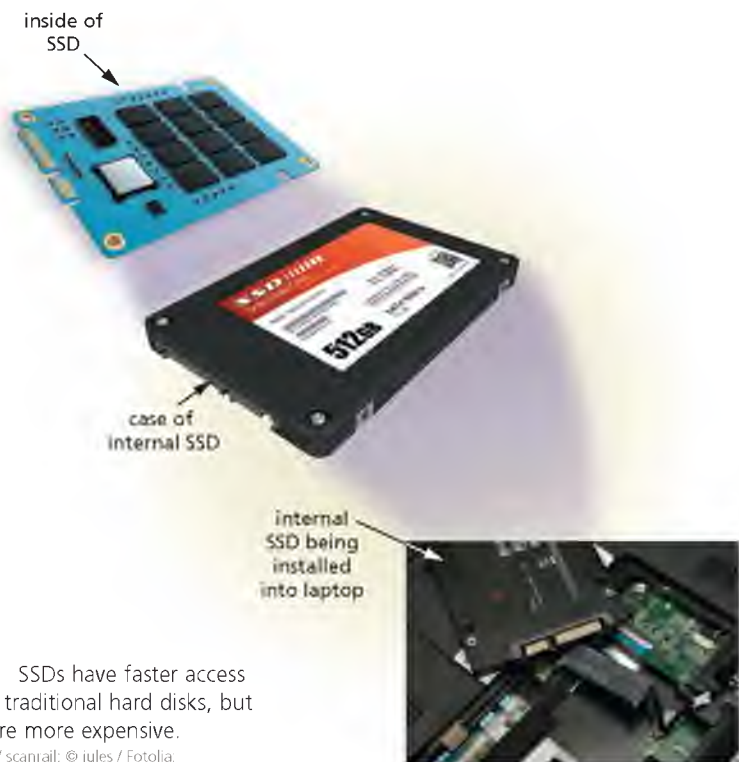


Figure 8-8 SSDs have faster access times than traditional hard disks, but they also are more expensive.

© iStockPhoto / scamail; © jules / Fotolia, © JIPEN / Shutterstock.com

HOW TO 8-2

Transfer Files from One Internal Hard Drive to Another

If you are replacing an existing internal hard drive (hard disk or SSD), you may want to transfer the files from one internal hard drive to another. The following list describes ways to transfer files from one internal hard drive to another.

- Connect the new internal hard drive as a second internal hard drive in your computer (refer to your computer's documentation to learn more about how to purchase and install a hard drive). When the operating system finishes loading, use the file manager in the operating system to drag the files you want to transfer from the original internal hard drive to the second one.
- Use a docking station or an external enclosure to connect the second internal hard drive to the computer that contains the original internal hard drive. (An enclosure is a case

that contains the same adapters found on a motherboard with which to connect the internal hard drive. The enclosure usually connects to a computer through a USB port. Be sure to select an enclosure that matches the dimensions and connections of your hard drive.) Use the file manager in the operating system to move or copy files from the original internal hard drive to the new one.



- Move or copy the files you want to transfer from the original internal hard drive to a separate storage device, such as a USB flash drive, or to a cloud storage provider. Next, connect the second internal hard drive and then move or copy the files from the storage device or cloud storage provider to the second internal hard drive.
- Install and run a program designed to transfer files from an old internal hard drive to a new one. Some programs not only will transfer files but also may transfer programs and settings.

Consider This: If you are purchasing a new internal hard drive, what types of files might you want to transfer from your existing internal hard drive? What types of files would you not transfer? Why?

SSDs have several advantages over traditional (magnetic) hard disks, including the following:

- Faster access times (can be more than 100 times faster)
- Faster transfer rates
- Quieter operation
- More durable
- Lighter weight
- Less power consumption (leads to longer battery life)
- Less heat generation
- Longer life (more than 10 times longer)
- Defragmentation is not required

Internet Research

Where might you buy a hard drive enclosure?

Search for: purchase hard drive enclosure

BTW

SSD Access Times

You do not need to defragment an SSD because the location of the stored data has no impact on its access times.

CONSIDER THIS

Why do SSDs have faster access times than hard disks?

Access time on a hard disk depends on the location of the data. That is, the data on the platter near the read/write head is accessed faster. The data on an SSD, by contrast, can be accessed almost instantly wherever it is located because the drive contains no moving parts.

The disadvantages of SSDs are that they typically have lower storage capacities than hard disks, data recovery in the event of failure can be more difficult than for traditional hard disks, and their cost is higher per gigabyte. In order to keep the price of a laptop affordable, laptops with SSDs usually have a lower storage capacity than laptops with a traditional hard disk.

CONSIDER THIS

Which should you use, a hard disk or SSD?

You may want to opt for a hard disk if you are looking for a looking for the lowest-cost option, use the computer or mobile device only for basic tasks at one location, or if you require a large amount of storage space on a hard drive, such as for high-end media. If you transport the computer or mobile device frequently, want faster access to stored items, need a quieter drive (such as for audio recording), you may want to choose an SSD. Another option is a dual-drive computer, that is, one that includes both a hard disk and SSD, so that you can take advantage of the benefits of both drives.

Discover More: Visit this chapter's free resources to learn more about SSDs.

External Hard Drives

An **external hard drive** is a separate freestanding storage device that connects with a cable to a USB port or other port on a computer or mobile device (Figure 8-9). Both hard disks and SSDs are available as external hard drives.

Sizes and storage capacities of external hard drives vary, with some having greater capacities than internal hard drives. Smaller external hard drives are portable and enable mobile users to transport photos and other files from one computer to another easily. As with an internal hard drive, an entire external hard drive is enclosed in an airtight, sealed case. External hard drives units can include multiple hard drives that you can use for different purposes, if desired.



Figure 8-9 Examples of external hard drives.
Courtesy of Western Digital; Courtesy of LaCie

CONSIDER THIS

Why would you use an external hard drive instead of a second internal hard drive?

Although the transfer rate of external hard drives usually is slower than that of internal hard drives, external hard drives do offer many advantages over internal hard drives:

- Transport a large number of files.
- Back up important files or an entire internal hard drive (most external hard drive models include backup software).
- Easily store large audio and video files.
- Secure your data; for example, at the end of a work session, you can relocate or lock up an external hard drive, leaving no data in a computer. Read Secure IT 8-1 for instructions about encrypting files or drives to protect data.
- Add storage space to a mobile computer, such as a laptop or tablet.
- Add storage space to a desktop without having to open the case or connect to a network.

SECURE IT 8-1

Encrypting Data and Files on Storage Devices

Hard drives and other storage devices are necessary tools for keeping, backing up, and transporting data and files. If they fall into the wrong hands, however, the data may be unprotected and subject to unrestricted access. Encryption encodes the data so that only authorized people can access the data.

Some operating systems provide a feature allowing users to encrypt individual files, folders, or the entire contents of a hard drive or external storage device. In addition, third-party programs are designed to encrypt data.

While each program may use a different method of encrypting files, they all use the process of cryptography. Mathematical functions, called algorithms, scramble the data. A password generally is needed to decrypt, or reassemble, this data. If this password is lost, the program or operating system's documentation may identify a procedure that allows users to access the encrypted files. In some cases, however, the software will not decrypt the files without the password, so people might reconsider encryption if they anticipate great risk when losing access to these files.

Encrypted files offer security, but users might notice that the operating system may require more time to open and access encrypted files. While no encryption program is infallible, security experts recommend using this process to protect individual files, folders, or entire storage media with personal or sensitive information.


 **Consider This:** What types of files would you encrypt on media in or attached to your computer or mobile device? Would you consider not using encryption in the chance that you might lose the password?



Figure 8-10 An example of RAID for the home or small business user.

Courtesy of LaCie

Internet Research

How much does RAID cost for the home user?

Search for: raid home storage



Serial versus Parallel

With serial transfers, data is sent one bit at a time. Parallel transfers, by contrast, send several bits at once.



CONSIDER THIS

How do drives connect to a computer?

A *controller*, formerly called a disk controller, consists of a special-purpose chip and electronic circuits that control the transfer of data, instructions, and information from a drive to and from the system bus and other components in the computer. The controller may be part of a drive, may be on the motherboard, or may be a separate adapter card inside the computer.

In personal computer advertisements, vendors usually state the type of interface supported by the controller. In addition to USB, which can function as an interface for an external hard drive, four other types of interfaces for use in personal computers are EIDE, SCSI, SAS, and SATA.

- *EIDE* (Enhanced Integrated Drive Electronics) is an interface that uses parallel signals to transfer data, instructions, and information. EIDE interfaces provide connections for hard disks, SSDs, RAID, optical disc drives, and tape drives.
- Like EIDE, *SCSI* (Small Computer System Interface) also uses parallel signals, but can support up to 8 or 15 peripheral devices. Supported devices include hard disks, SSDs, RAID, optical disc drives, tape drives, printers, scanners, network cards, and more.
- *SAS* (*serial-attached SCSI*) is a type of SCSI that uses serial signals to transfer data, instructions, and information. Advantages of SAS over parallel SCSI include thinner, longer cables; reduced interference; lower cost; support for many more connected devices at once; and faster speeds. SAS interfaces support connections to hard disks, SSDs, RAID, optical disc drives, printers, scanners, digital cameras, and other devices.
- *SATA* (Serial Advanced Technology Attachment) uses serial signals to transfer data, instructions, and information. The primary advantage of SATA interfaces is that their cables are thinner, longer, more flexible, and less susceptible to interference than cables that use parallel signals. SATA interfaces support connections to hard disks, SSDs, RAID, and optical disc drives. External drives can use the *eSATA* (external SATA) interface, which is much faster than USB.

Discover More: Visit this chapter's free resources to learn more about drive interfaces.



NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Storage and Hard Drives, as it relates to the chapter objectives.

Now you should know ...

- When you would use storage and when you use memory (Objective 1)
- What type of internal hard drive you would find in a desktop or laptop (Objective 2)
- Why you would use an SSD (Objective 3)
- Why you would use an external hard drive or RAID (Objective 4)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Portable Flash Memory Storage

In addition to SSDs discussed in the previous section, two other widely used types of flash memory storage include memory cards and USB flash drives. Users opt for memory cards and USB flash drives because they are portable.

Memory Cards

Memory cards enable mobile users easily to transport digital photos, music, videos, or other files to and from mobile devices and computers or other devices. As mentioned in Chapter 1, a **memory card** is a removable flash memory storage device, usually no bigger than 1.5 inches in height or width, that you insert in and remove from a slot in a computer, mobile device, or card reader/writer (Figure 8-11).



Technology Innovator
Discover More: Visit this chapter's free resources to learn about SanDisk (maker of flash memory products).

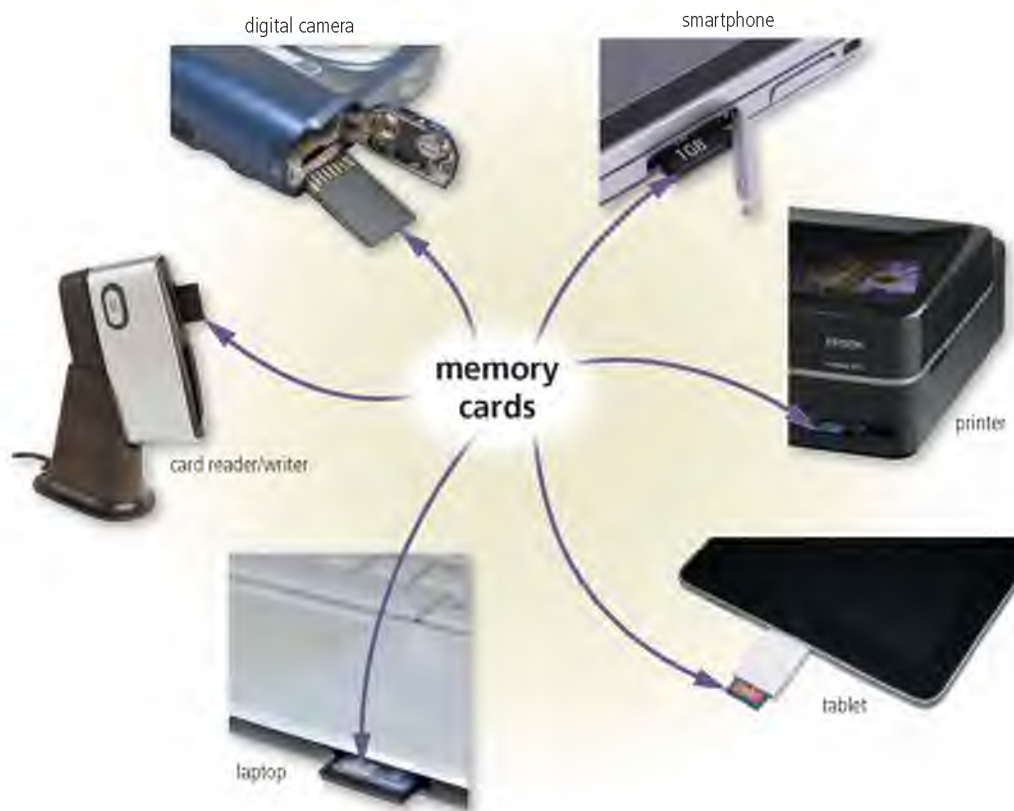


Figure 8-11 Many types of computers and devices have slots for memory cards.

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Common types of memory cards include **SDHC (Secure Digital High Capacity)**, **SDXC (Secure Digital Expanded Capacity)**, **miniSD**, **microSDHC**, **microSDXC**, **CF (CompactFlash)**, **xD Picture Card**, **Memory Stick PRO Duo**, and **M2 (Memory Stick Micro)**. Capacities of memory cards vary. A slot on a computer or device often accepts multiple types of cards. For example, an SD slot will accept an SDHC and SDXC card. To read a mini or micro card in a computer, you insert it in an adapter that fits in a standard-sized slot on the computer or device (shown in Figure 8-1 at the beginning of this chapter).

If your computer or printer does not have a built-in card slot, you can purchase a *card reader/writer*, which is a device that reads from and writes on memory cards. Card reader/writers usually connect to the USB port on a computer. The type of card determines the type of card reader/writer needed. Some accept multiple types of cards; others accept one type. Figure 8-12 shows how one type of memory card works with a card reader/writer.

How SD Cards Work

Step 1

When you insert a memory card in a card reader/writer or card slot, the memory card's metallic conductors make contact with connectors in the card reader/writer or card slot, allowing the transfer of photos and other items between the card and the reading/writing device.



Step 4

Some memory cards contain write-protect switches, which prevent you from accidentally erasing photos and other items stored on the flash memory chips.



Step 2

A notch on the side of the memory card prevents the card from accidentally slipping out of the card reader/writer or card slot.

Step 3

Flash memory chips store photos and other types of data and information. When requested, the controller transfers items stored on the flash memory chips to the metallic conductors, using registers for temporary storage, as needed.

Figure 8-12 This figure shows how an SD card works.

© iStockphoto/Hugo Oswald Lara Gamez; Courtesy of Kingston Technology Company Inc.; © Cengage Learning



CONSIDER THIS

What is the life span of a memory card?

Depending on the card, manufacturers claim their media can last from 10 to 100 years with proper care, including the following:

- Do not bend the card.
- Avoid dropping the card.
- Keep cards away from direct sunlight.
- Do not expose cards to extreme temperatures.
- Do not remove the card while data is transferring to or from it.

Internet Research

Which memory cards are best?

Search for: memory card reviews

Discover More: Visit this chapter's free resources to learn more about memory cards.

USB Flash Drives

Internet Research

What is the largest USB flash drive storage capacity available today?

Search for: largest usb flash drive

As mentioned in Chapter 1, a **USB flash drive**, sometimes called a *thumb drive*, is a flash memory storage device that plugs in a USB port on a computer or mobile device (Figure 8-13). USB flash drives are convenient for mobile users because they are small and lightweight enough to be transported on a keychain or in a pocket. With a USB flash drive, users easily transfer documents, photos, music, and videos from one computer to another. Storage capacities of USB flash drives vary. Read Secure IT 8-2 for pointers about safely removing a USB flash drive and other media.

Discover More: Visit this chapter's free resources to learn more about USB flash drives.



Figure 8-13 A close-up of the flash memory and circuitry inside a USB flash drive.

© Jeyaraj/ Shutterstock.com; © Stockbyte/Getty; © Cengage Learning

SECURE IT 8-2

Safely Remove Media

If you are using portable flash memory storage with your computer or mobile device, you should not remove the device or media while it is in use. Likewise, you should not remove a smartphone, digital camera, or portable media player that actively is connected to your computer. Although you might not be accessing files, the operating system still might be accessing the device, and disconnecting it may damage the files.

Operating systems typically provide an option to remove or eject the device or media safely and then will notify you when the device or media no longer is in use and can be removed. To remove or eject removable storage media, follow these steps:

1. Close any files or exit any programs that are open or running on the media.
2. Open the window displaying all the drives and media connected to your computer or mobile device and then select the drive or media you want to remove safely.
3. Tap or click the command to safely remove or eject the removable storage media. (If you are unable to locate this command, you may need to press and hold or right-click the icon representing the device or media to display a shortcut menu and then tap or click the command to remove or eject the device or media safely.)
4. When the notification appears stating that the device or media is safe to remove or eject, disconnect or remove it from your computer. If a notification does not appear, you can disconnect or remove the device or media once it no longer appears

in your operating system as connected to your computer.

These guidelines generally apply to all types of portable flash memory storage, including USB flash drives, memory cards, and solid-state drives. When handling these storage devices, do not subject them to extreme temperatures, moisture, dust, or static electricity. Store them in cases, and try to avoid dropping them.

Consider This: Do you follow the guidelines described here before disconnecting portable flash memory storage, smartphones, digital cameras, and portable media players from your computer? If not, have you encountered damaged files on your storage devices? Should storage companies provide instructions on their packaging materials about how to remove media safely?

Cloud Storage

Some users choose cloud storage in addition to storing data locally on a hard disk, SSD, or other media. As discussed in previous chapters, **cloud storage** is an Internet service that provides storage to computer or mobile device users.

Cloud storage is available for home and business users, with various levels of storage services available. Cloud storage fee arrangements vary, depending on the user's storage requirements.

Internet Research

Which cloud storage providers are the best?

Search for: cloud storage reviews



CONSIDER THIS

What are some advantages of cloud storage?

Users subscribe to cloud storage for a variety of reasons:

- To access files on the Internet from any computer or device that has Internet access
- To store large audio, video, and graphics files on the Internet instantaneously, instead of spending time downloading to a local hard drive or other media
- To allow others to access their files on the Internet so that others can listen to an audio file, watch a video clip, or view a photo — instead of sending the file to them via an email message
- To view time-critical data and images immediately while away from the main office or location; for example, doctors can view X-ray images from another hospital, home, or office, or while on vacation
- To store off-site backups of data
- To provide data center functions, relieving enterprises of this task



CONSIDER THIS

What is a personal cloud?

Some hard drive manufacturers sell networked hard drives that make your data available on a cloud that exists within your home or office. That is, the networked hard drive connects directly to your router, creating a *personal cloud* that allows you to access its files over the Internet. With a personal cloud, you maintain the storage device on which the files are located versus a cloud storage provider where your files are stored on servers on the Internet that a cloud storage provider configures, maintains, and backs up.



Technology Innovators
Discover More: Visit this chapter's free resources to learn about Amazon, and its founder, Jeff Bezos.

Mini Feature 8-2: Services Offered by Cloud Storage Providers

Cloud storage provides access to your files across many devices. Read Mini Feature 8-2 to learn about services provided by cloud storage providers.



MINI FEATURE 8-2

Services Offered by Cloud Storage Providers

Microsoft OneDrive, Google Drive, Apple's iCloud, Amazon Cloud Drive, Dropbox, and Box are among the many options that consumers consider for cloud storage. These and other cloud storage providers enable you to synchronize files, write documents, back up files on your computer or mobile device, share project work, stream music, post photos, and play games online. Many offer a limited amount of free storage and make additional storage available for a fee.



© iStockPhoto/Aaltazar

Synchronize Files

Many cloud storage providers place a folder on your computer with contents you can synchronize across multiple devices. Other providers allow you to upload files for storage online, and download them via a web app or mobile app. Cloud storage providers often retain previous versions of your files, in case you need to revert to an earlier one.

Write Documents

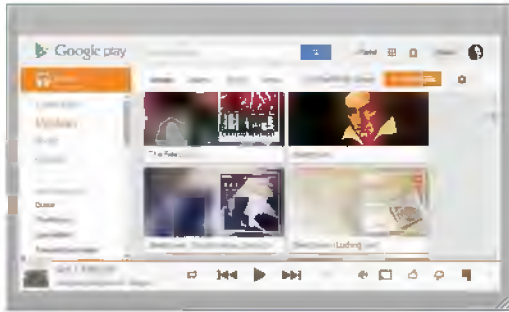
Google Drive and OneDrive provide integrated web apps to edit documents in a browser and store them on the cloud. Some third-party tools such as Evernote, an online note taking application, synchronize your notes with popular cloud storage providers.

Back Up Files

Storing files on the cloud is an easy way to back them up in case the hard drive on your computer fails or your mobile device is lost, stolen, or damaged. Some cloud backup services, such as Carbonite, automatically copy a computer or mobile device's new or changed files to the cloud, freeing users of performing backups themselves. Backup providers generally do not synchronize files across a user's multiple devices, but only provide capabilities to store and retrieve files on the cloud.

Stream Music

You can play music and videos stored offline (i.e., on your computer or mobile devices) in places without Internet access. Many people also store their media files on the cloud, so as not to use up the limited internal storage available on mobile devices. Some services, such as Google Play, support streaming music stored on the cloud to Android, iOS, and other devices.



Courtesy of Farrel Buchinsky; Source: Google, Inc.

Post Photos

Photo sharing sites and online social networks provide apps that support uploading photos taken with a smartphone or tablet to the cloud.

Play Games

Internet-connected game consoles enable you to save games in progress. Because game information is stored on the cloud, you can continue playing where you left off, regardless of whether you are using your own or another's game console.

Evaluating Providers

With so many providers offering free and paid cloud storage services, it is important to compare features to take advantage of the capabilities that each offers. Criteria to consider include the amount of free storage offered,

the cost to purchase more if needed, and the maximum file size that each service allows you to upload. Keep the files you use most on the service on which you have the most storage space; use services that support streaming to store and play media files. Photos, songs, and videos take longer to upload than smaller text or webpage files, so it is important to select a provider whose servers have sufficient bandwidth to support large file transfers.

It also is important to read a cloud storage provider's privacy policy and terms of agreement to which you must consent before using its services. Some cloud storage providers may not guarantee the protection of the files you upload, so you still should keep a backup of the files you stored on the cloud. Read How To 8-3 to learn about selecting a cloud storage provider and deciding what to upload.

Discover More: Visit this chapter's free resources to learn more about cloud storage providers and their offerings.

Consider This: What are advantages of storing your files on the cloud? When does it make sense to use physical storage media, such as a USB flash drive, to store your files? Storing files on the cloud encourages collaboration and sharing. How can you share files stored on the cloud with your team members? Are you concerned about the security of your files when stored on the cloud? What information, if any, would you not store on the cloud?

HOW TO 8-3

Select a Cloud Storage Provider and Decide What to Upload to the Cloud

Many people are choosing to back up data to the cloud in addition to, or instead of, backing up to storage media such as external hard drives and optical discs. Cloud storage providers enable you to synchronize data on your computers and mobile devices effortlessly to one or more servers in remote locations. Various cloud storage providers exist, and it is important to select one that adequately meets your needs. In addition to selecting a cloud storage provider, you also should decide what to upload to the cloud.

Selecting a Cloud Storage Provider

Consider the following guidelines when selecting a cloud storage provider:

- Verify the company is reputable and has been in business for an extended period of time.
- Choose a provider that encrypts your files.
- Make sure the company has not fallen victim to major security breaches.

- Determine whether the provider's service is compatible with your computer(s) and mobile device(s).
- Compare the price of various storage plans and choose a provider that offers competitive pricing.
- Verify the cloud storage provider will support the types of files you want to back up. For example, some cloud storage providers might allow you only to back up photos, so they would not be a good choice to back up your personal files, such as documents and spreadsheets.
- If desired, choose a cloud storage provider that allows you to share selected files with others.
- Consider whether the provider offers a mobile app that you can use to access your files using a mobile device.

Deciding What to Upload to the Cloud

Consider the following guidelines when determining what to upload to the cloud. Before ultimately deciding what to upload, make sure the cloud storage provider you choose will adequately protect your files.

- Consider uploading files that you cannot afford to lose, such as financial documents or scanned copies of insurance paperwork.
- Upload files that might have sentimental value, such as photos and video. In the unlikely event of a disaster that ruins your computer, mobile device, and backups you possess, the cloud storage provider will retain these files.
- Do not back up programs and apps if you have access to the installation media or files.
- If your cloud storage provider offers only a limited amount of storage space, back up only the files you are sure you will need again in the future.
- Routinely review the files you have stored on the cloud storage provider and remove files you no longer need.

Consider This: Which of your files would you back up to the cloud? Why? After reviewing at least three cloud storage providers, which one would you choose? Why?

Optical Discs

An **optical disc** is a type of storage medium that consists of a flat, round, portable disc made of metal, plastic, and lacquer that is written and read by a laser. Optical discs used in computers typically are 4.75 inches in diameter and less than 1/20 of an inch thick. Game consoles and mobile devices, however, may use a *mini disc* that has a diameter of 3 inches or less; mini discs also work in standard-sized optical disc drives. Three widely used types of optical discs are CDs (compact discs), DVDs (digital versatile discs or sometimes digital video discs), and Blu-ray Discs.



Figure 8-14 An optical disc in a disc drive.
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On some computers, you push a button to slide out a tray, insert the disc, and then push the same button to close the tray; others are slot loaded, which means you insert the disc in a narrow opening on the drive (Figure 8-14). When you insert the disc, the operating system automatically may run a program, play music, or start a video on the disc. Desktops and traditional laptops usually have an optical disc drive. Ultrathin laptops, tablets, and mobile devices typically do not have an optical disc drive.

Many different formats of optical discs are available today. Some are read only, meaning users cannot write (save) on the media. Others are read/write, which allows users to save on the disc just as they save on a hard drive. With most discs, you can read and/or write on one side only.

Manufacturers usually place a silk-screened label on the top layer of these single-sided discs. You insert a single-sided disc in the drive with the label side up.

Characteristics of Optical Discs

Optical discs store items by using microscopic pits (indentations) and lands (flat areas) that are in the middle layer of the disc (Figure 8-15). A high-powered laser light creates the pits. A lower-powered laser light reads items from the disc by reflecting light through the bottom of

How a Laser Reads Data on an Optical Disc

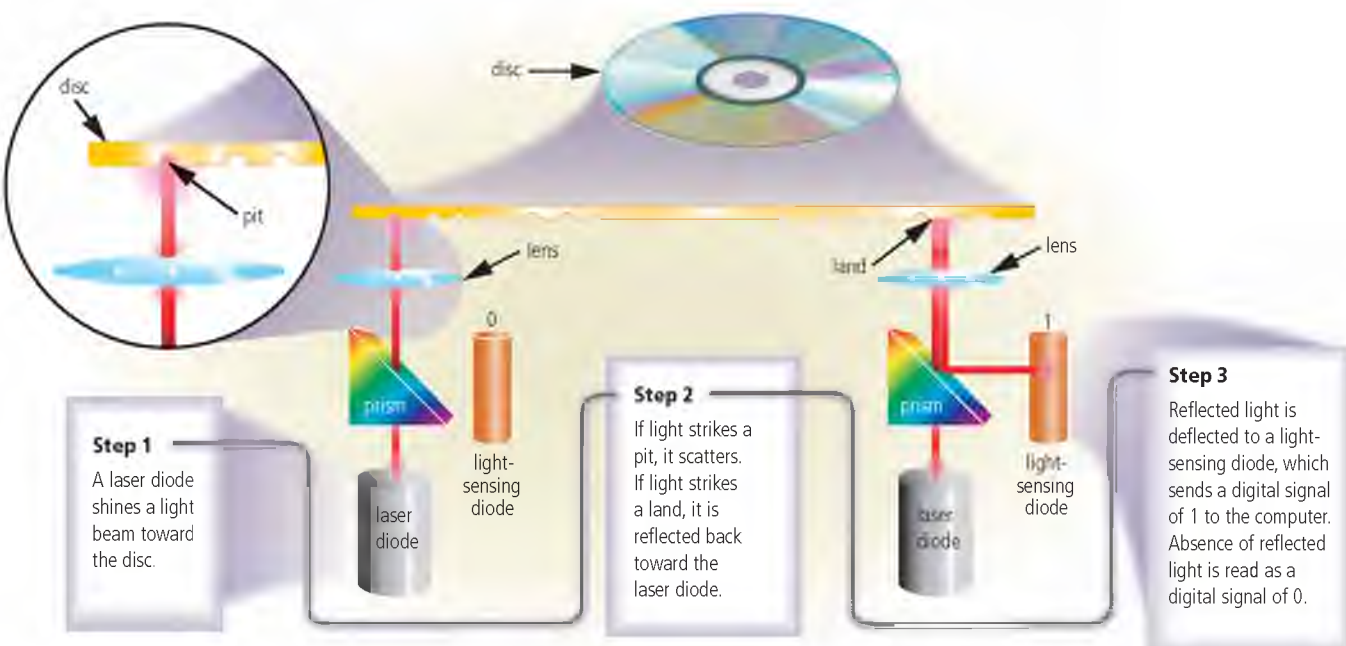


Figure 8-15 This figure shows how a laser reads data on an optical disc.
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the disc. The reflected light is converted into a series of bits the computer can process. A land causes light to reflect, which is read as binary digit 1. Pits absorb the light; this absence of light is read as binary digit 0.

Optical discs commonly store items in a single track that spirals from the center of the disc to the edge of the disc. As with a hard disk, this single track is divided into evenly sized sectors on which items are stored (Figure 8-16).

Discover More: Visit this chapter's free resources to learn more about optical disc formats.

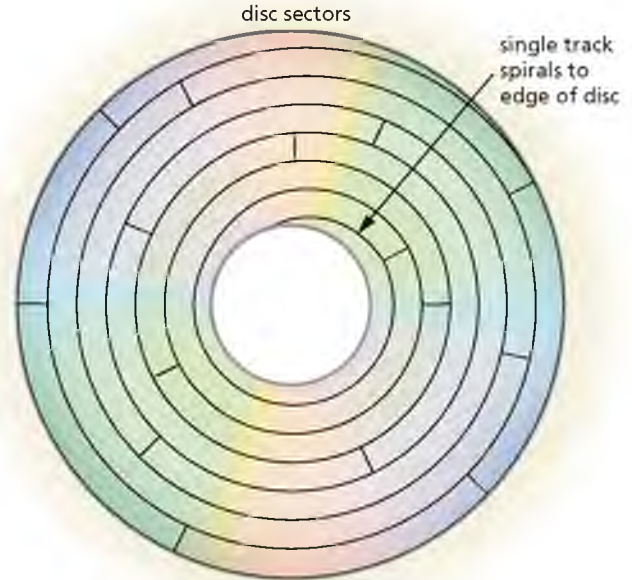


Figure 8-16 An optical disc typically stores data, instructions, and information in a single track that spirals from the center of the disc to the edge of the disc.
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CONSIDER THIS

What is the life span of an optical disc?

Manufacturers claim that a properly cared for, high-quality optical disc will last 5 years but could last up to 100 years. Tips for proper care of optical discs include the following:

- Never bend a disc; it may break.
- Do not expose discs to extreme temperatures or humidity. The ideal temperature range for disc storage is 50 to 70 degrees Fahrenheit.
- Stacking discs, touching the underside of discs, or exposing them to any type of contaminant may scratch a disc. Read How To 8-4 for instructions about cleaning and fixing scratches on a disc.
- Place an optical disc in its protective case, called a *jewel case*, when you are finished using it, and store it in an upright (vertical) position.

HOW TO 8-4

Clean an Optical Disc and Fix Scratches

If you are having trouble accessing programs and files on an optical disc, such as a CD or DVD, you may need to clean the disc or fix scratches on its surface. To avoid the risk of not being able to access a disc because it is dirty, you should clean a disc when you first notice dirt on its surface. The following steps describe how to clean or fix scratches on an optical disc:

Cleaning an Optical Disc

1. While holding the disc by its edges, use compressed air to blow excess dust off of its surface. Hold the can of compressed air upright while using it.
2. Use a soft, nonabrasive cloth to gently wipe debris off of the disc's surface. Wipe the disc from the center out to its edges.

3. If any dirt remains on the disc, dip a soft cloth or cotton ball in isopropyl alcohol (or a cleaner designed for optical discs) and then gently wipe the soiled areas.
4. Use a soft cloth to dry the disc's surface or allow it to air dry. You never should insert a wet disc in a computer.

Fixing Scratches on an Optical Disc

1. Complete the previous Steps 1 – 4 to clean the disc. If it still contains scratches, follow the remaining steps.
2. As with any maintenance you perform, risks are associated with attempting to fix scratches on an optical disc. For this reason, if possible, you should back up the data on the disc before attempting to fix a scratch.

3. Place a very small amount of rubbing compound (available at a hardware store) on a soft, nonabrasive cloth and rub the compound on the disc from its center outward at the location of the scratch. If rubbing compound is not available, place a small amount of toothpaste (not a gel) on the scratched area and rub from the inside of the disc outward.
4. Test the disc. If you still are experiencing problems because of the scratch(es), consider having a professional remove the scratch.

Consider This: What other household products can be used to clean or fix scratches on an optical disc?

CDs

CDs are available in three basic formats: read-only, recordable, and rewritable.

- A **CD-ROM** (CD-read-only memory) is a type of optical disc that users can read but not write on (record) or erase — hence, the name read-only. Manufacturers write the contents of standard CD-ROMs and distribute them to consumers. A standard CD-ROM is called a *single-session disc* because manufacturers write all items on the disc at one time. Software manufacturers sometimes distribute their programs using CD-ROMs. The term, *photo CD*, sometimes is used to refer to CDs that contain only photos.
- A **CD-R** (CD-recordable) is an optical disc on which users can write once, but not erase, their own items, such as text, graphics, and audio. Because a CD-R can be written on only one time, the format of these discs sometimes is called *WORM* (write once, read many). Some CD-Rs are *multisession*, which means you can write on part of the disc at one time and another part at a later time — if the disc has free space.
- A **CD-RW** (CD-rewritable) is an erasable multisession disc users can write on multiple times. CD-RW overcomes the major disadvantage of CD-R because it allows users to write and rewrite data, instructions, and information on the CD-RW disc multiple times — instead of just once. Reliability of the disc tends to drop, however, with each successive rewrite.

A popular use of CD-RW and CD-R discs is to create audio CDs. For example, you can record your own music and save it on a CD, purchase and download songs from the web, or rearrange tracks on a purchased music CD.



CONSIDER THIS

Can all CD drives read all CD formats?

A CD-ROM drive or a CD player may be able to read only CD-ROMs and sometimes CD-Rs. Because audio CDs and CD-ROMs use the same laser technology, you may be able to use a CD-ROM drive to listen to an audio CD while using the computer.

Most CD-R drives can read audio CDs, CD-ROMs, CD-Rs, and sometimes CD-RWs. Most CD-RW drives can read audio CDs, CD-ROMs, CD-Rs, and CD-RWs. To write on a CD-R disc, you must have a CD-R drive. Similarly, to write on a CD-RW disc, you must have a CD-RW drive.

DVDs

DVD quality for storing videos far surpasses that of CDs because items are stored in a slightly different manner, which enables DVDs to have greater storage capacities and higher resolutions than CDs. The first storage technique involves making the disc denser by packing the pits closer together. The second involves using two layers of pits. This technique doubles the capacity of the disc because the lower layer of pits is semitransparent, which allows the laser to read through it to the upper layer. Finally, some DVDs are double-sided. A more expensive DVD format is **Blu-ray**, which has a higher capacity and better quality than standard DVDs, especially for high-definition audio and video.

As with CDs, DVDs are available in three basic formats: read-only, recordable, and rewritable.

- A **DVD-ROM** (DVD-read-only memory) is a high-capacity optical disc that users can read but not write on or erase. Manufacturers write the contents of DVD-ROMs and distribute them to consumers. DVD-ROMs store movies, music, music videos, huge databases, and applications you install on a computer.
- **DVD-R** and **DVD+R** are competing DVD-recordable WORM formats, on which users can write once but not erase their own items, including video, audio, photos, graphics, and text.
- **DVD-RW**, **DVD+RW**, and **DVD+RAM** are competing DVD-rewritable formats that users can write on multiple times.



BTW

Burning and Ripping

The process of writing on an optical disc is called *burning*. The process of copying audio and/or video data from a purchased disc and saving it on your own media is called *ripping*.



BTW

DVD/CD-RW

Some drives, called DVD/CD-RW drives, are combination drives that read and write on DVD and CD media. Current computers that include optical drives often use these combination drives.

CONSIDER THIS

Can all DVD drives read all DVD formats?

No. In addition to DVD-ROMs, most DVD-ROM drives also can read audio CDs, CD-ROMs, CD-Rs, and CD-RWs. Recordable and rewritable DVD drives usually can read a variety of DVD and CD media. Blu-ray Disc (BD) drives and players are backward compatible with DVD and CD formats. Before investing in equipment, check to be sure it is compatible with the media on which you intend to record.

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Portable Flash Memory Storage, Cloud Storage, and Optical Discs, as it relates to the chapter objectives.

Now you should know ...

- Whether you should use a memory card or a USB flash drive (Objective 5)
- Why you would use cloud storage (Objective 6)
- Which optical disc format is best suited to your needs (Objective 7)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Enterprise Storage

Enterprise hardware allows large organizations to manage and store data and information using devices intended for heavy use, maximum efficiency, and maximum availability. The availability of hardware to users is a measure of how often it is online. Highly available hardware is accessible 24 hours a day, 365 days a year. To meet these needs, enterprise hardware often includes levels of *redundancy*, which means that if one component fails or malfunctions, another can assume its tasks.

Some organizations manage an enterprise storage system in-house. Others elect to offload all (or at least the backup) storage management to an outside organization or a cloud storage provider, a practice known as *outsourcing*. Enterprises use a combination of storage techniques to meet their large-scale needs, including cloud storage and some of the other previously discussed methods, along with RAID, network attached storage, storage area networks, and tape. Read Ethics & Issues 8-2 to consider issues with employees bringing their own devices into an enterprise.



Technology Trend

Discover More: Visit this chapter's free resources to learn about how organizations are digitizing nondigital media, such as microfilm and microfiche.

ETHICS & ISSUES 8-2



Are Businesses Vulnerable when Employees Use Their Own Devices to Access Company Data?

BYOD (bring your own device) strategies enable employees to access company data from a personal smartphone, tablet, or laptop. Companies might adopt or allow a BYOD policy to save money on the cost of buying and maintaining devices. Employers might increase productivity by allowing employees to work in the environment in which they are most comfortable.

BYOD raises many privacy and security concerns. IT managers, security experts, and human resource directors work together to create and enforce a BYOD policy. BYOD guidelines should balance securing company

data and preventing unauthorized network access with ensuring personal autonomy and privacy over employees' personal data. IT managers express concern over the potential need to service many different types of devices, if the company policy requires it to troubleshoot or secure employee devices. A company's security team must protect company data. In some cases, employees must install a tool to remotely wipe data, including personal data, if the device is lost, damaged, or stolen. Human resource directors help devise guidelines regarding cost-sharing and how to protect employees' private data and activities. Some industries may not be able to allow BYOD, as it may violate data privacy laws.

Many companies ban certain apps, such as gaming or file sharing, because of concerns over malware risks. In many cases, employees must agree to back up data. Employees should protect the device with a password or biometric security feature. Some companies employ a *geofence*, which is a virtual perimeter or boundary, to disable certain apps or cameras in secure areas, such as labs or meeting rooms.

Consider This: If you use your own device for work, would you be willing to give some control over the device to your company? Why or why not? Should companies be able to punish employees who violate BYOD policies? Why or why not?

Enterprise storage often uses *Fibre Channel (FC)* technology as the interface that connects the devices to the network because FC technology has much faster transmission rates than SCSI and other previously discussed interfaces.

Discover More: Visit this chapter's free resources to learn more about FC technology.



Figure 8-17 Shown here is a rack-mounted RAID chassis, including many integrated hard disks.

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High-Tech Talk

Discover More: Visit this chapter's free resources to learn more about how RAID levels optimize capacity, reliability, performance, and availability of data.

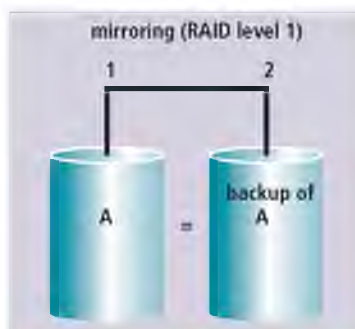
RAID

For applications that depend on reliable data access, users must have the data available when they attempt to access it. Some manufacturers provide a type of hard drive system that connects several smaller drives into a single unit that acts like a single large hard drive. As mentioned earlier in this chapter, a group of two or more integrated hard drives is called a RAID (Figure 8-17). Although RAID can be more expensive than traditional hard drives, it is more reliable. Computers and enterprise storage devices often use RAID.

RAID duplicates data, instructions, and information to improve data reliability. RAID implements this duplication in different ways, depending on the storage design, or level, being used. The simplest RAID storage design is *level 1*, called *mirroring*, which writes data on two drives at the same time to duplicate the data (Figure 8-18a). A level 1 configuration enhances storage reliability because, if a drive should fail, a duplicate of the requested item is available elsewhere within the array of drives.

Other RAID levels use a technique called *striping*, which splits data, instructions, and information across multiple drives in the array (Figure 8-18b). Striping improves drive access times, but does not offer data duplication. For this reason, some RAID levels combine both mirroring and striping.

(a)



(b)

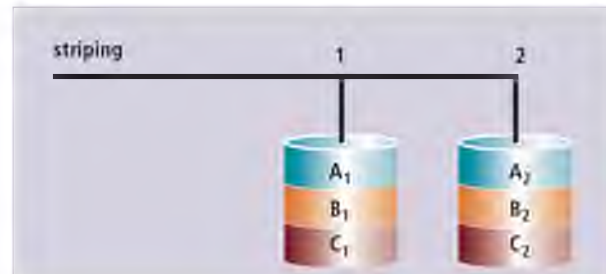


Figure 8-18 In RAID level 1, called mirroring, a backup disk exists for each drive. Other RAID levels use striping; that is, portions of each drive are placed on multiple drives.

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NAS and SAN

Network attached storage (NAS) is a server that is placed on a network with the sole purpose of providing storage to users, computers, and devices attached to the network (Figure 8-19). A network attached storage server, often called a *storage appliance*, has its own IP address, usually does not have a keyboard or display, and contains at least one hard drive, often configured in a RAID. Administrators can add storage to an existing network quickly by connecting a network attached storage server to a network.

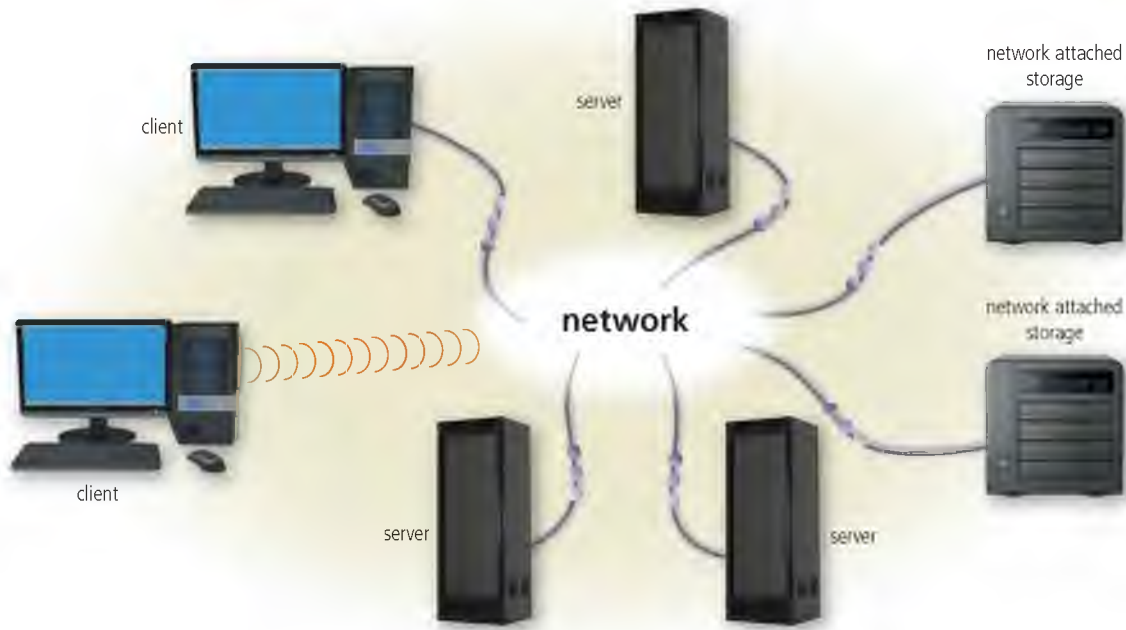


Figure 8-19 An example of how network attached storage connects on a network.
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A **storage area network (SAN)** is a high-speed network with the sole purpose of providing storage to other attached servers (Figure 8-20). In fact, a storage area network includes only storage devices. High-speed fiber-optic cable usually connects other networks and servers to the storage area network, so that the networks and servers have fast access to large storage capacities. A storage area network can connect to networks and other servers that are miles away using high-speed network connections.

Both network attached storage and storage area network solutions offer easy management of storage, fast access to storage, sharing of storage, and isolation of storage from other servers. Isolating the storage enables the other servers to concentrate on performing a specific task, rather than consuming resources involved in the tasks related to storage. Both storage solutions include disk, optical disc, and magnetic tape types of storage.

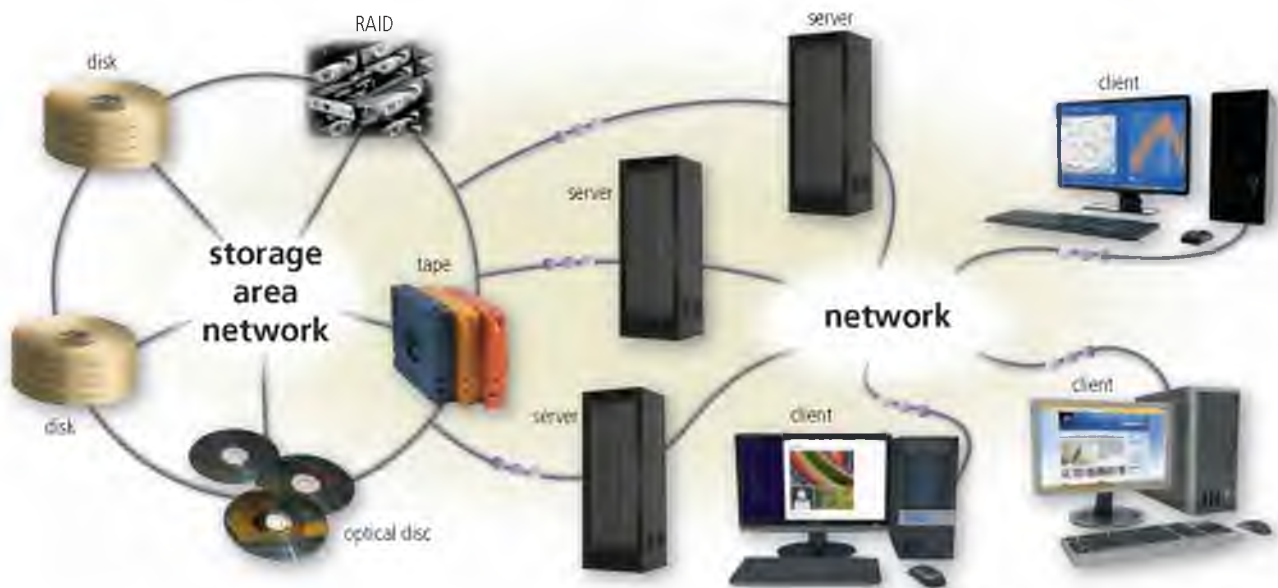


Figure 8-20 A storage area network provides centralized storage for servers and networks.
 © Cengage Learning; © stavklem/Shutterstock.com; © iStockphoto/luismmolina; © Cengage Learning; © bigmagic/Shutterstock.com; © Oleksiy Mark/Shutterstock.com; © iStockphoto/sweetym; © iStockphoto/123render; Source: Microsoft

CONSIDER THIS

Which do enterprises typically use, network attached storage or storage area networks?

Enterprises sometimes choose to implement both network attached storage and storage area network solutions. A network attached storage server is better suited for adding storage to an existing network, such as a department's file server. A company typically implements a storage area network solution as central storage for an entire enterprise.



Figure 8-21 A tape robot retrieves tape cartridges.

Courtesy of Oak Ridge National Laboratory

Magnetic Tape

One of the first storage media used with enterprise computers was tape. **Tape** is a magnetically coated ribbon of plastic that is capable of storing large amounts of data and information at a low cost. Before the use of digital music players became widespread, cassette tapes were a popular medium to store music. Tape no longer is used as a primary method of storage. Instead, businesses use tape most often for long-term storage and backup.

Comparable to a cassette recorder, a *tape drive* reads from and writes on a magnetic tape. Although older computers used reel-to-reel tape drives, today's tape drives use tape cartridges. A *tape cartridge* is a small, rectangular, plastic housing for tape. Enterprises typically use a *tape library*, where individual tape cartridges are mounted in a separate cabinet. Often, a tape robot automatically retrieves tape cartridges (Figure 8-21), which are identified by location or bar code.

CONSIDER THIS

Is tape as fast as other storage techniques?

No. Tape storage requires *sequential access*, which refers to reading or writing data consecutively. In much the same way you would find a specific song on a cassette tape or videotape, you must forward or rewind to a specific position to access a specific piece of data. On a tape, for example, to access items ordered A, B, C, and D, you must pass through items A, B, and C sequentially before you can access item D.

Hard drives, flash memory storage, and optical discs all use direct access. *Direct access*, also called *random access*, means that the device can locate a particular data item or file immediately, without having to move consecutively through items stored in front of the desired data item or file. When writing or reading specific data, direct access is much faster than sequential access.



Technology Trend

Discover More: Visit this chapter's free resources to learn about how RECAPTCHAs are used to digitize media.

Other Types of Storage

In addition to the previously discussed types of storage, other options are available for specific uses and applications. These include magnetic stripe cards, smart cards, RFID tags, and NFC chips and tags. Read Ethics & Issues 8-3 to consider the ramifications of devices not secured after product development.

ETHICS & ISSUES 8-3

Should Manufacturers Be Required to Close Back Doors after Product Development?

As discussed in Chapter 5, a back door is a program or set of instructions that allows users to bypass security controls when accessing a program, computer, or network. Software developers often include a back door during product development to modify program code when troubleshooting. In these instances, a back door is necessary. What happens, though, when a hacker finds or creates a back door?

Hackers look for known security issues in software to access a computer or mobile device through a back door. If a hacker is

unable to find and use a back door, they use trojan horses (previously discussed in Chapter 5) to deliver a payload that creates a back door. Hackers use back doors to gain control over a computer or mobile device so that they can use its resources to mount further malware attacks or to send spam. Using an unsuspecting user's resources to distribute spam or malware enables the hacker to avoid detection from and identification by authorities.

Back doors pose a serious security risk because they allow unauthorized access to your computer or mobile device's resources, files, and network whenever you are on the Internet.

Not only can hackers control your computer or mobile device, but they can look through your files to find and steal your personal information. Users often are unaware of a back door's existence and do not know when it is breached. If your computer acts strangely or performance decreases, you may have been the victim of a hacker. Do not connect to the Internet until you run an antivirus program.

Consider This: Should software developers close back doors created during product development? Why or why not? Has your computer or device ever been hacked using a back door? If so, how did you detect and resolve the issue?

Magnetic Stripe Cards

A **magnetic stripe card** is a credit card, entertainment card, bank card, or other similar card with a stripe that contains information identifying you and the card (Figure 8-22). The card issuer, such as a financial organization, encodes information in the stripe. The information in the stripe often includes your name, account number, and the card's expiration date. When you swipe the card through a magstripe reader, it reads information stored on the stripe.

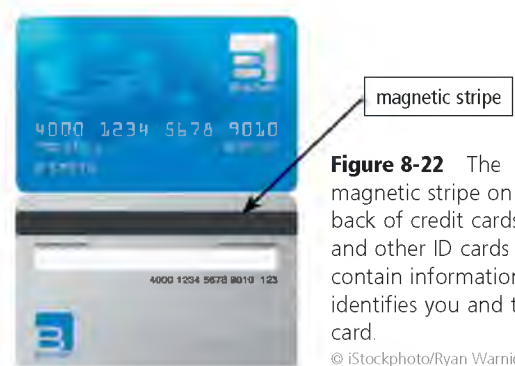


Figure 8-22 The magnetic stripe on the back of credit cards and other ID cards contain information that identifies you and the card.
© iStockphoto/Ryan Warnick

Smart Cards

A **smart card**, which is an alternative to a magnetic stripe card, stores data on an integrated circuit embedded in the card (Figure 8-23). Two types of smart cards, also called *chip cards*, are contact and contactless. When you insert a contact smart card in a specialized card reader, the information on the smart card is read and, if necessary, updated. Contactless smart cards communicate with a reader using a radio frequency, which means the user simply places the card near the reader.

Internet Research
Which credit cards are smart cards?
Search for: credit card chips



Figure 8-23 Examples of contact and contactless smart cards and their readers.
© iStockphoto/oytun karadayi; © iStockphoto/alexander kirch

CONSIDER THIS

What are some uses of smart cards?

Uses of smart cards include storing medical records, vaccination data, and other health care and identification information; tracking information, such as employee attendance or customer purchases; storing a prepaid amount of money, such as for student purchases on campus or fares for public transportation; and authenticating users, such as for Internet purchases or building access. In addition, a smart card can double as an ID card or credit card. Read Secure IT 8-3 for tips about protecting your credit cards.

SECURE IT 8-3

Using Credit Cards Safely

Consumers in the United States own more than 775 million credit and debit cards, and the average cardholder has multiple cards available to use. With this widespread use, the potential for theft is high.

The newest smart cards have embedded RFID tags that allow vendors to obtain the account number without physically touching the card. While this technology is convenient for both the merchant and consumer, it also enables thieves with remote scanners to capture the card's information without the owner's knowledge.

Thieves also use a handheld device to swipe the card and then obtain and store account details. This action, called *skimming*, is prevalent at gas stations, restaurants, and lounges, where unscrupulous employees sell the information to criminals who then spend your money or steal your identity.


Follow these tips to help keep your credit card account safe:

Do

- Use a card with added security features, such as a photo.
- Draw a line through blank areas on restaurant charge slips. If you have left a cash tip on the table, write the words, On Table, in the slip's tip amount section.
- Cover the keypad when entering a PIN.
- Save charge receipts and check them against monthly statements or online postings.
- Keep a record in a safe place of all your credit card numbers, expiration dates, and toll-free numbers to call if you need to report a lost or stolen card.
- Purchase an RFID-proof wallet to shield smart cards from remote readers.
- Shred new credit account mail solicitations.
- Look for skimmers, which can capture a credit card number. (Read Secure IT 3-2 in Chapter 3 for information about skimmers at ATMs and other self-service stations.)

Do Not

- Reveal your account number during a phone call unless you have initiated the call.
- Write your PIN on the card or on the protective envelope.
- Sign a blank charge slip.
- Carry extra cards, especially when traveling to unfamiliar locations.
- Let your card out of sight. While you may not be able to follow this advice at a restaurant when you hand the card to a server, you can be observant of employees' behaviors.

 **Consider This:** Do you know anyone who has been a victim of credit card theft? What steps will you take to use credit cards more safely after reading this information?

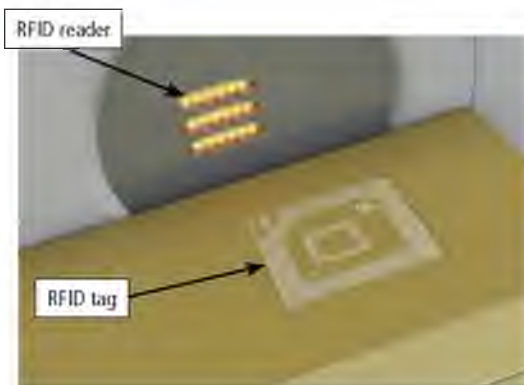


Figure 8-24 An RFID reader reads radio signals from an RFID tag that is affixed to this box.

© iStockPhoto/luismmolina

RFID Tags

Recall that RFID is a technology that uses radio signals to communicate with a tag placed in or attached to an object, an animal, or a person. The **RFID tag** consists of an antenna and a memory chip that contains the information to be transmitted via radio waves (Figure 8-24). An RFID reader reads the radio signals and transfers the information to a computer or computing device.

RFID tags are either passive or active. An active RFID tag contains a battery that runs the chip's circuitry and broadcasts a signal to the RFID reader. A passive RFID tag does not contain a battery and, thus, cannot send a signal until the reader activates the tag's antenna by sending out electromagnetic waves. Because passive RFID tags contain no battery, these can be small enough to be embedded in skin.

CONSIDER THIS

How do RFID tags differ from contactless smart cards?

The physical size of the chip and storage capacities in an RFID tag typically are much smaller than the chips in contactless smart cards. The chips in RFID tags usually are read only, whereas the chips in contactless smart cards can function as a processor. Also, RFID tags often are not as secure as contactless smart cards. Thus, credit cards that contain RFID tags, called RFID-enabled credit cards, may not be as secure as those that use contactless technology.

NFC Chips and Tags

Recall that NFC is a technology (based on RFID) that uses close-range radio signals to transmit data between two NFC-enabled devices or an NFC-enabled device and an NFC tag. NFC-enabled devices include smartphones, digital cameras, computers, televisions, and terminals. An NFC-enabled

device, such as a smartphone, contains an NFC chip (Figure 8-25). Other objects, such as credit cards and tickets, can contain an NFC chip. An *NFC tag*, similar to RFID tag, contains a chip and an antenna that contains information to be transmitted (shown in Figure 8-1 at the beginning of the chapter). Most NFC tags are self-adhesive, so that they can be attached to any location.

When a user places the NFC-enabled device close to another NFC-enabled device or an NFC tag, radio waves enable communications between the chips in the NFC-enabled devices or the chip in the NFC-enabled device and the NFC tag. Uses of NFC communications includes using a mobile device to pay for goods or services, displaying a webpage, making a phone call, sending a text message, or exchange contact information. Read Secure IT 8-4 for how to secure NFC transactions.

Discover More: Visit this chapter's free resources about uses of NFC technology.



Figure 8-25 This NFC-enabled phone communicates with the NFC reader to send a mobile payment.

© iStockPhoto/scyther5

SECURE IT 8-4



Keeping NFC Transactions Safe

NFC-enabled phones offer convenience when making contactless payments at the point of sale. A user simply waves his or her smartphone above a reader attached to a register, and money is deducted from a credit card or account that is registered when the NFC application is installed. The security of this technology, however, raises major issues.

Eavesdropping is one concern. The phones and the merchant's receivers need to be less than 8 inches apart to communicate with each other and complete the wireless data transfer, but even this short distance leads to vulnerabilities that allow cyberthieves to steal financial and other personal data. Attackers can stand near the sales counter to intercept the smartphone's signals or use antennas to

extend the signal's range. Another issue is data corruption and modification, when the high-tech criminals change or delete communications between the devices. Customers also are uneasy when the technology allows merchants to load coupons, advertisements, and other adware on the phone during the NFC transaction without the shopper's permission.

Hardware manufacturers and software engineers are working to improve security between the smartphones and the readers that receive the signals, but consumers need to exercise common sense and be proactive in protecting their sensitive information. They should follow these procedures in an attempt to avoid security breaches:

- Use a strong passcode on the phone and a PIN for the NFC transaction.

- Lock the phone when it has not been used for several minutes.
- Install antivirus software.
- Install an app that takes a photograph of a person trying to access a phone without permission and then sends a message to another mobile device when the phone has been stolen, or uses the phone's GPS to track its locations.
- Turn off Bluetooth discoverable status when not using this feature.

Consider This: Have you used NFC transactions? If so, did you take any precautions to keep your data safe? If not, would you consider using NFC technology to pay for goods and services? Why or why not?

Mini Feature 8-3: Backup Plans

To protect against data loss, users should back up the contents of their storage devices regularly. Read Mini Feature 8-3 to learn about backup plans.

MINI FEATURE 8-3

Backup Plans

Data loss or corruption can cause many issues. A user who accidentally misplaces a mobile device may lose contact information. A small business owner whose hard drive is infected with a virus may lose financial data, making billing and tax preparation difficult. A power user whose office floods and ruins a desktop not only may lose work completed on complex projects but also may need to replace expensive software. The best method for protecting against data loss from these types of unforeseen circumstances is to back up data.

A backup plan specifies a regular schedule for copying and storing important data, information, apps, and

programs. Organizations should state their backup plans clearly, document them in writing, and follow them consistently. Home and small business users can use a calendar app or other reminder to keep a backup schedule for their computers or mobile devices, or use a program or app that performs automatic backups. Backup plans should weigh the time and expense of performing a backup against the value of the data, information, apps, and programs. For example, a small business may perform one type of backup daily, while a home user may find that monthly backups are sufficient. Read Ethics & Issues 8-4 to consider storage requirements for public companies.

As briefly discussed in Chapter 5, business and home users can use four methods for backup: full, differential,

incremental, or selective. Typically, only large enterprises use a fifth type, continuous data protection. Cloud backup services, a sixth option, provide continuous data protection capabilities at a lower cost. Users can choose to backup to external media, or, as increasingly more are choosing to do, to the cloud.

- A *full backup*, sometimes called an *archival backup*, provides the best protection against data loss because it copies all program and data files. Generally, users should perform a full backup at regular intervals, such as at the end of each week and at the end of the month.
- Between full backups, you can perform differential or incremental backups. A *differential backup* copies only the files that have changed since the last full backup. An *incremental backup* copies only the files that have changed since the last full or last incremental backup.
- A *selective backup*, sometimes called a *partial backup*, allows the user to choose specific files to back up, regardless of whether or not the files have changed since the last incremental backup.


Backup software enables you to schedule backups, select the appropriate backup type, and choose the storage media for the backup. Traditional storage media includes CDs or DVDs, external hard drives, or removable SSDs, including USB flash drives or memory cards. Whichever storage media you choose, it should be stored separately from the device you are backing up to ensure it is available in case of theft or disaster. When choosing storage media, consider price and reliability. A USB flash drive may be inexpensive, but it also could be corrupted or lost easily. Cloud storage may be more expensive, but your data will be in a remote location and accessible from anywhere at any time.

Many smartphones and other mobile devices include services that sync data to a computer or to a cloud service. To sync data to a computer, the mobile device either requires cables to connect via a USB port or uses wireless methods, such as Wi-Fi or Bluetooth. Many mobile apps sync data to web apps automatically, which means you may not need to schedule a procedure to back up items on a mobile device, such as contacts, calendars, email messages, notes, and apps. For additional protection, however, some users still back up certain mobile data for easy retrieval if the device is lost or corrupted.

December					
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT/SUN
28 DAILY INCREMENTAL BACKUP	29 DAILY INCREMENTAL BACKUP	30 END OF MONTH FULL BACKUP	1 DAILY INCREMENTAL BACKUP	2 WEEKLY FULL BACKUP	3/4
5 DAILY INCREMENTAL BACKUP	6 DAILY INCREMENTAL BACKUP	7 DAILY INCREMENTAL BACKUP	8 DAILY INCREMENTAL BACKUP	9 WEEKLY FULL BACKUP	10/11
12 DAILY INCREMENTAL BACKUP	13 DAILY INCREMENTAL BACKUP	14 DAILY INCREMENTAL BACKUP	15 DAILY INCREMENTAL BACKUP	16 WEEKLY FULL BACKUP	17/18
19 DAILY INCREMENTAL BACKUP	20 DAILY INCREMENTAL BACKUP	21 DAILY INCREMENTAL BACKUP	22 DAILY INCREMENTAL BACKUP	23 WEEKLY FULL BACKUP	24/25
26 DAILY INCREMENTAL BACKUP	27 DAILY INCREMENTAL BACKUP	28 DAILY INCREMENTAL BACKUP	29 DAILY INCREMENTAL BACKUP	30 END OF MONTH FULL BACKUP	31/1

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Discover More: Visit this chapter's free resources to learn more about continuous data protection, incremental backups, backup software, and syncing data.

 **Consider This:** Do you have a backup plan for your mobile device and/or computer? Why or why not? How often do you think you need to back up your devices? Why? What storage media is best suited for your backup needs? Why?

ETHICS & ISSUES 8-4

How Much Data Should Companies Be Required to Keep?

More than a decade ago, after a string of corporate scandals, lawmakers enacted the *Sarbanes-Oxley (SOX) Act*. SOX provides a myriad of financial reporting requirements and guidelines for publicly traded companies. A main focus of SOX is the retention of business records. Because of SOX, companies have been confronted with massive new data storage requirements. For example, a company must retain all of its email messages just as it would other business records. Deleting stored email messages can result in a destruction of evidence infraction. Employees face penalties of up to 20 years in prison for altering or destroying records or documents. IT departments must not only understand

this complex law, but they also must ensure accuracy of financial data, determine policies for record retention, and provide storage capacity to hold all of the data.

Supporters of SOX state that it is essential to avoid corporate scandals caused by lack of accuracy in financial reporting. They also say that consumer confidence has increased because the financial statements are more transparent. Further, the financial costs for complying with SOX have decreased since companies have implemented plans. Opponents claim that the law is overreaching and costs too much for the added benefits. In addition, opponents blame the law for a decline in the number of IPOs (initial public offerings), as well as the transfer of several large companies

to foreign countries. Recently, the U.S. government passed the Jumpstart Our Business Startup (JOBS) Act. Supported by technology companies, startup businesses, and venture capitalists, the JOBS Act aims to support smaller and emerging companies. By redefining the size of companies, as well as tiers of responsibilities related to SOX, supporters of the JOBS Act hope to help new businesses grow.

Consider This: Is the Sarbanes-Oxley Act an unfair burden on companies? Why or why not? Should the government distinguish between large and smaller companies? Why or why not? Are such laws necessary in order to protect the public? Why or why not?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Enterprise Storage and Other Types of Storage, as it relates to the chapter objectives.

Now you should know ...


- When you might use RAID, network attached storage, storage area network, and tape (Objective 8)
- Where you would use a magnetic stripe card, smart card, RFID tag, and NFC tag (Objective 9)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter presented a variety of storage options. You learned about storage capacity and storage access times. The chapter discussed characteristics of hard disks, SSDs, external hard drives, and RAID. It discussed portable flash memory storage, including memory cards and USB flash drives. It presented advantages and various uses of cloud storage. Next, the chapter discussed characteristics of optical discs. Enterprise storage options were presented. You also learned about magnetic stripe cards, smart cards, RFID tags, and NFC chips and tags.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Pinterest/Ben Silbermann, Seagate/Al Shugart, SanDisk, and Amazon/Jeff Bezos; Technology Trends: Digitizing Nondigital Media and Digitizing Media with RECAPTCHAs; and High-Tech Talks: How Data Is Recovered and RAID Levels.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Automotive

The automotive industry plays a crucial role in today's society. To keep up with our growing population's increasing demand for transportation, organizations explore ways to streamline manufacturing processes in the automotive industry while simultaneously minimizing costs. These organizations often find that using technology in the manufacturing process requires fewer people-hours, and automobiles are manufactured with greater accuracy and less waste.

Automakers manufacture cars on an assembly line. In the early years of car manufacturing, people were involved at all stages of the manufacturing process. It was not uncommon to find hundreds or thousands of individuals working along the line. Although the assembly line allowed individuals to manufacture cars as quickly as they could, companies soon realized that computer-aided manufacturing (CAM) would increase output and decrease labor costs. In fact, CAM proved to be most

effective when used in conjunction with computer-aided design (CAD). CAD designs an item, such as a car, to manufacture; CAM then manufactures the car according to the original design. Computers also determine the exact amount of material necessary to build the car, as well as the expected output.

Communications during the assembly process is critical. Computers automatically communicate with each other along the assembly line and provide alerts when factors arise that can interrupt the process. For example, running out of hinges that attach the door to the car's body will halt the line until someone replenishes the hinges. Computers, however, often alert individuals to low supplies before they run out and the assembly halts. Failure to detect the missing hinges might result in the machinery attempting to manufacture the car without hinges. This could result in damage to the door and/or the car's body further along the assembly line.

Today, technology helps create quality automobiles efficiently. Although some might argue that computers perform jobs that people once held, their introduction has helped to meet society's increased demand for products and desire for low prices.

 **Consider This:** How else might computers and technology be used in the automotive industry?



Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to test your knowledge of digital content associated with this chapter and access the Study Guide resource from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

1. Define the term, secondary storage. List types of storage media.
2. Differentiate between writing and reading data to storage media.
3. ___ refers to the number of bytes a storage medium can hold. Identify terms manufacturers use to determine this.
4. Differentiate between storage and memory and describe how they interact.
5. Explain what access time measures and how transfer rates are stated.
6. Identify questions to ask before deciding how to share media files.
7. Define the term, hard drive.
8. Explain the ethical issues surrounding government search and seizure of computers.
9. List characteristics and functions of a hard disk.
10. ___ is the process of dividing the disk into tracks and sectors.
11. Define the term, read/write head.
12. List steps to defragment a hard drive.
13. Define the term, SSD. List devices that use SSDs.
14. Describe how to transfer files from one internal hard drive to another.
15. List advantages and disadvantages of SSDs versus magnetic hard disks.
16. Define the term, external hard drive. Explain why you would use an external hard drive instead of a second internal hard drive.
17. Explain how to encrypt files.
18. RAID is an acronym for ___.
19. Explain the role of a controller for transferring data from a drive to the computer components.
20. In addition to USB, list four other types of interfaces for use in personal computers.
21. Describe memory cards and their uses. List types of memory cards.
22. Explain who might use a USB flash drive, and for what purpose.
23. Explain how to eject removable storage media safely.
24. Define the term, cloud storage. List advantages of cloud storage.
25. List uses of a personal cloud.
26. Name uses of cloud storage. Explain criteria for evaluating cloud storage providers.
27. Define the term, optical disc. List types of optical discs.
28. List characteristics of optical discs.
29. List steps for cleaning and fixing scratches on optical discs.
30. Differentiate among CD-ROM, CD-R, and CD-RW discs.
31. The process of writing on an optical disc is called ___. The process of copying audio and/or video data from a purchased disc and saving it on your own media is called ___.
32. Describe the storage techniques that make DVD storage higher capacity than CD storage.
33. Define the terms, redundancy and outsourcing, as they relate to enterprise computing.
34. Explain issues surrounding BYOD policies in the workplace.
35. List and describe the levels of RAID used in enterprises.
36. Differentiate between a network attached storage (NAS) and a storage area network (SAN).
37. Explain how enterprise computers use tape for storage.
38. Differentiate between sequential and direct access.
39. Explain issues surrounding the use of back doors in software development.
40. Define the terms, magnetic stripe card and smart card. Describe the uses of each.
41. List tips for using credit cards safely. ___ occurs when thieves use a handheld device to swipe the card and then obtain and store account details.
42. Differentiate between active and passive RFID tags.
43. Describe NFC technology and its uses.
44. List guidelines for conducting NFC transactions safely.
45. Describe types of backup used by business and home users. Explain considerations when creating a backup plan.
46. Explain the ethical issues surrounding the Sarbanes-Oxley Act.
47. Describe how technology is used in the automotive industry.

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

Discover More: Visit this chapter's premium content to **view definitions** for each term and to **access the Flash Cards** resource from your smartphone, tablet, laptop, or desktop.

Key Terms

Primary Terms (shown in bold-black characters in the chapter)

access time (371)	DVD+RW (388)	microSDHC (381)	SDXC (Secure Digital Expanded Capacity) (381)
Blu-ray (388)	external hard drive (378)	microSDXC (381)	smart card (393)
capacity (370)	hard disk (373)	miniSD (381)	SSD (solid-state drive) (376)
CD-R (388)	hard disk drive (HDD) (373)	network attached storage (NAS) (390)	storage area network (SAN) (391)
CD-ROM (388)	hard drive (373)	optical disc (386)	storage device (368)
CD-RW (388)	M2 (Memory Stick Micro) (381)	RAID (380)	tape (392)
CF (CompactFlash) (383)	magnetic stripe card (393)	read/write head (375)	USB flash drive (382)
cloud storage (383)	memory card (381)	reading (368)	writing (368)
DVD-R (388)	Memory Stick PRO Duo (381)	RFID tag (394)	xD Picture Card (381)
DVD-ROM (388)		SDHC (Secure Digital High Capacity) (381)	
DVD-RW (388)			
DVD+R (388)			
DVD+RAM (388)			

Secondary Terms (shown in italic characters in the chapter)

<i>archival backup (396)</i>	<i>geotag (372)</i>	<i>perpendicular recording (374)</i>	<i>single-session disc (388)</i>
<i>burning (388)</i>	<i>gigabyte (GB) (370)</i>	<i>personal cloud (384)</i>	<i>skimming (394)</i>
<i>card reader/writer (381)</i>	<i>head crush (375)</i>	<i>petabyte (PB) (370)</i>	<i>solid-state media (376)</i>
<i>chip cards (393)</i>	<i>incremental backup (396)</i>	<i>photo CD (388)</i>	<i>storage appliance (390)</i>
<i>controller (380)</i>	<i>jewel case (387)</i>	<i>platter (374)</i>	<i>striping (390)</i>
<i>Creative Commons (372)</i>	<i>KBps (371)</i>	<i>random access (392)</i>	<i>tape cartridge (392)</i>
<i>density (374)</i>	<i>kilobyte (KB) (370)</i>	<i>redundancy (389)</i>	<i>tape drive (392)</i>
<i>differential backup (396)</i>	<i>level 1 (390)</i>	<i>revolutions per minute (rpm) (375)</i>	<i>tape library (392)</i>
<i>direct access (392)</i>	<i>longitudinal recording (374)</i>	<i>ripping (388)</i>	<i>terabyte (TB) (370)</i>
<i>EIDE (380)</i>	<i>MBps (371)</i>	<i>Sarbanes-Oxley Act (SOX) (390)</i>	<i>thumb drive (382)</i>
<i>eSATA (380)</i>	<i>megabyte (MB) (370)</i>	<i>SAS (serial-attached SCSI) (380)</i>	<i>track (374)</i>
<i>exabyte (EB) (370)</i>	<i>mini disc (386)</i>	<i>SATA (380)</i>	<i>transfer rate (371)</i>
<i>Fibre Channel (FC) (390)</i>	<i>mirroring (390)</i>	<i>SCSI (380)</i>	<i>WORM (388)</i>
<i>formatting (374)</i>	<i>multisession (388)</i>	<i>secondary storage (368)</i>	<i>yottabyte (YB) (370)</i>
<i>full backup (396)</i>	<i>NFC tag (396)</i>	<i>sectors (374)</i>	<i>zettabyte (ZB) (370)</i>
<i>GBps (371)</i>	<i>outsourcing (390)</i>	<i>selective backup (396)</i>	
<i>geofence (389)</i>	<i>partial backup (396)</i>	<i>sequential access (392)</i>	



RFID tag (394)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. Storage devices can be categorized as input or output devices. (368)
- _____ 2. A storage medium is volatile; that is, items stored on it remain intact even when you turn off a computer or mobile device. (370)
- _____ 3. Compared with the access time of memory, the access time of storage devices is slow. (371)
- _____ 4. On storage media, a higher density means less storage capacity. (374)
- _____ 5. Because of current standards, head crashes no longer occur. (375)
- _____ 6. The access time of a hard disk can be more than 100 times faster than an SSD. (378)
- _____ 7. While encrypted files offer greater security than unencrypted files, an operating system may require more time to open and access encrypted files. (379)
- _____ 8. While each program may use a different method of encrypting files, they all use the process of cryptography. (379)
- _____ 9. With serial transfers, data is sent one bit at a time. (380)
- _____ 10. When you are finished using a USB flash drive, simply remove it from the USB port. (383)
- _____ 11. Mini discs require a separate mini disc drive; that is, they do not work in standard-sized optical disc drives. (386)
- _____ 12. An active RFID tag contains a battery that runs the chip's circuitry and broadcasts a signal to the RFID reader; because they are so small, they can be embedded in skin. (394)

Multiple Choice


Select the best answer.

1. _____ measures the amount of time it takes a storage device to locate an item on a storage medium and/or the time required to deliver an item from memory to the processor. (371)
 - a. Rpm(s)
 - b. Transfer time
 - c. Access time
 - d. Clock speed
2. A(n) _____ is a storage device that contains one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information. (373)
 - a. hard disk
 - b. SSD
 - c. USB flash drive
 - d. optical disc
3. Which of the following is *not* an advantage of SSDs over hard disks? (378)
 - a. faster transfer time
 - b. lighter weight
 - c. more durable
 - d. higher storage capacity
4. A group of two or more integrated hard drives is called a(n) _____. (380)
 - a. RAID
 - b. SSD
 - c. HDD
 - d. EIDE
5. A disc you can read but not write on or erase is a _____. (388)
 - a. CD-RW
 - b. CD-ROM
 - c. multisession
 - d. WORM
6. The process of copying audio and/or video data from a purchased disc and saving it on your own media is called _____. (388)
 - a. ripping
 - b. burning
 - c. tearing
 - d. formatting
7. Enterprise storage often uses _____ technology as the interface that connects the devices to the network because it has much faster transmission rates than SCSI. (390)
 - a. SAS
 - b. serial transfer
 - c. Fibre Channel (FC)
 - d. SATA
8. A selective backup sometimes is called a(n) _____ backup. (396)
 - a. differential
 - b. incremental
 - c. partial
 - d. archival

Checkpoint

Matching Match the terms with their definitions.

- | | |
|---|---|
| _____ 1. writing (368) | a. storage method in which the magnetic particles are aligned horizontally around a disk's surface |
| _____ 2. reading (368) | b. server whose sole purpose is providing storage to users, computers, and devices attached to the network |
| _____ 3. capacity (370) | c. the number of bytes a storage medium can hold |
| _____ 4. perpendicular recording (374) | d. special-purpose chip and electronic circuits that control the transfer of data, instructions, and information from a drive to and from the system bus and other components in the computer |
| _____ 5. longitudinal recording (374) | e. flash memory chip type that consists entirely of electronic components, such as integrated circuits, and contains no moving parts |
| _____ 6. solid-state media (376) | f. flash memory storage device that plugs in a USB port on a computer or mobile device |
| _____ 7. controller (380) | g. process of transferring data, instructions, and information from memory to a storage medium |
| _____ 8. thumb drive (382) | h. storage method in which the magnetic particles are aligned vertically to a disk's surface, making much greater storage capacities possible |
| _____ 9. network attached storage (390) | i. storage technique that reads or writes data consecutively |
| _____ 10. sequential access (392) | j. process of transferring data, instructions, and information from a storage medium into memory |

 **Consider This** Answer the following questions in the format specified by your instructor.

1. Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (373, 389, 393, 396), How To (376, 377, 385, 387), Mini Features (372, 384, 395), Secure IT (379, 383, 394, 395), and Technology @ Work (397).
2. In terms of storage devices, what is reading and writing? (368)
3. Is a screen display volatile or nonvolatile? (371)
4. What does access time measure? (371)
5. How does the access time of storage compare with the access time of memory? (371)
6. What does Creative Commons provide? (372)
7. How does longitudinal recording differ from perpendicular recording? (374)
8. What is a head crash? (375)
9. What are some disadvantages of SSDs? (378)
10. Why might you opt for a hard disk rather than an SSD? (378)
11. Why is it not necessary to defrag an SSD? (378)
12. What advantages does SAS have over SCSI? (380)
13. What is the life span of a memory card? (382)
14. How do optical discs store items? (386)
15. What is the life span of an optical disc? (387)
16. What are the differences among a CD-ROM, a CD-R, and a CD-RW? (388)
17. What does redundancy mean with respect to enterprise storage? (389)
18. What does the term, geofence, mean? (389)
19. How does mirroring differ from striping? (389)
20. How do businesses most often use tape? (392)
21. Which is faster: sequential or direct access? Why? (392)
22. Why would a developer include a backdoor in a program? (393)
23. What are the two types of smart cards? (393)
24. How do contactless smart cards communicate with a reader? (393)
25. What is skimming? (394)
26. What is contained in an NFC card? (395)
27. What are three types of backup plans? (396)

Problem Solving

The **Problem Solving** exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The **Collaboration** exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Unrecognized Storage Device** You have connected an external storage device to your new MacBook Pro, but the operating system is not recognizing the device's contents. Instead, it asks whether you want to format the device. Why might this be happening?
- 2. Second Hard Drive Connection** While installing a second hard drive in your computer, you realize that your computer does not include a cable to connect the hard drive to the motherboard. How can you determine what type of cable to purchase?
- 3. Incompatible Memory Card** While attempting to copy files from your digital camera to your laptop, you realize that the memory card from your camera does not fit in the memory card slot on your laptop. What other steps can you take to copy the photos from the camera to the laptop?
- 4. Missing Files** You stored some files on a USB flash drive, but when you attempted to access them you noticed that they no longer were there. What might have happened, and what next steps will you take to attempt to recover these files?



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5. Media Not Supported You purchased a program that came on a DVD, but your laptop does not have an optical disc drive. What next steps can you take to install this program?

Professional

- 6. Inaccessible Files** Your company requires you to store your files on a remote server so that you can access the files from any location within the company. When you sign in to another computer using your account, you cannot see your files. What might be causing this?
- 7. Encrypted Storage Device** You have purchased an external storage device so that you can back up files on your office computer. The IT department in your company informs you that you must make sure the data on the device is encrypted. What are your next steps?
- 8. Alternative to Tape Storage** Your company still uses tape storage to back up important files, but your manager has asked you to begin researching alternatives to the aging technology. What steps will you take to research current storage technologies that are suitable to store company backups?
- 9. Faulty RFID Card** You use an RFID card to obtain access to your office. When you attempt to scan your card, the RFID reader acts like it does not recognize your card is nearby. What are your next steps?
- 10. Files Not Synchronizing** You have saved files on the cloud from your home computer, but the files are not appearing on the computer in your office. What might have happened, and what steps can you take to retrieve the files?

Collaboration

- 11. Technology in the Automotive Industry** Technology is used in the automotive industry to increase speed and efficiency. Your instructor would like everyone to realize the importance of technology in this industry and the different ways it is used. Form a team of three people. One team member should investigate how technology is used to build automobiles. Another team member should investigate how technology is used to help ensure the safety of individuals working in the automobile manufacturing process, and the last team member should research how technology is used to market and sell cars. Write a brief report summarizing your findings.

The **How To: Your Turn** exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

How To: Your Turn

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn exercises**, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Determine Your Device's Storage Capacity

It may be necessary to determine your device's storage capacity before you decide to install a new operating system, program, or app, or if you want to transfer a large number of files to your computer or mobile device. For example, a new program you want to install may state that it requires a certain amount of storage capacity, so you should verify the storage capacity available on your device before deciding to purchase and install the program. One way to determine a device's total storage capacity is to review the documentation or specifications that were included with your computer or mobile device. The following steps guide you through the process of determining your device's storage capacity using other methods.

Computers

- Open the window that shows the available storage devices on the computer.
- Press and hold or right-click the drive for which you want to display the total storage capacity and then select the option to display the drive properties.
- Navigate to the location showing the total storage capacity and available storage space.

or

- Some operating systems allow you to hover your pointer over the icon representing the drive for which you want to determine the storage capacity, and the storage information will appear.

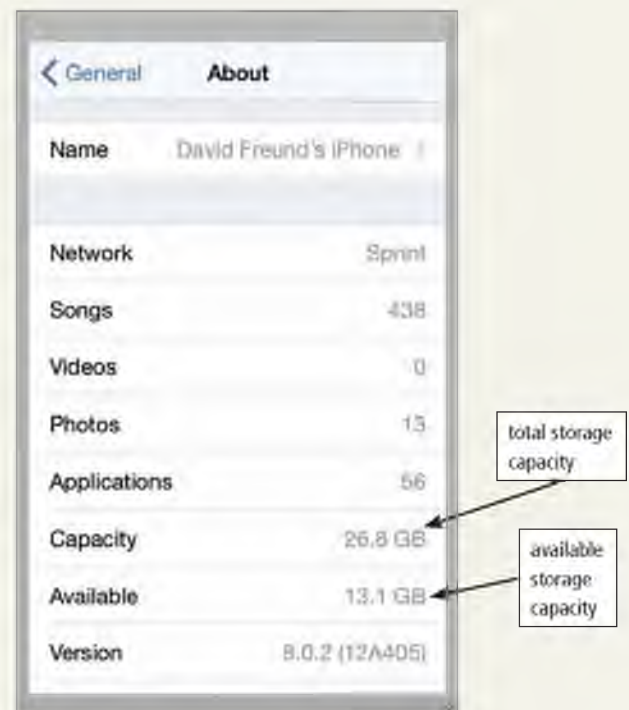
Mobile Devices

- Display the device settings.
- Navigate to the storage settings.
- If necessary, navigate to the screen showing the total storage capacity and available storage space.

Exercises

- What are other reasons why you might need to determine the total storage capacity or available storage space on your computer or mobile device?

- Does the total storage capacity displayed on your computer or mobile device match the exact amount advertised when you purchased your computer or mobile device? If not, what might cause the discrepancy?
- How much storage space is available on your computer or mobile device? What steps can you take if the storage on your device is almost completely used?



Source: Apple, Inc.

2 Organize Files on a Storage Device Using Folders

Organizing the files on a storage device not only can improve your computer's performance, but it also can make your files easy to locate. If you are accustomed to saving files to your desktop or to a folder on your storage device, you should consider organizing the files by storing them in appropriate folders. The following steps guide you through the process of using folders to organize files on a storage device.

- Review the types of files you currently store on your device.

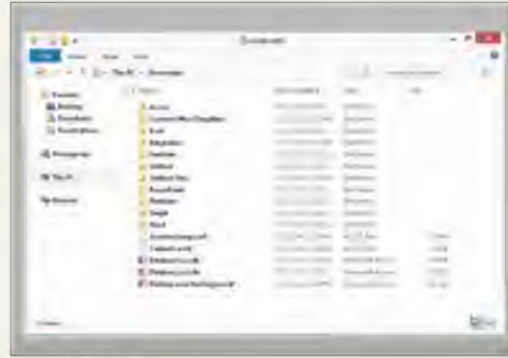
How To: Your Turn

- b. Current operating systems, such as Windows and Mac OS, include locations for storing different types of files, such as documents, music, video, and photos. Within these locations, however, you should create additional folders to further organize these file types. The method you use to organize each file type might vary.
1. Create folders to store your documents by the type of content they contain. For example, you might create separate folders to store files related to academics, finances, and entertainment. Then, consider whether you should create folders within these folders. For instance, you might create additional folders within the Academics folder to organize your files by subject.
 2. Create folders to store your music by genre. Within each genre, create additional folders to sort your music by artist. If you have many songs for a particular artist, consider creating folders within the artist's folder to store the songs by album.
 3. Create folders to store your photos and videos either by date, event, or a combination of the two. For example, you could have a folder for a particular year, and then within that folder, create additional folders for all events that occurred within that year.
- c. Although the desktop seems to be a convenient location to store files, it quickly can become cluttered. The only files you should store on the desktop are the ones you will need in the immediate future. If you will not need a file again for at least several days, consider storing it in one of the folders mentioned previously.
- d. Review the files on your storage device periodically and delete the ones you no longer need. Delete only the files you have placed on your storage device; be careful not to delete files that any programs or the operating system may need to run.

Exercises

1. Review the files and folders on your storage device. In your opinion, do you feel they are organized effectively? Why or why not?
2. How are the files and folders on your storage device organized?

3. When you take photos on a digital camera, the camera often generates a file name consisting of a generic prefix and sequential number. What are some ways to identify the photos easily on your digital camera's memory card?



Source: Microsoft

3 Copy Individual Files to Another Storage Device, and Copy Files to Cloud Storage

If you save a file on your computer or mobile device and later will need to access it on another device, you likely will have to copy the file to another storage device or to the cloud so that you can access the file on the other device. The following steps guide you through the process of copying files to another storage device or to the cloud.

Copying Files to Another Storage Device

- a. Navigate to the location containing the file you want to copy. If the file is on an external storage device or memory card, connect the storage device to your computer or insert the memory card into your computer's card reader. Next, navigate to the location containing the file you want to copy.
- b. Navigate to the location to which you want to copy the file. If the location to which you want to copy the file is on an external storage device or on a memory card, connect the external storage device to your computer or insert the memory card into your computer's card reader. Next, navigate to the location to which you want to copy the file.
- c. Drag the file you want to copy to the destination location. After you drag the file, make sure the file exists both in the source and destination location.

How To: Your Turn

Copying Files to the Cloud

- If necessary, sign up for an account with an online service that can store your files. Some online services store only photos and videos, while other services store all types of files, such as documents and other media files.
- Sign in to the online service and navigate to the page where you can upload files.
- Tap or click the button or link to upload a file.
- Navigate to and then tap or click the file you want to upload.
- Tap or click the button or link to upload the file.

Exercises

- What types of files might you want to copy to the cloud? Why would you copy files to the cloud instead of copying them to an external storage device?
- What are at least three online services that allow you to store files? Are they free, or do they charge a fee? How much space do they provide? How do you obtain more storage space?
- What steps would you take to copy a file from the cloud to your computer or mobile device?



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4 Manage Space on a Storage Device

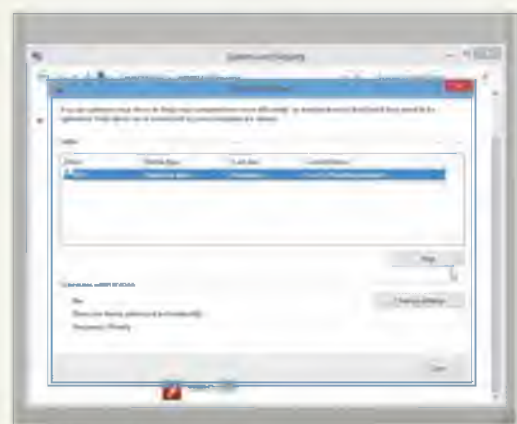
As you use your computer or mobile device, chances are that you are storing more files and installing additional programs and apps. At some point, you might require additional space or need to improve performance on your storage device. While purchasing an additional storage device might seem like the best option, ways may be available to help you manage the space on your existing storage device so that an additional purchase is not necessary. The following steps guide you through the process of managing space on a storage device.

- Review the files on your storage device and identify unused files you might be able to delete. Be careful

- not to remove files that the operating system, programs, or apps require to run properly.
- View the list of programs and apps you have installed on your computer or mobile device. If you no longer need a program or app, uninstall it.
- If you have files you may need in the future but not immediately, consider compressing them or copying them to an external storage device or to cloud storage. Verify the files have copied properly and then remove the files from your primary storage device.
- If possible, defragment the storage device. If the storage device has not been defragmented recently, this process might improve performance significantly.
- Search for and use any other tools that might be available in your operating system to maximize available space or improve performance. Note that some programs that claim to increase free space by compressing the files on your hard drive may slow your computer's performance.
- If the above options do not increase performance enough or create sufficient free space, you might need to purchase an additional storage device.

Exercises

- What files on your storage device might you consider deleting to save space? Why?
- Does your computer or mobile device contain any programs or apps that you no longer need? How can you uninstall programs and apps from your computer or mobile device?
- How does defragmentation help increase performance on your computer?



Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to challenge yourself with additional Internet Research exercises, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Educational and Science

General reference websites, which include online encyclopedias, almanacs, and reference collections, are excellent sources of comprehensive, accurate, and organized facts on specific topics. For example, history and literary buffs can appreciate the websites that translate text, contain thousands of free books to download, and provide literary analyses. Among the more comprehensive websites are those sponsored by the American Library Association and the Library of Congress.

Answers to perplexing science questions and math problems are available on several educational websites that include practice tests, conversion tables, and current news articles. Environmental websites seek to educate and often persuade citizens to become aware of issues. The information helps consumers to make environmentally responsible purchasing decisions and urges people to become involved in solving global environmental problems. Scientists' research efforts extend beyond investigating this planet to exploring the great frontier of space. Their science websites contain information about current studies, conferences, and breakthroughs in such areas as biology, earth and ocean sciences, physics, and chemistry.

Research This: (a) Visit a general reference website and locate any free resources that you can download to your computer or mobile device. What materials are available to download? Which general topics are available? For which classes would you find the contents useful? Are you able to browse and search the collections? What types of current news articles are displayed? Are links to news stories or research articles shown? How often are they updated? Are previous stories archived so that you can research these events?

(b) Visit two environmental or science websites or apps, such as NASA, and browse their contents or download related apps. Which general topics are available for students? What types of current news articles are displayed? Are additional resources, such as videos and photos, available? Are online social network accounts listed to interact with scientists and researchers?



2 Social Media

Digital footprints tracking your Internet activity are relatively easy to find. Maintaining online anonymity is difficult to achieve once you have established online social network accounts with your actual name. While deleting an online social network account is a fairly easy process, deleting all remnants of information relating to the account can be a more difficult task. Just because you no longer can sign in to the account does not mean your posts, photos, and personal information do not exist somewhere on a website.

If you desire to remove an Internet presence for security or personal reasons, begin by searching for your name or account user names. Remove your profiles from any online social network account that is displayed in the search results. Each of the online social network websites has a process to close an account, generally through the account's settings page. Next, contact the websites listed in the search results and ask that your name be removed. Many companies have a form to complete and submit. A third place to hunt for your information is on websites listing public records and people searches. Again, attempt to contact these companies and request that your personal information be removed. As a last resort, some services will perform these tasks for a fee.

Research This: Use a search engine to locate instances of your name or user names. Did the search results list these names? If so, which online social networks or companies have records of your name? Then, search for your name on at least two websites that have public records or people databases. Did you see your name on these websites? If so, do you want the details, such as a phone number or address, available for anyone to see? If not, attempt to remove this data and write a report of the steps you took and your success in deleting the personal information.

Internet Research

3 Search Skills

Image Search

An image search locates photos and images related to your search text or similar to other images. Tap or click the Images link on a search engine's home page and then type the search text describing images you would like to find. For example, type the search text, solid state drive, to find photos of solid state drives. Search engines allow you to narrow your results by specifying additional conditions on the images found. These may include size (icon, wallpaper, or dimensions in pixels), color, time taken (past day, week, or month), type (photo, clip art, face, animation, or drawing), shape (wide, tall, square), usage rights (whether a photo may be reused, and under what conditions), and safe search. Safe search filters content inappropriate for minors.

Some search engines allow you to upload or specify the web address for an image, so that the search engine can locate images with similar features. Searching for similar images can be effective if the image is of a well-known person, place, or object.

Image search results usually display an arrangement of thumbnail images; tap or click each thumbnail to see it in full size, download it, or obtain its web address from the browser's address bar.



Source: Yahoo!

Research This: Create search text using the techniques described above or in previous Search Skills exercises and then type it in a search engine to find these images: (1) an RFID tag, exactly 400 x 400; (2) an external DVD drive, with a transparent background; (3) an internal hard drive, labeled for noncommercial reuse; (4) a person holding an SD card; and (5) images similar to a photo of a laptop computer (take a photo of a laptop and upload it). How successful was your image search?

Create a document containing each image, its web address, and the name or web address of the website on which it appears.

4 Security

Permanently destroying files on storage media is recommended when donating or selling a computer. Federal laws have imposed strict requirements and penalties for data security, particularly regarding health and insurance records and credit transactions. While procedures exist to restore deleted files or erased media, often companies and individuals truly desire that the data never can be recovered. Sensitive medical and financial information, in particular, should be erased so that savvy criminals and digital forensics examiners cannot recover deleted files. The U.S. Department of Defense and the National Security Agency set standards for sanitizing magnetic media and specify that degaussing, or demagnetizing, is the preferred method in lieu of permanently destroying the storage medium.

Research This: What types of degaussers are available? How do they wipe a drive's contents? How are Gauss and Oersted ratings applied? What length of time is required to degauss a drive? Some companies offer degaussing services. What procedures do they use to ensure secure practices?

5 Cloud Services

Cloud Backups (IaaS)

Backing up files to the cloud provides a systematic way for organizations and individuals to create off-site copies of their files. Backing up files to the cloud is an example of infrastructure as a service (IaaS), a service of cloud computing which allows users to access and store files online.

Cloud backup providers offer continuous backup of new and changed files, transmitting them over a secure Internet connection. Like many cloud services, they offer a "pay as you go" pricing model, where customers subscribe to a service for a period, and pay for the features or storage they use. Many cloud backup providers offer web and mobile apps to access and restore files.

Cloud backup services differ from cloud storage services. Cloud backup services offer the software and infrastructure to back up and restore files only. They generally do not support synchronizing files across devices or sharing files with many users, which are common features of cloud storage services.

Research This: (1) Use a search engine to find two different cloud backup providers. Compare their pricing plans, storage offered, file types backed up, security features, and other services offered. (2) Why are cloud backup services attractive options for small to medium-sized businesses? (3) When is it practical to use cloud backup services, and when is it practical to use cloud storage?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Increasing Storage Capacity

You are the office manager at a local boutique. The store needs to increase its storage capacity, and so decides to buy an external hard drive. Your boss asks you to research access times and storage capacities of various external hard drives.

Do This: Use the web to learn more about available hard drive options. What other factors should you evaluate when determining the appropriate hard drive to purchase? Analyze the advantages and disadvantages of using external hard drives for storage. Include in your discussion backup plans, costs, and alternate options. Recommend two hard drives to your boss. Include user reviews and any information by industry experts in your comparison between the two different hard drives. Which is the best option? Why? Compile your findings.

2. NFC

Your new smartphone includes NFC capabilities. You are curious about its uses but are concerned about potential risks. Before you enable NFC and install apps that can use this technology, you want to do some research.

Do This: Use the web to find and then list current and developing uses of NFC. If possible, find reviews or blog posts about these technologies. Describe any safety issues you found in your research. List ways you can protect yourself when using NFC technology. Locate apps that can use NFC. For what purposes

can you use this new technology? What disadvantages and risks exist? How can you avoid any negative experiences and protect your data? Do any current laws govern or restrict the use of NFC for data collection? What are they? Can you provide additional potential uses for NFC at home, school, or work?

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The board of directors has asked you to create a backup plan for the league's computers and devices. The employees in the league office have access to multiple shared laptops, a desktop, and a tablet. Several employees use their own smartphones and tablets for work, according to the league office's BYOD policy.

Do This: Use the web to find industry experts' recommendations for backing up data. Write a sample backup plan and schedule for the board, and include types of backups you will use. Describe each backup type you propose and why you recommend it. Is any special software required to back up the different devices? The board asked you to present reasons for using cloud storage as part of your backup plan. Research the benefits of using cloud storage over other backup methods. Why would you choose cloud storage? What are the cost differences? Compare three cloud storage providers, ranking them by cost and storage capacity.

Collaboration

4. Computers in Telemarketing Your team is performing IT research for a magazine-subscription telemarketing company. The company's 150 telemarketers must make a minimum of 100 calls a day. If telemarketers do not meet the minimum number, they must finish the calls from home. The company must decide on the type of storage device to provide the telemarketers so that they can take the necessary data home. Management has narrowed the choice to three storage options: rewritable optical discs, cloud storage, or USB flash drives.

Do This: Form a three-member team and assign an option to each member. Each team member should evaluate the advantages and disadvantages. Include features such as capacity, access time, durability of media, ease of transporting between home and office, and cost. Meet with your team, and discuss and compile your findings. Which method would you recommend? Why? What are the advantages of each? Share your findings with the class.



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OPERATING SYSTEMS: Managing, Coordinating, and Monitoring Resources

9



“My laptop is running slower than when I bought it, but it seems to be working properly. I install operating system updates regularly on my computer and smartphone. I added a printer using my operating system’s configuration options. Aside from knowing where my files are stored, what more could I learn about operating systems?”

While you may be familiar with some of the content in this chapter, do you know how to . . .

- Remove a program or app?
- Prevent a computer from thrashing?
- Resolve a low memory issue with a mobile device?
- Locate and install a driver for a device connected to your computer?
- Identify bloatware?
- Evaluate an operating system’s built-in security tools?
- Use the Windows interface?
- Use the Mac OS interface?
- Determine whether to use an open or closed source operating system?
- Set up a virtual machine?
- Use the Windows operating system on a Mac computer?
- Recognize BYOD security issues?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

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Operating systems provide a variety of functions to users.





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Objectives

After completing this chapter, you will be able to:

- 1 Explain the purpose of an operating system
- 2 Describe the start-up process and shutdown options on computers and mobile devices
- 3 Explain how an operating system provides a user interface, manages programs, manages memory, and coordinates tasks
- 4 Describe how an operating system enables users to configure devices, establish an Internet connection, and monitor performance
- 5 Identify file management and other tools included with an operating system, along with ways to update operating system software
- 6 Explain how an operating system enables users to control a network or administer security
- 7 Summarize the features of several desktop operating systems: Windows, OS X, UNIX, Linux, and Chrome OS
- 8 Briefly describe various server operating systems: Windows Server, OS X Server, UNIX, and Linux
- 9 Summarize the features and uses of several mobile operating systems: Google Android, Apple iOS, and Windows Phone

Operating Systems

When you purchase a computer or mobile device, it usually has an operating system and other tools installed. As previously discussed, the operating system and related tools collectively are known as system software because they consist of the programs that control or maintain the operations of the computer and its devices. An **operating system (OS)** is a set of programs that coordinate all the activities among computer or mobile device hardware. Other tools, which were discussed in Chapter 4, enable you to perform maintenance-type tasks usually related to managing devices, media, and programs used by computers and mobile devices.

Most operating systems perform similar functions that include starting and shutting down a computer or mobile device, providing a user interface, managing programs, managing memory, coordinating tasks, configuring devices, monitoring performance, establishing an Internet connection, providing file management and other device or media-related tasks, and updating operating system software. Some operating systems also allow users to control a network and administer security (Figure 9-1).

Although an operating system often can run from a USB flash drive, media in an optical drive, or an external drive, in most cases, an operating system resides inside a computer or mobile device. For example, it is installed on a hard drive in a laptop or desktop. On mobile devices, the operating system may reside on firmware in the device. *Firmware* consists of ROM chips or flash memory chips that store permanent instructions.

Operating systems often are written to run on specific types of computers, based on their computing needs and capabilities. That is, servers do not run the same operating system as tablets or laptops because these computers perform different computing tasks. For example, a tablet or laptop operating system might have a feature to turn the device off after a few minutes of inactivity in order to conserve battery power. A server, by contrast, always is plugged in and generally remains on all of the time, which means its operating system would not need this power-saving feature. The same types of computers, such as laptops, may run different operating systems. It also is possible to run more than one operating system on the same computer.



When purchasing a program or an application, you must ensure that it works with the operating system installed on your computer or mobile device. The operating system that a computer uses sometimes is called the *platform* because applications are said to run “on top of” it, or because the platform supports the applications. With purchased applications, their specifications will identify the required platform(s), or the operating system(s), on which they will run. A *cross-platform application* is an application that runs the same way on multiple operating systems.

Operating System Functions

Every computer and mobile device has an operating system. Regardless of the type of the computer or device, however, their operating systems provide many similar functions. The following sections discuss functions common to most operating systems. These functions include starting and shutting down computers and mobile devices, providing a user interface, managing programs, managing memory, coordinating tasks, configuring devices, monitoring performance, establishing an Internet connection, updating operating system software, providing file and disk management tools, controlling a network, and administering security.



Figure 9-2 Examples of power buttons on computers and mobile devices.

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Starting Computers and Mobile Devices

If a computer or mobile device is off, you press a power button to turn it on (Figure 9-2). If it is on, you may need to restart (also called reboot) the computer or mobile device for a variety of reasons. For example, you might install a new program or app, update existing software, or experience network or Internet connectivity problems. Alternatively, you might notice that the performance of the computer or device is sluggish, or it may stop responding altogether. The method you use to restart a computer or device differs, depending on the situation and also the hardware. You may be able to use operating system instructions or press keys on the keyboard to restart the computer or device. Or, you might be required to respond to on-screen prompts. Sometimes, the computer or device restarts automatically.

When you start or restart a computer or mobile device, a series of messages may appear on the screen. The actual information displayed varies depending on the make and type of the computer or mobile device and the equip-

ment installed. The start-up process, however, is similar for large and small computers and mobile devices, as described in the following steps.

- Step 1:** When you turn on the computer or mobile device, the power supply or battery sends an electrical current to circuitry in the computer or mobile device.
- Step 2:** The charge of electricity causes the processor chip to reset itself and finds the firmware that contains start-up instructions.
- Step 3:** The start-up process executes a series of tests to check the various components. These tests vary depending on the type of computer or devices and can include checking the buses, system clock, adapter cards, RAM chips, mouse, keyboard, and drives. It also includes making sure that any peripheral devices are connected properly and operating correctly. If any problems are identified, the computer or device may beep, display error messages, or cease operating — depending on the severity of the problem.
- Step 4:** If the tests are successful, the kernel of the operating system and other frequently used instructions load from the computer or mobile device’s internal storage media to its memory (RAM). The *kernel* is the core of an operating system that manages memory and devices, maintains the internal clock, runs programs, and assigns the resources, such

as devices, programs, apps, data, and information. The kernel is *memory resident*, which means it remains in memory while the computer or mobile device is running. Other parts of the operating system are *nonresident*; that is, nonresident instructions remain on a storage medium until they are needed, at which time they transfer into memory (RAM).

Step 5: The operating system in memory takes control of the computer or mobile device and loads system configuration information. The operating system may verify that the person attempting to use the computer or mobile device is a legitimate user. Finally, the user interface appears on the screen, and any start-up applications, such as antivirus software, run.



CONSIDER THIS

What is meant by the phrase, booting a computer?

The process of starting or restarting a computer or mobile device is called *booting*. Some people use the term *cold boot* to refer to the process of starting a computer or mobile device from a state when it is powered off completely. Similarly, *warm boot* refers to the process of restarting a computer or mobile device while it remains powered on.

A warm boot generally is faster than a cold boot because it skips some of the operating system start-up instructions that are included as part of a cold boot. If you suspect a hardware problem, it is recommended that you use a cold boot to start a computer or device because this process detects and checks connected hardware devices. If a program or app stops working, a warm boot often is sufficient to restart the device because this process clears memory.

A **boot drive** is the drive from which your personal computer starts, which typically is an internal hard drive, such as a hard disk or SSD. Sometimes, an internal hard drive becomes damaged and the computer cannot boot from it, or you may want to preview another operating system without installing it. In these cases, you can start the computer from a *boot disk*, which is removable media, such as a CD or USB flash drive, that contains only the necessary operating system files required to start the computer.

When you purchase a computer, it may include recovery media in the form of a CD. If it does not, the operating system usually provides a means to create one. When the word, *live*, is used with a type of media, such as *Live USB* or *Live CD*, this usually means the media can be used to start the computer.



BTW

Recovery Media

In situations when a boot disk is required to restart a computer or device that will not start from its boot drive, the boot disk often is referred to as *recovery media*.

Discover More: Visit this chapter's free resources to learn more about restarting computers and mobile devices.

Shutting Down Computers and Mobile Devices

Some users choose to leave their computers or mobile devices running continually and rarely turn them off. Computers and devices that are left on always are available, and users often run back up or other similar programs while the computer or device is not being used. These users also do not need to wait for the boot process, which can be time consuming on older computers. Other users choose to shut down their computers and mobile devices regularly. These users might be concerned with security, want to reduce energy costs, or prefer to clear memory often. To turn off a computer or mobile device, you may be required to use operating system commands, press keyboard key(s), push a power button, or a combination of these methods. Read Secure IT 8-2 in Chapter 8 for tips on safely removing media before shutting down a computer or mobile device.

Power options include shutting down (powering off) the computer or mobile device, placing it in sleep mode, or placing it in hibernate mode. Both sleep mode and hibernate mode are designed to save time when you resume work on the computer or device. *Sleep mode* saves any open documents and running programs or apps to RAM, turns off all unneeded functions, and then places the computer in a low-power state. If, for some reason, power is removed from a computer or device that is in sleep mode, any unsaved work could be lost. *Hibernate mode*, by contrast, saves any open documents and running programs or apps to an internal hard drive before removing power from the computer or device.

The function of the power button on a computer or mobile device varies, and users typically are able to configure its default behavior. For example, you typically can place a computer or mobile device in sleep mode by quickly pressing its power button or closing its lid or cover (for example, on a laptop or a tablet). Pressing and holding down the power button may remove all power from the computer or mobile device.



Internet Research

When should I turn off a computer, and when should I use sleep mode?

Search for: shut down or sleep computer

Providing a User Interface

You interact with an operating system through its user interface. That is, a **user interface (UI)** controls how you enter data and instructions and how information is displayed on the screen. Two types of operating system user interfaces are graphical and command line. Operating system user interfaces often use a combination of these techniques to define how a user interacts with a computer or mobile device.

Graphical User Interface Most users today work with a graphical user interface. With a *graphical user interface (GUI)*, you interact with menus and visual images by touching, pointing, tapping, or clicking buttons and other objects to issue commands (Figure 9-3). Many current GUI operating systems incorporate features similar to those of a browser, such as links and navigation buttons (i.e., Back button and Forward button) when navigating the computer or mobile device's storage media to locate files.

A graphical user interface designed for touch input sometimes is called a *touch user interface*. Some operating systems for desktops and laptops and many operating systems for mobile devices have a touch user interface.

Internet Research

Which operating systems have a touch user interface?

Search for: touch operating systems



CONSIDER THIS

What is a natural user interface?

With a **natural user interface (NUI)**, users interact with the software through ordinary, intuitive behavior. NUIs are implemented in a variety of ways: touch screens (touch input), gesture recognition (motion input), speech recognition (voice input), and virtual reality (simulations).



Figure 9-3 Examples of operating system graphical user interfaces on a variety of computers and mobile devices. Courtesy of Apple Inc.; Courtesy of SAMSUNG; Courtesy of Microsoft; Courtesy of SAMSUNG; Courtesy of Apple Inc.

Command-Line Interface To configure devices, manage system resources, automate system management tasks, and troubleshoot network connections, network administrators and other technical users work with a command-line interface. In a *command-line interface*, a user types commands represented by short keywords or abbreviations (such as `dir` to view a directory, or list of files) or presses special keys on the keyboard (such as function keys or key combinations) to enter data and instructions (Figure 9-4).

Some people consider command-line interfaces difficult to use because they require exact spelling, form, and punctuation. Minor errors, such as a missing period, generate an error message. Command-line interfaces, however, give a user more control to manage detailed settings. When working with a command-line interface, the set of commands used to control actions is called the *command language*.

Managing Programs

How an operating system handles programs directly affects your productivity. An operating system can be single tasking or multitasking:

- A single tasking operating system allows only one program or app to run at a time. For example, if you are using a browser and want to check email messages, you must exit the browser before you can run the email program. Operating systems on embedded computers and some mobile devices use a single tasking operating system.
- Most operating systems today are multitasking. A *multitasking* operating system allows two or more programs or apps to reside in memory at the same time. Using the example just cited, if you are working with a multitasking operating system, you do not have to exit the browser to run the email program. Both programs can run concurrently.

When a computer is running multiple programs concurrently, one program is in the foreground and the others are in the background (Figure 9-5). The one in the *foreground* is the active program, that is, the one you currently are using. The other programs running but not in use are in the *background*. The foreground program typically is displayed on the screen, and the background programs are hidden partially or completely behind the foreground program. A multitasking operating system's user interface easily allows you to switch between foreground and background programs.



Figure 9-4 A command-line interface requires you to enter exact spelling, form, and punctuation.

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Figure 9-5 The foreground application, Microsoft Word, is displayed on the screen. The other applications (Microsoft Outlook, Google Maps in Internet Explorer, and File Explorer) are in the background.

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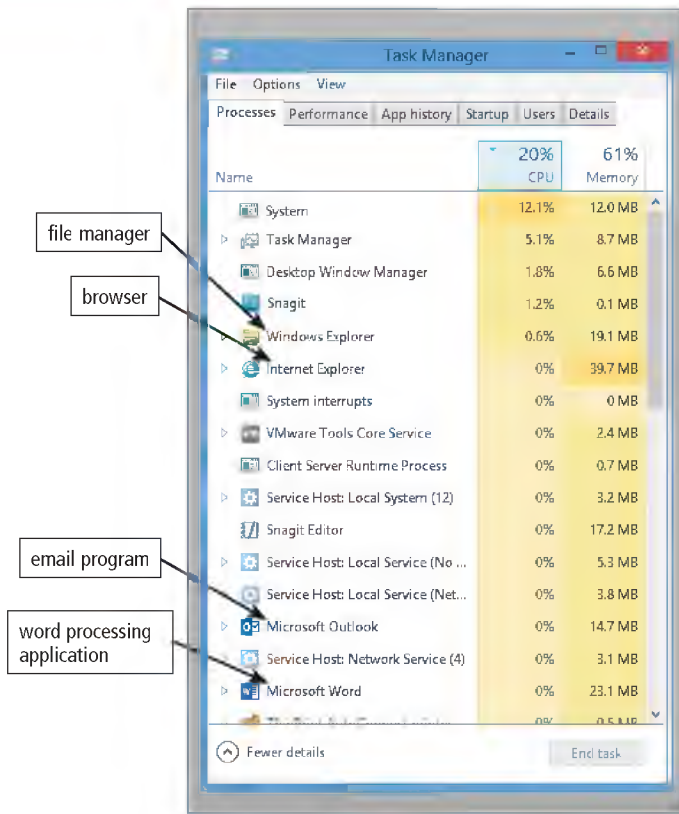


Figure 9-6 An operating system manages multiple programs and processes while you use a computer or mobile device.

Source: Microsoft

In addition to managing applications, an operating system manages other processes. These processes include programs or routines that provide support to other programs or hardware. Some are memory resident. Others run as they are required. Figure 9-6 shows a list of some processes running on a Windows computer; notice the list contains the applications running in Figure 9-5, as well as other programs and processes.

Some operating systems support a single user; others support thousands of users running multiple programs. A *multiuser* operating system enables two or more users to run programs simultaneously. Networks, servers, and supercomputers allow hundreds to thousands of users to connect at the same time and, thus, use multiuser operating systems.

Through the operating system, you also can install programs and apps, as well as remove them. For instructions on installing programs and apps, refer to How To 1-4 in Chapter 1. Read How To 9-1 for instructions on removing a program or app.

Discover More: Visit this chapter's free resources to learn more about single tasking, multitasking, and multiuser operating systems.

HOW TO 9-1

Remove a Program or App

If you are running low on space on your computer or mobile device, you may want to remove programs and apps you no longer use. The following steps describe how to remove a program or app from your computer or mobile device:

1. Sign in to a user account that has administrative privileges; that is, the user account should have the capability

to perform functions such as removing programs or apps.

2. Make sure the program or app you want to remove is not running.
3. Display the list of programs or apps installed on your computer or mobile device.
4. Select the program or app you wish to remove.
5. Tap or click the button to remove the program or app.

6. If necessary, when the installation is complete, restart your computer or device.

7. Verify the program or app you removed no longer is on your computer or mobile device.

Consider This: What are some other reasons why you might want to remove a program or app from your computer or mobile device?

Managing Memory

The purpose of memory management is to optimize the use of a computer or device's internal memory, i.e., RAM. As Chapter 6 discussed, RAM (random access memory) consists of one or more chips on the motherboard that hold items such as data and instructions while the processor interprets and executes them. The operating system allocates, or assigns, data and instructions to an area of memory while they are being processed. Then, it carefully monitors the contents of memory. Finally, the operating system releases these items from being monitored in memory when the processor no longer requires them.

If several programs or apps are running simultaneously, your computer or mobile device may use up its available RAM. For example, assume an operating system requires 2 GB of RAM to run, an antivirus program — 256 MB, a browser — 512 MB, a productivity software suite — 1 GB, and a photo editing program — 512 MB. With all these programs running simultaneously, the total RAM required would be 4.352 GB (2048 MB + 256 MB + 512 MB + 1024 MB + 512 MB) (Figure 9-7). If the computer has only 4 GB of RAM, the operating system may have to use virtual memory in order to run all of the applications at the same time. When a computer or mobile device runs low on available RAM, this often results in the computer or mobile device running sluggishly.

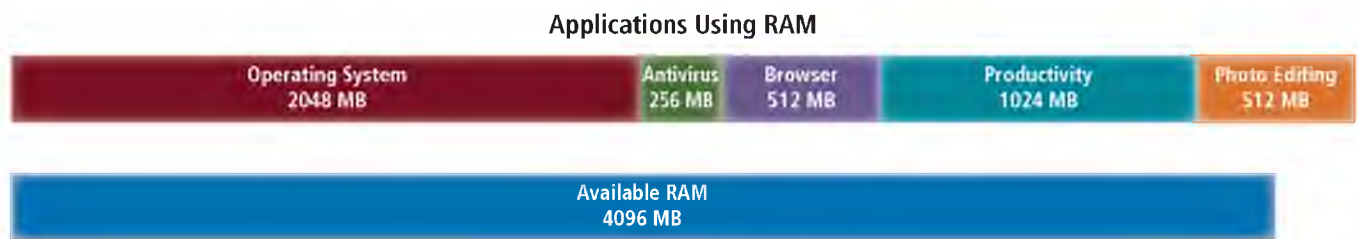


Figure 9-7 Many applications running at the same time may deplete a computer’s or device’s available RAM.
© Cengage Learning

With **virtual memory**, the operating system allocates a portion of a storage medium, such as a hard drive or a USB flash drive, to function as additional RAM (Figure 9-8). As you interact with a program, part of it may be in physical RAM, while the rest of the program is on the hard drive as virtual memory. Because virtual memory is slower than RAM, users may notice the computer slowing down while it uses virtual memory.

How a Computer Might Use Virtual Memory

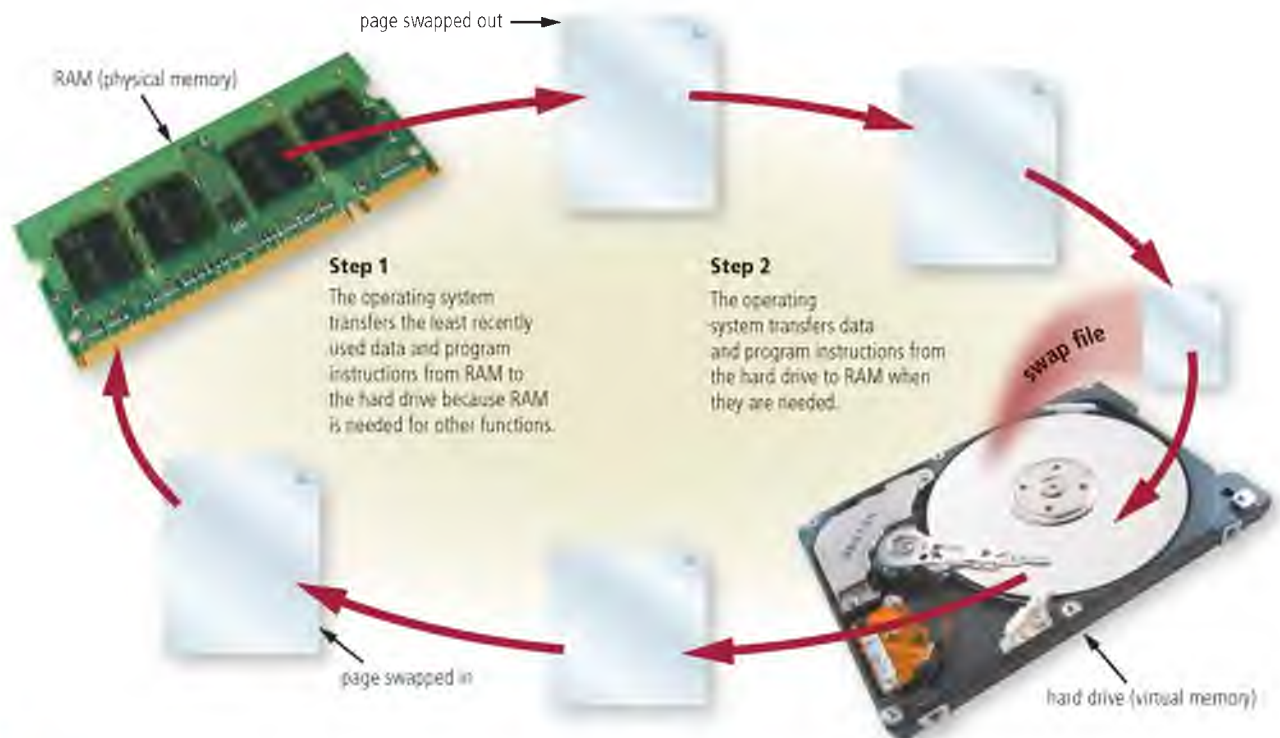


Figure 9-8 This figure shows how a computer might use virtual memory.
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The area of the hard drive used for virtual memory is called a *swap file* because it swaps (exchanges) data, information, and instructions between memory and storage. A *page* is the amount of data and program instructions that can swap at a given time. The technique of swapping items between memory and storage, called *paging*, is a time-consuming process for the computer. When an operating system spends much of its time paging, instead of executing application software, it is said to be *thrashing*.



CONSIDER THIS

What happens if an application stops responding or the computer appears to run sluggishly?

If an application, such as a browser, has stopped responding, the operating system may be thrashing. When this occurs, try to exit the program. If that does not work, try a warm boot and then a cold boot. To help prevent future occurrences of thrashing, you might consider the following:

1. Remove unnecessary files and uninstall seldom used programs and apps. (Read How To 9-1 earlier in this chapter for instructions about removing programs and apps.)
2. If your computer has a hard disk (instead of an SSD), try defragmenting the hard disk. (Read How To 8-1 in Chapter 8 for instructions about defragmenting a hard disk.)
3. Purchase and install additional RAM. (Read How To 6-3 in Chapter 6 for instructions about installing memory modules.)



CONSIDER THIS

What if my smartphone runs out of memory?

If your smartphone or other mobile device displays a message that it is running low on memory, try the following:

1. Exit unnecessary applications that are running.
2. Restart the smartphone or mobile device.
3. Uninstall seldom used applications. (Read How To 9-1 earlier in this chapter for instructions about removing programs and apps.)
4. Remove unnecessary files, including photos and videos (you may want to copy them to cloud storage, a computer, or a memory card first).
5. If your smartphone supports the use of a memory card, specify that applications, photos, videos, or downloaded files should be saved on a memory card instead of the smartphone's internal memory.

Coordinating Tasks

The operating system determines the order in which tasks are processed. A task, or job, is an operation the processor manages. Tasks include receiving data from an input device, processing instructions, sending information to an output device, and transferring items from storage to memory and from memory to storage.

Sometimes, a device already may be busy processing one task when it receives a request to perform a second task. For example, if a printer is printing a document when the operating system sends it a request to print another document, the printer must store the second document in memory until the first document has completed printing.

While waiting for devices to become idle, the operating system places items in buffers. A *buffer* is a segment of memory or storage in which items are placed while waiting to be transferred from an input device or to an output device.

An operating system commonly uses buffers with printed documents. This process, called *spooling*, sends documents to be printed to a buffer instead of sending them immediately to the printer. If a printer does not have its own internal memory or if its memory is full, the operating system's buffer holds the documents waiting to print while the printer prints from the buffer at its own rate of speed. By spooling documents to a buffer, the computer or mobile device's processor can continue interpreting and executing instructions while the printer prints. This allows users to perform other activities on the computer while a printer is printing. Multiple documents line up in a **queue** (pronounced Q) in the buffer. A program, called a *print spooler*, intercepts documents to be printed from the operating system and places them in the queue (Figure 9-9).



BTW

Higher-Priority Tasks

A multiuser operating system does not always process tasks on a first-come, first-served basis. If a user or task has been assigned a higher priority than others by the network administrator, the operating system performs higher-priority tasks first. For example, an operating system on a corporate server may process tasks to check for incoming email more frequently than it processes tasks to access archived documents.

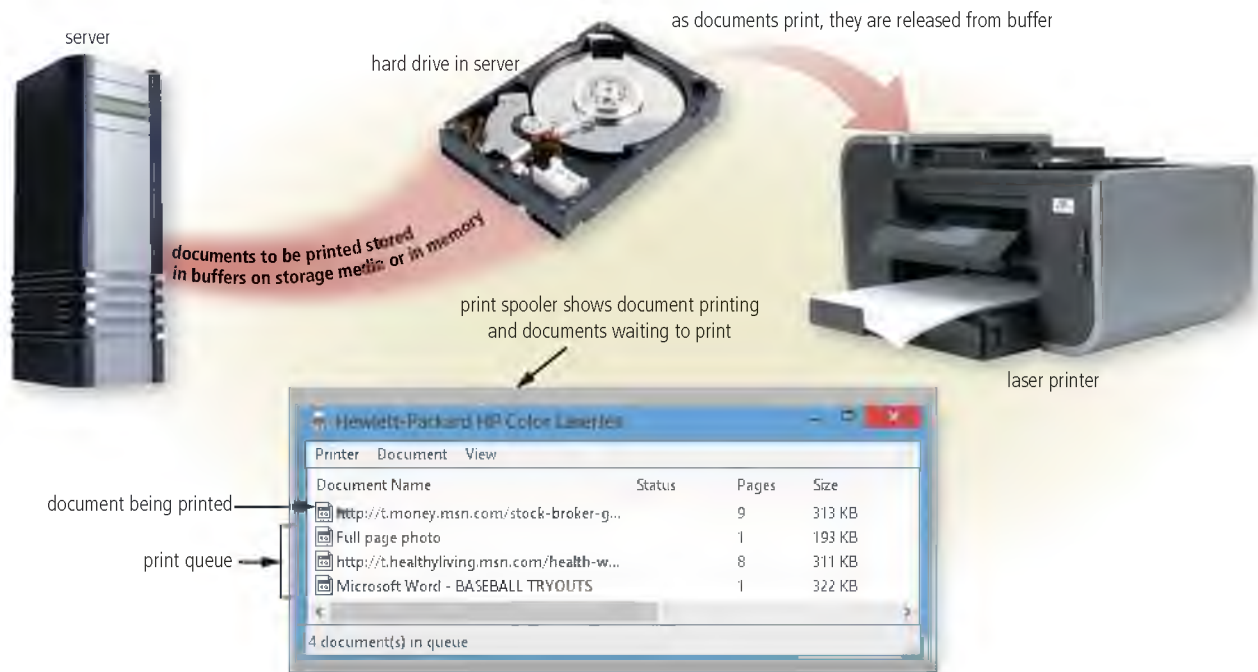


Figure 9-9 Spooling increases both processor and printer efficiency by placing documents to be printed in a buffer or on storage media before they are printed. This figure shows three documents in the queue with one document printing.

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Configuring Devices

A **driver**, short for *device driver*, is a small program that tells the operating system how to communicate with a specific device. Each device connected to a computer, such as a mouse, keyboard, monitor, printer, card reader/writer, digital camera, webcam, portable media player, or smartphone, has its own specialized set of commands and, thus, requires its own specific driver. When you start a computer or connect a device via a USB port, the operating system loads the device's driver. Drivers must be installed for each connected device in order for the device to function properly. Read How To 9-2 for instructions about finding the latest drivers for devices.

If you attach a new device, such as a portable media player or smartphone, to a computer, its driver must be installed before you can use the device. Today, most devices and operating systems support *Plug and Play*. As discussed in Chapter 6, *Plug and Play* means the operating system automatically configures new devices as you install or connect them. Specifically, it assists you in the device's installation by loading the necessary drivers automatically from the device and checking for conflicts with other devices. With *Plug and Play*, a user plugs in a device and then immediately can begin using the device without having to configure it manually.

HOW TO 9-2

Find the Latest Drivers for Devices

Device manufacturers sometimes release updated driver versions either to correct problems with previous drivers, enhance a device's functionality, or increase compatibility with new operating system versions. The following steps describe how to find the latest drivers for devices:

1. Search for and navigate to the device manufacturer's website.

2. Tap or click the link on the website to display the webpage containing technical support information.

3. Select or enter the device's model number to display support information for the device.

4. Browse the device's support information and then tap or click the link or button to download the most current driver. Manufacturers often create different versions of drivers for different operating

systems, so make sure you download the driver that is compatible with the operating system you currently are using.

5. When the download is complete, follow the instructions that accompanied the driver to install it.

Consider This: What might you do if you are unable to locate your device's driver on the manufacturer's website?

BTW
High-Tech Talk

Discover More: Visit this chapter's free resources to learn about benchmarking.

Monitoring Performance

Operating systems typically include a performance monitor. A **performance monitor** is a program that assesses and reports information about various computer resources and devices (Figure 9-10). For example, users can monitor the processor, drives, network, and memory usage.

The information in performance reports helps users and administrators identify a problem with resources so that they can try to resolve any issues. If a computer is running extremely slow, for example, the performance monitor may determine that the computer's memory is being used to its maximum. Thus, you might consider installing additional memory in the computer.

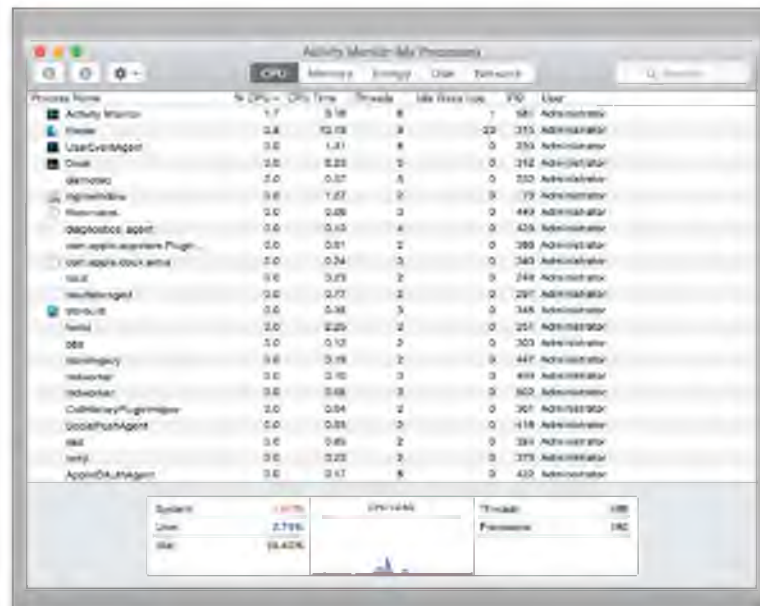


Figure 9-10 The Activity Monitor in this figure is tracking CPU (processor) usage.
Source: Apple Inc.

Establishing an Internet Connection

Operating systems typically provide a means to establish Internet connections. You can establish wired connections, such as cable and DSL, or wireless connections, such as Wi-Fi, mobile broadband, and satellite. Some connections are configured automatically as soon as you connect to the Internet. With others, you may need to set up a connection manually (Figure 9-11).

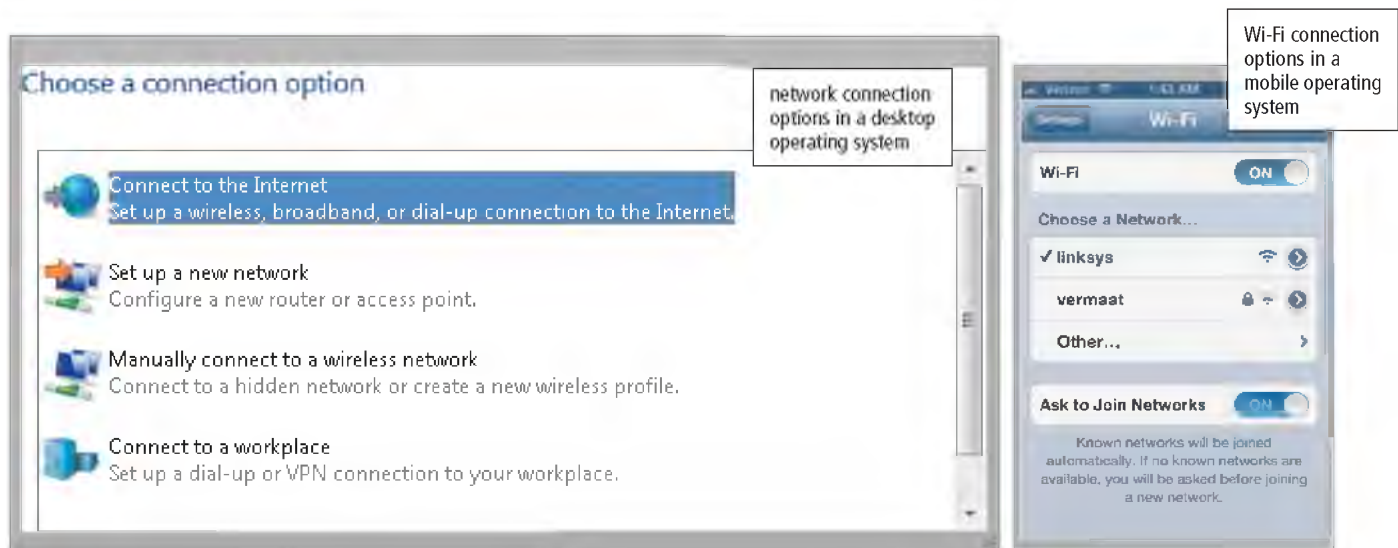


Figure 9-11 Shown here are Internet connection options for desktop and mobile operating systems.
Source: Microsoft; Source: Apple Inc.

Some operating systems also include a browser and an email program, enabling you to begin using the web and communicating with others as soon as you set up an Internet connection. Operating systems also sometimes include firewalls and other tools to protect computers and mobile devices from unauthorized intrusions and unwanted software. Read Ethics & Issues 9-1 to consider whether operating systems should include antivirus and other programs.

ETHICS & ISSUES 9-1



Should Manufacturers Include Extra Programs in Operating Systems for Computers and Mobile Devices?

OEMs (original equipment manufacturers) often include and profit from including extra programs installed with a computer or device's operating system. These additional programs and apps, often called *bloatware*, mostly are harmless. Users object to their inclusion, however, because these programs and apps take up space, may slow start-up time, and can decrease the computer or device's overall efficiency.

Bloatware can come in many forms: antivirus programs, games, productivity apps, and more. Some programs or apps cause nuisances for the user, such as those that display alarming messages about a computer's virus protection and then

offer more protection for additional costs. Programs that run when the operating system starts or run in the background cause unnecessary slowdowns. Websites exist that you can use to check your installed programs or apps against a list of those other users commonly have uninstalled, as well as the reasons for uninstalling. Independent computer programmers post fixes to remove bloatware. These fixes may or may not be legal, depending on your license agreement, and could violate any warranties for which you may be eligible.

Critics of this practice state that OEMs and operating system manufacturers should offer users the option to purchase a computer or device with a clean installation (without bloatware) of the operating system. A clean install may lead to an increased

cost to make up for the lost revenue the manufacturer receives by including the extra programs or apps. Many say that charging more for a clean installation is unethical. Some recommend giving users the option to install the programs or apps that provide additional functionality as plug-ins or add-ons. Open source software advocates state that these versions offer more options to avoid bloatware.

Consider This: Should OEMs be able to install programs and apps to run alongside capabilities built into a computer or mobile device's operating system? Why or why not? Would you pay more for a clean installation of your operating system? Why or why not?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the section titled Operating Systems and the first nine sections in Operating System Functions, as it relates to the chapter objectives.

Now you should know...

- The purpose of an operating system (Objective 1)
- What processes are occurring when you start up or shut down your computers or mobile devices (Objective 2)
- How an operating system enables you to interact with the user interface, manage programs, manage memory, coordinate tasks, configure devices, monitor performance, and establish an Internet connection (Objectives 3 and 4)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Updating Operating System Software

Many programs, including operating systems, include an **automatic update** feature that regularly provides new features or corrections to the program. That is, the operating system automatically checks to see if new updates are available, and if so, downloads them from the Internet and installs them on your computer. With an operating system, these updates can include fixing program errors, improving program functionality, expanding program features, enhancing security, and modifying device drivers (Figure 9-12).

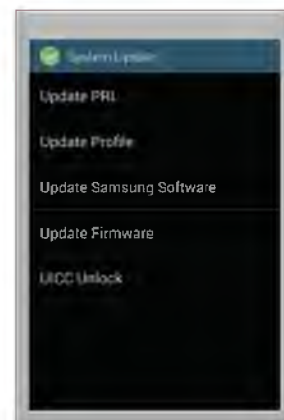


Figure 9-12 An operating system usually includes a means to download and install important updates.

Source: Google Inc.

**Bugs**

An error in a program sometimes is called a *bug*.

Many software makers provide free downloadable updates, sometimes called a *service pack*, to users who have registered and/or activated their software. With operating systems, the automatic update feature can be configured to alert users when an update is available or to download and install the update automatically. Users without an Internet connection usually can order the updates on an optical disc for a minimal shipping fee. Read Secure IT 9-1 for issues related to automatic updates.


SECURE IT 9-1**Automatic Updates — Safe or Not?**

Software updates often improve security and reliability, and they also may add significant features that optimize the computer's performance. In most cases, you have the choice either to allow the software to update automatically or to assess and then decide whether to install each update individually. Software manufacturers often recommend you download and install all available updates when they become available.

The automatic update option occasionally has caused problems. In one case, people

preparing their income tax returns were unable to print forms when a leading software company issued an automatic update one week before the filing deadline. In another situation, an automatic update was installed on all computers — even those with this feature disabled. The company claimed that the update was harmless and was for the benefit of its customers. Only later did some users realize that this secret update caused serious problems. One problem, ironically, was that updates no longer could be installed on the affected

computers. Customers were furious about the issues, especially because the company made the changes without informing the computer owners. One consequence of the ensuing outrage was that many people turned off the automatic update feature, fearing that future updates might cause even more damage.

 **Consider This:** Is the automatic update feature enabled or disabled on your computer? Why? Should software companies be able to send automatic updates to your computer without your knowledge? Why or why not?

Providing File, Disk, and System Management Tools

Operating systems often provide users with a variety of tools related to managing a computer, its devices, or its programs. These file, disk, and system management tools were discussed in Chapter 4 and are summarized in Table 9-1. Read Secure IT 9-2 to learn more about an operating system's built-in security tools.

 **Table 9-1 File, Disk, and System Management Tools**

Tool	Function
<i>File Manager</i>	Performs functions related to displaying files; organizing files in folders; and copying, renaming, deleting, moving, and sorting files
<i>Search</i>	Attempts to locate files on your computer or mobile device based on specified criteria
<i>Image Viewer</i>	Displays, copies, and prints the contents of graphics files
<i>Uninstaller</i>	Removes a program or app, as well as any associated entries in the system files
<i>Disk Cleanup</i>	Searches for and removes unnecessary files
<i>Disk Defragmenter</i>	Reorganizes the files and unused space on a computer's hard disk so that the operating system accesses data more quickly and programs and apps run faster
<i>Screen Saver</i>	Causes a display's screen to show a moving image or blank screen if no keyboard or mouse activity occurs for a specified time
<i>File Compression</i>	Shrinks the size of a file(s)
<i>PC Maintenance</i>	Identifies and fixes operating system problems, detects and repairs drive problems, and includes the capability of improving a computer's performance
<i>Backup and Restore</i>	Copies selected files or the contents of an entire storage medium to another storage location

SECURE IT 9-2

Using and Evaluating an Operating System's Built-In Security Tools

Security software must run constantly to protect against new viruses and malware and spyware attacks. Operating systems can include the following security tools:

- **Firewall:** Security experts recommend using a firewall and configuring it to turn on or off automatically.
- **Automatic updating:** Security updates are issued at least once daily, and other updates are generated on an as-needed basis. Many people enjoy the convenience offered by allowing these fixes to install automatically instead of continually checking for new files to download. Users can view the update history to see

when specific updates were installed. If an update caused a problem to occur, a user can uninstall these new files.

- **Antivirus software:** Many operating systems include antivirus programs that are updated regularly. Some users mistakenly think they should install and run another antivirus program simultaneously for more protection. They should not run more than one antivirus program on a computer because multiple programs might conflict with one another and slow overall performance.
- **Spyware and malware detection software:** Sophisticated malware and spyware threats are emerging at an unparalleled rate, so comprehensive

spyware and malware detection software is mandatory to fend off attacks on the computer or device.

The operating system generally is scheduled to scan and update when the computer is idle, such as in the middle of the night. Overall, the security tools should run constantly and quietly in the background to ensure a safe computing experience.

Consider This: Does your operating system have a firewall and protection against spyware and malware? Do updates occur automatically or manually? Which operating systems are more susceptible to malware attacks? Why?

Controlling a Network

Some operating systems are designed to work with a server on a network. These multiuser operating systems allow multiple users to share a printer, Internet access, files, and programs.

Some operating systems have network features built into them. In other cases, the operating system for the network is a set of programs that are separate from the operating system on the client computers or mobile devices that access the network. When not connected to the network, the client computers use their own operating system. When connected to the network, the operating system on the network may assume some of the operating system functions on the client computers or mobile devices.

The *network administrator*, the person overseeing network operations, uses the server operating system to add and remove users, computers, and other devices to and from the network. The network administrator also uses the operating system on the network to configure the network, install software, and administer network security.

Administering Security

Network administrators, as well as owners of computers, typically have an *administrator account* that enables them to access all files and programs, install programs, and specify settings that affect all users on a computer, mobile device, or network. Settings include creating user accounts and establishing permissions. These *permissions* define who can access certain resources and when they can access those resources.

For each user, the network administrator or computer owner establishes a user account. A user account enables a user to **sign in** to, or access resources on, a network or computer (Figure 9-13). Each user account typically consists of a user name and password. Recall that a **user name**, or user ID, is a unique combination of characters, such as letters of the alphabet and/or numbers, that identifies a specific user.



Guest Account

If you want to provide someone temporary access to your computer, you can create a secure guest account that provides access to basic functions.



Figure 9-13 Most multiuser operating systems allow each user to sign in, which is the process of entering a user name and a password into the computer. Single-user operating systems often use a password to lock an entire device or computer.

Source: Microsoft

**Passwords**

While users type a password, most computers and mobile devices hide the actual password characters by displaying some other characters, such as asterisks (*) or dots.

A **password** is a private combination of characters associated with the user name that allows access to certain computer, mobile device, or network resources. Some operating systems allow the network administrator to assign passwords to files and commands, restricting access to only authorized users. Mobile device owners often assign a password to the entire device, restricting all access until the correct password is entered. Read Secure IT 1-3 in Chapter 1 for tips on creating strong passwords.

To prevent unauthorized users from accessing computer resources, keep your password confidential. After entering a user name and/or password, the operating system compares the user's entry with the authorized user name(s) and password(s). If the entry matches the user name and/or password stored in a file, the operating system grants the user access. If the entry does not match, the operating system denies access to the user.

The operating system on a network records successful and unsuccessful sign-in attempts in a file. This allows the network administrator to review who is using or attempting to use the computer. The administrators also use these files to monitor computer usage. Read Ethics & Issues 9-2 to consider who is responsible for operating system security flaws.

**ETHICS & ISSUES 9-2****Should Operating System Manufacturers Be Liable for Breaches Due to Security Flaws?**

If you purchase a household device with a warranty, you can hold the manufacturer responsible for replacing and fixing it. Some argue that the same product liability laws that protect consumers in other industries should apply to software. Users' devices and data are vulnerable when security flaws exist in operating systems for computers and mobile devices. A flaw in an operating system can affect the performance of the computer or mobile device and subject data to corruption or unauthorized use. A user may not even be aware when a computer or mobile device is corrupted.

Hackers look for ways to break into a computer or mobile device using flaws in the operating system. An operating system is complex software that includes millions of lines of code. Developers write code as securely as possible, but with the volume of code, mistakes are bound to occur. Users sometimes are unaware of their own role in infecting their own computer or mobile device. Perhaps a hacker took advantage of a user with an unsecured Wi-Fi connection, or the user did not install or enable the latest updates to the operating system.

Some argue that making software manufacturers responsible for flaws will inhibit innovation. If a company spends

more time looking for potential security flaws, it has less time to spend enhancing the software. In addition, some of the same features that enhance an operating system, such as web integration, increase the software's vulnerability.

Consider This: Has your computer or mobile device become infected with malware due to a flaw in the operating system? How did you know? What responsibility does a software manufacturer have for preventing and fixing operating system flaws? Should users expect their software to be perfect? Why or why not?

**CONSIDER THIS****What are some alternatives to passwords?**

Many computers and mobile devices offer alternatives to setting and entering a password in order to gain access. Alternatives to passwords include specifying passcodes containing only numeric characters, swiping or touching areas of the screen in a specified order or pattern, or fingerprint or facial recognition.

**CONSIDER THIS****Do operating systems encrypt data and files?**

To protect sensitive data and information further as it travels over a network, the operating system may encrypt it. Recall that *encryption* is the process of encoding data and information into an unreadable form. Administrators can specify that data be encrypted as it travels over a network to prevent unauthorized users from reading the data. When an authorized user attempts to read the data, it is automatically decrypted, or converted back into a readable form.

Types of Operating Systems

Many of the first operating systems were device dependent and proprietary. A *device-dependent* program is one that runs only on a specific type or make of computer or mobile device. *Proprietary software* is privately owned and limited to a specific vendor or computer or device model.

Some operating systems still are device dependent. The trend today, however, is toward *device-independent* operating systems that run on computers and mobile devices provided by a variety of manufacturers. The advantage of device-independent operating systems is you can retain existing applications and data files even if you change computer or mobile device models or vendors.

When you purchase a new computer or mobile device, it typically has an operating system preinstalled. As new versions of the operating system are released, users often upgrade their existing computers and mobile devices to incorporate features of the new versions. Some upgrades are free; some offer an upgrade price that is less than the cost of purchasing the entire operating system. Read Ethics & Issues 9-3 to consider when you should upgrade.

Discover More: Visit this chapter’s free resources to learn more about device-independent operating systems.

ETHICS & ISSUES 9-3

Should You Be an Early Adopter of a New Technology?

Consumers’ reactions to the release of a new device, program or app, or operating system fall into two camps: those who cannot wait, and those who exercise caution. Early adopters is the term given to users who sleep in line on the street outside a store in order to be one of the first to own a new device, or those who stay up until midnight to start the download of a program or app the moment it is released.

Some early adopters of new technology do so for the same reasons one might purchase a new item of clothing — to make a statement. Others do so out of

curiosity, or for a desire to Tweet, blog, or post on social media his or her experiences. Manufacturers and developers rely on early adopters to provide valuable feedback and insight into the user experience, as well as to help generate excitement. In some cases, early adopters receive additional customer assistance in exchange for feedback. As one manufacturer said, the more people who initially use the product, the better the resulting product will be.


Critics of early adoption cite security risks and usability issues that may be uncovered. Many feel that waiting until the initial reviews, and subsequent patches or updated releases,

are available is prudent. Others are concerned with compatibility issues between syncing the new technology with the user’s current devices, data, or apps. Another factor in waiting is that the price of the new technology often drops within a few months of its release. Early adopters may have paid more for a less satisfying experience than those who wait.

Consider This: Have you ever been an early adopter of a new technology? What was your experience? Will you be an early adopter in the future? Why or why not? Should manufacturers give benefits to early adopters? Why or why not?

New versions of an operating system usually are *backward compatible*, which means they recognize and work with applications written for an earlier version of the operating system (or platform). The application, by contrast, may or may not be *upward compatible*, meaning it may or may not run on new versions of the operating system.

The three basic categories of operating systems on computers and mobile devices are desktop, server, and mobile. Table 9-2 lists examples in each of these categories, which are discussed on the following pages.

 **Table 9-2 Examples of Operating Systems by Category**

Category	Name
Desktop	Windows
	OS X
	UNIX
	Linux
	Chrome OS
Server	Windows Server
	Mac OS X Server
	UNIX
	Linux
Mobile	Google Android
	Apple iOS
	Windows Phone

Desktop Operating Systems

Internet Research

What is the most widely used desktop operating system?

Search for: desktop os market share

A **desktop operating system**, sometimes called a *stand-alone operating system*, is a complete operating system that works on desktops, laptops, and some tablets. Desktop operating systems sometimes are called *client operating systems* because they also work in conjunction with a server operating system. Client operating systems can operate with or without a network.

Examples of the more widely used desktop operating systems are Windows, Mac OS, UNIX, Linux, and Chrome OS.

Windows/Mini Feature 9-1

In the mid-1980s, Microsoft developed its first version of Windows, which provided a graphical user interface. Since then, Microsoft continually has updated its Windows operating system, incorporating innovative features and functions with each subsequent version. In addition to basic capabilities, the latest versions of Windows offer these features:

- Uses tiles to access apps
- Includes the desktop interface
- Support for input via touch, mouse, and keyboard
- Email app, calendar app, and browser (*Internet Explorer*) included
- Photos, files, and settings can sync with *OneDrive*, Microsoft's cloud server
- Enhanced security through an antivirus program, firewall, and automatic updates
- Windows Store offers additional applications for purchase

Discover More: Visit this chapter's free resources to learn more about the Windows Store. Read Mini Feature 9-1 to learn more about the interface of the Windows operating system.

BTW

Networking

Some desktop operating systems include networking capabilities, allowing the home and small business user to set up a small network.

BTW

PC

The term, PC, sometimes is used to describe a computer that runs a Windows operating system.

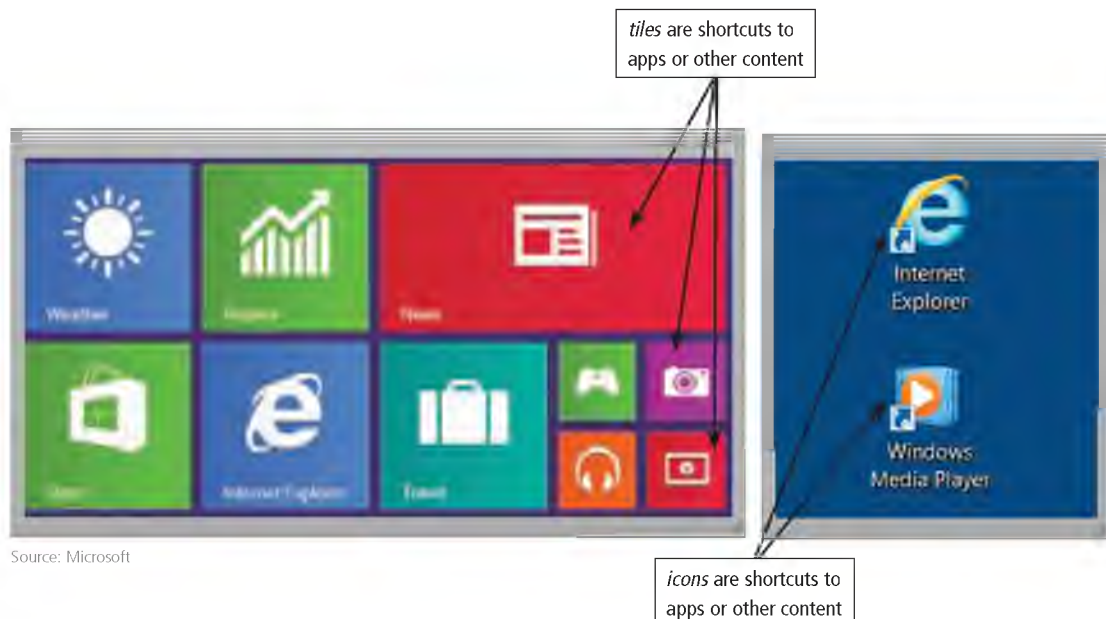
MINI FEATURE 9-1

Windows User Interface

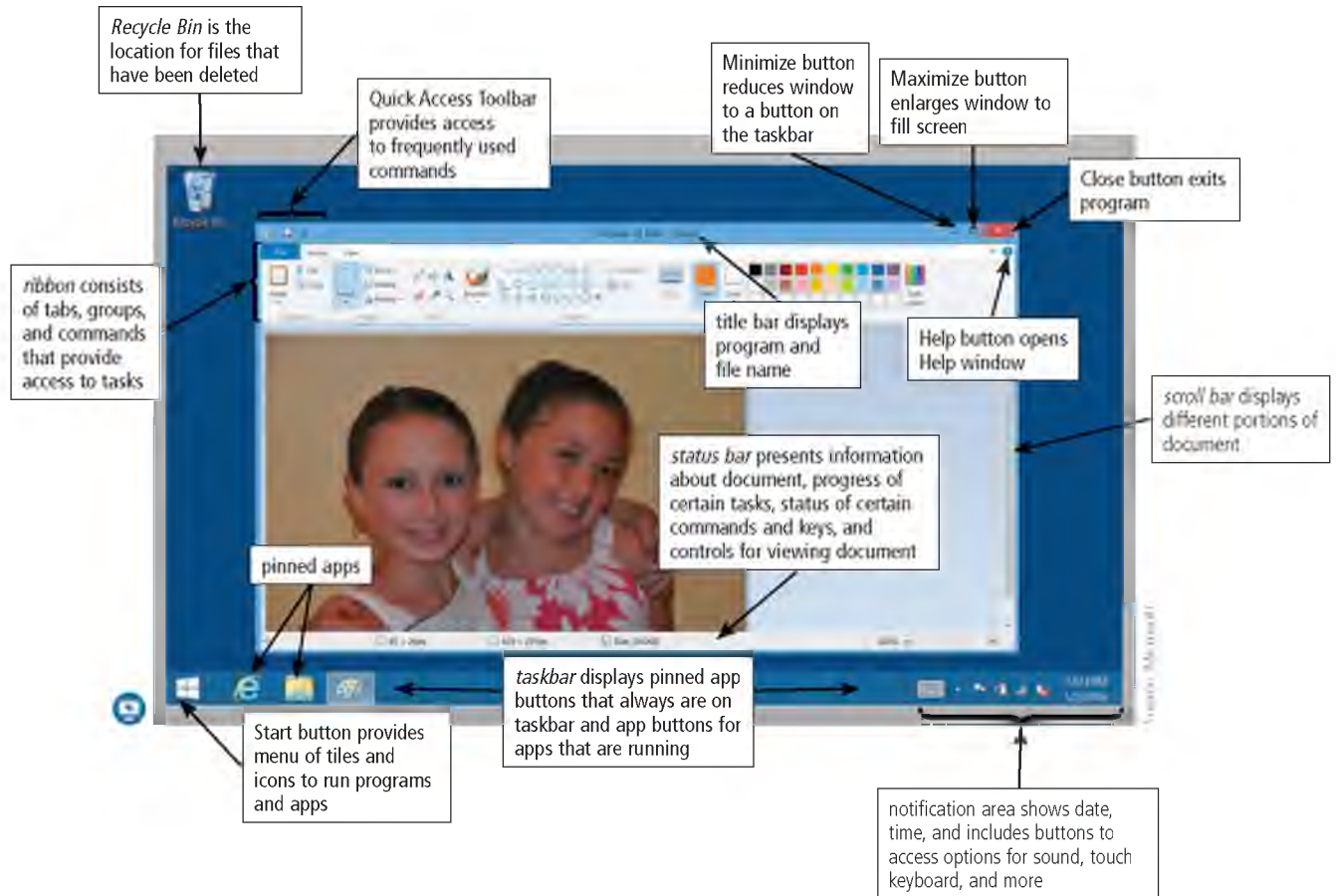
The following screens show the components of the Windows interface. The Windows operating system simplifies the process of working with documents and apps by organizing the manner in which you interact with the computer.

The Windows interface includes tiles and icons, as shown in the figure below. You tap or click tiles to run apps, and double-tap or double-click icons to run apps.

When you run an app in Windows, it may appear in an on-screen work area app, called the desktop, shown in the second figure in this mini feature. Many Office and Windows programs, such as Paint, contain common elements.



Source: Microsoft



Discover More: Visit this chapter's free resources to learn about the current Windows version.

Consider This: Have you used Windows? If so, which version? What was your experience? What

features of the Windows interface make it easy to run apps and open documents? Why? How does the ribbon help make learning a new program easier?

Mac OS/Mini Feature 9-2

Since it was released in 1984 with Macintosh computers, Apple's *Macintosh operating system* (*Mac OS*) has earned a reputation for its ease of use and has been the model for most of the new GUIs developed for non-Macintosh systems. The latest version, **OS X**, is a multitasking operating system available for computers manufactured by Apple. Features of the latest version of OS X include the following:

- Mail, calendars, contacts, and other items sync with *iCloud*, Apple's cloud server
- Communicate and play games with users of mobile devices running Apple's mobile operating system (*iOS*)
- Built-in Facebook and Twitter support allows you to post a status, comments, or files from any app
- Browser (*Safari*)
- Open multiple desktops at once
- Dictated words convert to text
- Support for Braille displays
- Mac App Store provides access to additional apps and software updates

Discover More: Visit this chapter's free resources to learn more about the Mac App Store. Read Mini Feature 9-2 to learn more about the interface of the Mac operating system.


MINI FEATURE 9-2

Mac OS User Interface

The following screens show the components of the OS X user interface. Mac OS is installed on Apple computers, such as iMacs, MacBook Pros, MacBook Airs, Mac Pros, and Mac minis. The user interface contains components such as the Dock, icons, and windows.

The OS X user interface begins with the desktop. Many OS X programs and apps contain common elements, as shown in the desktop figure below.

You can use the Launchpad to view, organize, and run apps, as shown in the second figure below.



Discover More: Visit this chapter's free resources to learn more about the latest version of Mac OS.

Consider This: How is the user interface in OS X similar to the Windows user interface? How is it different?

UNIX

UNIX (pronounced YOU-nix) is a multitasking operating system developed in the early 1970s by scientists at Bell Laboratories. Bell Labs (a subsidiary of AT&T) was prohibited from actively promoting UNIX in the commercial marketplace because of federal regulations. Bell Labs instead licensed UNIX for a low fee to numerous colleges and universities, where UNIX obtained a wide following. UNIX was implemented on many different types of computers. In the 1980s, the source code for UNIX was licensed to many hardware and software companies to customize for their devices and applications. As a result, several versions of this operating system exist, each with slightly different features or capabilities.

Today, a version of UNIX is available for most computers of all sizes. Although some versions of UNIX have a command-line interface, most versions of UNIX offer a graphical user interface (Figure 9-14). Power users often work with UNIX because of its flexibility and capabilities. An industry standards organization, *The Open Group*, now owns UNIX as a trademark.

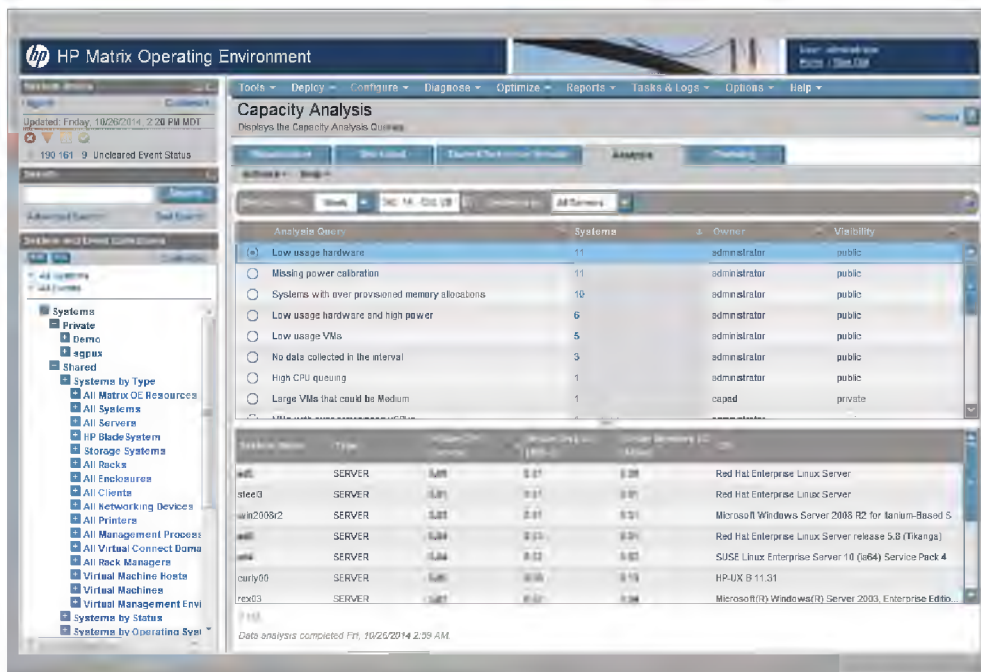


Figure 9-14 One version of the UNIX operating system.

Courtesy of Hewlett-Packard Company

Linux

Linux (pronounced LINN-uks), introduced in 1991, is a popular, multitasking UNIX-based operating system that runs on a variety of personal computers, servers, and devices. In addition to the basic operating system, Linux also includes many free tools and programming languages.

Linux is not proprietary software like the operating systems discussed thus far. Instead, Linux is *open source software*, which means its code is provided for use, modification, and redistribution. Many programmers have donated time to modify and redistribute Linux to make it the most popular UNIX-based operating system.

CONSIDER THIS

Why use open source software?

Open source software has no restrictions from the copyright holder regarding modification of the software's internal instructions and redistribution of the software. Promoters of open source software state two main advantages: users who modify the software share their improvements with others, and customers can personalize the software to meet their needs. Read Secure IT 9-3 to consider security issues associated with open and closed source programs.



OS X

OS X is a UNIX-based operating system.



Technology Innovator

Discover More: Visit this chapter's free resources to learn about Linus Torvalds, the creator of Linux.



Technology Trend

Discover More: Visit this chapter's free resources to learn more about innovations of Linux powering the Internet of Things.

SECURE IT 9-3

Open Source or Closed Source — Which Is More Secure?

Supporters of open source software maintain that this operating system enables developers to create high-quality programs. Source code, along with any changes, remains public, so communities of open source programmers can examine, correct, and enhance programs. They also can make changes immediately when security issues arise.

Many proponents of open source software use Linux, which is known for its speed and stability. Of the 500 fastest supercomputers, more than 90 percent use variants of Linux. Many of these computers perform high-performance tasks, including detecting and preventing fraud. Companies and nonprofit

organizations can distribute and sell their versions of Linux, which enables those without the expertise to modify open source software and to benefit from the creative efforts of the Linux community.

Developers of closed source operating systems, on the other hand, refuse to share some or all of the code. They believe that companies and developers should be able to control, and profit from, the operating systems they create. Their philosophy may hinder third-party software developers who create programs and apps for the operating system.

Fear of viruses and other security concerns can lead some to question about whether open source software is worthwhile. While

dishonest and anonymous developers can use open source software to create programs that may be or may include malware, cryptography experts emphasize that Linux systems have fewer reported security exposures than Windows-based systems. In general, Linux systems do not run antivirus software, but they do use detection programs that check for signs of attacks and probes.

Consider This: Are the security concerns about open source software legitimate? Why or why not? Why is antivirus software not needed on Linux-based systems? Does the open source model lead to higher-quality software? Why or why not?



Figure 9-15 A GUI distribution of Linux.

Courtesy of KDE



Technology Innovator

Discover More: Visit this chapter's free resources to learn about Red Hat, a distributor of Linux.

Chrome OS

Chrome OS, introduced by Google, is a Linux-based operating system designed to work primarily with web apps (Figure 9-16). Apps are available through the Chrome Web Store, and data is stored on Google Drive. The only apps typically installed on the computer are the Chrome browser, a media player, and a file manager. A specialized laptop that runs Chrome OS is called a *Chromebook*, and a specialized desktop that runs Chrome OS is called a *Chromebox*. Chromebooks and Chromeboxes typically use SSDs for internal storage. Users also can run Chrome OS as a virtual machine (which is discussed in the next section).

Because computers running Chrome OS work mostly with web apps, they do not require as much internal storage capacity as other desktop operating systems discussed in this section. Their start-up and shutdown time also is considerably less than other desktop operating systems because Chrome OS uses a streamlined start-up procedure.

Discover More: Visit this chapter's free resources to learn more about Chromebooks and Chromeboxes.

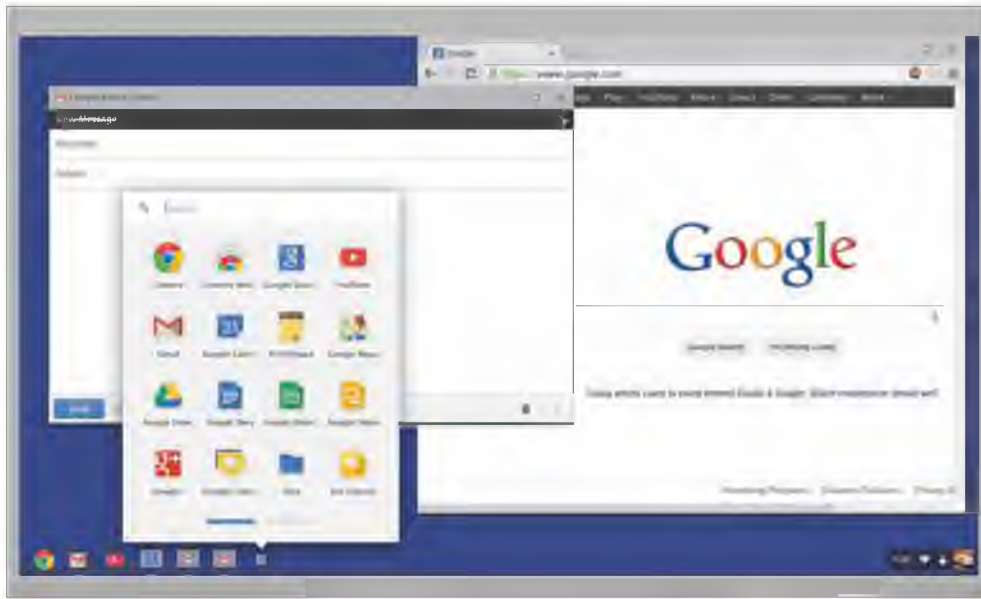


Figure 9-16 Chrome OS is a Linux-based operating system by Google.
Courtesy of Volha Kryvets; Source: Google Inc.

Running Multiple Desktop Operating Systems

If you want to run multiple operating systems on the same computer, you could partition the hard drive or you could create a virtual machine. *Partitioning* divides a hard drive in separate logical storage areas (partitions) that appear as distinct drives. When you partition a drive, you can install a separate operating system in each partition, sometimes called a dual boot. Because partitioning requires advanced skills, users often opt to create a virtual machine instead. A *virtual machine (VM)* is an environment on a computer in which you can install and run an operating system and programs. VMs enable you to install a second operating system on a computer. Read How To 9-3 for instructions about creating a virtual machine. Another option for Mac users who want to run Windows programs is a program called Boot Camp. Read How To 9-4 for instructions about installing the Windows operating system on a Mac computer.

HOW TO 9-3



Set Up and Use a Virtual Machine

A virtual machine enables a computer to run another operating system in addition to the one installed. Various reasons exist for using a virtual machine. For example, if you are running the latest version of Windows on a computer but require an app that runs only in a previous version of Windows, you might set up a virtual machine running the previous version of Windows so that you can run the desired app. The computer still will have the latest version of Windows installed, but you easily will be able to switch to the previous version when necessary.


To set up a virtual machine, you will need the required software, as well as installation media for the operating system you want to install in the virtual machine. The following steps describe how to set up a virtual machine:

1. Obtain and install an app that creates and runs virtual machines.

2. Run the app and select the option to create a new virtual machine.
3. Specify the settings for the new virtual machine.
4. If necessary, insert the installation media for the operating system you want to run in the virtual machine.
5. Run the virtual machine. Follow the steps to install the operating system in the virtual machine.
6. When the operating system has finished installing, remove the installation media.
7. While the virtual machine is running, if desired, install any apps you want to run.
8. When you are finished using the virtual machine, shut down the operating system in the same manner you would shut down your computer.
9. Exit the virtual machine software.

After you set up the virtual machine, you can use the virtual machine any time by performing the following steps:

1. Run the virtual machine software.
2. Select the virtual machine you want to run.
3. Tap or click the button to run the virtual machine.
4. When you are finished using the virtual machine, shut down the operating system similar to how you would shut down your computer.
5. Exit the virtual machine software.


 **Consider This:** What are some other reasons that might require you to set up and use a virtual machine on a computer?

 HOW TO 9-4**Use Boot Camp to Install the Windows Operating System on a Mac**

If you are using an Apple computer, such as an iMac or MacBook Pro, you may encounter instances where you need to run apps in the Windows operating system. Newer versions of Mac OS enable you to install Windows on a computer using a program called *Boot Camp*. The following steps describe how to use Boot Camp to install the Windows operating system on a Mac:

1. Obtain the installation media for the version of Windows you want to install.
2. Use the operating system's search feature to locate the Boot Camp Assistant application. (*Hint:* Use the search text, boot camp.)
3. Click the search result for the Boot Camp Assistant application.
4. When the Boot Camp Assistant runs, read the introduction and then click the Continue button.
5. Next, you create a partition, which is a section of storage or memory reserved for a specific program or application. Partitions enable a single drive to be treated as multiple drives. Follow the remaining steps to create a Windows partition and install Windows:
 - a. Specify the amount of disk space to use for the Windows partition. The partition should be large enough to store all operating system files, apps you want to run in Windows, and any files you want to store using Windows.
 - b. Complete the steps described in the Windows installation process.
6. When the installation is complete and Windows starts, if necessary, enter your user name and password to sign in to Windows.

If you want to switch between Mac OS and Windows, press and hold the option key on the keyboard while turning on or restarting the computer. When the list of operating systems is displayed, select the operating system you want to run.

 **Consider This:** What apps might someone want to run in Windows that are unavailable in Mac OS? How does Boot Camp differ from a virtual machine?

 NOW YOU SHOULD KNOW

Be sure you understand the material presented in the last four sections in Operating System Functions and the sections titled Types of Operating Systems and Desktop Operating Systems, as it relates to the chapter objectives. *Now you should know ...*

- How to update your operating system and tools (Objective 5)
- How you can use an operating system to control a network or administer security (Objective 6)
- Which desktop operating system is best suited to your needs (Objective 7)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Server Operating Systems

 BTW**Multipurpose OS**

Operating systems, such as UNIX and Linux, that function as both desktop and server operating systems sometimes are called *multipurpose operating systems*.

 BTW**High-Tech Talk**

Discover More: Visit this chapter's free resources to learn more about virtualization.

A **server operating system** is a multiuser operating system that organizes and coordinates how multiple users access and share resources on a network. Client computers on a network rely on server(s) for access to resources.

Many of the desktop operating systems discussed in the previous section function as clients and work in conjunction with a server operating system. Although desktop operating systems may include networking capability, server operating systems are designed specifically to support all sizes of networks, including medium- to large-sized businesses and web servers. Server operating systems can handle high numbers of transactions, support large-scale messaging and communications, and have enhanced security and backup capabilities.

Many also support virtualization. Recall that *virtualization* is the practice of sharing or pooling computing resources, such as servers or storage devices. Through virtualization, for example, server operating systems can separate a physical server into several virtual servers. Each virtual server then can perform independent, separate functions.

Examples of server operating systems include the following:

- **Windows Server:** Developed by Microsoft, Windows Server enables organizations to manage applications and websites on-site and/or on the cloud.
- **OS X Server:** Developed by Apple, OS X Server enables organizations to collaborate, share files, host websites and mail servers, and more on Mac computers and iOS devices.

- **UNIX:** Capable of handling a high volume of transactions in a multiuser environment and working with multiple processors, UNIX often is used on web servers.
- **Linux:** Because it provides a secure, stable multiuser environment, Linux often is used on web servers and on supercomputers.

Discover More: Visit this chapter's free resources to learn more about the latest versions of Windows Server and OS X Server.



Internet Research
What is the most widely used server operating system?

Search for: server os market share



BTW Technology Innovators
Discover More: Visit this chapter's free resources to learn about the products and services of Sun and IBM.

Mobile Operating Systems

The operating system on mobile devices and many consumer electronics is called a **mobile operating system** and resides on firmware. Mobile operating systems typically include or support the following: calendar and contact management, text messaging, email, touch screens, accelerometer (so that you can rotate the display), digital cameras, media players, speech recognition, GPS navigation, a variety of third-party apps, a browser, and wireless connectivity, such as cellular, Wi-Fi, and Bluetooth. Read Ethics & Issues 9-4 to consider the privacy of text messages.

ETHICS & ISSUES 9-4

Should Text Messages Sent by Employees Be Private?

When an employer asks a worker to disclose work-related text messages, is the employee legally required to reveal all messages, even personal ones? Is the employer liable for damages caused by inappropriate messages sent by an employee?

Many companies provide employees with mobile devices, such as smartphones, for work communications. Employers typically create acceptable use policies. These policies address ownership of electronic communications, including email messages, voice mail messages, and text messages. Regardless of the policy,

employees may believe they have the rights of privacy and self-expression when they use a company-issued mobile device for personal use. The issue is complicated further when companies employ BYOD (bring your own device) policies. When an employee uses a personal device for business-related communications, it is unclear who owns the communications, and who takes responsibility for any misuse. Read Secure IT 9-4 for security issues associated with BYOD.

The U.S. Supreme Court ruled that an employer can read workers' text messages on company-owned devices if the employer has reason to believe the text messages violate workplace rules. The Court held that employees

can purchase their own mobile devices for personal use. Critics state that employees have a reasonable expectation of privacy. Supporters of the decision argue that employers own the devices because they provide the devices and pay for the service for the employee. They claim, therefore, that employers have a right to view the content of all text messages.

Consider This: Should text messages sent by employees be private? Why or why not? How can employers impose policies regarding text messages sent on company-issued mobile devices? Should employers be able to access work-related communications on an employee-owned device? Why or why not?

SECURE IT 9-4

BYOD Security Issues

Effective BYOD (bring your own device) policies can lead to many benefits for businesses, but they also give rise to many issues that affect information security and data protection. When employees bring their smartphones, tablets, and laptops into the workplaces, the companies surrender much control over this hardware compared to devices they own.

One of the biggest problems is that employees can carry their devices everywhere outside of work. If these devices are lost or stolen, the company's sensitive information can land in the hands of criminals. Many of these allegedly lost devices are sold on online auctions and other services websites, even if the original owners have wiped their devices remotely.

Companies need to educate employees on *mobile device management (MDM)*. One point they need employees to know is that phishing scams abound in email messages, text messages, Facebook posts, and Tweets. Other security measures to emphasize are the need to use strong passwords, to not reveal these passwords to other employees, and to avoid apps that collect information about the user, especially those that monitor the employee's location and shopping habits.

BYOD policies should be developed that address technical, legal, and human resources issues. The language in these policies should cover these topics:

- Ensuring that work data will not be merged with the employee's personal data

- Requiring that nonemployees, such as family members who use the device, will not access work data
- Following procedures when an employee resigns or is terminated
- Alerting management immediately when the device is lost or stolen

Consider This: Do you or people you know work at a business that allow employees to bring their own devices to work? If so, do these businesses have a BYOD policy? If so, how were the policy's terms communicated? For example, were they explained verbally and available in written form?

Internet Research

What is the most widely used mobile operating system?

Search for: mobile os market share

BTW

Android Releases

Google names its Android releases alphabetically after sweet treats, such as Gingerbread, Honeycomb, Ice Cream Sandwich, Jelly Bean, Key Lime Pie, KitKat, and Lollipop.

Popular mobile operating systems include Android, iOS, and Windows Phone. The following sections discuss each of these operating systems.

CONSIDER THIS

Do other mobile operating systems exist?

Yes. Several other mobile operating systems exist, although they are not as widely used as Android, iOS, and Windows Phone. For example, the *Blackberry operating system* is a proprietary mobile operating system that runs on Blackberry smartphones and Blackberry tablets. *Firefox OS* is a Linux-based open source operating system that runs on smartphones and tablets developed by Mozilla. *Fire OS* is a Linux-based operating system for Amazon Kindle tablets and Amazon Fire Phones. Several phones also run a version of Linux.



Figure 9-17 An Android phone and tablet.
© iStockPhoto / deepblue4you; Courtesy of Sony Corporation

Android

Android is an open source, Linux-based mobile operating system designed by Google for smartphones and tablets (Figure 9-17). A variety of manufacturers produce devices that run the Android operating system, adding their own interface elements and bundled software. As a result, an Android smartphone manufactured by Samsung may have different user interface features from one manufactured by Google.

Features unique to recent versions of the Android operating system include the following:

- *Google Play* app store provides access to apps, songs, books, and movies.
- *Google Drive* provides access to email, contacts, calendar, photos, files, and more.
- Face recognition or fingerprint scanner can unlock the device.
- Share contacts and other information by touching two devices together (using NFC technology).
- Speech output assists users with vision impairments.
- Voice recognition capability enables users to speak instructions.
- Built-in heart rate monitor works with phone apps.

Discover More: Visit this chapter’s free resources to learn more about the Android operating system.



Figure 9-18 An iOS phone and tablet.
© iStockPhoto / cotesebastien

iOS

iOS (originally called iPhone OS), developed by Apple, is a proprietary mobile operating system specifically made for Apple’s mobile devices (Figure 9-18). Supported devices include the iPhone, iPod Touch, and iPad. Features unique to recent versions of the iOS operating system include the following:

- *Siri*, a voice recognition app, enables you to speak instructions or questions to which it takes actions or responds with speech output.
- *Apple Pay* provides a centralized, secure location for credit and debit cards, coupons, boarding passes, loyalty cards, and mobile payment accounts.
- *iCloud* enables you to sync mail, calendars, contacts, and other items.
- *iTunes Store* provides access to music, books, podcasts, ringtones, and movies.
- Integrates with iPod to play music, video, and other media.
- Improves connectivity with other devices running the Mac operating system.
- *Mac App Store* provides access to additional apps and software updates.

Discover More: Visit this chapter’s free resources to learn more about the iOS operating system.

Windows Phone

Windows Phone, developed by Microsoft, is a proprietary mobile operating system that runs on some smartphones (Figure 9-19). Features unique to recent versions of the Windows Phone operating system include the following:

- Sync photos, files, and settings with OneDrive.
- Use your phone as a remote control for your television.
- Access a global catalog of music, videos, or podcasts, or listen to iTunes music.
- Geofencing enables your phone to send or receive notification when you enter or exit a geographic location. (Read Ethics & Issues 8-2 in Chapter 8 for other uses of geofencing.)
- *Windows Phone Store* provides access to additional apps and software updates.
- *Wallet* app provides a centralized location for coupons, credit cards, loyalty cards, and memberships in a single, easily accessible location.

Discover More: Visit this chapter's free resources to learn more about the Windows Phone operating system.



Figure 9-19 A Windows Phone.
Courtesy of Microsoft

Mini Feature 9-3: Mobile versus Desktop Operating Systems

While mobile and desktop operating systems share many similarities, they also have differences designed for their operating environment. Read Mini Feature 9-3 for a comparison of mobile and desktop operating systems.

MINI FEATURE 9-3

Mobile versus Desktop Operating Systems

An operating system has the same role, whether for a desktop or mobile device. It manages operations and provides a user interface. Because of this shared role, many similarities exist between the functions of desktop and mobile operating systems. From a user's perspective, operating systems enable you to work with apps and to monitor and maintain the functions of the computer or device. Typical functions included in mobile operating systems include the following:

- Main areas, such as a desktop or home screen, enable you to access and organize apps
- Methods to return to the main area quickly
- The ability to organize the app icons or tiles in the main areas easily by moving them to pages or folders or by adding them to menus
- System tools, such as to manage battery power and Internet connections
- Options for security settings

Whether you are purchasing a computer or mobile device, the choice of an operating system plays an important role.

Historically, the two types of operating systems have had different uses and capabilities. The differences are due in part to the disparity in screen size, keyboards, and processing power. Because of convergence, as well as the increased reliance on mobile devices for communications and productivity, the use and function of mobile and desktop operating systems are becoming more similar. The prevalence of web apps and cloud storage services enables users to access the same programs and files they work with on their desktop from a mobile device. Some developers now create operating systems that share code and have common features, regardless of whether they are installed on a computer or mobile device. Features, such as tiles and icons (typically used in mobile devices), make the transition between using a mobile device and computer easier. For example, mobile device operating systems include capabilities that allow users to take advantage of the touch screen displays. As more computer desktop monitors today are touch enabled, computer users can take advantage of this feature.

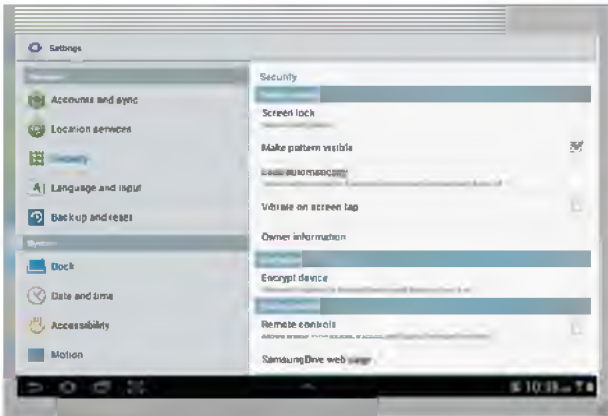
Many differences exist in the way a user interacts with a mobile operating system.



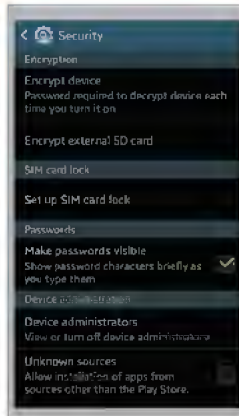
BTW

Technology Trend

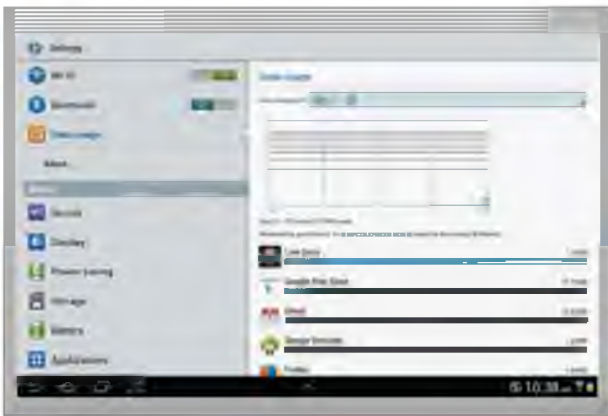
Discover More: Visit this chapter's free resources to learn more about mobile versus desktop operating system usage.



Source: SAMSUNG



Source: Google Inc.



Source: SAMSUNG



Source: Google Inc.

- A desktop operating system may use menus, windows, and bars to run apps and to access features within apps. On a desktop, you can run multiple programs simultaneously and seamlessly due to the large screen and the use of pointing devices. This feature makes desktops more relevant than mobile operating systems to productivity and multitasking.
- A mobile operating system typically has one program running at a time, although others may be running in the background. Quick movements and gestures are often all that you need to perform tasks on a mobile device. Mobile operating systems use technologies such as cellular, Bluetooth, Wi-Fi, GPS, and NFC to communicate with other devices and to connect to the Internet. Mobile devices also typically include cameras, video cameras, voice recorders, and sometimes speech recognition.

Discover More: Visit this chapter's free resources to learn more about mobile and desktop operating systems.

Consider This: What similarities have you noticed between mobile and desktop operating systems? What differences have you noticed between mobile and desktop operating systems? What features work better with a mobile versus a desktop operating system? Why? Is the convergence trend beneficial or should each device type take advantage of its strengths? Why?

CONSIDER THIS

Do embedded computers use mobile operating systems?

Typically, an embedded computer uses an embedded operating system, sometimes called a *real-time operating system (RTOS)*. Examples of products that use embedded operating systems include digital cameras, ATMs, digital photo frames, HDTV receivers, fuel pumps, ticket machines, process controllers, robotics, and automobile components. Embedded operating systems often perform a single task, usually without requiring input from a user. Several embedded operating systems are available, each intended for various uses.

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Server Operating Systems and Mobile Operating Systems, as it relates to the chapter objectives.

Now you should know ...


- When you might use a server operating system (Objective 8)
- Which mobile operating system you would prefer to use (Objective 9)

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Chapter Summary

This chapter discussed the functions common to most operating systems: starting and shutting down computers and mobile devices, providing a user interface, managing programs, managing memory, coordinating tasks, configuring devices, monitoring performance, establishing an Internet connection, updating operating system software, providing file, system, and disk management tools, controlling a network, and administering security. It also presented a variety of desktop operating systems, server operating systems, and mobile operating systems.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Linus Torvalds, Red Hat, Sun, and IBM; Technology Trends: Linux Powering the Internet of Things and Mobile versus Desktop Operating System Usage; and High-Tech Talks: Benchmarking and Virtualization.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test apps that run on your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Meteorology

With the television tuned to the local weather station, you anxiously are awaiting to see the projected path of a hurricane in the tropics. Having experienced hurricanes in the past, you rely heavily on the accuracy of weather forecasts so that you can prepare adequately if a storm travels through the area. Technology allows meteorologists to better estimate the severity and path of storms, enabling people to make potentially life-saving preparations.

The National Hurricane Center uses powerful computers to generate multiple computer models to determine a storm's path. These models consider factors such as the storm's current strength, the effects of nearby weather systems, the storm's central pressure, and whether the storm may travel over land. These models also may consider previous storms that traveled a similar path. While these models are not 100 percent accurate, they do ensure that everyone who may be affected by the storm has enough time to prepare.


Violent, rotating thunderstorms potentially can spawn tornadoes, which sometimes cause catastrophic damage. For this reason, it is important for everyone to watch or listen closely to the weather during the storm. Meteorologists can monitor weather systems on multiple radars and send additional severe weather warnings automatically to weather radios and apps. Technology enables these messages to be

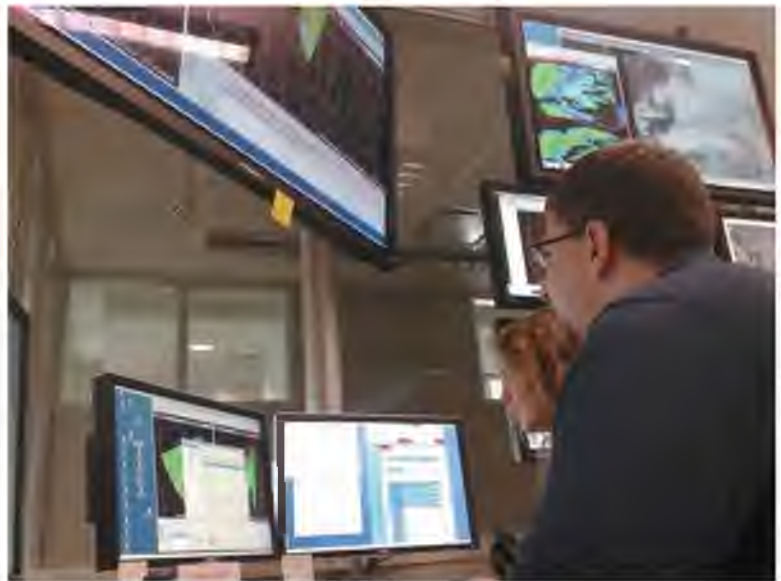
broadcast automatically to weather radios and apps only in areas that may be affected.

In addition to computers helping us stay safe during severe storms, they also assist with day-to-day weather forecasting. Several years ago, meteorologists could predict the weather for only a few days into the future. Beyond that point, the forecast was very uncertain. Meteorologists presently are able to predict the weather, including temperature and chance of precipitation, one week or more into the future with much greater accuracy because computers create models using historical weather data and behavior to predict the future path of various weather systems.

News and weather stations have weather apps and also post their weather forecasts online. In fact, several websites have interactive radars that allow visitors to zoom in and view how weather is affecting their immediate neighborhood.

The meteorology field has made significant advancements because of computer technologies. Weather forecasts are more accurate, which not only helps us prepare on land, but also helps to protect those traveling by air or by sea.

 **Consider This:** In what other ways do computers and technology play a role in the meteorology field?



Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to **test your knowledge of digital content** associated with this chapter and **access the Study Guide resource** from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

1. Define the term, operating system. List the functions of an operating system.
2. Define the term, firmware. Name another term for an operating system.
3. List methods to start a computer or device.
4. Identify the five steps in the start-up process.
5. The _____ is the core of an operating system. Differentiate between resident and nonresident, with respect to memory.
6. Explain the role of a boot drive.
7. List reasons why users might shut down computers or mobile devices regularly. Differentiate between sleep mode and hibernate mode.
8. Define the term, user interface. Distinguish between GUI, natural-user, and command-line interfaces.
9. Define the terms, foreground and background, in a multitasking operating system.
10. List steps for removing a program or app.
11. Describe how a computer manages memory. Define the term, virtual memory.
12. The technique of swapping items between memory and storage is called _____.
13. Explain what occurs during thrashing, and list steps to prevent it.
14. List actions you should take if a mobile device displays a message that it is running low on memory.
15. Explain how a computer coordinates tasks. Define these terms: buffer, spooling, and queue.
16. Describe the role of a driver. Explain how to find the latest drivers for a device.
17. Describe the role of a performance monitor.
18. Explain how an operating system establishes an Internet connection.
19. Explain the issues surrounding an operating system's inclusion of additional software.
20. Identify changes that may be made to an operating system during an automatic update. List security concerns regarding automatic updates.
21. List file and disk management tools, and describe the function of each.
22. List and describe security tools used by operating systems.
23. Describe the role of a network administrator.
24. Explain the capabilities of administrator and user accounts on a network.
25. Explain the use of permissions on a network.
26. Explain issues surrounding responsibility for operating system security flaws.
27. List alternatives to using passwords.
28. Explain how an operating system uses encryption.
29. Differentiate between device-dependent and device-independent programs.
30. Define these terms: proprietary software, backward compatible, and upward compatible.
31. Explain issues surrounding being an early adopter of a new technology.
32. List two other names for a desktop operating system.
33. Identify features of Windows. Define the term, desktop, with respect to Windows and Mac OS.
34. The term, _____, sometimes is used to describe a computer that runs a Windows operating system.
35. Identify features of OS. You can use the _____ to view, organize, and run apps.
36. Describe uses and features of the UNIX operating system.
37. Define the term, open source software. _____ is an example of an open source operating system.
38. Explain the issues surrounding open source versus closed source operating systems.
39. Identify features of Chrome OS.
40. Identify reasons to use a virtual machine. List steps for setting up a virtual machine.
41. List steps for using Boot Camp to install the Windows operating system on a Mac computer.
42. Describe a server operating system. List examples of server operating systems.
43. Identify common features of mobile operating systems.
44. Explain issues surrounding ownership of text messages sent using company-issued devices.
45. Explain security concerns regarding BYOD policies.
46. Differentiate among the features of the Android, iOS, and Windows Phone mobile operating systems.
47. List differences and similarities between how a user interacts with mobile versus desktop operating systems.
48. Describe how embedded computers use operating systems.
49. Explain how the meteorology industry uses technology.

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

Discover More: Visit this chapter's premium content to **view definitions** for each term and to **access the Flash Cards resource** from your smartphone, tablet, laptop, or desktop.

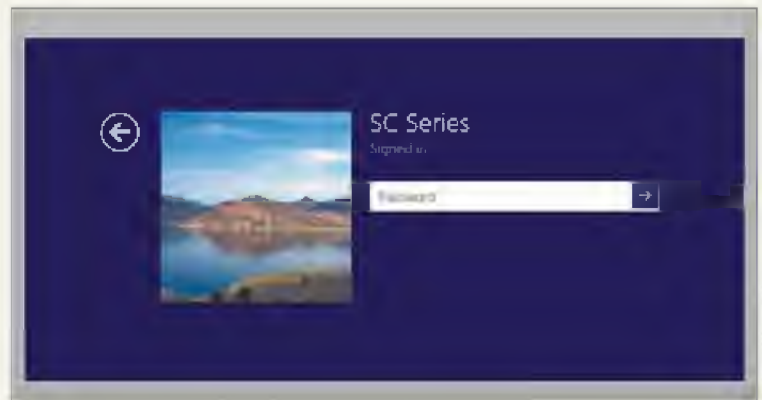
Key Terms

Primary Terms (shown in bold-black characters in the chapter)

Android (434)	iOS (434)	OS X (427)	UNIX (429)
automatic	Linux (429)	password (424)	user interface
update (421)	mobile operating	performance	(UI) (414)
boot drive (413)	system (433)	monitor (420)	user name (423)
Chrome OS (430)	natural user interface	queue (418)	virtual memory (417)
desktop operating	(NUI) (414)	server operating	Windows Phone (435)
system (426)	operating system	system (432)	
driver (419)	(OS) (410)	sign in (423)	

Secondary Terms (shown in italic characters in the chapter)

<i>administrator account (423)</i>	<i>Google Drive (434)</i>	<i>permissions (423)</i>	<i>spooling (418)</i>
<i>background (415)</i>	<i>Google Play (434)</i>	<i>platform (412)</i>	<i>stand-alone operating system (426)</i>
<i>backup and restore (422)</i>	<i>graphical user interface</i>	<i>Plug and Play (419)</i>	<i>status bar (427)</i>
<i>backward compatible (425)</i>	<i>(GUI) (414)</i>	<i>print spooler (418)</i>	<i>swap file (418)</i>
<i>Blackberry operating system (434)</i>	<i>hibernate mode (413)</i>	<i>proprietary software (425)</i>	<i>taskbar (427)</i>
<i>bloatware (421)</i>	<i>iCloud (427)</i>	<i>real-time operating system (RTOS)</i>	<i>The Open Group (429)</i>
<i>Boot Camp (432)</i>	<i>icons (426)</i>	<i>(436)</i>	<i>thrashing (418)</i>
<i>boot disk (413)</i>	<i>image viewer (422)</i>	<i>recovery media (413)</i>	<i>tiles (426)</i>
<i>booting (413)</i>	<i>Internet Explorer (426)</i>	<i>Recycle Bin (427)</i>	<i>touch user interface (414)</i>
<i>buffer (418)</i>	<i>iTunes Store (434)</i>	<i>ribbon (427)</i>	<i>uninstaller (422)</i>
<i>bug (422)</i>	<i>kernel (412)</i>	<i>Safari (427)</i>	<i>upward compatible (425)</i>
<i>Chromebook (430)</i>	<i>Live CD (413)</i>	<i>screen saver (422)</i>	<i>virtual machine (VM) (431)</i>
<i>Chromebox (430)</i>	<i>Live USB (413)</i>	<i>scroll bars (427)</i>	<i>virtualization (432)</i>
<i>client operating systems (426)</i>	<i>Macintosh operating system</i>	<i>search (422)</i>	<i>Wallet (435)</i>
<i>cold boot (413)</i>	<i>(MAC OS) (427)</i>	<i>service pack (422)</i>	<i>warm boot (413)</i>
<i>command language (415)</i>	<i>memory resident (413)</i>	<i>Siri (434)</i>	<i>Windows Phone Store (435)</i>
<i>command-line interface (414)</i>	<i>mobile device management</i>	<i>sleep mode (413)</i>	
<i>cross-platform application (412)</i>	<i>(MDM) (433)</i>		
<i>desktop (428)</i>	<i>multipurpose operating</i>		
<i>device driver (419)</i>	<i>systems (432)</i>		
<i>device-dependent (425)</i>	<i>multitasking (415)</i>		
<i>device-independent (425)</i>	<i>multiuser (416)</i>		
<i>disk cleanup (422)</i>	<i>network administrator</i>		
<i>disk defragmenter (422)</i>	<i>(423)</i>		
<i>Dock (428)</i>	<i>nonresident (413)</i>		
<i>encryption (424)</i>	<i>OneDrive (426)</i>		
<i>file compression (422)</i>	<i>open source software</i>		
<i>file manager (422)</i>	<i>(429)</i>		
<i>Fire OS (434)</i>	<i>page (418)</i>		
<i>Firefox OS (434)</i>	<i>paging (418)</i>		
<i>firmware (410)</i>	<i>partitioning (431)</i>		
<i>foreground (415)</i>	<i>PC maintenance (422)</i>		



sign in (423)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. An operating system must reside inside a computer or mobile device; that is, it cannot run from a USB flash drive or other external drives. (410)
- _____ 2. The kernel is nonresident, which means it remains in memory while the computer or mobile device is running. (413)
- _____ 3. A user interface controls how you enter data and instructions and how information is displayed on the screen. (414)
- _____ 4. Most users today work with a command-line interface. (414)
- _____ 5. Most operating systems today are multitasking. (415)
- _____ 6. The area of the hard drive used for virtual memory is called a swap file. (418)
- _____ 7. Each device connected to a computer requires its own specific driver. (419)
- _____ 8. Hackers often look for ways to break into a computer or device using flaws in the operating system. (424)
- _____ 9. Many of the first operating systems were device dependent and proprietary. (425)
- _____ 10. An upward compatible application means it can recognize and work with applications written for an earlier version of the operating system. (425)
- _____ 11. Linux is proprietary software. (429)
- _____ 12. Operating systems that function as both desktop and server operating systems sometimes are called multipurpose operating systems. (432)

Multiple Choice

Select the best answer.

1. A _____ application is an application that runs the same on multiple operating systems. (412)
 - a. cross-platform
 - b. stand-alone
 - c. device driver
 - d. multitasking
2. Placing a computer in _____ mode saves any open documents and running programs or apps to an internal hard drive before power is removed from the computer or device. (413)
 - a. sleep
 - b. hibernate
 - c. kernel
 - d. NUI
3. With a _____ interface, users interact with the software through ordinary, intuitive behavior. (414)
 - a. command-line interface
 - b. proprietary software
 - c. natural user interface
 - d. graphical user interface
4. A _____ operating system allows two or more programs or apps to reside in memory at the same time. (415)
 - a. foreground
 - b. background
 - c. multiuser
 - d. multitasking
5. With _____, the operating system allocates a portion of a storage medium to function as additional RAM. (417)
 - a. Live USB
 - b. a natural user interface
 - c. virtual memory
 - d. spooling
6. The technique of swapping items between memory and storage is called _____. (418)
 - a. thrashing
 - b. paging
 - c. spooling
 - d. buffering
7. In Windows, a _____ is a shortcut to apps or other content. (426)
 - a. tile
 - b. Launchpad
 - c. ribbon
 - d. Recycle Bin
8. A _____ is a multiuser operating system that organizes and coordinates how multiple users access and share resources on a network. (432)
 - a. stand-alone operating system
 - b. server operating system
 - c. virtual machine
 - d. multipurpose operating system

Checkpoint

Matching Match the terms with their definitions.

- | | |
|--------------------------------------|---|
| _____ 1. firmware (410) | a. operating system problem that occurs when it spends much of its time paging, instead of executing application software |
| _____ 2. command language (415) | b. small program that tells the operating system how to communicate with a specific device |
| _____ 3. thrashing (418) | c. Windows term for a shortcut to an app or other content |
| _____ 4. buffer (418) | d. software that is privately owned and limited to a specific vendor or computer or device model |
| _____ 5. driver (419) | e. ROM chips or flash memory chips that store permanent instructions |
| _____ 6. bloatware (421) | f. operating system that runs on computers and mobile devices provided by a variety of manufacturers |
| _____ 7. proprietary software (425) | g. software whose code is provided for use, modification, and redistribution |
| _____ 8. device-independent (425) | h. additional programs and apps included with operating systems, usually for profit |
| _____ 9. icons (426) | i. segment of memory or storage in which items are placed while waiting to be transferred from an input device or to an output device |
| _____ 10. open source software (429) | j. set of commands used to control actions performed in a command-line interface |

**Consider This** Answer the following questions in the format specified by your instructor.

- Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (421, 424, 425, 433), How To (416, 419, 431, 432), Mini Features (426, 428, 435), Secure IT (422, 423, 430, 433), and Technology @ Work (437).
- What is the role of the operating system? (410)
- What does firmware do? (410)
- What is a platform? (412)
- What is a cross-platform application? (412)
- What does the kernel do? (412)
- How do resident and nonresident memory differ? (413)
- What does the word, live, signify when used to describe a type of media (i.e., Live USB or Live CD)? (413)
- What is the difference between a cold and warm boot? (413)
- How does sleep mode differ from hibernate mode? (413)
- Why do some users find command-line interfaces difficult to use? (415)
- What is the role of virtual memory? (417)
- In terms of speed, how does virtual memory compare with RAM? (417)
- What does it mean when an operating system is thrashing? (418)
- What is meant by the term, swap file? (418)
- What remedies can you try if your computer or application runs sluggishly? (418)
- What is a buffer? (418)
- In a multiuser operating system, are tasks processed on a first-come, first-served basis? Why or why not? (418)
- Why do some users object to bloatware? (421)
- What is a service pack? (422)
- How do users without an Internet connection obtain updates? (422)
- What built-in security tools are included in most operating systems? (422)
- What duties does a network administrator perform? (423)
- What is the advantage of device-independent operating systems? (425)
- What are some widely used desktop operating systems? (426)
- How are tiles used in the Windows user interface? (426)
- What elements are contained in the OS Dock? (428)
- Why do computers running Chrome OS require less internal storage capacity than those running other desktop operating systems? (430)
- What are some popular mobile operating systems? (434)

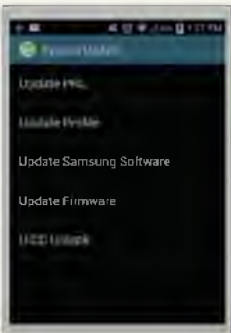
Problem Solving

The Problem Solving exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The Collaboration exercise should be completed with a team.

instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Difficulty Signing In to Operating System** You are attempting to sign in to your operating system, but you receive an error message stating that you have entered an invalid password. What are your next steps?
- 2. Missing Customization Settings** When you sign in to your operating system, your customized desktop background does not appear. Instead, the operating system displays the default desktop background. What might have happened?
- 3. Incompatible Program** You have upgraded to the latest version of an operating system on your computer. After the upgrade, you realize that programs that used to run without issue now do not run. What are your next steps?
- 4. Insufficient Access** You are attempting to install a program on your computer and a dialog box appears informing you that you have insufficient privileges to install the program. What might be wrong?



Source: Google Inc.

- 5. Software Update Issues** You have heard that new software updates are available for your operating system, but when the operating system checks for updates, it shows that no updates are available. Why might this be the case?

Professional

- 6. Virtual Machine Error** You use virtual machines on your office computer so that you can run and test software in multiple operating system versions. When you attempt to run one of the virtual machines, you receive an error message that the virtual machine already is running. You are certain that the virtual machine is not running. What steps can you take to correct the problem?
- 7. Missing Files and Settings** When you sign in to various computers at work with the credentials assigned by your IT department, you typically see all your files. When you recently signed in to the computer in your office, however, you were unable to view your files. What are your next steps?
- 8. Faulty Update** Your computer is set to install updates for the operating system, programs, and apps automatically. You have learned through your company's IT department that a recent operating system update causes a problem to occur with a program you use regularly. What are your next steps?
- 9. Mobile Device Operating System Upgrade** A notification appears on your mobile phone stating that an operating system upgrade has been downloaded and is ready to install. Your company has provided the mobile phone to you for work-related business, and you are hesitant to install the upgrade. What are your next steps?
- 10. Slow System Performance** Your office computer has been running slow lately, and you are attempting to determine the cause. What steps can you take to determine what might be slowing your computer's performance?

Collaboration

- 11. Technology in Meteorology** Your environmental sciences instructor is teaching a lesson about how technology has advanced the meteorology field. Form a team of three people to prepare a brief report about how technology and meteorology are connected. One team member should research how meteorologists predicted weather patterns before computer use became mainstream. Another team member should create a timeline illustrating when and how technology was introduced to the meteorology field, and the third team member should research the technology required for a typical news station to forecast and present the weather.

The **How To: Your Turn** exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn** exercises, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Determine Your Operating System Version

Companies such as Microsoft, Apple, and Google release new versions of operating systems periodically. Software and drivers sometimes are designed for specific operating system versions, which means you may need to determine your operating system version so that you can obtain the proper software. The following steps describe how to determine your operating system version.

- If necessary, turn on your computer or mobile device and, if necessary, sign in to the operating system. Some operating systems will display the version when they run. If the operating system version is not displayed, continue following these steps.
- If you are using a Mac computer, click the command on the Apple menu to display information about the computer to determine the operating system version. If you are running an operating system other than Mac OS, continue following these steps.
- Display the control panel or settings for your computer or mobile device.
- Navigate to and then tap or click the command to display system information about the computer or device, and then locate the operating system version.



Source: Google Inc.

Exercises

- What operating system are you running?
- What are some other reasons why you might need to know the operating system version on your computer or mobile device?
- What might happen if you attempt to install a program or app that is not designed for your operating system version?

2 Search for Files on a Computer

Advances in technology enable users to store a large number of files, such as documents, photos, videos, and music, on their computers. Users store contacts, appointments, email messages, and other information on mobile devices to retrieve at a later time. With all the information you can store on computers and mobile devices, it sometimes can be difficult to locate an item you need to access. Today's operating systems contain a search tool that provides an easy way to locate files stored on a computer or mobile device. To search for an item on a computer or mobile device, you should know information about the item for which you are searching. The following steps guide you through the process of searching a computer or mobile device.

- If necessary, run the search tool on your computer or mobile device. If you are using a mobile device, such as a smartphone or tablet, you may be able to access the search tool by pressing a search button on the phone or tablet.



Courtesy of Volha Kryvets; Source: Google Inc.

How To: Your Turn



How To: Your Turn

- If you remember all or part of the name of the file for which you are searching, enter all or part of the file name in the search box.
- Tap or click the search button to display the search results. Depending upon the number of files and folders on your computer or mobile device, it may take several minutes for search results to appear.
- If no search results are displayed, consider searching again and entering less information in the search box.
- When you locate the file for which you are searching, you can open it either by tapping, double-tapping, or double-clicking the file. The method you should use to open the file will depend on the operating system you are using.

Exercises

- Have you used the search tool on your computer? If so, what files were you attempting to locate? If not, do you think the search tool will be helpful to you?
- Have you used the search tool on a mobile device? What were you attempting to locate?
- In addition to searching for files, what other items might the search tool locate?

3 Personalize Your Operating Environment

When you purchase a new computer or mobile device, the first task you might want to complete is to personalize the operating environment to suit your tastes. For example, you might want to have your favorite sports team's logo as your desktop background, a screen saver consisting of a slide show containing photos of your recent vacation, or specific sounds that play when certain events occur. The following steps guide you through the process of personalizing your operating environment.

- If necessary, sign in to your operating system.
- Display your operating system's control panel, settings, or system preferences.
- Tap or click the option to modify the display settings and then navigate to the specific setting to change the desktop background (the desktop background also may be referred to as wallpaper).
- Tap or click the option to locate the image to use as your desktop background. If you are planning to download an image from the web, you should do

so before completing this step. Download only an image that is not protected by copyright.

- Navigate to the location of the image to use as the desktop background and then select the image to set it as your desktop background.
- Navigate to the screen saver settings and then select the desired screen saver. If necessary, set the desired preferences for the screen saver.
- Navigate to the sound settings.
- Select the event for which you want to assign or change the sound.
- Select the sound you want to play. If you are not using one of the operating system's prerecorded sounds, navigate to the location of the sound you want to use and then select the sound.
- If necessary, save the changes and close the control panel, settings, or system preferences.

Exercises

- What image are you currently using as your desktop background or wallpaper?
- Do you have a screen saver configured on your computer or mobile device? If so, what does it look like?
- What other personalization settings do you customize?



Courtesy of KDE

4 Configure Accessibility Settings

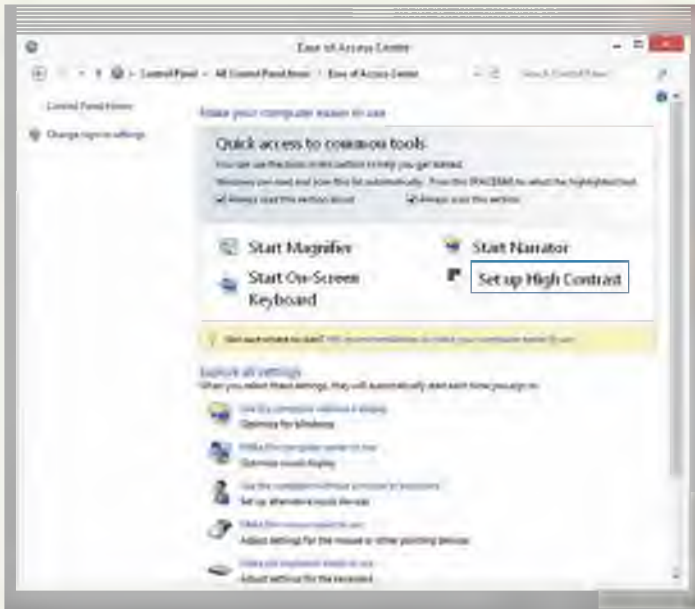
Many modern operating systems allow users to configure accessibility settings to make it easier for some individuals to interact with them. Accessibility features can perform functions such as enhancing the contrast between colors on the display device, narrating text that is displayed on the screen, and allowing the user to control the pointer using keys on

How To: Your Turn

5 Add Users to an Operating System

If you share your computer with others, you can add more user accounts to the operating system. When users sign in to their accounts, they can customize their settings and store files in locations that may not be accessible to other users on the computer. The following steps guide you through the process of adding users to an operating system.

- a. Sign in to a user account that has administrative privileges; that is the user account should have the capability to perform functions such as adding users.
- b. Display the operating system settings.
- c. Tap or click the option to display user accounts.
- d. Tap or click the option to add a new user account.
- e. Specify the options for the new user account:
 - Enter a name to identify the user account.
 - Specify a default password for the user account.
 - Select the type of user account (administrative, standard, etc.). You should create user accounts with administrative access only if you want the user to be able to perform tasks such as change computer settings; add or remove programs and apps; and add, modify, or remove a user account.
 - If necessary, set parental controls for the user account.
- f. Save the settings for the new user account.
- g. Sign out of the existing user account.
- h. Sign in to the newly created user account and make sure everything works as intended.



Source: Microsoft

the keyboard. The following steps guide you through the process of configuring accessibility settings.

- a. If necessary, sign in to the operating system.
- b. Display your operating system's control panel, settings, or system preferences.
- c. Tap or click the command to display accessibility settings.
- d. Select the accessibility setting you want to configure, and specify your desired settings.
- e. Repeat the previous step for all remaining accessibility settings you want to configure.
- f. When you have finished configuring the accessibility settings, save your changes and then close the window containing the control panel, settings, or system preferences.
- g. If you no longer require the accessibility settings, display your operating system's control panel, settings, or system preferences, display the setting you want to disable, and then disable the setting.

Exercises

1. Accessibility settings are not only for people with impairments; these settings can make it easier for anyone to use a computer. Can you think of any accessibility settings that you might consider using to make it easier to interact with the computer?
2. Which third-party programs can provide additional features for accessibility?
3. Do you feel that the accessibility features in your computer or mobile device's operating system are sufficient? Why or why not?

Exercises

1. Do you have multiple user accounts on your computer? Why or why not?
2. Do you think it is a good idea for students in a school computer lab to have administrative access to the computers? Why or why not?
3. What types of parental controls can you enable using your operating system? Do you think these controls are relevant only to parents, or can you determine other people who might benefit from using parental controls? What parental controls might those other people use, and why?



Source: Microsoft

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to **challenge yourself with additional Internet Research exercises**, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Banking and Finance

Managing money and making wise investments and are among the most important skills consumers need to master. Abundant advice is available on a variety of banking and financial websites. More than 80 percent of Americans who manage household finances have enrolled in online banking programs, and 20 percent have used a banking app on their smartphones or mobile devices. Whether their financial institutions are a retail bank, a virtual bank, or a credit union, they enjoy the convenience of monitoring account balances, depositing checks, transferring funds, receiving text message alerts, and paying bills.

Personal finance websites provide information on portfolio management, tax preparation, real estate investing, mortgage rates, retirement planning, credit card and student loan advice, and a host of other lifestyle and educational topics. Also available are calculators to help make saving, spending, and real estate decisions. Business finance websites include market data, company earnings, interest rates, and corporate news.

Research This: (a) Visit two online banking websites: one for a financial institution that has a physical presence in your community and another that is virtual. Compare the services and featured products. For example, do they offer bill payment,

retirement accounts, and mobile banking apps? What fees are charged for these services? Which bank has the highest money market and certificate of deposit rates?

(b) Visit two financial websites, such as Yahoo! Finance, that feature information about managing personal credit and debt. Read two stories discussing student loans, credit card debt, overspending, or retirement planning. According to these articles, what mistakes do people make managing their money? Who are the economic professionals writing or being quoted in the articles? What advice is given that can help you handle your expenses?

2 Social Media

Operating systems constantly evolve as developers add new features, fix security issues, and modify functions. Computer and mobile device users need to stay abreast of these changes, especially when the updates affect performance and safety. Many blogs feature content about operating systems. Their posts cover industry news, photos, product reviews, previews of forthcoming software and hardware, and management changes. Most of these blogs are unofficial, meaning that the writers are not necessarily employees of the companies that develop the operating systems. The

bloggers generally have extensive experience in the technology field and desire to share their expertise with others.

Research This: Search online for a blog that tracks features or updates to a mobile, desktop, or other operating system that you use or about which you would like more information. Report the web address of the blog, along with a summary of the most recent blog post.



Source: Yahoo

Internet Research

3 Search Skills

Video, Audio, and Voice Search

A video search allows you to locate video files posted or shared online. Tap or click the Videos link on a search engine's home page and then type the search text. For example, type the search text, linux tutorial, in the search box to find videos for learning about Linux. You can narrow your results by specifying additional conditions. These may include length (in minutes), time taken (such as past day, week, or month), quality, popularity (based on number of views), and source (YouTube or other websites).

To search for audio files, type the search text, audio search, in a search engine's search box and look for a search engine that specializes in finding audio clips, streaming audio, and other audio files. Alternatively, visit a website for sharing audio and music files, and search that site directly. For example, type the search text, ios podcast, in an audio sharing site's search box to find podcasts about Apple's mobile operating system.

Some search apps allow you to speak your search text. For example, using Google, tap or click the microphone button in the search box or say the phrase, "ok google" to activate voice search and then speak your question. The app will convert your speech to text and provide the search results.



Source: SoundCloud

Research This: Using a search app that accepts voice input, either speak the search text or find an audio sharing site in which to type search text to find podcasts, audio files, or videos about these topics: (1) a video about how to manage security settings on your computer posted within the past month; (2) a video tutorial about how to use the Mac Finder, shorter than four minutes in length; (3) a video that was not posted on YouTube, describing how to partition a hard

drive; and (4) audio files of Windows operating system start-up sounds.

Create a document containing the web address of each audio or video clip and the name or web address of the website on which it appears. Watch or listen to comments on how accurately they reflect your search text.

4 Security

An operating system should include antivirus and spyware and malware detection software to fend off intrusions. The use of this security software is discussed in Secure IT 9-2 in this chapter. Major companies that provide this software often include information on their websites about recently discovered virus threats and hoaxes. They also track scheduled virus payload strikes and map global and regional virus attacks.

Research This: Visit at least two virus protection websites to obtain virus information. When were the latest active threats discovered and updated? What are their names and risk levels? When is the next virus payload strike scheduled? What type of malware is spreading via mobile device use? Which virus removal tools and resources are available?

5 Cloud Services

Cloud Development Platforms (PaaS)

Developers have many choices for the programming languages, operating systems, databases, and tools they use to create apps hosted on the cloud. Microsoft Azure, Amazon Web Services, and Google App Engine are providers of platform as a service (PaaS), a service of cloud computing that delivers tools for developing, testing, and deploying apps on the cloud.

A PaaS provider manages the computing resources required to run apps on the cloud so that developers can concentrate on writing the code, logic, interfaces, and operations of the software.

Research This: (1) Read a customer case study about Microsoft Azure, Amazon Web Services, or Google App Engine. In what industry is the customer involved? What was the challenge for which the customer was seeking a PaaS solution? How did this solution meet their needs? (2) Research one of these PaaS providers. Which operating systems and development tools does it support? How does it support scalability when additional computing resources are required? What pricing model is in place?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Using Operating System Tools

You are the office manager at a social media consulting business. The office recently upgraded and replaced several computers. You now are running the latest version of Windows on all of your computers. Your boss asks you to explore the various tools that are included with the operating system and to evaluate any additional needs you might have.

Do This: Use the web to learn more about the following Windows operating system tools: firewalls, automatic updates, and software that scans for viruses, spyware, and other malware. Read reviews by industry experts and users. Analyze the advantages and disadvantages of using built-in operating system tools. Do any built-in operating system tools present security concerns? If so, what would you recommend? Explore alternatives for each of the tools, and determine whether you should disable the Windows tool and if any risks exist. Compile your findings.



Source: Microsoft

2. Complete Security Solutions

Your neighbor started a new construction business. He would like to hire you to set up his new computers. His business will use the Internet to communicate with clients via email, store backups of data, and access cloud-based accounting software. The office will include two networked computers, which will share a printer and an Internet connection. In addition, he will use a tablet so that he can access the cloud-based accounting software using Wi-Fi. Because of security concerns with

using the Internet, he first would like you to install a program(s) designed to protect his computers from various security threats.

Do This: Use the web to find answers to the following questions. What types of security threats exist on the Internet that could impact his business? What types of security measures should he use? Evaluate two programs that provide a comprehensive security solution. What are the programs' functions? What are their costs? Do the services charge subscription fees in order to receive automatic updates? Which would you recommend? Why?

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The board of directors has asked you to recommend options for mobile operating systems for the new smartphones they would like to purchase.

Do This: Select two mobile operating systems to explore (such as Android, iOS, and Windows Phone). Use the web to find industry experts' recommendations and user reviews for each operating system. Include the different device types for which each is available. Examine differences in security, features, speed, and reliability. What security concerns exist? What security features enable you to protect the smartphone and its data? Which mobile operating system offers the best features? Which is considered faster and/or more reliable? Your office computers run the Mac OS operating system. Do compatibility issues exist with any of the mobile operating systems? If so, what are the issues? Can you find solutions that would enable you to sync data? Compile your findings.

Collaboration

4. Desktop Operating Systems You are an analyst for a large manufacturer of laundry soaps. The company currently uses an early version of the Windows operating system on its 5,000 desktops. This year, the company plans to upgrade the operating system and, if necessary, its desktops. The company asks your team to compare the latest versions of the Windows, Mac OS, and Linux operating systems.

Do This: Form a three-member team and assign each member an operating system. Each member should use the web to develop a feature/benefit analysis and answer the following questions. What is the initial cost of the operating system per computer? What are the memory and storage requirements? Will the operating system require the company to purchase new computers? Which is best at protecting against viruses, spam, and spyware? Which support touch input? As a team, compile your findings and share your recommendation with the class.

COMMUNICATING DIGITAL CONTENT: Wired and Wireless Networks and Devices

10



A variety of media are used for worldwide communications.

“I use my smartphone to make phone calls, send text messages, video chat with family and friends, listen to voice mail messages, and navigate using a GPS app. At home, I have a broadband Internet connection, and I access the Internet wirelessly at local hot spots and on campus. What more could I learn about communications and networks?”


While you may be familiar with some of the content in this chapter, do you know how to . . .

- Add a computer or mobile device to a network?
- Determine if you should use a BAN to monitor medical data?
- Use mobile communications?
- Evaluate the risks and benefits of telemedicine?
- Use Bluetooth technology?
- Prevent Bluebugging?
- Use an NFC tag?
- Use your smartphone as a mobile hot spot?
- Strengthen a wireless signal?
- Detect an intruder accessing your wireless signal?
- Plan and design a home network?
- Add a wireless printer to a network?
- Describe how fake cell towers are intercepting calls?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

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Objectives

After completing this chapter, you will be able to:

- 1 Discuss the purpose of components required for successful communications (sending device, communications device, transmission media, and receiving device) and identify various sending and receiving devices
- 2 Differentiate among LANs, MANs, WANs, and PANs
- 3 Differentiate between client/server and peer-to-peer networks
- 4 Explain the purpose of communications software
- 5 Describe various network communications standards and protocols: Ethernet, token ring, TCP/IP, Wi-Fi, Bluetooth, UWB, IrDA, RFID, NFC, and LTE
- 6 Describe various types of communications lines: cable, DSL, ISDN, FTTP, T-carrier, and ATM
- 7 Describe commonly used communications devices: broadband modems, wireless modems, wireless access points, routers, network cards, and hubs and switches
- 8 Discuss ways to set up and configure a home network
- 9 Differentiate among physical transmission media: twisted-pair cable, coaxial cable, and fiber-optic cable
- 10 Differentiate among wireless transmission media: infrared, broadcast radio, cellular radio, microwaves, and communications satellite

Communications

The process in which two or more computers or devices transfer data, instructions, and information is known as digital communications. Today, even the smallest computers and devices can communicate directly with one another, with hundreds of computers on a corporate network, or with millions of other computers around the globe — often via the Internet.

Figure 10-1 shows a sample communications system. Some communications involve cables and wires; others are sent wirelessly through the air. For successful communications, you need the following:

- A **sending device** that initiates an instruction to transmit data, instructions, or information
- A communications device that connects the sending device to transmission media
- **Transmission media**, or a *communications channel*, on which the data, instructions, or information travel
- A communications device that connects the transmission media to a receiving device
- A **receiving device** that accepts the transmission of data, instructions, or information

As shown in Figure 10-1, all types of computers and mobile devices serve as sending and receiving devices in a communications system. This includes servers, desktops, laptops, tablets, smartphones, portable media players, handheld game devices, and GPS receivers. Communications devices, such as modems, wireless access points, and routers, connect transmission media to a sending or receiving device. Transmission media can be wired or wireless.

This chapter presents types of networks, along with various types of communications lines and devices, and transmission media.

Communications System



Figure 10-1 A simplified example of a communications system. Some devices that serve as sending and receiving devices are (a) servers, (b) desktops, (c) laptops, (d) tablets, (e) smartphones and headsets, (f) portable media players, (g) handheld game devices, and (h) GPS receivers in vehicles. Transmission media consist of phone and power lines, cable television and other underground lines, microwave stations, and satellites.

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Networks

As discussed in Chapter 1, a **network** is a collection of computers and devices connected together via communications devices and transmission media. A network can be internal to an organization or span the world by connecting to the Internet. Many home and business users create a network to facilitate communications, share hardware, share data and information, share software, and transfer funds (Figure 10-2):

- **Facilitate communications.** Using a network, people communicate efficiently and easily via email, Internet messaging, chat rooms, blogs, wikis, online social networks, video calls, online meetings, videoconferences, VoIP, text messaging, and more. Some of these communications occur within an internal network. Other times, they occur globally over the Internet.
- **Share hardware.** Each computer or device on a network can be provided access to hardware on the network. For example, each computer and mobile device user can access a printer on the network, as they need it. Thus, home and business users create networks to save money on hardware expenses.

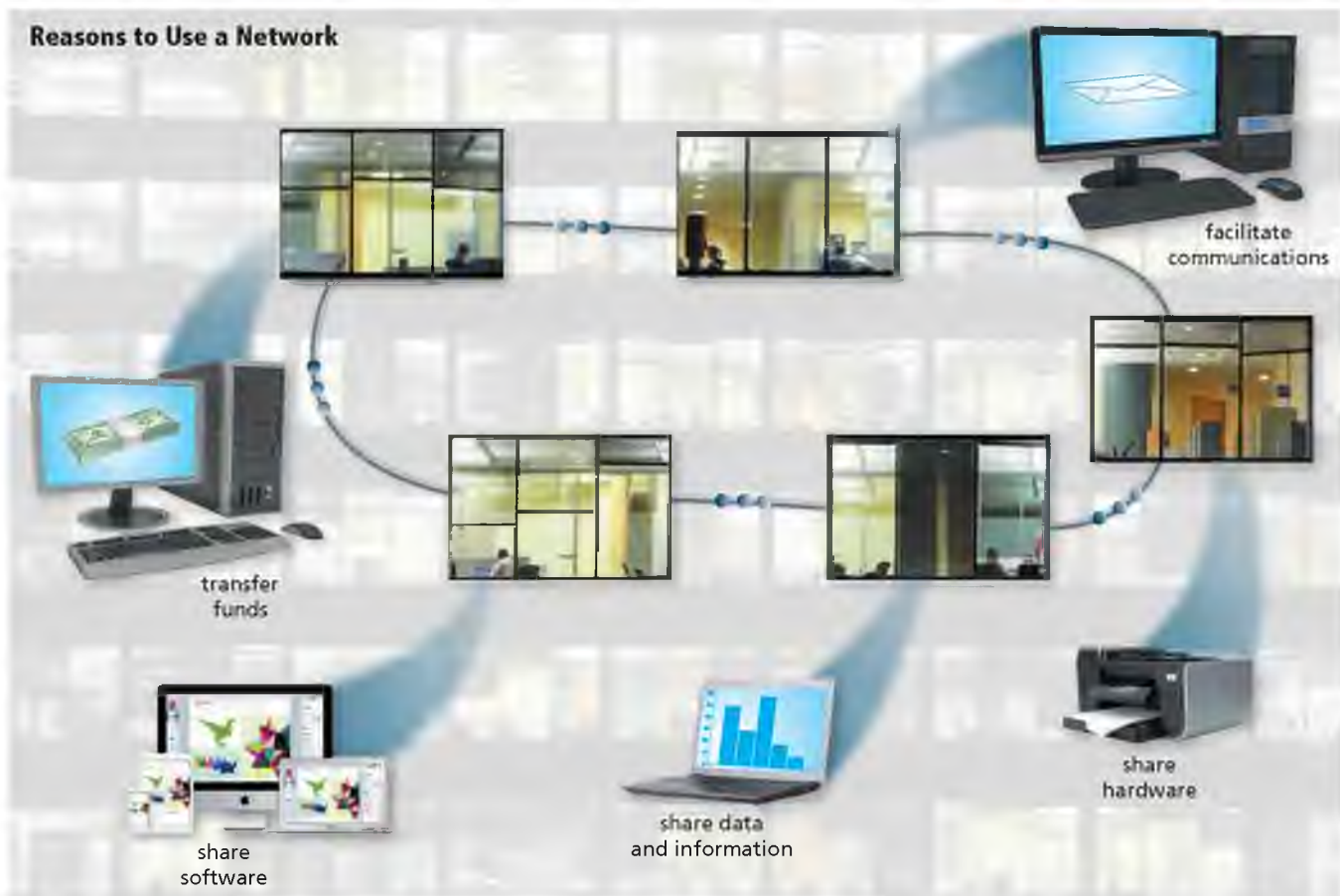


Figure 10-2 Networks facilitate communications; enable sharing of hardware, data and information, and software; and provide a means for transferring funds.

Courtesy of Apple Inc.; © YanLev / Shutterstock.com; © Sergey Peterman / Shutterstock.com; © Kitch Bain / Shutterstock.com; © Oleksiy Mark / Shutterstock.com; © iStockphoto / 123render; © Cengage Learning

- **Share data and information.** Any authorized user can access data and information stored on a network. A large company, for example, might have a database of customer information. Any authorized employee can access the database using a computer or mobile device connected to the network.

Most businesses use a standard, such as *EDI (electronic data interchange)*, that defines how business documents travel across transmission media. For example, businesses use EDI to send bids and proposals, place and track orders, and send invoices.

- **Share software.** Users connected to a network can access software on the network. To support multiple users' software access, vendors often sell versions of their software designed to run on a network or as a web app on the Internet. These network and Internet subscription versions usually cost less than buying individual copies of the software for each computer. The license fees for these programs typically are based on the number of users or the number of computers or mobile devices attached to the network.
- **Transfer funds.** *Electronic funds transfer (EFT)* allows users connected to a network to exchange money from one account to another via transmission media. Both businesses and consumers use EFT. Examples include wire transfers, use of credit cards and debit cards, direct deposit of funds into bank accounts, online banking, and online bill payment.

Instead of using the Internet or investing in and administering an internal network, some companies hire a value-added network provider for network functions. A *value-added network (VAN)* provider is a third-party business that provides networking services such as EDI services, secure data and information transfer, storage, or email. Some VANs, such as PayPal, charge an annual or monthly fee; others charge by the service used.

Discover More: Visit this chapter's free resources to learn more about sharing hardware, data, and information.



Sharing Network Software

When you use a network to share software, you sometimes have to install the software on your computer, and a server on the network manages the licenses.



Internet Research

How do you physically transfer files without a network connection?

Search for: sneakernet

CONSIDER THIS

What is an intranet?

Recognizing the efficiency and power of the Internet, many organizations apply Internet and web technologies to their internal networks. An *intranet* (intra means within) is an internal network that uses Internet technologies. Intranets generally make company information accessible to employees and facilitate collaboration within an organization. Files on an intranet generally are not accessible from the Internet.

One or more servers on an intranet host an organization's internal webpages, applications, email messages, files, and more. Users locate information, access resources, and update content on an intranet using methods similar to those used on the Internet. A company hosts its intranet on servers different from those used to host its public webpages, apps, and files.

Sometimes a company uses an *extranet* (extra means outside or beyond), which allows customers or suppliers to access part of its intranet. Package shipping companies, for example, allow customers to access their intranet via an extranet to print air bills, schedule pickups, and track shipped packages as the packages travel to their destinations.

LANs, MANs, WANs, and PANs

Networks usually are classified as a local area network, metropolitan area network, wide area network, or personal area network. The main difference among these classifications is their area of coverage.

LAN A **local area network (LAN)** is a network that connects computers and devices in a limited geographical area, such as a home, school, office building (Figure 10-3), or closely positioned group of buildings. Each computer or device on the network, called a *node*, often shares resources, such as printers, large hard drives, and programs. Often, the nodes are connected via cables.

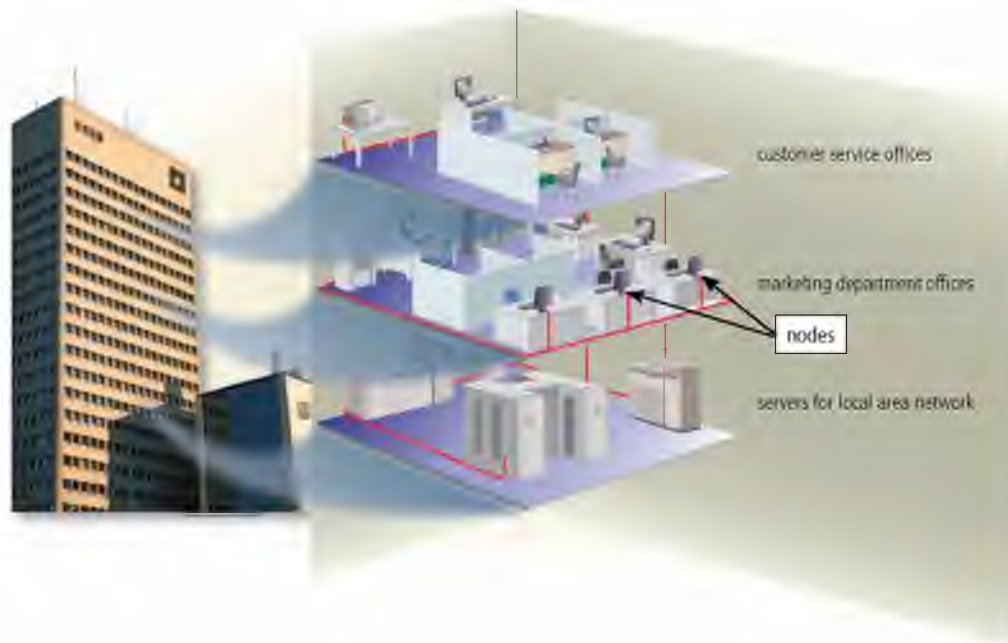


Figure 10-3 Computers and devices on different floors access the same LAN in an office building. Computers and devices on the network often are identified as nodes.

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A **wireless LAN (WLAN)** is a LAN that uses no physical wires. Computers and devices that access a wireless LAN must have built-in wireless capability or the appropriate wireless network card, USB adapter, or other wireless device. A WLAN may communicate with a wired LAN for access to its resources, such as software, hardware, and the Internet (Figure 10-4). Read How To 10-1 for instructions about adding mobile computers or devices to wireless networks.



Figure 10-4 Computers and mobile devices on a WLAN may communicate via a wireless access point with a wired LAN to access its hardware, software, Internet connection, and other resources.

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HOW TO 10-1

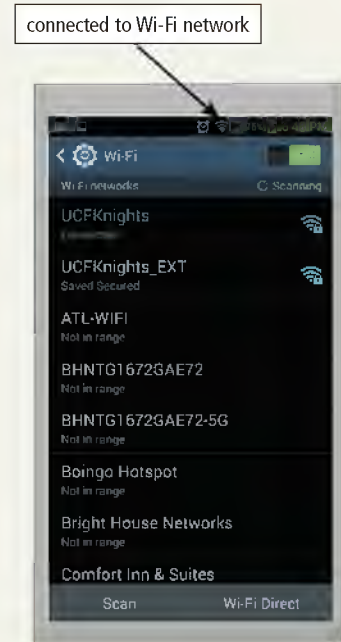
Add a Computer or Mobile Device to a Wi-Fi Network

If you are using a mobile computer or device, such as a tablet or smartphone, in a location that has a Wi-Fi network, you might want to add the device to the network. When a mobile device is connected to a Wi-Fi network, you not only can transfer data and information more quickly, but you also might save charges imposed by a mobile service provider if you subscribe to a mobile data plan. The following steps describe how to add a mobile computer or device to a Wi-Fi network:

1. Obtain the necessary network information required to connect. This might include the network's SSID and password. Read How To 5-3 in Chapter 5 for additional information about SSIDs.
2. If necessary, enable the device's capability of connecting to Wi-Fi networks.

3. If necessary, display the list of available Wi-Fi networks that are in range of the mobile computer or device.
4. Select the Wi-Fi network to which you want to connect.
5. If necessary, enter the required password for the network.
6. If desired, disconnect from the mobile network so that your device communicates using only the Wi-Fi network.
7. Run a browser and navigate to a webpage to verify that the device is connected to the network properly.

Consider This: What other reasons might you have for wanting to connect a mobile computer or device to a Wi-Fi network?



Source: Google, Inc.

MAN A *metropolitan area network (MAN)* is a high-speed network that connects local area networks in a metropolitan area, such as a city or town, and handles the bulk of communications activity across that region. A MAN typically includes one or more LANs, but covers a smaller geographic area than a WAN.

A MAN usually is managed by a consortium of users or by a single network provider that sells the service to the users. Local and state governments, for example, regulate some MANs. Phone companies, cable television providers, and other organizations provide users with connections to the MAN.

WAN A *wide area network (WAN)* is a network that covers a large geographic area (such as a city, country, or the world) using a variety of wired and wireless transmission media (Figure 10-5). A WAN can be one large network or can consist of multiple LANs connected together. The Internet is the world's largest WAN.

PAN A *personal area network (PAN)* is a network that connects computers and devices in an individual's workspace using wired and wireless technology. Devices



Figure 10-5 A simplified example of a WAN.

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High-Tech Talk

Discover More: Visit this chapter's free resources to learn about the star, bus, and ring network topologies.

include smartphones, digital cameras, printers, and more. A PAN may connect devices through a router using network cables or directly using special USB cables. PANs also may use Bluetooth or Wi-Fi technology. A *body area network* (BAN), sometimes called a body sensor network (BSN), is a type of PAN that wirelessly connects sensors worn by, carried by, implanted in, or attached to a human body. Read Ethics & Issues 10-1 to consider how BANs are used to monitor medical data.

ETHICS & ISSUES 10-1

Would You Use a BAN to Monitor Medical Data?

By wearing, carrying, implanting, or attaching small devices to a person's body, medical professionals can track vital signs and monitor heart rhythms, breathing rates, and much more via a BAN, which uses low-powered sensors to collect data. The BAN sends the collected data wirelessly to an Internet-connected device, which relays the data to a medical data server. In some cases, the data transmits directly to emergency services. Some devices also automatically can dispense medications based on the data collected.

Because of these devices, a patient may not have to visit a medical facility to receive treatment. Heart patients, diabetics, or those

with asthma or other similar conditions can perform regular daily activities while wearing the device. If it collects any unusual data, the patient can receive medical resources immediately. First responders also use these devices. A fire chief, for example, can monitor firefighters' body temperature and oxygen levels as they battle a fire.

The disadvantages of BANs include data validity and security. What happens if a device stops working or its data becomes corrupt? Serious health complications could result if the patient is not monitoring conditions via another technique. For example, devices that administer medication could cause an overdose or underdose if not working properly. Medical data is highly sensitive. An unscrupulous individual could

intercept vital signs and other personal data during transfer, violating a patient's confidentiality. Privacy advocates also have concerns about nonmedical uses of BANs. The FCC (Federal Communications Commission) controls the registration of MBANs (medical BANs). The FCC regulates the radio frequency in which an MBAN can transmit data. Some types of MBANs are restricted to be used only within a licensed medical facility.

Consider This: Should insurance companies be required to pay for BANs? Why or why not? Would you use a BAN for a medical condition? Why or why not?



Figure 10-6 As illustrated by the communications in this simplified diagram, on a client/server network, one or more computers act as a server, and the client computers and mobile devices access the server(s). Connections can be wired or wireless and may occur through a communications device.

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Network Architectures

The configuration of computers, devices, and media on a network is sometimes called the *network architecture*. Two examples of network architectures are client/server or peer-to-peer.

Client/Server On a **client/server network**, one or more computers act as a server, and the other computers on the network request services from the server (Figure 10-6). A **server**, sometimes called a *host computer*, controls access to the hardware, software, and other resources on the network and provides a centralized storage area for programs, data, and information. The **clients** are other computers and mobile devices on the network that rely on the server for its resources. For example, a server might store an organization's email messages. Clients on the network, which include any users' connected computers or mobile devices, access email messages on the server. Both wired and wireless networks can be configured as a client/server network.

Although it can connect a smaller number of computers, a client/server network architecture typically provides an efficient means to connect 10 or more computers. Most client/server networks require a person to serve as a network administrator because of the large size of the network.

As discussed in Chapter 3, some servers are dedicated servers that perform a specific task. For example, a network server manages network traffic (activity), and a web server delivers requested webpages to computers or mobile devices.

Peer-to-Peer A *peer-to-peer (P2P) network* is a simple, inexpensive network architecture that typically connects fewer than 10 computers. Each computer or mobile device, called a *peer*, has equal responsibilities and capabilities, sharing hardware (such as a printer), data, or information with other computers and mobile devices on the peer-to-peer network (Figure 10-7). Peer-to-peer networks allow users to share resources and files located on their computers and to access shared resources found on other computers on the network. Peer-to-peer networks do not have a common file server. Instead, all computers can use any of the resources available on other computers on the network. For example, you might set up a P2P network between an Android tablet and a Windows laptop so that they can share files using Bluetooth or so that you can print from the tablet to a printer accessible to all devices on the network. Both wired and wireless networks can be configured as a peer-to-peer network.

P2P networks are ideal for very small businesses and home users. Some operating systems include a P2P networking tool that allows users to set up a peer-to-peer network. Many businesses also see an advantage to using P2P. That is, companies and employees can exchange files using P2P, freeing the company from maintaining a network server for this purpose. Business-to-business e-commerce websites find that P2P easily allows buyers and sellers to share company information such as product databases.



Figure 10-7 As illustrated by the communications in this simplified diagram, each computer or mobile device on a P2P network shares its hardware and software with other computers and mobile devices on the network. Connections can be wired or wireless and may occur through a communications device.

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CONSIDER THIS

What is P2P file sharing?

P2P file sharing, sometimes called a *file sharing network*, describes a network configuration on which users access one another's hard drives and exchange files directly via a file sharing program. As more users connect to the network, each user has access to shared files on other users' hard drives. When users sign out of the network, others no longer have access to their hard drives.

Discover More: Visit this chapter's free resources to learn more about file sharing programs.

Internet Research

Why have some file sharing networks been shut down?

Search for: file sharing network shutdown

Communications Software

Communications software consists of programs and apps that (1) help users establish a connection to another computer, mobile device, or network; (2) manage the transmission of data, instructions, and information; and (3) provide an interface for users to communicate with one another. The first two often are provided by or included as tools with an operating system or bundled with a communications device. The third is provided by applications such as email, FTP, browser, discussion boards, chat rooms, Internet messaging, videoconferencing, and VoIP.

Sometimes, communications devices are preprogrammed to accomplish communications tasks. Some routers, for example, contain firmware for various protocols. Other communications devices require separate communications software to ensure proper transmission of data. Communications software works with the network standards and protocols (presented in a later section) to ensure data moves through the network or the Internet correctly.

Mini Feature 10-1: Mobile Communications

Users often communicate with one another via mobile computers and devices. Read Mini Feature 10-1 to learn about communications options for mobile devices and associated data plans.

Internet Research

What are examples of apps that provide free text messaging services?

Search for: free text messages


MINI FEATURE 10-1

Mobile Communications

After visiting your parents for the weekend, you receive an email message from your mom asking about your trip home. You respond that it was fine and that you were able to send text messages over the Internet to your sister because the bus had a Wi-Fi connection. Meanwhile, your roommate sends you a text message with directions to the restaurant where you are meeting for dinner. That night, you chat on Facebook with a classmate about your homework and catch up on your friends' updates. You see your brother is online, so you invite him to a video call where you talk about the ball game streaming on your phone. From email and text messages to voice and video calls, computers and mobile devices offer many ways to communicate.

Email is best for sharing longer, detailed messages. For shorter or time-sensitive messages, consider using the following forms of immediate communications.

Text/Picture/Video Messaging

Text, picture, and video messages often take the place of phone conversations among many people, who find exchanging these messages to be less intrusive and more efficient than voice conversations. SMS (short message service) text messages are messages of 300 or fewer characters sent from one user to another through a mobile service provider's cell phone tower. With MMS (multimedia message service), users also can send and receive photos, videos, and audio files. Occasional users might subscribe to a text-messaging plan, where providers charge a small fee for each message sent or received. In contrast, avid users, who send frequent text, picture, or video messages, might subscribe to an unlimited plan. To avoid paying fees to mobile service providers for sending text messages, some people opt for free messaging apps and services available via third-party providers. These services send messages over the Internet rather than a provider's network. Some of these services are free when both parties subscribe. Free messaging apps often include advertising content alongside the messages.

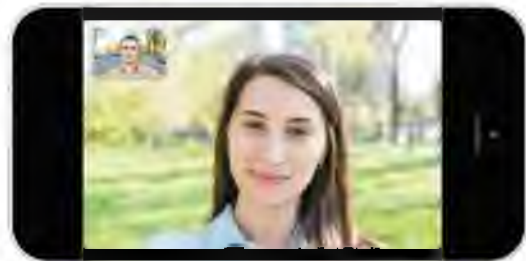
Internet Messaging

With Internet messaging services, you can send text or media messages in real time to other online users. To access an Internet messaging service, you need the service's desktop, web, or mobile app, and an Internet connection on your computer or mobile device. Users with accounts on multiple Internet messaging services often use an Internet messaging aggregator app to manage contact lists and chat on different Internet messaging networks simultaneously.

Some providers allow you to merge your text/picture/video (SMS and MMS) and Internet messages so that you can see messages of both types from the same contact in a single conversation.

Voice and Video Calling

VoIP services, such as Skype and FaceTime, also provide voice and video calling services over the Internet. These often are much less expensive than making phone calls over a mobile service provider's network. It also is possible to make calls from a VoIP program to a mobile or landline phone. Voice and video calling require large amounts of bandwidth. As a result, some carriers prohibit the use of calling services over their networks, requiring users to connect via Wi-Fi to make these calls. Read Ethics & Issues 10-2 to consider video calling and other issues associated with communications technologies and medical care.




© radub85 / Fotolia

Data Plans

Your mobile device's data plan enables you to access the Internet through your mobile service provider's network when Wi-Fi is not available. Without a data plan, you must use Wi-Fi or a wired connection to access the Internet on your computer or mobile device. Some mobile service providers offer an unlimited data plan for your device, while many offer limited data plans. If you exceed your data limit in a given month, additional fees apply. By monitoring your data usage to see how much you use on average over a few months, you can decide on the best plan for you. Some carriers offer a shared data plan that provides an allotted amount of data to be shared across several smartphones, tablets, laptops, gaming devices, and mobile hot spots. Using Wi-Fi when available to access the Internet will save on data usage charges if you have a limited data plan.

Discover More: Visit this chapter's free resources to learn more about mobile communications, messaging, and voice and video calling.

 **Consider This:** Think about how you use different forms of mobile communications to share information or communicate with your family, friends, or coworkers as part of your daily routine. For what purposes do you generally send email messages or text messages? After exchanging text messages, when might you make a phone call or use VoIP service to talk in real time? Under what circumstances is each form of communication most efficient?

ETHICS & ISSUES 10-2

Do the Benefits of Telemedicine Outweigh the Risks?

After your doctor asks you several questions, she gives you a diagnosis and sends a prescription to your local pharmacy electronically. Instead of walking out of the exam room, you turn off your tablet's webcam, receiving medical care without leaving your home. *Telemedicine* is the use of communications and information technology to provide and assist with medical care. Patients use telemedicine to communicate with a doctor, nurse, or pharmacist from their home or workplace. Healthcare professionals benefit from collaborating and consulting with specialized physicians in other locations.

Proponents of telemedicine state that its use can provide healthcare access to

patients in remote areas, or those who are unable to leave their home safely. The Mayo Clinic is testing in-office kiosks which enable employees to videoconference with a medical professional to diagnose minor health conditions without the employee having to leave work. Another benefit of telemedicine is in cases where spread of infectious disease is a concern.

Some healthcare experts state that the cost of the equipment and time spent training healthcare professionals outweighs the benefits. The inability of healthcare professionals to perform hands-on tasks, such as take a temperature or examine the patient's ears or throat, can lead to misdiagnosis or an incomplete exam. If a patient requires immediate care, such as for

an allergic reaction, a medical professional is not on hand to give treatment, causing delays. Insurance companies may require physicians to have medical licenses in the state where the patient resides in order to cover the expenses. Privacy advocates warn that hackers can access shared data or spy on videoconferences between doctors and patients.

Consider This: Have you ever used telemedicine to communicate with your healthcare provider? Why or why not? Would you use a kiosk at your workplace to communicate with a healthcare provider? Why or why not? Is it practical to rely on telemedicine to provide care to people in remote areas? Why or why not?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Communications, Networks, and Communications Software, as it relates to the chapter objectives.

Now you should know . . .

- When you are using a sending device, a communications device, transmission media, and a receiving device (Objective 1)
- When you might use a LAN, MAN, WAN, and PAN (Objective 2)
- Why you would use a client/server or a P2P network (Objective 3)
- Why you would use communications software and what types of mobile communications you might use (Objective 4)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Network Communications Standards and Protocols

Today's networks connect terminals, devices, and computers from many different manufacturers across many types of networks. For the different devices on various types of networks to be able to communicate, the network must use similar techniques of moving data through the network from one application to another.

To alleviate the problems of incompatibility and ensure that hardware and software components can be integrated into any network, various organizations such as ANSI (American National Standards Institute) and IEEE (Institute of Electrical and Electronics Engineers) propose, develop, and approve network standards. A *network standard* defines guidelines that specify the way computers access the medium to which they are connected, the type(s) of medium used, the speeds used on different types of networks, and the type(s)



High-Tech Talk

Discover More: Visit this chapter's free resources to learn about the OSI reference model.

Table 10-1 Network Communications Standards and Protocols

Name	Type	Sample Usage
Ethernet	Standard	LAN
Token ring	Standard	LAN
TCP/IP	Protocol	Internet
Wi-Fi	Standard	Hot spots
Bluetooth	Protocol	Wireless headset
UWB	Standard	Inventory tracking
IrDA	Standard	Remote control
RFID	Protocol	Tollbooth
NFC	Protocol	Mobile phone payment
LTE	Standard	Mobile phones

of physical cable and/or the wireless technology used. Hardware and software manufacturers design their products to meet the guidelines specified in a particular standard, so that their devices can communicate with the network. A standard that outlines characteristics of how two devices communicate on a network is called a *protocol*. Specifically, a protocol may define data format, coding schemes, error handling, and the sequence in which data transfers over a network.

Table 10-1 identifies some of the more widely used network communications standards and protocols for both wired and wireless networks. The following sections discuss each of these standards and protocols.



CONSIDER THIS

Do network standards and protocols work together?

Network standards and protocols often work together to move data through a network. Some of these standards define how a network is arranged physically, while others specify how messages travel along a network. Thus, as data moves through a network from one program to another, it may use one or more of these standards.



BTW

Technology Innovator

Discover More: Visit this chapter's free resources to learn about Robert Metcalfe, Ethernet inventor.



BTW

Data Transfer Rates

Mbps (megabits per second) is one million bits per second, and *Gbps* (gigabits per second) is one billion bits per second.

Ethernet

Ethernet is a network standard that specifies no central computer or device on the network (nodes) should control when data can be transmitted. That is, each node attempts to transmit data when it determines the network is available to receive communications. If two computers or devices on an Ethernet network attempt to send data at the same time, a collision will occur. When this happens, the computers or devices resend their messages until data transfer is successful.

The Ethernet standard defines guidelines for the physical configuration of a network (e.g., cabling, network devices, and nodes). Ethernet currently is the most popular network standard for LANs because it is relatively inexpensive and easy to install and maintain. Depending on the transmission media used, Ethernet networks have data transfer rates that range from 10 Mbps for home/small office users to 100 Gbps for enterprise users.

Token Ring

The **token ring** standard specifies that computers and devices on the network share or pass a special signal, called a token, in a unidirectional manner and in a preset order. A *token* is a special series of bits that functions like a ticket. The device with the token can transmit data over the network. Only one token exists per network. This ensures that only one computer transmits data at a time. Although token ring is not as widely used today, many networks use the concept of a token.

The token ring standard defines guidelines for the physical configuration of a network (e.g., cabling, network cards, and devices). Some token ring networks connect up to 72 devices. Others use a special type of wiring that allows up to 260 connections. The data transfer rate on a token ring network ranges from 4 Mbps to 1 Gbps.

TCP/IP

Short for Transmission Control Protocol/Internet Protocol, **TCP/IP** is a network protocol that defines how messages (data) are routed from one end of a network to the other, ensuring the data arrives correctly. TCP/IP describes rules for dividing messages into small pieces, called *packets*; providing addresses for each packet; checking for and detecting errors; sequencing packets; and regulating the flow of messages along the network.

TCP/IP has been adopted as the network standard for Internet communications. Thus, all hosts on the Internet follow the rules defined in this standard. As shown in Figure 10-8, Internet communications also use other standards, such as the Ethernet standard, as data is routed to its destination.

When a computer sends data over the Internet, the data is divided into packets. Each packet contains the data, as well as the recipient (destination), the origin (sender), and the sequence information used to reassemble the data at the destination. Each packet travels along the fastest individual available path to the recipient's computer or mobile device via routers. This technique of breaking a message into individual packets, sending the packets along the best route available, and then reassembling the data is called *packet switching*. Read Secure IT 10-1 for another use of packets.

How Communications Standards Might Work Together



Figure 10-8 This figure illustrates how Internet communications use TCP/IP and Ethernet to ensure that data travels correctly to its destination.

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 **SECURE IT 10-1**
**Monitoring Network Traffic**


Network monitoring software constantly assesses the status of a network and sends an email or text message, usually to the network administrator, when it detects a problem. These messages may state that an outage has occurred, the server's available memory space is near capacity, a new user account has been added, or some other critical event has developed.

Monitoring software can measure the amount of network traffic, graph network usage, determine when a specific program

uses the network, and show the bandwidth used by each computer or mobile device. On networks that use the TCP/IP protocol, for example, *packet sniffer software* monitors and logs packet traffic for later analysis. Packet sniffing can detect problems, such as why traffic is flowing slowly.

The software also can play a security role, including identifying unusual or excessive network activity. For example, it can flag a remote computer always connected to the network or someone making repeated attempts to sign in to an account. Hackers

use packet sniffer software to hijack a computer, which means they capture a user's packets and then reconstruct the contents of webpages that were visited, obtain user names and passwords, and trace photos and videos viewed.

 **Consider This:** How would you determine if your employer or school has network monitoring software? Would you change your computer activities, including browsing certain websites, if you knew the software could track your computer or mobile device usage?

**CONSIDER THIS****Can IP addresses be used to determine a computer or device's location?**

In many cases, you can determine a computer or a device's location from its IP address. For example, if an IP address begins with 132.170, a small amount of research will uncover that the University of Central Florida assigns IP addresses beginning with these numbers; however, additional research would be necessary to determine where the computer or mobile device is located on the network. Certain websites allow visitors to find a location by entering an IP address. Some web apps infer your approximate location from your IP address when GPS is not available in order to provide you with local information or nearby search results.

Discover More: Visit this chapter's free resources to learn more about finding locations based on IP addresses.

**Internet Research**

What does it mean to be
Wi-Fi CERTIFIED?

Search for: wifi certified

Wi-Fi

Computers and devices that have the appropriate wireless capability can communicate via radio waves with other computers or devices using **Wi-Fi** (wireless fidelity), which identifies any network based on the 802.11 standards. Developed by IEEE, **802.11** is a series of network standards that specifies how two wireless devices communicate over the air with each other. Common standards include 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac, 802.11ad, and 802.11af, with data transfer rates ranging from 11 Mbps to 7 Gbps. Many devices support multiple standards. For example, a designation of 802.11 ac/b/g/n on a computer, router, or other device indicates it supports those four standards (ac, b, g, and n).

Wi-Fi sometimes is referred to as *wireless Ethernet* because it uses techniques similar to the Ethernet standard to specify how physically to configure a wireless network. Thus, Wi-Fi networks easily can be integrated with wired Ethernet networks. When a Wi-Fi network accesses the Internet, it works in conjunction with the TCP/IP network standard.

One popular use of the Wi-Fi network standard is in hot spots that offer mobile users the ability to connect to the Internet with their Wi-Fi-enabled wireless computers and devices. Many homes and small businesses also use Wi-Fi to network computers and devices wirelessly. In open or outdoor areas free from interference, the computers or devices should be within 300 feet of a wireless access point or hot spot. In closed areas, the wireless network range is about 100 feet. To obtain communications at the maximum distances, you may need to install extra hardware to extend or strengthen a wireless signal.

Discover More: Visit this chapter's free resources to learn more about 802.11 standards.

LTE

LTE (Long Term Evolution) is a network standard that defines how high-speed cellular transmissions use broadcast radio to transmit data for mobile communications. Developed by the Third Generation Partnership Project (3GPP), LTE has the potential of 100 Mbps *downstream rate*

(receiving data) and 30 Mbps *upstream rate* (sending data). Based on the TCP/IP network standard, LTE supports data, messaging, voice, and video transmissions. Many mobile service providers, including AT&T and Verizon Wireless, offer LTE service.

Two competing standards for LTE are WiMax (Worldwide Interoperability for Microwave Access) and UMB (Ultra Mobile Broadband).

Discover More: Visit this chapter's free resources to learn more about LTE.



Technology Innovators
Discover More: Visit this chapter's free resources to learn about AT&T and Verizon.

Bluetooth/Mini Feature 10-2

Bluetooth is a network protocol that defines how two Bluetooth devices use short-range radio waves to transmit data. The data transfers between devices at a rate of up to 3 Mbps. To communicate with each other, Bluetooth devices often must be within about 33 feet but can be extended to about 325 feet with additional equipment.

A Bluetooth device contains a small chip that allows it to communicate with other Bluetooth devices. For computers and devices not Bluetooth-enabled, you can purchase a Bluetooth wireless port adapter that will convert an existing USB port into a Bluetooth port. Most current operating systems have built-in Bluetooth support. When connecting two devices using Bluetooth, the originating device sends a code to the connecting device. The codes must match to establish the connection. Devices that share a Bluetooth connection are said to be paired. Read Mini Feature 10-2 to learn about Bluetooth uses, advantages, and disadvantages.



MINI FEATURE 10-2

Bluetooth Technology

Most mobile devices and computers manufactured today are equipped with Bluetooth capability. One of the earliest and most popular uses of Bluetooth is to connect hands-free headsets to a mobile phone. Bluetooth has many additional uses, and device manufacturers are increasingly including Bluetooth technology.

Uses

You can use Bluetooth-enabled or Bluetooth-enhanced devices in many ways, including the following:

- Connect devices, such as mobile phones, portable media players, or GPS devices, with vehicle stereos, which use the vehicle's speakers to project sound (shown in the figure).
- Use GPS receivers to send directions to a mobile phone or GPS-enabled device.
- Transfer photos wirelessly from a digital camera to a laptop or server.
- Play music on a smartphone through the speakers on a computer or other Bluetooth-enabled device.
- Send signals between video game accessories, video game devices, and a television.
- Establish a PAN (personal area network).

- Allow communications between a computer and devices, such as a keyboard, printer, Smart TV, or mobile phone. Connecting these devices enables you to print documents, share calendar appointments, and more.
- Replace wired communications devices, such as bar code readers, with wireless devices to enhance portability.
- Transmit data from a medical device, such as a blood glucose monitor, to a mobile phone or other device.
- Change the channel, pause a program, or schedule a recording using a Bluetooth-compatible or Bluetooth-enabled television and remote control.
- Track objects that include tags or nodes used to send wireless signals read by a real-time location system.



Internet Research
What are future uses of Bluetooth?

Search for: future bluetooth uses



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(continued)

Advantages and Disadvantages

Advantages of using Bluetooth technology include the following:


- If a device has Bluetooth capability, using Bluetooth technology is free.
- Although Bluetooth devices need to be near each other, they do not have to be in the same room, within the same line of sight, or facing each other.
- Bluetooth devices typically require low processing power and use little energy, so using Bluetooth technology will not drain a device's batteries.
- Establishing a wireless Bluetooth connection is easy. With most Bluetooth-enabled devices, you simply tap or click a Bluetooth shortcut or icon to enable Bluetooth. Once enabled, the devices usually immediately recognize a connection. (Before initial use, you may need to pair two Bluetooth devices so that they can communicate with each other. Read How To 3-1 in Chapter 3 for instructions about pairing Bluetooth devices.)
- Bluetooth connections have low security risks. If you want to secure a Bluetooth channel, you would define an identification number for the connection and create a PIN that you can distribute as needed. If the secured computer or device detects an unknown Bluetooth connection, you can choose to accept or

reject it. Read Secure IT 10-2 to learn about security risks associated with using Bluetooth technology.

- Bluetooth technology is standardized globally, meaning it can be used to connect devices that are not the same make or model.
- Bluetooth connections have little risk of interference with other wireless networks because the strength of the wireless signals is weak and because of frequency hopping, which changes frequency channels periodically.

One disadvantage of Bluetooth technology is its low bandwidth. Because of its slow data transfer speeds, Bluetooth technology is not an ideal solution for replacing a LAN. Because Bluetooth-enabled mobile payment services are new, security risks may exist. Most agree that the advantages of Bluetooth technology far outweigh the disadvantages.

Discover More: Visit this chapter's free resources to learn more about Bluetooth technology.

 **Consider This:** Have you used Bluetooth technology to connect two devices? What devices did you connect, and what was your experience? In your opinion, what is the best reason to use Bluetooth? Why? What devices do you think will include Bluetooth technology in the future?

SECURE IT 10-2

Preventing Bluebugging


One reason why Bluetooth technology is so popular is because connections generally have low security risks, as described in Mini Feature 10-2. Despite this advantage, security experts have seen an increase in *Bluebugging*, which occurs when cyberthieves exploit Bluetooth devices that have been paired. Smartphones and other mobile devices are discoverable to other Bluetooth devices only for a short period when they first are turned on, but during this time the hackers can intercept the signals or use hardware that has the same identifying characteristics as the smartphone or other mobile device. Once hackers have

intercepted a device, they take control and read or download personal data, place calls, monitor conversations, review text and email messages, and modify contacts.

Security experts recommend following these practices to prevent Bluebugging:

- Turn off Bluetooth capability if it is not required. Use a Bluetooth earpiece only when you need to be hands free.
- Use your device in a remote area. Bluebuggers often work in crowded and public places, such as shopping centers, parks, and public transportation, and they can intercept signals up to 30 feet away from the device.

- Prevent hackers from intercepting your device by pairing it for the first time in a secure location, such as your home.
- If Bluetooth is required, be certain the device's visibility setting is hidden and all paired devices are set to unauthorized so that the user must authorize each connection request.
- Upgrade your phone. Older devices are more vulnerable to these intrusions.

 **Consider This:** Have you paired your phone with any Bluetooth devices? If so, did you pair them in a private location? Which of these guidelines will you follow to attempt to prevent Bluebugging?

UWB

UWB, which stands for **ultra-wideband**, is a network standard that specifies how two UWB devices use short-range radio waves to communicate at high speeds with each other. At distances of about 33 feet, the data transfer rate is 110 Mbps. At closer distances, such as about 6.5 feet, the transfer rate is at least 480 Mbps. UWB can transmit signals through doors and other obstacles. Because of its high transfer rates, UWB is best suited for transmission of large files, such as video, graphics, and audio. Examples of UWB uses include locating and tracking inventory, equipment, or personnel (especially in remote or dangerous areas).

IrDA

Some devices, such as television remote controls, use the **IrDA** (Infrared Data Association) standard to transmit data wirelessly to each other via infrared (IR) light waves. The devices transfer data at rates from 115 Kbps (thousand bits per second) to 4 Mbps between their IrDA ports. Infrared requires *line-of-sight transmission*; that is, the sending device and the receiving device must be in line with each other so that nothing obstructs the path of the infrared light wave. Because Bluetooth and UWB do not require line-of-sight transmission, these technologies are more widespread than IrDA.

RFID

RFID (*radio frequency identification*) is a protocol that defines how a network uses radio signals to communicate with a tag placed in or attached to an object, an animal, or a person. The tag, called a transponder, consists of an antenna and a memory chip that contains the information to be transmitted via radio waves. Through an antenna, an RFID reader, also called a transceiver, reads the radio signals and transfers the information to a computer or computing device. Read Secure IT 6-2 in Chapter 6 for uses of animal implants.

Depending on the type of RFID reader, the distance between the tag and the reader ranges from 5 inches to 300 feet or more. Readers can be handheld or embedded in an object, such as a doorway or a tollbooth (Figure 10-9).

Discover More: Visit this chapter’s free resources to learn more about RFID tags.

Internet Research
 Are RFID chips safe?
Search for: rfid implant side effects

How Electronic RFID Toll Collection Works

Step 1

Motorist purchases an RFID transponder or RFID tag and attaches it to the vehicle’s windshield.

Step 2

As the vehicle approaches the tollbooth, the RFID reader in the tollbooth sends a radio wave that activates the windshield-mounted RFID tag. The activated tag sends vehicle information to the RFID reader.



Step 3

The RFID reader sends the vehicle information to the lane controller. The lane controller, which is part of a local area network, transmits the vehicle information to a central computer that subtracts the toll from the motorist’s account. If the vehicle does not have an RFID tag, a high-speed camera takes a picture of the license plate and the computer prints a violation notice, which is mailed to the motorist.



Figure 10-9 This figure shows how electronic RFID toll collection works.

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Figure 10-10 Some objects, such as credit cards, are NFC enabled. You also can program NFC tags yourself.

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NFC

NFC (*near field communications*) is a protocol, based on RFID, that defines how a network uses close-range radio signals to communicate between two devices or objects equipped with NFC technology (Figure 10-10). Examples of NFC-enabled devices include smartphones, digital cameras, televisions, and terminals. Credit cards, tickets, and NFC tags are examples of objects that also use NFC technology. An NFC tag is a chip that can store small amounts of data. NFC tags are in a variety of objects, such as posters, ski lift tickets, business cards, stickers, and wristbands.

For successful communications, the devices or objects touch or are placed within an inch or two of each other. For example, you can touch two NFC-enabled phones together to transfer contacts, touch an NFC-enabled phone to an NFC tag to display a map, or hold an NFC-enabled phone near a parking meter to pay for parking. Contactless payment, such as the parking meter example, is a popular use of NFC technology. Other uses of NFC technology include sharing contacts or photos, downloading apps, and gaining access or admittance.

Internet Research

How secure is contactless payment?

Search for: contactless payment security

CONSIDER THIS

Can you buy a blank NFC tag?

Yes. Consumers can purchase blank NFC tags (shown in the bottom photo in Figure 10-10) at a reasonable cost and easily program them to perform certain actions. For example, you can program an NFC tag to contain your home network user name and password. Visitors to your home can touch their phones to the NFC tag to access your home network without entering the user name and password.

Discover More: Visit this chapter’s free resources to learn more about NFC-enabled devices.

Communications Lines

A **dedicated line** is a type of always-on physical connection that is established between two communications devices. Businesses often use dedicated lines to connect geographically distant offices. Dedicated lines can be either analog or digital. Digital lines increasingly are connecting home and business users to networks around the globe because they transmit data and information at faster rates than analog lines.

Digital dedicated lines include cable television lines, DSL, ISDN lines, FTTP, T-carrier lines, and ATM. Table 10-2 shows speeds of various dedicated digital lines.

Cable

The cable television (CATV) network provides high-speed Internet connections, called *cable Internet service*. The CATV signal enters a building through a single line, usually a coaxial cable. This cable connects to a modem (discussed in the next section), which typically attaches to your computer via an Ethernet cable. Home and small business users often subscribe to cable Internet service.

Table 10-2 Speeds of Various Dedicated Digital Lines

Type of Line	Transfer Rates
Cable	256 Kbps to 52 Mbps
DSL	256 Kbps to 8.45 Mbps
ISDN	Up to 1.54 Mbps
FTTP	5 Mbps to 300 Mbps
Fractional T1	128 Kbps to 768 Kbps
T1	1.544 Mbps
T3	44.736 Mbps
ATM	155 Mbps to 622 Mbps, can reach 10 Gbps

DSL

DSL (*Digital Subscriber Line*) transmits on existing standard copper phone wiring. Some DSL installations include a dial tone, providing users with both voice and data communications. These DSL installations often require that filters be installed to reduce noise interference when voice communications share the same line. DSL is a popular digital line alternative for the small business or home user.

ADSL is a popular type of DSL. As shown in Figure 10-11, *ADSL* (*asymmetric digital subscriber line*) is a type of DSL that supports faster downstream rates than upstream rates. ADSL is ideal for Internet access because most users download more information from the Internet than they upload.

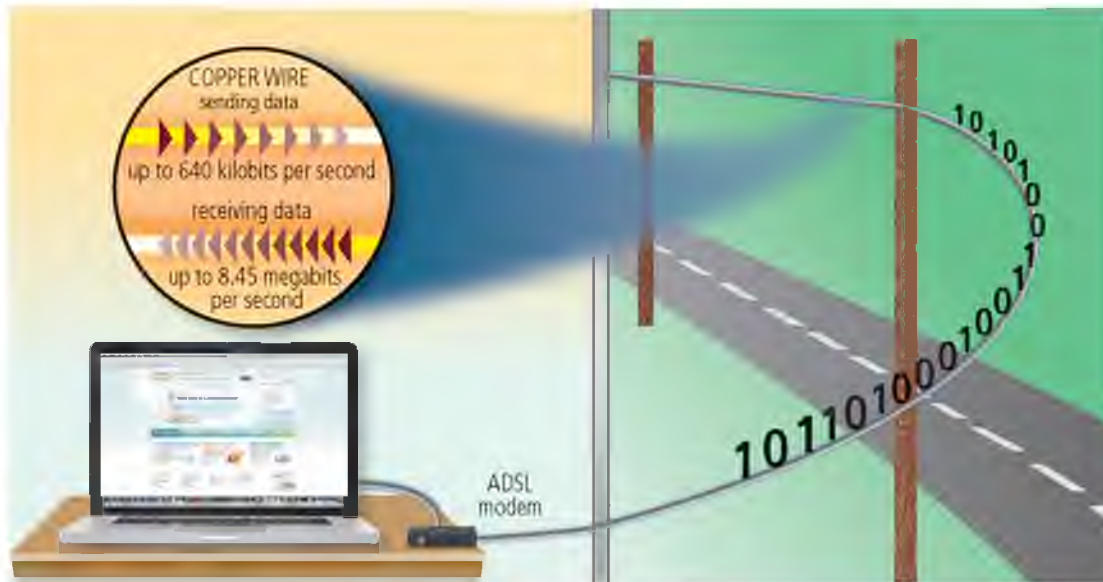


Figure 10-11 ADSL connections transmit data downstream (receiving) at a much faster rate than upstream (sending).
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CONSIDER THIS

Which is a better choice, DSL or cable Internet service?

Each has its own advantages. DSL uses a line that is not shared with other users in the neighborhood. With cable Internet service, by contrast, users might share the node with up to hundreds of other cable Internet users. Simultaneous access by many users can cause the cable Internet service to slow down. Cable Internet service, however, has widespread availability and usually has faster transmission rates.

ISDN

Not as widely used today as in the past, *ISDN* (Integrated Services Digital Network) is a set of standards for digital transmission of data over standard copper phone lines. With ISDN, the same phone line that could carry only one computer signal now can carry three or more signals at once through the same line, using a technique called *multiplexing*.

FTTP

FTTP, which stands for **Fiber to the Premises**, uses fiber-optic cable to provide extremely high-speed Internet access to a user's physical permanent location.

- *FTTH* (*Fiber to the Home*) provides home users with Internet access via fiber-optic cable.
- *FTTB* (*Fiber to the Building*) refers to small businesses that use fiber-optic cables to access the Internet.

With FTTP service, an optical terminal at your location receives the signals and transfers them to a router connected to a computer. As the cost of installing fiber decreases, more homes and businesses are expected to choose FTTP.

T-Carrier

A **T-carrier line** is any of several types of long-distance digital phone lines that carry multiple signals over a single communications line. Whereas a standard phone line carries only one signal, digital T-carrier lines use multiplexing so that multiple signals share the line. T-carrier lines provide very fast data transfer rates. Only medium to large companies usually can afford the investment in T-carrier lines because these lines are so expensive.

The most popular T-carrier line is the *T1 line*. Businesses often use T1 lines to connect to the Internet. Home and small business users purchase *fractional T1*, in which they share a connection to the T1 line with other users. Fractional T1 is slower than a dedicated T1 line, but it also is less expensive. Users who do not have other high-speed Internet access in their areas can opt for fractional T1. With fractional T1 lines, the data transfer rates become slower as additional users are added.

A *T3 line* is equal in speed to 28 T1 lines. T3 lines are quite expensive. Main users of T3 lines include large corporations, phone companies, and ISPs connecting to the Internet backbone. The Internet backbone itself also uses T3 lines.

ATM

ATM (Asynchronous Transfer Mode) is a service that carries voice, data, video, and media at very high speeds. Phone networks, the Internet, and other networks with large amounts of traffic use ATM. Some experts predict that ATM eventually will become the Internet standard for data transmission, replacing T3 lines.



NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Network Communications Standards and Protocols and Communications Lines, as it relates to the chapter objectives.

Now you should know . . .

- Which network communications standards and protocols you have used (Objective 5)
- Which communications line is best suited to your needs (Objective 6)

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Transmission Media

Computers process data as digital signals. Data, instructions, and information travel along transmission media in either analog or digital form, depending on the transmission media.

Communications Devices

A **communications device** is any type of hardware capable of transmitting data, instructions, and information between a sending device and a receiving device. At the sending end, a communications device sends the data, instructions, or information from the sending device to transmission media. At the receiving end, a communications device receives the signals from the transmission media.

The following pages describe a variety of communications devices: modems, wireless access points, routers, network cards, and hubs and switches.

Digital Modems: Cable, DSL, and ISDN

A *broadband modem*, also called a *digital modem*, is a communications device that sends and receives data and information to and from a digital line. Three types of broadband modems are cable modems, DSL modems, and ISDN modems. These modems typically include built-in Wi-Fi connectivity.

A **cable modem** is a broadband modem that sends and receives digital data over the CATV network. To access the Internet using the CATV service, as shown in Figure 10-12, the CATV provider installs a splitter inside your house. From the splitter, one part of the cable runs to your televisions and the other part connects to the cable modem. Many CATV providers include a cable modem as part of the installation; some offer a rental plan, and others require that you purchase one separately. A cable modem usually is an external device, in which one end of a cable connects to a CATV wall outlet and the other end plugs in a port on a computer.

A **DSL modem** is a broadband modem that sends digital data and information from a computer to a DSL line and receives digital data and information from a DSL line. Similarly, an **ISDN modem** is a broadband modem that sends digital data and information from a computer to an ISDN line and receives digital data and information from an ISDN line. DSL and ISDN modems usually are external devices, in which one end connects to the phone line and the other end connects to a port on the computer.



Figure 10-12 A typical cable modem installation.

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Cable and DSL

Cable and DSL are more widely used than ISDN.

CONSIDER THIS

What are dial-up modems?

A *dial-up modem* is a communications device that converts digital signals to analog signals and analog signals to digital signals, so that data can travel along an analog phone line. For example, a dial-up modem connected to a sending computer converts the computer's digital signals into analog signals. The analog signals then can travel over a standard phone line. A dial-up modem connected to a receiving computer converts the analog signals from a standard phone line into digital signals that the computer can process.

A dial-up connection must be reestablished each time the modem is used. With transfer rates of only up to 56 Kbps, dial-up connections also are much slower than broadband connections. For these reasons, dial-up connections are used only in remote areas or where high-speed or wireless options are not available.

Wireless Modems

Some mobile users have a *wireless modem* that uses a mobile service provider's network to connect to the Internet wirelessly from a computer or mobile device (Figure 10-13). Wireless modems, which have an external or built-in antenna, are available as USB adapters and other devices.

Some smartphones also can function as a wireless modem, called a *mobile hot spot*, when tethered to a personal computer or mobile device. Read How To 10-2 for instructions about using your phone as a mobile hot spot.



Figure 10-13 Wireless modems allow users to access the Internet wirelessly using a mobile service provider's network. Some manufacturers refer to the type of wireless modem shown in this figure as a USB modem.

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HOW TO 10-2

Use Your Phone as a Mobile Hot Spot

If you are in a location without a wireless Internet connection, you may be able to access the Internet from your desktop or mobile computer if you enable your smartphone as a mobile hot spot. When you enable a phone as a mobile hot spot, the phone acts as a wireless access point. You then can connect your desktop or mobile computer to the phone and utilize the data plan on your phone to access the Internet. If you have a limited data plan with your mobile service provider, you should be careful not to use your phone as a hot spot too often. While the speed from a mobile hot spot might not be as fast as your home or office network, it should be more than sufficient for performing tasks such as browsing the web or sending and receiving email messages that contain mostly text. The next steps describe how to use your phone as a mobile hot spot:

1. Contact your mobile service provider and determine whether your plan allows for your phone to be used as a mobile hot spot. Using your phone as a mobile hot spot may carry an additional monthly charge.
2. Determine whether your phone has built-in functionality to be used as a

mobile hot spot. If not and if supported by your service plan, you may be able to download a separate app that allows your phone to function as a mobile hot spot.

3. Access your phone's settings and enable the mobile hot spot. Your phone should display the SSID and password to access the hot spot. Read How To 5-3 in Chapter 5 for additional information about SSIDs.
4. Connect to the mobile hot spot on a computer or mobile device using

the SSID and password displayed in the previous step.

5. When you are finished using the hot spot, disconnect from the wireless network on your computer and disable the hot spot feature on your phone.

Consider This: How can you determine how much data you are using on your smartphone's data plan?



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Figure 10-14 Wireless access point.

Copyright 2013 NETGEAR

Wireless Access Points

A *wireless access point (WAP)* is a central communications device that allows computers and devices to transfer data wirelessly among themselves or to a wired network using wireless technologies, such as Wi-Fi (Figure 10-14). Wireless access points have high-quality internal or external antennas for optimal signals. For the best signal, some manufacturers suggest positioning the wireless access point at the highest possible location and using a device to strengthen your wireless signal. Read How To 10-3 for

tips to strengthen your wireless signal. A wireless access point either connects to a router via an Ethernet or other cable or is part of a router.

HOW TO 10-3

Strengthen Your Wireless Signal

If you reside in a large apartment or house and use a wireless network, you may find that you either experience poor network performance or you are unable to access the network in certain locations. These problems may be related to a weak wireless signal in your home. Various options are available to strengthen a wireless signal to increase network performance and ensure you have a wireless connection throughout your home. The following points describe how to strengthen a wireless signal:

- If your wireless router or wireless access point has an antenna(s), make sure the antenna(s) is extended completely.
- If you are able to remove the antenna(s) from your wireless router or wireless access point, consider replacing it with a wireless signal booster. Check your device's and the wireless

signal booster's documentation to determine whether it will work with your device.

- If possible, position the wireless router or wireless access point in a central location of your home and away from appliances or other electronic devices that may degrade the signal.
- Purchase a range extender for your wireless router or wireless access point. Some range extenders are compatible only with specific wireless routers or wireless access points, and others are universal. Make sure the range extender you purchase is compatible with your device. Once installed, follow the range extender's instructions to enable it on your network.
- If you still experience problems with the strength of your wireless signal after following the suggestions above, consider replacing

your wireless router or wireless access point with a newer model.

Consider This: What problems may arise if your wireless network's range extends beyond the confines of your home? How can you determine the range of your wireless network?



Routers

A *router* is a communications device that connects multiple computers or other routers together and transmits data to its correct destination on a network. A router can be used on a network of any size. On the largest scale, routers along the Internet backbone forward data packets to their destination using the fastest available path. For smaller business and home networks, a router allows multiple computers and mobile devices to share a single broadband Internet connection, such as through a cable modem or DSL modem (Figure 10-15).

If the network has a separate router, it connects to the router via a cable. Similarly, if the network has a separate wireless access point, it connects to the router via a cable. Many users, however, opt for routers that provide additional functionality:

- A *wireless router* is a device that performs the functions of a router and also a wireless access point.
- A *broadband router* is a device that performs the functions of a router and also a broadband modem.



Internet Research

What is a core router?

Search for: core router definition

Figure 10-15 Through a router, home and small business networks can share access to a broadband Internet connection, such as through a cable or DSL modem.

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Hardware Firewall

To prevent unauthorized users from accessing files and computers, many routers are protected by a built-in firewall, called a *hardware firewall*. Some also have built-in antivirus protection.

- A *broadband wireless router* is a device that performs the functions of a router, a wireless access point, and a cable or DSL modem.
- A *mobile broadband wireless router* is a device that performs the functions of a router, a wireless access point, and a wireless modem (Figure 10-16). Consumers use mobile broadband wireless routers to create a mobile hot spot.

These combination devices eliminate the need for a separate wireless access point and/or modem on a network. These routers also enable you easily to configure and secure the device against unauthorized access.

CONSIDER THIS

How many connections can a router support?

Although a router may be able to connect more than 200 wired and/or wireless computers and mobile devices, the performance of the router may decline as you add connections. Some mobile service providers limit the number of connections to their mobile broadband wireless routers.



Figure 10-16 Through a mobile broadband wireless router, users can create a mobile hot spot via 3G or 4G mobile broadband Internet service.

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Motherboards

Many computers and mobile devices have motherboards that integrate networking capability, eliminating the need for a separate network card.

Network Cards

A *network card*, sometimes called a *network interface card (NIC)* pronounced nick), is a communications device that enables a computer or device that does not have built-in networking capability to access a network. The network card coordinates the transmission and receipt of data, instructions, and information to and from the computer or device containing the network card.

Network cards are available in a variety of styles. A network card for a desktop is an adapter card that has a port to which a cable connects (Figure 10-17). A network card for mobile computers and devices is in the form of a USB adapter or other device. A network card follows the guidelines of a particular network communications standard, such as Ethernet or token ring.



Figure 10-17 Network card for a desktop computer.
Courtesy of D-Link Corporation

Hubs and Switches

Today, thousands of computer networks exist, ranging from small networks operated by home users to global networks operated by widespread telecommunications firms. Interconnecting these many types of networks requires various types of communications devices. A *hub* or *switch* is a device that provides a central point for cables in a network (Figure 10-18). Larger networks typically use a hub, while smaller networks use a switch. Some hubs and/or switches include routers. That is, the hub or switch receives data from many directions and then forwards it to one or more destinations.



BTW

Technology Innovator
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Figure 10-18 A hub or switch is a central point that connects several devices in a network together, as well as connects to other networks, as shown in this simplified diagram.

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Home Networks

Many home users connect multiple computers and devices together in a **home network**. Vendors typically offer home networking packages that include all the necessary hardware and software to network your home using wired or wireless techniques. You no longer need extensive knowledge of networks to set up a home network. For example, desktop operating systems often enable you to connect all computers in your house to a home network easily. Read Secure IT 10-3 to learn how to detect if an intruder is accessing your network.



Internet Research

What is an intelligent home network?

Search for: intelligent home network

 **SECURE IT 10-3**

Detecting an Intruder Accessing Your Wireless Home Network

One of the largest Internet security threats is *IP hijacking*, which occurs when cyberthieves tap into home routers or cable modems or other Internet access point to intercept a paid Internet service. Some cyberthieves use the connection to commit illegal acts; others just steal the Internet connection. The incidences of IP hijacking are growing, and catching thieves is a difficult task for law enforcement officials.


Unscrupulous people hijack Internet service in one of two ways. Either the network has no security, or the thieves determine the network name and password and then reprogram their modem's settings to duplicate the network's settings. The Electronic Communications Privacy Act (ECPA) and a lack of funding prevent fraud examiners from investigating and prosecuting many IP hijackers.

Experts recommend using the following steps to determine if someone is accessing a wireless network without permission:

- **Sign in to the administrative interface.** The modem's user's guide will provide instructions to view wireless clients actively using a wireless access point.
- **Count the number of connected devices.** Each device connected wirelessly to the network should be displayed in a table that shows, at a minimum, the device's name, MAC address, and IP address. (Read How To 5-3 in Chapter 5 for additional information about MAC address controls.) Wireless devices that might be connected to the network include smartphones, game consoles, DVD players, and other hardware. If the number of devices seems extraordinarily high, use a MAC lookup website, which can help you

to determine the manufacturer of wireless devices in the list.

- **Secure the network.** The router's manufacturer's website should provide instructions about upgrading the security strength. Change the default network name and password, and be certain to use the latest wireless encryption technology. Enable the router's firewall and, if possible, use "stealth mode" to make the network less visible to outsiders. Disable the feature that allows users to administer the router wirelessly, so that changes can be made only when using a physical connection with an Ethernet cable.

 **Consider This:** If you use a wireless router, have you taken any of these steps to prevent IP hijacking? Which steps will you now take? Do you know anyone who has had a cyberthief access his or her network?

Mini Feature 10-3: Planning and Designing Your Home Network

As with any network, a home network's basic purpose is to share resources and connect devices. You can use a home network to share files and folders or to allow multiple devices to share a printer. Read Mini Feature 10-3 to learn about planning and designing your home network.

 **MINI FEATURE 10-3**

Planning and Designing Your Home Network

A home network enables you to use a common Internet connection among many computers and mobile devices. Other uses include connecting entertainment devices, such as digital video recorders (DVRs) and televisions, to the Internet and establishing a connection between devices in order to play multiplayer games.

Before purchasing hardware, or contracting a network expert to set up your network, consider how your network will be used, and by whom. Ask yourself the following questions:

- What devices will connect to the network? The number of devices, as well as the operating system or platform on which the devices operate will determine the speed and strength needed to run your wireless network.
- How large of a range do you need, and where will most of the use take place? If you have a small apartment, your needs will differ from those with a large home.
- How many users typically will be using the network, how will they use it, and for what purposes? The number of users affects the capabilities of the network and determines whether you need to define permissions for certain users or devices.

- How secure do you need your network? Hiding the network name, requiring passwords, or having a user with network administration capabilities can help ensure your network is safe from unauthorized use.

A home network can be as simple as using a cable to connect two devices. More complex home networks include wireless technologies that connect several devices to one another and to the Internet. Hardware needed for a wireless, Internet-connected home network includes the following:

- A modem, such as a cable or DSL modem, that connects to an ISP and establishes the Internet connection for the network
- A router, which establishes the connection between the Internet and all computers and devices on the home network and also enables the devices to communicate with one another
- A wireless access point, often included as part of the router, in order to connect wireless devices
- Computers and devices, such as desktops, laptops, tablets, smartphones, televisions, cable set-top boxes, or a VoIP phone, that you connect to the home network

Read How To 10-4 for instructions about creating a home network. Once you configure your wireless network,

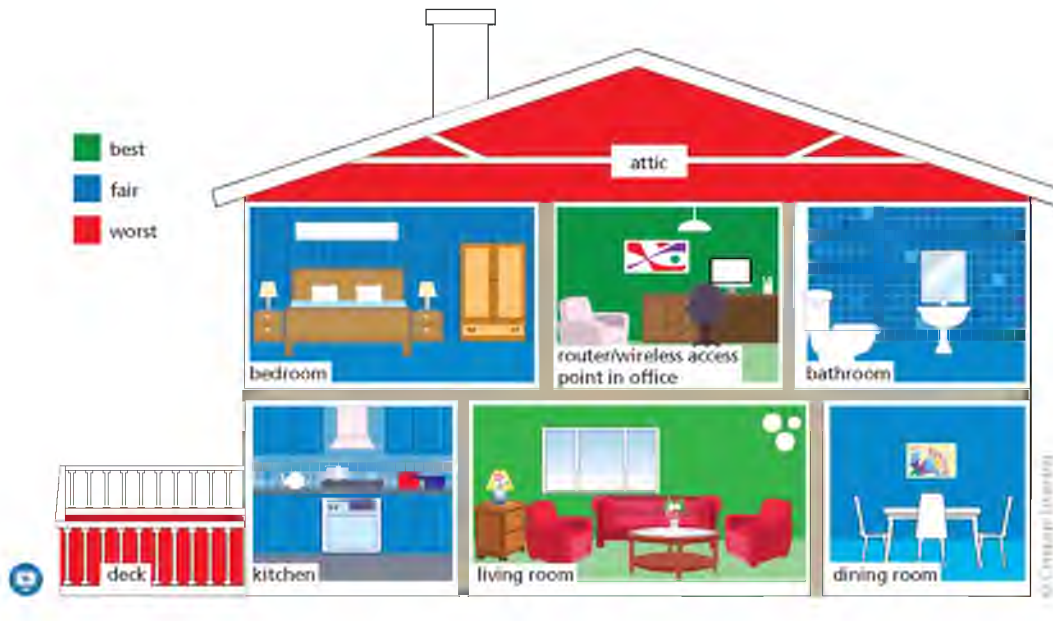
you can create user names and user groups. Names and groups establish network users, who can share files (such as documents, music, and photos), as well as devices (such as printers), with others connected to the network.

Maintaining the network involves monitoring the security settings and network activity, establishing connections to new devices as needed, and enhancing the wireless signal if necessary. Wireless home network speeds and ranges vary. The strength of the wireless signal affects the range of the network. Read How To 10-3 earlier

in this chapter for instructions about strengthening a wireless signal.

Discover More: Visit this chapter's free resources to learn more about planning and designing a home network.

Consider This: Do you have a home network? What devices are connected to it? Is your network password protected? Why or why not? Is the signal weaker in certain areas in your home? If so, where? What can you do to increase the effectiveness and security of your network?



HOW TO 10-4

Create a Home Network

If you have multiple computers and mobile devices in your home and want to share resources, you can create a home network. The following steps describe how to create a home network:

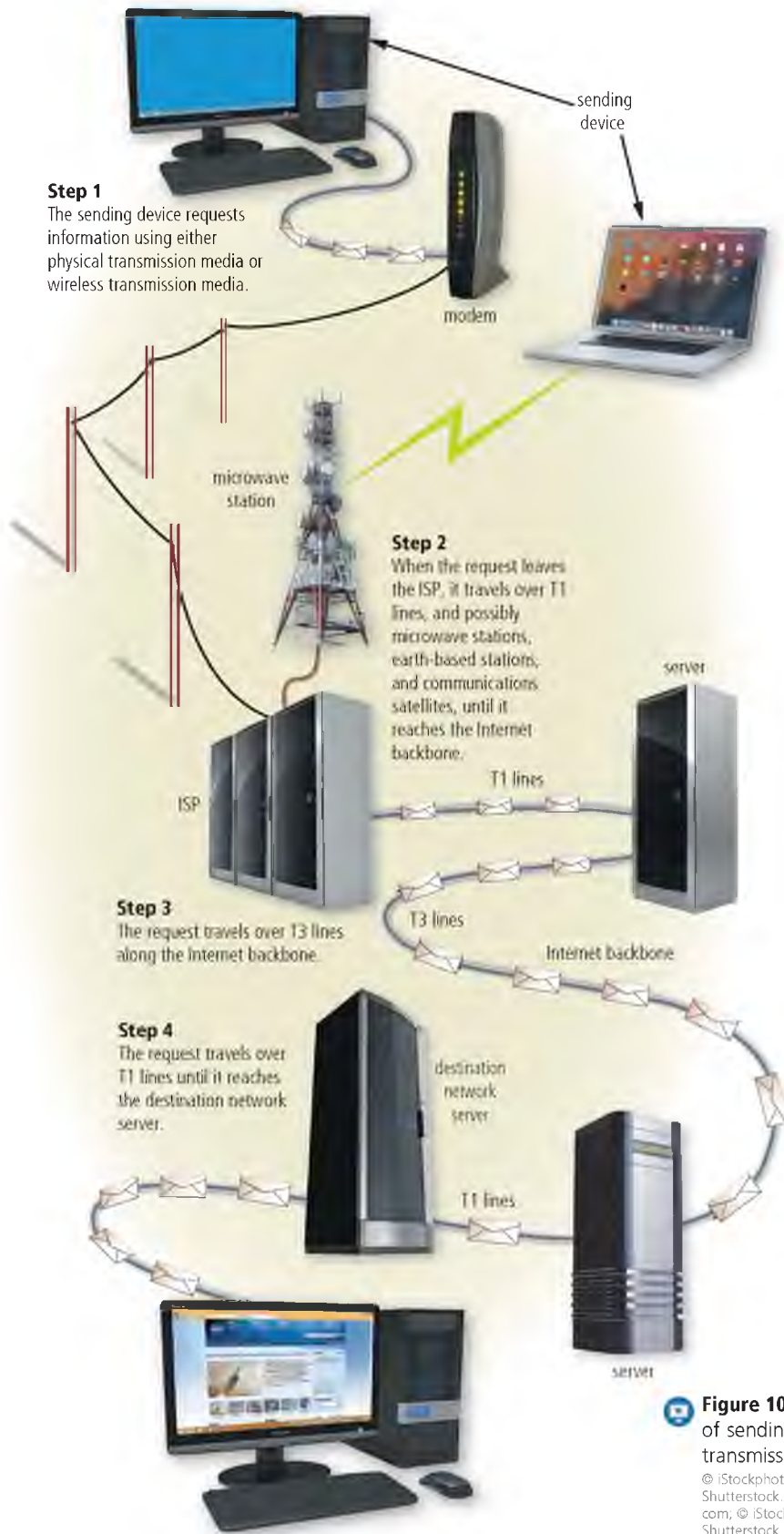
1. Establish a connection to the Internet. In many cases, your ISP will provide a modem that serves as the connection between the computers and mobile devices in your home and the Internet connection.
2. Most modems allow you to connect only one computer or mobile device and may not have the capability to serve also as a wireless access point. If you intend to use more than one computer or mobile device with your Internet connection, purchase and connect a router with a sufficient number of ports and then connect it to the modem. If you want wireless access in your home, purchase and connect a wireless router or mobile hot spot.
3. For computers that will use a wired network connection, connect a network cable from the computer to an available port on the router.
4. Follow the router's instructions to configure it. If you are configuring wireless access, you may need to perform the following steps:
 - a. Set an SSID to uniquely identify your wireless network.
 - b. Select an encryption method and choose an encryption key that will be easy for you to remember but very difficult for others to guess.
 - c. Connect the wireless devices to the network by enabling the wireless card if necessary, selecting the SSID of your wireless network, and specifying the proper encryption key. Read How To 5-3 in Chapter 5 for additional information about SSIDs and encryption methods.
5. Test the connection on all devices, whether wired or wireless, that are connected to the

network. You can verify that your network is working properly by running a browser and navigating to a webpage.

6. If desired, enable file sharing so that you can share files among the computers and mobile devices on your home network. Operating systems today typically include a feature that allows you to enable sharing with other computers on the same network. For another computer or mobile device to access shared files on your computer, the user will need to know the IP address or name of your computer, as well as the location of the files.
7. For maximum security, disable Internet and network connections when you are not using them.

Consider This: What are some other benefits of creating a home network? What disadvantages might be associated with creating a home network?

An Example of Sending a Request over the Internet Using a Variety of Transmission Media



Transmission Media

Transmission media consist of materials or substances capable of carrying one or more communications signals. When you send data from a computer or mobile device, the signal that carries the data may travel over various transmission media. This is especially true when the transmission spans a long distance. Figure 10-19 illustrates the variety of transmission media, including both physical and wireless, used to complete a data request over the Internet. Although many media and devices are involved, the entire communications process could take less than one second.

Broadband media transmit multiple signals simultaneously. The amount of data, instructions, and information that can travel over transmission media sometimes is called the **bandwidth**. The higher the bandwidth, the more data transmitted. For transmission of text only, a lower bandwidth is acceptable. For transmission of music, graphics, photos, virtual reality images, or 3-D games, however, you need a higher bandwidth. When the bandwidth is too low for the application, you will notice a considerable slowdown in system performance.

Latency, with respect to communications, is the time it takes a signal to travel from one location to another on a network. Several factors that negatively can affect latency include the distance between the two points, the type of transmission media, and the number of nodes through which the data must travel over the network. For best performance, bandwidth should be high and latency low. Read Ethics & Issues 10-3 to consider whether ISPs should be able to control Internet usage.

Figure 10-19 This figure shows a simplified example of sending a request over the Internet using a variety of transmission media.

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ETHICS & ISSUES 10-3

Should ISPs Be Allowed to Control Your Internet Usage?

People often compare the early days of the Internet and web to a wild frontier. ISPs simply offered customers an Internet connection and exerted no control over how the customer used the connection. This is similar to a phone company, which does not control who a customer calls, the length of a call, or the reason for the call. Online gaming, VoIP, video and audio streaming, and the use of web apps and cloud services led to an increased reliance on the Internet. Because of these increases, ISPs are attempting to regulate and limit their customers' usage.

Capping is a practice ISPs use that provides a certain amount of data usage at the optimal

speed. Once a customer has used his or her allotted amount, the customer's Internet access is restricted, is slowed, or incurs additional costs. *Throttling* occurs when a network reduces upload and download speeds of certain high-data users at peak times in order not to tie up network resources for a small pool of users.

Controversy surrounds capping and throttling practices. Providers argue that caps are necessary to regulate traffic and ensure equal access to the Internet for all of its users. Critics argue that ISPs use limits to unfairly increase customer fees. Legislators are attempting to resolve the issues surrounding *net neutrality*, which is the concept of an open Internet, accessible to all users, without

interference from ISPs or other third-parties. Proposals include standardizing how data transfer rates are measured and involving the Federal Communications Commission (FCC). The FCC would evaluate the regulations to ensure that ISPs intend merely to regulate traffic, rather than make a profit. It would examine whether caps or throttling are appropriate for low-usage times, such as in the middle of the night, and other related issues.

Consider This: Should ISPs control your Internet usage? Why or why not? Are data caps at peak usage times reasonable? Why or why not? Should the government enforce net neutrality? Why or why not?

Physical Transmission Media

Physical transmission media use wire, cable, and other tangible materials to send communications signals. These wires and cables typically are used underground or within or between buildings. Ethernet and token ring LANs often use physical transmission media.

Table 10-3 lists the transfer rates of LANs using various physical transmission media. The following sections discuss each of these types.

Twisted-Pair Cable

One of the more widely used transmission media for network cabling and landline phone systems is twisted-pair cable. **Twisted-pair cable** consists of one or more twisted-pair wires bundled together (Figure 10-20). Each *twisted-pair wire* consists of two separate insulated copper wires that are twisted together. The wires are twisted together to reduce **noise**, which is an electrical disturbance that can degrade communications.

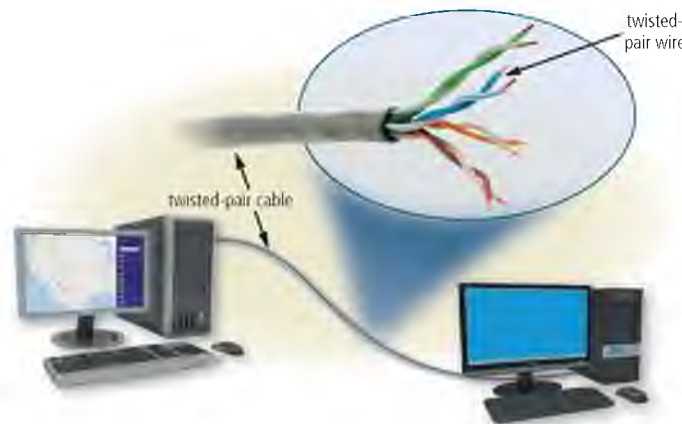


Table 10-3 Transfer Rates for Physical Transmission Media Used in LANs

Type of Cable and LAN	Maximum Transfer Rate
Twisted-Pair Cable	
• 10Base-T (Ethernet)	10 Mbps
• 100Base-T (Fast Ethernet)	100 Mbps
• 1000Base-T (Gigabit Ethernet)	1 Gbps
• Token ring	4 Mbps to 16 Mbps
Coaxial Cable	
• 10Base2 (ThinWire Ethernet)	10 Mbps
• 10Base5 (ThickWire Ethernet)	10 Mbps
Fiber-Optic Cable	
• 10Base-F (Ethernet)	10 Mbps
• 100Base-FX (Fast Ethernet)	100 Mbps
• FDDI (Fiber Distributed Data Interface) token ring	100 Mbps
• Gigabit Ethernet	1 Gbps
• 10-Gigabit Ethernet	10 Gbps
• 40-Gigabit Ethernet	40 Gbps
• 100-Gigabit Ethernet	100 Gbps

Figure 10-20 A twisted-pair cable consists of one or more twisted-pair wires. Each twisted-pair wire usually is color coded for identification. Landline phone networks and LANs often use twisted-pair cable.

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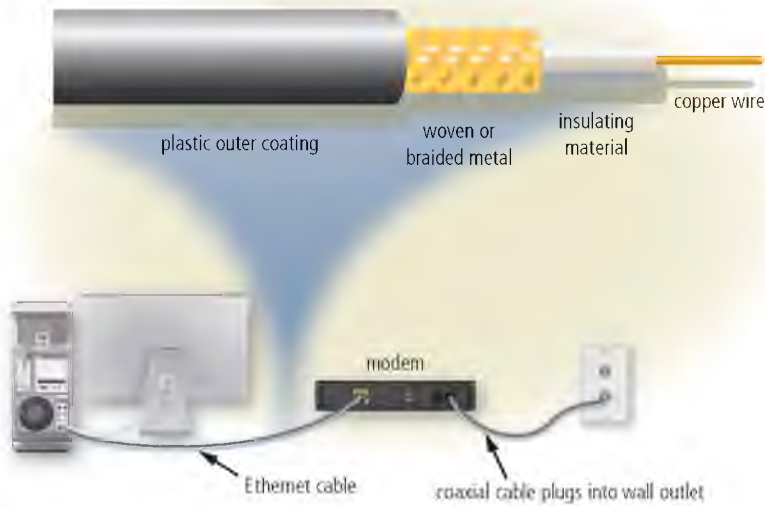


Figure 10-21 On coaxial cables, data travels through a copper wire. This simplified illustration shows a computer connected to a modem, which is also connected to the CATV network through a coaxial cable.

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is as thin as a human hair. Inside the fiber-optic cable, an insulating glass cladding and a protective coating surround each optical fiber (Figure 10-22).

Fiber-optic cables have the following advantages over cables that use wire, such as twisted-pair and coaxial cables:

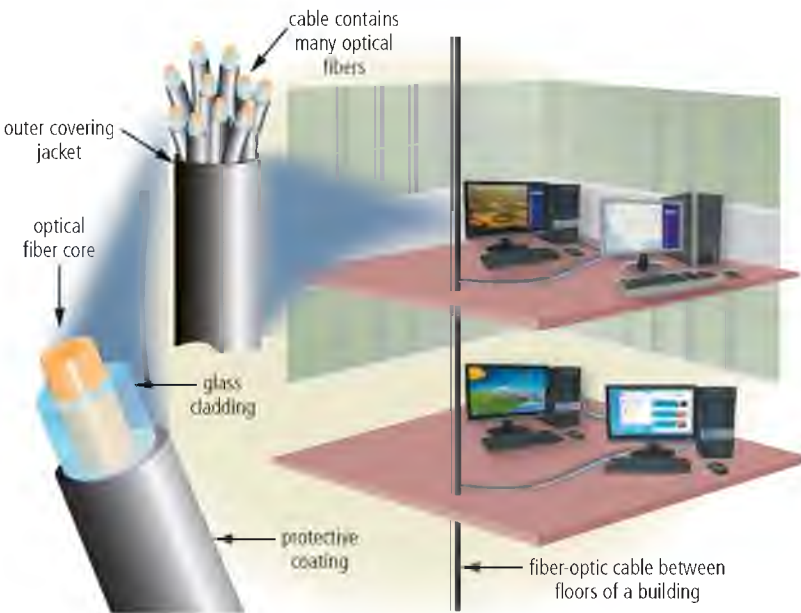


Figure 10-22 A fiber-optic cable consists of hair-thin strands of glass or plastic that carry data as pulses of light, as shown in this simplified example.

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Coaxial Cable

Coaxial cable, often referred to as *coax* (pronounced KO-ax), consists of a single copper wire surrounded by at least three layers: (1) an insulating material, (2) a woven or braided metal, and (3) a plastic outer coating (Figure 10-21).

CATV network wiring often uses coaxial cable because it can be cabled over longer distances than twisted-pair cable. Most of today's computer networks, however, do not use coaxial cable because other transmission media, such as fiber-optic cable, transmit signals at faster rates.

Fiber-Optic Cable

The core of a **fiber-optic cable** consists of dozens or hundreds of thin strands of glass or plastic that use light to transmit signals. Each strand, called an *optical fiber*,

- Capability of carrying significantly more signals than wire cables
- Faster data transmission
- Less susceptible to noise (interference) from other devices, such as a copy machine
- Better security for signals during transmission because they are less susceptible to noise
- Smaller size (much thinner and lighter weight)

Disadvantages of fiber-optic cable are it costs more than twisted-pair or coaxial cable and can be difficult to install and modify. Despite these limitations, many phone companies replaced original analog phone lines with fiber-optic cables, enabling them to offer fiber-optic Internet access to home and business users. Businesses also use fiber-optic cables in high-traffic networks or as the backbone in a network.



Technology Trend

Discover More: Visit this chapter's free resources to learn about wireless charging.

Wireless Transmission Media

Wireless transmission media send communications signals through the air or space. Many users opt for wireless transmission media because it is more convenient than installing cables. In addition to convenience, businesses use wireless transmission media in locations where it is impossible to install cables. Read How To 10-5 for instructions about adding a printer to a wireless network.

HOW TO 10-5

Add a Wireless Printer to a Home/Small Office Network

Adding a wireless printer to a home or small office network has several advantages. For example, multiple computers and mobile devices on the network can use the printer. You also can place the printer anywhere in the home or office, as long as it is within range of the wireless signal. For example, a wireless router can be on the first floor of your house, and a wireless printer can be on the second floor. The following steps describe how to add a wireless printer to a home/small office network:

1. Determine the location to install the wireless printer. This location must have an electrical outlet for the printer and also be within range of the wireless network. You can check the strength of wireless signals in your home or office by walking

around with a mobile computer or device while connected to the network and monitoring the signal strength.

2. Be sure to place the printer on a stable surface.
3. Access the printer's settings and navigate to the network settings.
4. Connect to the wireless network in your home or small office. If necessary, specify the encryption key for your network.
5. Enter any remaining required information.
6. Install the printer software on the computer(s) from which you want to print to the wireless printer. During the installation process, you will select the wireless printer that you have connected and configured. If the printer does not appear, return to Step 4 and try connecting the printer to the wireless network again. If

the problem persists, consider contacting the printer's manufacturer.

7. Verify the computers are able to print successfully to the wireless printer.

Consider This: What are some ways to prevent some computers or mobile devices on your network from printing on your wireless printer?



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Types of wireless transmission media used in communications include infrared, broadcast radio, cellular radio, microwaves, and communications satellites. Table 10-4 lists transfer rates of various wireless transmission media, which are discussed in the following sections.

Infrared

As discussed earlier in the chapter, infrared (IR) is a wireless transmission medium that sends signals using infrared light waves. Mobile computers and devices, such as a mouse, printer, and smartphone, may have an IrDA port that enables the transfer of data from one device to another using infrared light waves.

Broadcast Radio

Broadcast radio is a wireless transmission medium that distributes radio signals through the air over long distances, such as between cities, regions, and countries, and short distances, such as within an office or home.

For radio transmissions, you need a transmitter to send the broadcast radio signal and a receiver to accept it. To receive the broadcast radio signal, the receiver has an antenna that is located in the range of the signal. Some networks use a transceiver, which both sends and receives signals from wireless devices. Broadcast radio is slower and more susceptible to noise than physical transmission media, but it provides flexibility and portability.

Bluetooth, UWB, and Wi-Fi communications technologies discussed earlier in this chapter use broadcast radio signals. Bluetooth and UWB are alternatives to infrared communications, with the latter designed for high-bandwidth transmissions. Hot spots use Wi-Fi.

Table 10-4 Wireless Transmission Media Transfer Rates

Medium		Maximum Transfer Transmission Rate
Infrared		115 Kbps to 4 Mbps
Broadcast radio	<ul style="list-style-type: none"> • Bluetooth • 802.11b • 802.11a • 802.11g • 802.11n • 802.11ac • 802.11ad • UWB 	1 Mbps to 24 Mbps 11 Mbps 54 Mbps 54 Mbps 300 Mbps 500 Mbps to 1 Gbps up to 7 Gbps 110 Mbps to 480 Mbps
Cellular radio	<ul style="list-style-type: none"> • 2G • 3G • 4G 	9.6 Kbps to 144 Kbps 144 Kbps to 3.84 Mbps Up to 100 Mbps
Microwave radio		Up to 10 Gbps
Communications satellite		Up to 2.56 Tbps



Data Transfer Rates
Tbps (terabits per second) is one trillion bits per second.

Cellular Radio

Cellular radio is a form of broadcast radio that is in wide use for mobile communications, specifically wireless modems and mobile phones (Figure 10-23). A mobile phone uses high-frequency radio waves to transmit voice and digital data messages. Because only a limited number of radio frequencies exist, mobile service providers reuse frequencies so that they can accommodate the large number of users. Some users install an amplifier or booster to improve the signal strength. Read Secure IT 10-4 to consider issues related to fake cell towers.



Figure 10-23 As a person with a mobile phone drives from one cell to another, the radio signals transfer from the base station (microwave station) in one cell to a base station in another cell.

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SECURE IT 10-4



Fake Cell Towers Are Tracking Devices

At least 17 cell towers located throughout the United States are intercepting mobile phone calls, according to technical security company ESD America. The company has identified these towers but does not know who owns them. It does know, however, that they do not belong to a mobile service provider or to the National Security Agency (NSA).

Every mobile device has a unique *International Mobile Subscriber Identity (IMSI)* that allows it to communicate with a cell tower. The interceptor technology on fake towers grasps, or catches, this IMSI

signal; hence, it is known as an IMSI catcher. According to some reports, cyberthieves can purchase IMSI catchers for \$1,800 or can build the devices themselves. The interceptors, also called stingrays, slow the protocol, so consumers may notice that the display on their smartphone shows that the 4G connection has dropped to 2G and that the performance has degraded. Higher-quality interceptors, however, will not change the phone's display when the phone has been attacked.

The Federal Communications Commission (FCC) is investigating these fake towers to determine who or what entity is intercepting the calls. It has established a task force to

protect cellular networks and to address the threat of illicit IMSI catcher technology. It also is working with several industry organizations to develop new, secure cybersecurity standards. In addition, the FCC urges consumers to update their mobile devices' operating systems and apps because the latest software often addresses security vulnerabilities.

Consider This: Have you read any articles or publications disclosing the illicit and unauthorized use of IMSI catchers? Who or what organization do you think is using these interceptors?

Several categories of cellular radio transmissions exist, defining the development of cellular networks. Although the definitions of these categories may vary by mobile service providers, below are some general guidelines:

- *1G* (first generation of cellular transmissions)
 - Analog data transfer at speeds up to 14.4 Kbps
- *2G* (second generation of cellular transmissions)
 - Digital data transfer at speeds from 9.6 Kbps to 144 Kbps
 - Improved voice transmissions, added data communications, and added SMS (short message service) or text messaging services
 - Standards include *GSM* (Global System for Mobile Communications) and *GPRS* (General Packet Radio Service)
- *3G* (third generation of cellular transmissions)
 - Digital data transfer at speeds from 144 Kbps to 3.84 Mbps
 - Improved data transmissions, added MMS (multimedia message services)
 - Standards include *UMTS* (Universal Mobile Telecommunications System), *CDMA* (Code Division Multiple Access), *EDGE* (Enhanced Data GSM Environment), and *EVDO* (Evolution Data Optimized)
- *4G* (fourth generation of cellular transmissions)
 - Digital data transfer at speeds up to 100 Mbps
 - Improved video transmissions
 - Standards include Long Term Evolution (*LTE*), Ultra Mobile Broadband (*UMB*), and IEEE 802.16 (*WiMAX*)
- *5G* (fifth generation of cellular transmissions)
 - Future generation of cellular transmissions
 - Expected to improve bandwidth
 - Expected to provide artificial intelligence capabilities on wearable devices

Read Ethics & Issues 10-4 to consider whether mobile service providers should be able to force customers to switch from landlines to mobile phones.

ETHICS & ISSUES 10-4

Should Phone Companies Be Allowed to Force Customers to Switch from Landlines to Mobile Phones?

Many people today rely solely on a mobile phone and have no need for a traditional landline installed in their home. A mobile phone enables users to keep their same phone number if they move and ensures that they can receive communications when not at home. Around 100 million Americans still rely on a landline for phone access, especially in rural areas. As the copper lines that connect these phones deteriorate from age and rust, phone companies are pushing customers to purchase VoIP or mobile services instead of a landline.

Critics of these measures cite that mobile phones are less reliable in certain areas and during extended power failures, and may or may not properly connect to emergency services. The elderly and people with certain illnesses rely on medical devices that use a landline to send medical information or alerts. The FCC (Federal Communications Commission) would need to approve the phone companies' plans to eliminate landline service. Because of rules known as 'common carrier' guidelines, phone companies must provide phone access to all users, at a fair price. Different pricing rules exist for Internet usage and mobile phones, which some fear may lead phone companies to raise prices unfairly.

Phone companies argue that the current landlines are expensive to maintain. Many feel that they have a right to refuse to repair, install, or continue service to areas for which they do not see a profit. They argue that uses of satellites and Internet technologies can provide service to even the most rural areas. Two major phone providers have proposed eliminating landline service by 2020.

Consider This: Do you have a landline? Why or why not? Should phone companies require users to switch to mobile phones? Why or why not? Should the government force phone companies to provide service without a profit? Why or why not?

Microwaves

Microwaves are radio waves that provide a high-speed signal transmission. Microwave transmission, often called *fixed wireless*, involves sending signals from one microwave station to another (Figure 10-24). A *microwave station* is an earth-based reflective dish that contains the antenna, transceivers, and other equipment necessary for microwave communications. As with infrared, microwaves use line-of-sight transmission. To avoid possible obstructions, such as buildings or mountains, microwave stations often sit on the tops of buildings, towers, or mountains.

Microwave transmission typically is used in environments where installing physical transmission media is difficult or impossible and where line-of-sight transmission is available. For example, microwave transmission is used in wide-open areas, such as deserts or lakes, between buildings in a close geographic area, or to communicate with a satellite. Current users of microwave transmission include universities, hospitals, city governments, CATV providers, and phone companies. Homes and small businesses that do not have other high-speed Internet connections available in their area also opt for lower-cost fixed wireless plans.

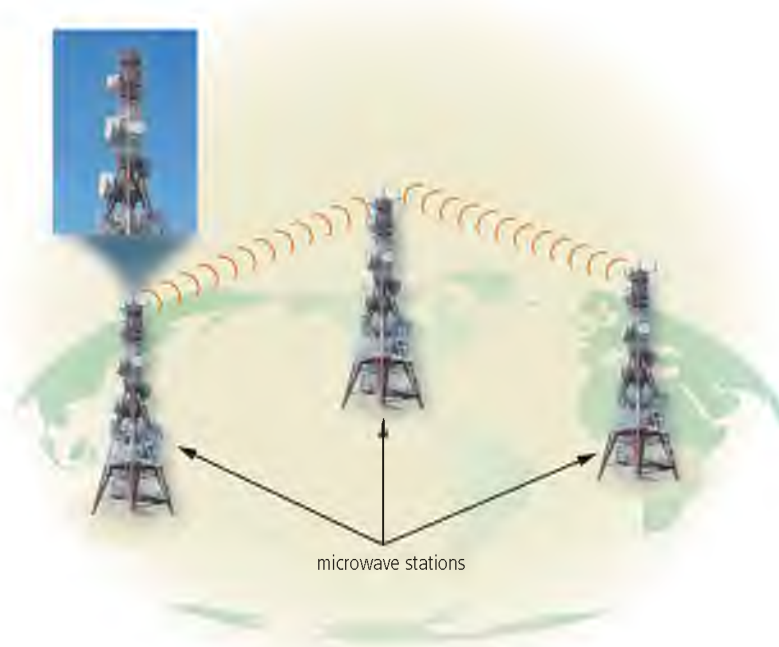


Figure 10-24 A microwave station is a ground-based reflective dish that contains the antenna, transceivers, and other equipment necessary for microwave communications.

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Communications Satellite

A **communications satellite** is a space station that receives microwave signals from an earth-based station, amplifies (strengthens) the signals, and broadcasts the signals back over a wide area to any number of earth-based stations (Figure 10-25). These earth-based stations often are microwave stations. Other devices, such as smartphones and GPS receivers, also can function as earth-based stations. Transmission from an earth-based station to a satellite is an *uplink*. Transmission from a satellite to an earth-based station is a *downlink*.

Applications such as air navigation, television and radio broadcasts, weather forecasting, videoconferencing, paging, GPS, and Internet connections use communications satellites. With the proper satellite dish and a satellite modem, consumers can access the Internet using satellite technology. With satellite Internet connections, however, uplink transmissions usually are slower

than downlink transmissions. This difference in speeds usually is acceptable to most Internet satellite users because they download much more data than they upload. Although a satellite Internet connection is more expensive than cable Internet or DSL connections, sometimes it is the only high-speed Internet option in remote areas.



Figure 10-25 Communications satellites are placed about 22,300 miles above the Earth's equator.

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GPS As described previously, a **GPS** (*global positioning system*) is a navigation system that consists of one or more earth-based receivers that accept and analyze signals sent by satellites in order to determine the receiver's geographic location.

Many mobile devices, such as smartphones, have GPS capability built into the device or as an add-on feature. Some users carry a handheld GPS receiver; others mount a receiver to an object such as an automobile, a boat, an airplane, farm and construction equipment, or a computer or mobile device. A GPS receiver is a handheld, mountable, or embedded device that contains an antenna, a radio receiver, and a processor. Many include a screen display that shows an individual's location on a map. Figure 10-26 shows how a GPS works.



Technology Trend

Discover More: Visit this chapter's free resources to learn about geocaching.



Figure 10-26 This simplified figure shows how a GPS works.

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 **CONSIDER THIS**

What are uses of GPS?

The first and most used application of GPS technology is to assist people with determining where they are located. The data obtained from a GPS, however, can be applied to a variety of other uses: creating a map, ascertaining the best route between two points, locating a lost person or stolen object, monitoring the movement of a person or object, determining altitude, and calculating speed.

Many vehicles use GPSs to provide drivers with directions or other information, such as alternate traffic routes, automatically call for help if the airbag is deployed, dispatch roadside assistance, unlock the driver's side door if keys are locked in the car, and track the vehicle if it is stolen. Newer GPS receivers also give drivers information about nearby points of interest, such as gas stations, restaurants, and hotels. Hikers and remote campers may carry GPS receivers in case they need emergency help or directions.

Some GPS receivers work in conjunction with a cellular radio network. Parents, for example, can locate the whereabouts of a child who carries a mobile phone with GPS capability or other GPS-enabled device.

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Communications Devices, Home Networks, Transmission Media, Physical Transmission Media, and Wireless Transmission Media, as it relates to the chapter objectives. *Now you should know ...*

- When you would use various communications devices (Objective 7)
- How you can set up and configure a home network (Objective 8)
- Which types of transmission media are best suited to your needs (Objectives 9 and 10)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter presented a variety of networks and communications technologies. It discussed various types of network architectures and standards and protocols. It explained communications software. Several types of communications lines and communications devices were presented. The chapter discussed how to create a home network. It also presented a variety of physical transmission media and wireless transmission media.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Robert Metcalfe, AT&T and Verizon, and Cisco; Technology Trends: Wireless Charging and Geocaching; and High-Tech Talks: Network Topologies: Star, Bus, Ring, and the OSI Reference Model.

- Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test apps that run on your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK**Agriculture**

The world's dependence on the agriculture industry is enormous. The demand to keep food prices affordable encourages those working in this industry to operate as efficiently as possible. Although people have worked in agriculture for more than 10,000 years, advances in technology assist with maintaining and protecting land and crops.

Almost all individuals and organizations in this industry have many acres of land that they must maintain. It is not always feasible for farmers to take frequent trips around the property to perform basic tasks, such as watering soil in the absence of rain. The number of people-hours required to water soil manually on several thousand acres of land might result in businesses spending thousands of dollars in labor and utility costs. If an irrigation system is installed instead, one or more individuals still are responsible for deciding when to water and how long to water. If the irrigation process is automated, sensors detect how much rain has fallen recently, as well as whether the soil is in need of watering. The sensors then send

this data to a computer that processes it and decides when and how much to water. Many automated home irrigation systems also are programmable and use rain sensors, which regulate operation of the irrigation system.

In addition to keeping the soil moist and reducing maintenance costs, computers also can use sensors to analyze the condition of crops in the field and determine whether pests or diseases are affecting the crops. If sensors detect pests and/or diseases, computers send a notification to the appropriate individual to take corrective action. In some cases, the discovery of pests might trigger a pesticide to discharge in the affected area automatically.

Until recently, the lack of adequate cellular and wireless network signals in the fields made communications difficult for farmers. Mobile cellular antennas and amplifiers stretch mobile broadband coverage across entire farms, enabling farmers to receive wireless signals up to eight times farther from the cellular tower than they would without the antennas and amplifiers. Wireless access

throughout the farm also allows farmers to monitor their farms and communicate with colleagues from remote locations.

The next time you take a bite of a delicious carrot or juicy cucumber, you can appreciate how technology has helped to maintain an ideal environment for these vegetables to grow and protected them from unwanted pests, all for a reasonable price when you purchase them from your local supermarket.

- **Consider This:** How else might computers and technology be used in the agriculture industry?



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Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to test your knowledge of digital content associated with this chapter and access the Study Guide resource from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- List the device types and media you need for successful communications.
- A(n) _____ is a collection of computers and devices connected together via communications devices and transmission media.
- List reasons home and business users create a network. Identify how networks facilitate communications.
- A(n) _____ is a third-party business that provides networking services, such as EDI.
- Define the terms, intranet and extranet.
- Differentiate among LANs, WLANs, MANs, WANs, and PANs.
- List steps to add a computer or mobile device to a wireless network.
- Explain issues surrounding the use of BANs.
- Name and describe two types of network architectures. Define the terms, client and server.
- Explain how P2P networks function, and describe the uses of P2P file sharing.
- List functions of communications software. List and describe forms of immediate mobile communications.
- Explain issues surrounding the use of telemedicine.
- Define the terms, network standard and protocol. Explain whether they work together.
- Define the term, Ethernet. Explain what happens when two devices on an Ethernet attempt to send data at the same time.
- Describe how a network transmits data using a token.
- TCP/IP is the network standard for _____ communications. Describe how packet switching works.
- Explain how network monitoring software and packet sniffers identify network security risks.
- Explain whether you can use an IP address to determine a computer or device's location.
- Describe how Wi-Fi enables users to connect to the Internet.
- _____ is a network standard that defines how high-speed cellular transmissions use broadcast radio to transmit data for mobile communications.
- List uses for Bluetooth devices. Name advantages and disadvantages of using Bluetooth.
- Describe how to prevent Bluebugging.
- Differentiate among UWB, IrDA, RFID, and NFC technologies.
- Identify the role of a dedicated line. List types of digital dedicated lines.
- Explain the advantages of cable Internet services and DSL.
- List and differentiate among different T-carrier lines.
- Define the term, communications device.
- List and describe three widely used types of broadband modems. Define the term, dial-up modem.
- Define the terms, wireless modem and mobile hot spot.
- List the steps to use your phone as a mobile hot spot.
- Define the term, wireless access point. Explain how to strengthen your wireless signal.
- Identify the role of a router. List types of routers that offer additional functionality.
- To prevent unauthorized users from accessing files and computers, many routers are protected by a built-in _____ firewall.
- Describe the function of a network card.
- Identify the roles of hubs and switches on a network.
- List questions to ask when planning a home network. Identify hardware needed to set up a home network.
- List steps to create a home network.
- Explain how to determine if someone is accessing a wireless network without permission.
- Define the terms, broadband, bandwidth, and latency.
- Explain issues surrounding ISPs setting limits on Internet usage.
- Name types of physical transmission media. Define the term, noise.
- Identify advantages and disadvantages of fiber-optic cables.
- List steps to add a wireless printer to a home/small office network.
- Name types of wireless transmission media.
- Explain how cyberthieves use fake cell towers to intercept communications.
- Differentiate among 1G, 2G, 3G, 4G, and 5G cellular transmissions.
- Explain issues surrounding phone companies forcing customers to switch to mobile phones.
- List uses of GPS.
- Explain how the agriculture industry uses technology.

Key Terms

You should be able to define the Primary Terms and be familiar with the Secondary Terms listed below.

Discover More: Visit this chapter’s premium content to view definitions for each term and to access the Flash Cards resource from your smartphone, tablet, laptop, or desktop.

Primary Terms (shown in **bold-black** characters in the chapter)

- 802.11 (462)
- ATM (468)
- bandwidth (476)
- Bluetooth (463)
- broadband (476)
- broadcast radio (479)
- cable modem (469)
- cellular radio (480)
- client/server network (456)
- clients (456)
- coaxial cable (478)
- communications device (468)
- communications satellite (482)
- communications software (457)
- dedicated line (466)
- DSL (467)
- DSL modem (469)
- Ethernet (460)
- fiber-optic cable (478)
- FTTP (Fiber to the Premises) (467)
- GPS (483)
- home network (473)
- IrDA (465)
- latency (476)
- local area network (LAN) (453)
- LTE (462)
- microwaves (482)
- network (452)
- NFC (466)
- noise (477)
- personal area network (PAN) (455)
- receiving device (450)
- RFID (465)
- sending device (450)
- server (456)
- T-carrier line (468)
- TCP/IP (461)
- token ring (460)
- transmission media (450)
- twisted-pair cable (477)
- UWB (ultra-wideband) (464)
- wide area network (WAN) (455)
- Wi-Fi (462)
- wireless LAN (WLAN) (454)

Secondary Terms (shown in *italic* characters in the chapter)

- 1G (481)
- 2G (481)
- 3G (481)
- 4G (481)
- 5G (481)
- ADSL (*asymmetric digital subscriber line*) (467)
- Bluebugging (464)
- body area network (BAN) (456)
- broadband modem (468)
- broadband router (471)
- broadband wireless router (472)
- cable Internet service (466)
- capping (477)
- coax (478)
- communications channel (450)
- dial-up modem (469)
- digital modem (468)
- Digital Subscriber Line (467)
- downlink (482)
- downstream rate (462)
- EDI (*electronic data interchange*) (453)
- electronic funds transfer (EFT) (453)
- extranet (453)
- file sharing network (457)
- fixed wireless* (482)
- fractional T1* (468)
- FTTB (*Fiber to the Building*) (467)
- FTTH (*Fiber to the Home*) (467)
- Gbps (460)
- global positioning system (483)
- GPRS (481)
- GSM (481)
- hardware firewall (472)
- host computer (456)
- hub (473)
- International Mobile Subscriber Identity (IMSI) (480)
- intranet (453)
- IP hijacking (474)
- ISDN (467)
- ISDN modem (469)
- line-of-sight transmission (465)
- Mbps (460)
- metropolitan area network (MAN) (455)
- microwave station (482)
- mobile broadband wireless router (472)
- mobile hot spot (469)
- multiplexing (467)
- near field communications* (466)
- net neutrality* (477)
- network architecture* (456)
- network card* (472)
- network interface card (NIC)* (472)
- network monitoring software* (462)
- network standard* (459)
- node* (453)
- optical fiber* (478)
- packet sniffer software* (462)
- packet switching* (461)
- packets* (461)
- peer* (457)
- peer-to-peer (P2P) network* (457)
- protocol* (460)
- radio frequency identification* (465)
- router (471)
- switch (473)
- T1 line (468)
- T3 line (468)
- Tbps (479)
- telemedicine (459)
- throttling (477)
- token (460)
- twisted-pair wire (477)
- UMB (481)
- UMTS (481)
- uplink (482)
- upstream rate (463)
- value-added network (VAN) (453)
- wireless access point (470)
- wireless Ethernet (462)
- wireless modem (469)
- wireless router (471)



wireless modem (469)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. All types of computers and mobile devices serve as sending and receiving devices in a communications system. (450)
- _____ 2. Files on an intranet also are accessible from the Internet. (453)
- _____ 3. Disadvantages of BANs include data validity and security. (456)
- _____ 4. A client computer sometimes is called a host computer. (456)
- _____ 5. Voice and video calling require large amounts of bandwidth. (458)
- _____ 6. UWB requires line-of-sight transmission, so its technology is not as widespread as IrDA. (465)
- _____ 7. For successful communications with NFC devices, the devices or objects must touch or be placed within an inch or two of each other. (466)
- _____ 8. DSL transmits on existing standard copper phone wiring. (467)
- _____ 9. Large corporations, phone networks, the Internet, and other networks with large amounts of traffic use DSL. (468)
- _____ 10. A broadband modem is a communications device that converts digital signals to analog signals and analog signals to digital signals, so that data can travel along an analog phone line. (469)
- _____ 11. Although some routers may be able to connect more than 200 wired and/or wireless computers and mobile devices, the performance of the router may decline as you add connections. (472)
- _____ 12. With satellite Internet connections, uplink transmissions usually are slower than downlink transmissions. (483)

Multiple Choice

Select the best answer.

1. For successful communications, you need all of the following *except* a _____. (450)
 - a. sending device
 - b. transponder
 - c. communications channel
 - d. receiving device
2. A(n) _____ is an internal network that uses Internet technologies. (453)
 - a. router
 - b. extranet
 - c. intranet
 - d. communications channel
3. A _____ is a network that connects computers and devices in an individual's workspace using wired and wireless technology. (455)

a. LAN	c. BAN
b. PAN	d. WAN
4. A(n) _____ network is a simple, inexpensive network architecture that typically connects fewer than 10 computers. (457)

a. protocol	c. extranet
b. WAN	d. P2P
5. A _____ is a special series of bits that functions like a ticket. (460)
 - a. packet
 - b. Bluebug
 - c. token
 - d. host
6. _____ occurs when cyberthieves exploit Bluetooth devices that have been paired. (464)
 - a. Bluebugging
 - b. IP hijacking
 - c. Capping
 - d. Throttling
7. Which of the following is *not* a digital dedicated line? (466)


a. NFC	c. FTTP
b. ISDN	d. T-carrier lines
8. The practice used by some ISPs that provides a certain amount of data usage at the optimal speed is known as _____. (477)

a. Bluebugging	c. capping
b. IP hijacking	d. throttling

Checkpoint

Matching Match the terms with their definitions.

- | | |
|--|--|
| _____ 1. value-added network (VAN) (453) | a. standard that outlines characteristics of how two devices communicate on a network |
| _____ 2. client (456) | b. guidelines that specify the way computers access the medium to which they are connected, the type(s) of medium used, the speeds used on different types of networks, and the type(s) of physical cable and/or the wireless technology used |
| _____ 3. network standard (459) | c. third-party business that provides networking services, such as EDI services, secure data and information transfer, storage, or email |
| _____ 4. Ethernet (460) | d. program that monitors and logs packet traffic for later analysis |
| _____ 5. protocol (460) | e. network protocol that defines how messages are routed from one end of a network to the other, ensuring the data arrives correctly |
| _____ 6. TCP/IP (461) | f. the amount of data, instructions, and information that can travel over transmission media |
| _____ 7. packet sniffer software (462) | g. network standard that specifies no computer or device on the network should control when data can be transmitted |
| _____ 8. LTE (462) | h. computers or mobile devices on the network that rely on the server for its resources |
| _____ 9. bandwidth (476) | i. the time it takes a signal to travel from one location to another on a network |
| _____ 10. latency (476) | j. network standard that defines how high-speed cellular transmissions use broadcast radio to transmit data for mobile communications |

 **Consider This** Answer the following questions in the format specified by your instructor.

- Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (456, 459, 477, 481), How To (455, 470, 471, 475, 479), Mini Features (458, 463, 474), Secure IT (462, 464, 474, 480), and Technology @ Work (485).
- What elements are necessary for successful communications? (450)
- For what purposes do home and business users create networks? (452)
- What are EDI and EFT? (453)
- Why might a company use an intranet or extranet? (453)
- What are disadvantages of BANs? (456)
- How might small business and home users benefit from a P2P network? (457)
- What does communications software do? (457)
- What are some benefits and drawbacks of telemedicine? (459)
- What are some network communications standards and protocols? (460)
- What happens when a collision occurs on an Ethernet network? (460)
- What is a disadvantage of using Bluetooth? (464)
- What practices can you follow to prevent Bluebugging? (464)
- Which wireless technology requires line-of-sight transmission? (465)
- What are some examples of NFC-enabled devices? (466)
- How might you use an NFC tag for personal purposes? (466)
- What types of objects might contain an NFC tag? (466)
- How does DSL differ from cable Internet service? (466)
- Why is ADSL ideal for Internet access? (467)
- What are three types of broadband modems? (468)
- What steps can you take to strengthen a wireless signal? (471)
- What steps are involved in maintaining a network? (475)
- What factors negatively affect latency? (476)
- What is throttling? (477)
- What advantages do fiber-optic cables have over cables that use wires? (478)
- What are some examples of wireless transmission media? (479)
- How does an uplink differ from a downlink? (482)

Problem Solving

The **Problem Solving** exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The **Collaboration** exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Problems Exchanging Files** You are attempting to use Bluetooth to send files from your phone to your computer. When you try sending the files from your phone, it does not display your computer as a device to which it can send the file. What might be the problem?
- 2. Cannot Connect to Hot Spot** You are sitting in a fast food restaurant that offers free Wi-Fi. When you search for available hot spots using your computer, the restaurant's hot spot does not appear in the computer's list of wireless networks. What are your next steps?
- 3. Paired Bluetooth Devices** You and your brother each have your Bluetooth-enabled smartphones paired with your car so that you can talk through the car's microphone and listen through its speakers. When you and your brother are both in the car at the same time, his phone rings but it is not connected to the car's audio. Why might this be the case?
- 4. Slow Internet Connection** Your Internet speed has suffered a sharp decline in performance recently. You have not added any computers or mobile devices to your house that might be accessing the network, and you are puzzled by the sudden performance problems. What might be the problem?
- 5. Wireless Network Coverage** You installed a new wireless network in your house. You notice that you sometimes have trouble connecting to the network from certain locations in the house, but other times you can connect from the same location without issue. What might be causing the problem?



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Professional

- 6. Cannot Access Network** You brought your personal laptop to your place of employment so that you can take care of some personal obligations while you are on lunch break. You successfully connect to your company's wireless network but are unable to access the Internet. What might be the problem?
- 7. Cannot Sign In** Your corporate network requires you to sign in with a user name and password as soon as your computer or mobile device connects. After entering your user name and password, the computer still does not connect to the network. What might be the problem?
- 8. Too Many Networks** While attempting to connect to the wireless network at your job, you notice that five different wireless networks are available. How can you determine the network to which you should connect?
- 9. No Network Connection** You have unpacked, installed, and turned on a new computer at your desk. When the operating system starts and you run the browser to display a webpage, you receive an error message stating that you are not connected to the Internet. You check the network card on the back of the computer and although the cable is plugged in, the lights next to the port are not flashing. What are your next steps?
- 10. Connecting Corporate Email** You are visiting your company's remote office for the day and realize that you do not have the necessary information to connect to their wireless network. Your boss has asked you to check your email throughout the day, so it is important that you connect to the Internet. What are your next steps?

Collaboration

- 11. Technology in Agriculture** Your employer owns hundreds of acres of orange groves and realizes labor and utility costs can be decreased by installing automated systems to manage the property. As a digitally literate employee of the organization, your supervisor asks you to research automated systems that can help decrease expenses. Form a team of three people to research automated agricultural solutions. One team member should research automated irrigation systems that water the trees only as needed. Another team member should research solutions that can keep the trees healthy and free from pests, and the third team member should create a list of reasons why these automated systems can decrease costs, bolster efficiency, and increase profit. Compile your findings and submit them to your instructor.

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

How To: Your Turn

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn exercises**, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Evaluate Internet Access Plans

If you are planning to connect to the Internet from your computer or mobile device, you will need to subscribe to an Internet access plan. Cable companies, phone companies, and mobile service providers all offer Internet access plans, so it is important to evaluate the plans in your area to determine which one is best for you. The following steps guide you through the process of evaluating Internet access plans.

- Create a budget. Internet access plans are available for a monthly fee, so determine how much money you are able to spend for Internet access on a monthly basis.
- Locate and list the Internet access plans available in your area. To determine Internet access plans that are available, check the local cable or phone company's website and search for available plans. You may have to enter your ZIP code to determine whether certain plans are available in your area. Alternatively, visit a local electronics store and inquire about wireless Internet access plans available in your area.
- Compare Internet access speeds. Each Internet access plan may offer a different speed, so determine which speed is sufficient for you. If you mainly browse webpages and send or receive email messages, you may not need a plan that offers the fastest transfer rates. If you plan to download files, play online games, and watch movies on the Internet, you should consider a plan with faster transfer rates. You also should consider a plan with faster transfer rates if you will have multiple devices accessing the Internet simultaneously in your household. If an ISP offers multiple plans with a variety of transfer rates, it often will let you switch back and forth between plans without penalty so that you can find the one with the transfer rate that is best for you.
- Check for package deals. If you already have service with an existing CATV or phone provider, they may be able to add Internet access to your current services at a reduced rate. Bundling multiple services can make each service (such as Internet access) less expensive, but you should be careful not to sign up for services you do not need.
- Think about how much data you intend to transfer each month. Some Internet access plans limit the amount of data you can upload or download each month. While it can be difficult to determine how much data you will upload or download, you first should purchase a plan that might allow you to transfer more than you think you will need. Monitor your data usage each month and consider downgrading to a plan that provides the amount of data transfer that better represents your use.
- Determine where you require Internet access. Some ISPs will allow you to use their hot spots for free in locations such as shopping malls, coffeehouses, and airports. Consider the additional locations from where you can access the Internet for free, and determine whether it makes the Internet access plan more desirable.
- Consider whether a wireless Internet access plan is appropriate. While these plans can cost more and transfer rates often are not as fast, they do provide the flexibility of allowing you to connect to the Internet from almost anywhere. If you often travel and regularly need to access the Internet while away from home, a wireless Internet access plan might be right for you.

Exercises

- What Internet access plans are available in your area?
- Prepare a table comparing the Internet access plans in your area. Based on your current Internet usage, which plan appears to be the best? Why?
- How can you determine approximately how much data you will transfer each month?

2 Locate Hot Spots

If you are using a mobile computer or device and need to access the Internet, you will need to locate a hot spot. Hot spots are available in a variety of locations, such as coffeehouses, shopping malls, public libraries, airports, and educational institutions. Once you locate a hot spot, be sure to use it safely. Read Secure IT 2-1 in Chapter 2 for more information about using public Wi-Fi hot spots safely. If you plan to connect

How To: Your Turn

to a wireless hot spot, make sure you are authorized to connect. For example, you should not connect to people's or businesses' hot spots without their knowledge or consent. If you are unsure of whether you are authorized to connect to a hot spot, contact someone representing the residence or business providing the hot spot. The following are guidelines that can assist you in locating a hot spot:

- Enable (turn on) your mobile computer or device's Wi-Fi and see whether it automatically detects any wireless networks. If one or more wireless networks are detected, connect to the one with the SSID that accurately describes your location. For example, if you are at a coffeehouse, the SSID of the wireless network might be the coffeehouse's name. If you are unsure of the wireless network to which you should connect, contact an employee at the location and inquire. If the wireless network is protected with a password, the employee may be able to provide the password.
- You can check the location's website or app in advance to determine whether it has free Wi-Fi. For example, if you are flying out of your local airport, the airport's website might indicate whether Wi-Fi is available.
- Businesses offering free Wi-Fi sometimes have a decal on a front door or window indicating the location has Wi-Fi. If necessary, contact an employee to determine how to connect to the wireless network.
- Search for and navigate to a website that lists Wi-Fi hot spots in a particular area. These websites sometimes do not provide the most up-to-date information, so do not rely completely on the information you locate.



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Exercises

1. What public hot spots are available near where you live?
2. Have you connected to a public hot spot before? If so, when?
3. What security risks may be associated with connecting to a public hot spot?

3 Test Your Internet Speed

Internet connection speeds will vary depending on the type of Internet connection you currently are using. If you believe your Internet speed is not what was promised by your Internet access provider, you can

test your Internet speed to see how it is performing. The following steps guide you through the process of testing your Internet speed:

- a. Turn off any computers or mobile devices that might be accessing the Internet, except for the computer on which you want to test your broadband speed.
- b. If your broadband Internet service is provided through your phone company, do not talk on the phone during the test. If your CATV company provides your broadband Internet service, turn off all devices accessing the cable television. If you have cable boxes or converters, disconnect them from their power source so that they cannot communicate using the Internet connection while you are testing your broadband speed.
- c. Run the browser.
- d. Search for and navigate to a website that can test your Internet speed.
- e. Tap or click the button to start the test. The test may take up to one minute to complete before displaying results.
- f. Internet speeds sometimes can vary with the time of day or day of the week. Repeat the previous steps to test your Internet speed at various times throughout the day, as well as on weekdays and weekends.
- g. If you have any concerns regarding your Internet speed, contact your Internet access provider.

Exercises

1. What is the speed of the Internet connection on the computer or mobile device you currently are using?
2. Test your Internet speed while other computers and mobile devices also are using the Internet connection. How do the results vary from when your other devices are turned off?
3. Do you see differences in the Internet speed when you test it during the day versus at night? If so, what might explain these differences in speed?



speedtest.net

2 Connect Your Computer and Mobile Device via Bluetooth and Exchange Files

Bluetooth enables you to exchange files wirelessly between computers and mobile devices via Bluetooth. Before you are able to transfer files between devices, you first must enable Bluetooth and pair the devices so that they can communicate.

Connecting Your Computer and Mobile Device

The following steps guide you through the process of connecting your computer and mobile device via Bluetooth:

- If necessary, display the settings on your computer and enable (turn on) Bluetooth.
- If necessary, display the settings on your mobile device and enable (turn on) Bluetooth. Configure the mobile device so that it is discoverable to other Bluetooth devices. The mobile device must be discoverable so that your computer will be able to locate it.
- In the Bluetooth settings on the computer, select the option to add a device.
- When the computer has finished locating nearby discoverable Bluetooth devices, select your mobile device.
- When the devices communicate with each other, the computer will display a passcode. Enter the passcode into your mobile device to complete the pairing, or verify the passcode on the computer and the mobile device match. The steps required to connect Bluetooth devices will vary, depending on the types of devices and operating system in use. Be sure to follow all instructions on the screen while connecting the computer to the mobile device.

Exchanging Files between Devices

When the computer and mobile device have been paired successfully, you are able to transfer files between the devices. The following steps guide you through the process of exchanging files between devices.

Transferring Files from a Mobile Device to a Computer

- Display the file on the mobile device that you want to transfer to the computer.
- Tap the button to share the file.
- Select the option to share the file via Bluetooth.
- Select the device to which you want to send the file.
- Tap the button to begin the transfer.
- On the computer, verify that you want to receive the incoming file. If necessary, specify a name and location for the file.
- When the file has finished transferring, locate the file and open it so that you can verify it has transferred properly.

How To: Your Turn

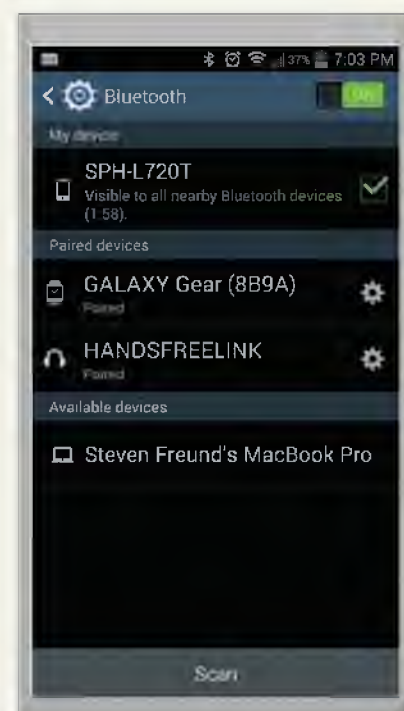
Transferring Files from a Computer to a Mobile Device

- Display the location containing the file you want to transfer to the mobile device.
- Select the file you want to transfer to the mobile device.
- Select the command to send the file via Bluetooth (this command may be on a shortcut menu, so you may need to press and hold or right-click the file).
- Select the device to which you want to send the file.
- On the mobile device, verify that you want to receive the incoming file and, if necessary, specify a name and location for the file.
- When the file has finished transferring, locate the file and open it so that you can verify it has transferred properly.

When you have finished transferring files between your computer and mobile device, disable Bluetooth if you do not intend to use it.

Exercises

- In addition to using Bluetooth to connect a computer to a mobile device, what other types of devices can you connect to your mobile device?
- Are any risks associated with leaving Bluetooth enabled (turned on) even when you are not using it?
- What types of files might you want to transfer between your computer and mobile device using Bluetooth?



Source: Google, Inc.

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to **challenge yourself with additional Internet Research exercises**, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Blogs, Wikis, and Collaboration

Writers can publish their views and share their interests using blogs, as you learned in Chapter 2. The blogosphere began as an easy way for individuals to express their opinions on the web. Today, this communications vehicle has become a powerful tool for individuals, groups, and corporations to promote their ideas and to advertise their products. Individuals easily may set up a blog free or for a fee, and they do not need to have knowledge of web design or programming.

Wikis are collaborative websites. As discussed in Chapter 2, users can develop, modify, and delete content on these public or private websites. This information can include articles, documents, photos, and videos. Other collaboration websites, such as Google Docs, allow users to share documents and to work together in real time. All files are stored online, so participants can access these documents everywhere at any time.

Research This: (a) Visit two blogging services, such as Tumblr, WordPress, or Blogger. What steps are required to start a blog? Do these services have monthly or annual fees? Do storage limitations exist? What options are available to customize the design? Can products or services be sold or advertised? If you were to set up a blog, which topics would you cover? Could you assign your own domain name to your blog?

(b) Visit two reference wikis. Which subjects are featured? Which organizations host the websites? How are the wikis funded? Are they public or private? Who may edit the content? What procedure is used to add, modify, or delete information?

(c) Visit two collaboration websites. What features are available for sharing content, such as managing projects, scheduling, blogging, discussing forum topics,

publishing information, delivering announcements, or uploading photos and videos? Are chat windows and whiteboards offered? What is the charge for using these services? Do they offer a mobile app? Do members receive notifications when content is updated?

2 Social Media

Using social media can be an excellent opportunity to unite with people who share similar interests. In some cases, local groups form for members to improve themselves and their communities. Dog owners, runners, photographers, entrepreneurs, parents, and travelers are among the thousands of groups with members who met online. In addition, more than 41 million people in the United States have subscribed to at least one of the 2,500 online dating services. Online dating can offer a safe opportunity to meet a variety of people if some practical advice is followed. Reputable dating services keep information confidential and have many members. Some have niche dating demographics, such as age, professions, religion, cultural interests, or geographical regions, and members can search for matches with desired criteria.

Research This: Search at least two online dating websites for information about these services. How many members do they have? What is the cost to join? What are the monthly membership fees? What claims do their privacy statements make about not disclosing personal information? What policies are in place to report members who have acted inappropriately?

3 Search Skills Map Search

Search engines provide capabilities to search for maps, directions, and local attractions. Type search text in a search engine and then tap or click the Maps link on a search engine's home page to see a map of locations for your search text. For example, type the search text, verizon wireless chicago, in the search box to find locations of Verizon Wireless stores in Chicago. Type the search text, cisco boston, to view the location of the Boston Cisco office on a map. To obtain directions, type the address to or from which to obtain directions, and specify walking, driving, or by public transportation. On mobile devices with GPS capability, you can



Internet Research

specify to use your current location as a starting or ending location. You also can search near a location. For example, type the search text, pizza near 125 high street boston, to display the names of pizza restaurants near that location. Some mapping search tools allow you to zoom, pan, and navigate a map in aerial view or street view, showing the location when looking from above or on the street.



Source: Google, Inc.

Research This: Create search text using the techniques described above or in previous Search Skills exercises, and type it in a search engine to create maps that provide this information: (1) aerial and street view of your home, (2) directions to a local store that sells wireless networking equipment, (3) locations of your mobile service provider's retail stores in your current city, and (4) distance between Microsoft's headquarters in Redmond, Washington and Apple's headquarters in Cupertino, California. Take screenshots to capture and document your results.

4 Security

The Social Media exercise in this section discusses online dating websites. According to some of these dating services, 20 percent of people currently in committed relationships met online. While using these dating websites may result in a positive experience, the Better Business Bureau and other consumer-oriented organizations receive thousands of complaints each year about these services. Online dating fraud is rising, so security experts caution online dating members to follow safe practices, including the following:

- Compose a profile carefully, and be certain it reflects the image you want to portray. Do not post your full name, phone number, or home or work location.
- Use the service's messaging system before sending email or text messages or having a phone conversation.
- When arranging a first date, meet in a safe location, such as a restaurant during a busy time of the day.

Share your plans with a friend, and keep a mobile phone handy.

- Trust your instincts. If you feel uncomfortable or threatened, leave the location and call a friend.

Research This: Visit at least two websites providing advice for online dating members. What guidance is provided in addition to the four safe practices listed above? What behaviors may signal potentially dangerous situations? Where can members verify other members' reputations? How can members report fraud and inappropriate behavior?

5 Cloud Services

Streaming Media from the Cloud (SaaS)

Streaming media allows users to play music or videos from the cloud without having to wait for the entire file to download. Streaming media is an example of software as a service (SaaS), a service of cloud computing that allows access to software apps using a browser, without the need to install software on a computer or device. Streaming media has become popular because of the decreasing cost of cloud storage; the increasing download speeds for business, home, and mobile users; and the growing number of devices available to play downloaded content.

When streaming, a provider sends the media to the user's device over the Internet in a compressed format. The user runs a media player app to uncompress the data as it arrives and then play the resulting audio data as sound; or, the user can display the resulting video data on mobile devices, computers, Smart TVs, and other devices that have an appropriate player.

Content providers, such as Netflix, Hulu, and Amazon, allow users to subscribe to their services for a monthly fee and watch videos on demand, or instantly, by streaming them to Internet-connected devices.

Individuals and businesses use streaming services to broadcast video of their events live, on the Internet in high definition. Many will use this service to broadcast presentations, product demonstrations, performances, and other events online.

Research This: (1) What file formats are used to compress audio and video files for streaming? (2) Compare the offerings of Netflix, Hulu, and Amazon for providing video on demand. Do you use any of these services? Which would you choose? Why? (3) Find a television or radio broadcast that is streamed live on the Internet and simultaneously broadcast "on air." Watch or listen to part of the live stream and then do the same for the broadcast on television or radio. How do the experiences and quality compare? What other events often are streamed live online?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Transmission Media

You work as an intern in the IT department for a local newspaper. The newspaper's management team recently approved a budget for redesigning the interior of its century-old building as part of an urban rehabilitation project. Because the employees at the newspaper more often use mobile devices and laptops than desktops, the newspaper plans to set up a wireless LAN.

Do This: Prepare information that summarizes the issues surrounding wireless network setup. Include the following information: What hardware is required for a wireless network? Could the thick walls in the building present a problem? If so, how can the issue be resolved? Does a wireless network present any health hazards? What security concerns exist for a wireless network? What advantages does a wireless network have over a wired network for the newspaper's needs?



2. Wireless Networking Standards

Several networking standards exist for wireless networks, including 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac, 802.11ad, and 802.11af. You want to install a wireless network in your house and want to ensure that you choose the standard that best meets your needs.

Do This: Use the web to research the various wireless networking standards and answer the following questions: Which was the first developed standard? Are

any of the standards more susceptible to interference from other wireless devices in your home, such as alarm systems and mobile phones? Which standard is the fastest? Is the fastest standard always the best, or do other factors on your wireless network or on the Internet affect performance? Is equipment to support one standard more expensive than the equipment that supports the other standards? Which would you recommend? Why? Address the answers to those questions, as well as any other information you find pertinent. Compile your findings.

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The league's office equipment consists of a few laptops and tablets, a printer, and several smartphones. The board of directors has asked you to investigate how the league might use Bluetooth technology in its offices.

Do This: Review the uses of Bluetooth technology listed in Mini Feature 10-2 in this chapter. Which uses might apply to the league? Can you think of other ways the league might use Bluetooth technology? What are the advantages of using Bluetooth technology? Use the web to find industry experts' recommendations for Bluetooth use in a small office. What other wireless technologies might the league's office use? Examine issues related to bandwidth, speed, and reliability. What security concerns exist? What measures should the league take to prevent Bluebugging? Would you recommend the league use Bluetooth in its offices? Why or why not? Should the league replace its LAN with Bluetooth? Why or why not? Compile your findings.

Collaboration

4. Network Security You are a network administrator for a small security firm. The company's main office includes 20 workers, most of whom use laptops. This year, the company plans to upgrade the network. The company asks your team to create a list of common network security issues, to make recommendations for hardware and software, and to create guidelines to secure the network.

Do This: Form a three-member team. As a team, list different networking security risks discussed in this chapter. Each member should choose a different risk to research. Members should determine the following: Describe the risk. Find an example of an industry article or blog post describing an experience with the risk. What damage was done? What steps did the network administrator take to recover from the damage, and/or prevent future attacks? What hardware or software can be used to safeguard against the risk? What guidelines for network users should be in place to help avoid the risk? As a team, compile your findings and share your recommendation with the class.

BUILDING SOLUTIONS: Database, System, and Application Development Tools

11



Users share data and information using solutions created by analysts and developers.

"I check my grades on the school's portal and recently learned the school finished upgrading its database and related systems. The conversion process has been lengthy, but seems worth it because the new features are quite useful. Although I am just a user of these and other systems, what more should I know about databases, system development, and application development?"

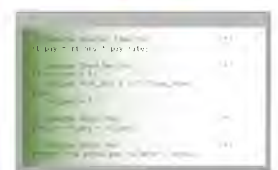
While you may be familiar with some of the content in this chapter, do you know how to . . .


- Recover from identity theft?
- Tell how your personal data is being used?
- Identify uses of databases on the web?
- Recognize Big Data?
- Import data from a spreadsheet into a database?
- Secure and maintain a database?
- Participate in system development?
- Identify security issues that can arise from outsourcing business tasks?
- Justify whether schools should teach hacking?
- Determine which object-oriented programming language or application development tool to use?
- Record a macro?
- Protect your computer from macro viruses?
- Publish a webpage?
- Develop a web application?

In this chapter, you will discover how these tasks are performed along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

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 Objectives

After completing this chapter, you will be able to:

- 1 Differentiate among a character, field, record, and data file and describe validation techniques
- 2 Differentiate between file processing systems and the database approach
- 3 Describe uses of web databases, types of databases, and Big Data
- 4 Discuss functions common to most database management systems: data dictionary, file retrieval and maintenance, data security, and backup and recovery
- 5 Define system development, list the system development phases, and identify the guidelines for system development
- 6 Discuss the importance of project management, feasibility assessment, documentation, and data and information gathering techniques
- 7 Discuss the purpose of and tasks conducted in each system development phase
- 8 Differentiate between low-level languages and procedural languages
- 9 Identify the benefits of object-oriented programming languages and application development tools
- 10 Describe various ways to develop webpages and web applications

Databases, Data, and Information

As presented in Chapter 4, a **database** is a collection of data organized in a manner that allows access, retrieval, and use of that data. As discussed in previous chapters, data is a collection of unprocessed items, which can include text, numbers, images, audio, and video. Information is processed data; that is, it is organized, meaningful, and useful.

Computers process data in a database to generate information for users. A database at a school, for example, contains data about its students and classes. When students are accepted to a school, they typically complete an online admission form that is displayed as a form in a browser. Students type their personal information into an online form and, at a later date, stop by the school to have their photo taken. Upon submitting the form, the page uploads the student's personal information in a database on a server at the school. When the school takes the student's photo, it also is stored in the school's database. The school's admission system assigns an ID number to the student and stores it in the database. The system then sends the student an email message with advising information. When the student's photo is taken on campus, relevant information is sent to an ID card printer, where the student's photo, name, and address is printed on the front of the card and the ID number is encoded on a magnetic stripe on the back of the card. Figure 11-1 illustrates this process.

With **database software**, often called a **database management system (DBMS)**, users create a computerized database; add, modify, and delete data in the database; sort and retrieve data from the database; and create forms and reports from the data in the database.

How a School's Admissions Department Might Process New Student Data into Information

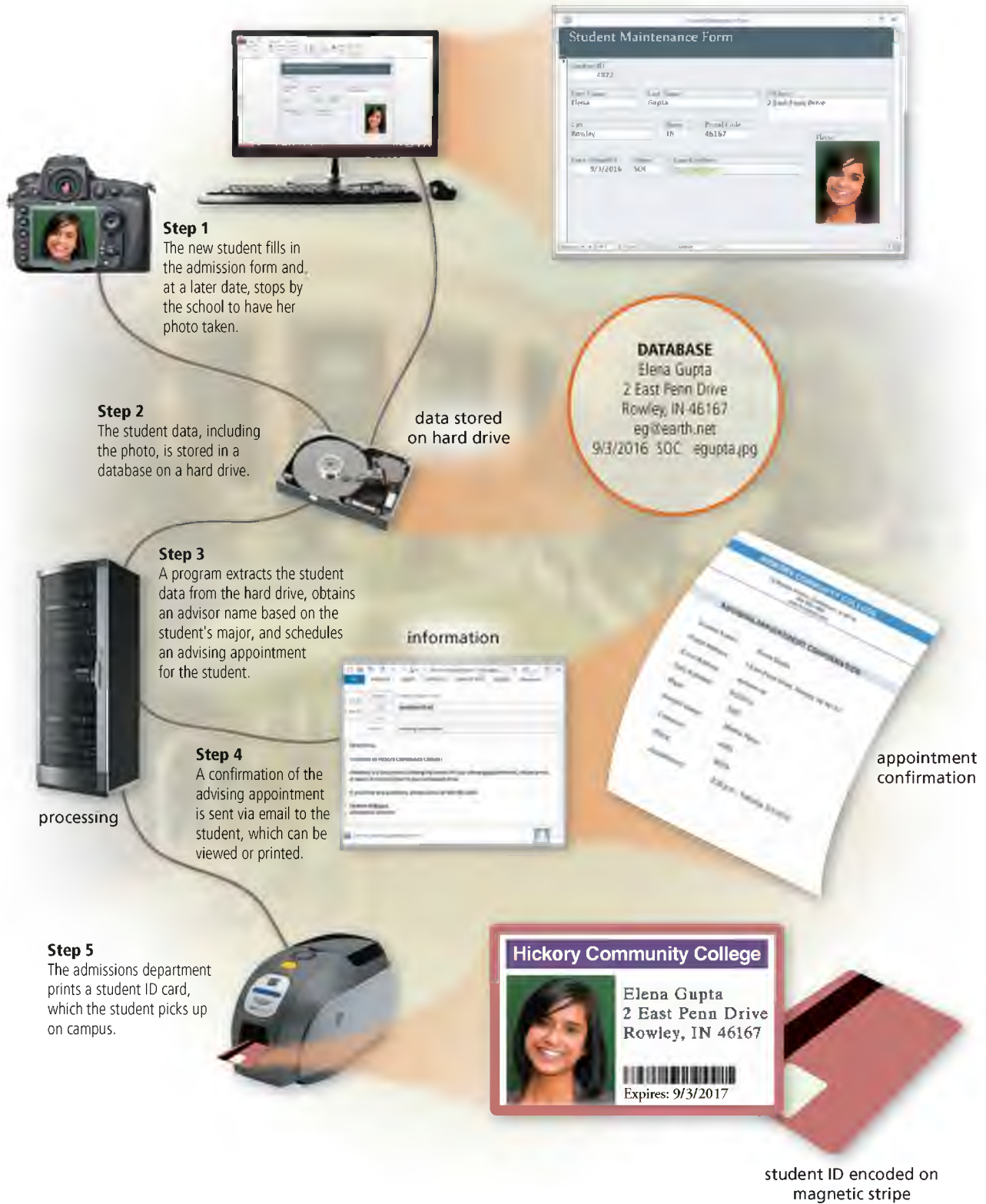


Figure 11-1 This figure shows how a school's admissions department might process new student data into information.
 © iStockphoto / Kemter; © Steve Reed / Shutterstock.com; © iStockphoto / Believe_In_Me; © iStockphoto / scanrail; © iStockphoto / ozgurdonmaz; Courtesy of Zebra Technologies; © Cengage Learning; Source: Microsoft; © Konstantin L/Shutterstock.com

The Hierarchy of Data

Data is organized in levels. Information technology (IT) professionals classify data in a hierarchy. Each higher level of data consists of one or more items from the lower level. Depending on the application and the user, different terms describe the various levels of the hierarchy.

As shown in Figure 11-2, a database contains a group of related data files. A data file contains records, a record contains fields, and a field is composed of one or more characters. This sample School database contains four data files: Student, Instructor, Schedule of Classes, and Student Schedule.



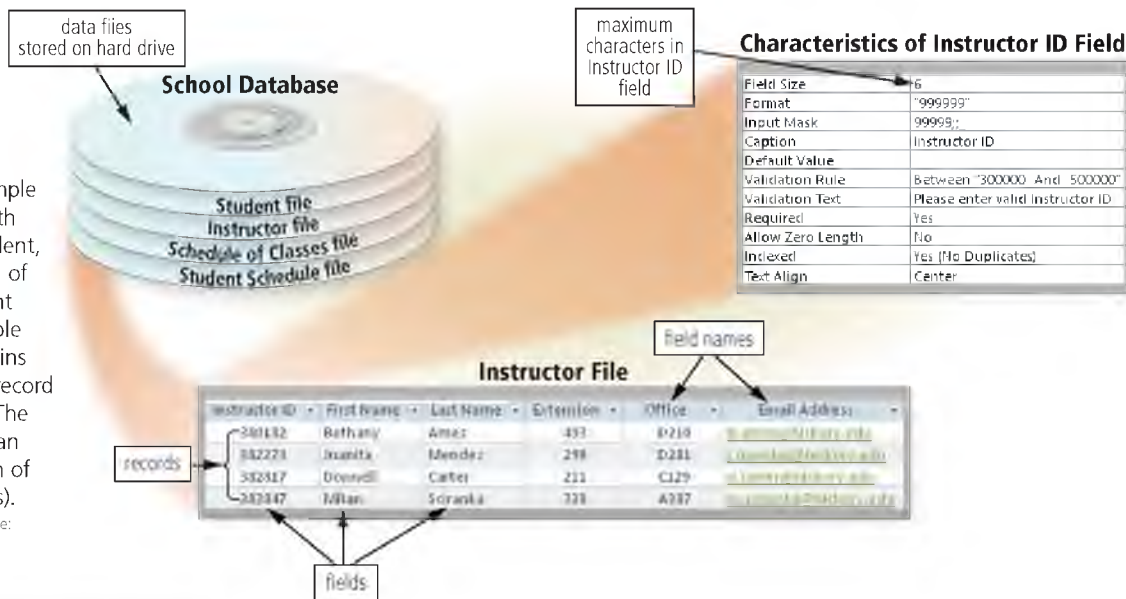
Tables

In some database programs, a data file is referred to as a table (i.e., Student table, Instructor table, etc.).

- The Student file contains records about enrolled students.
- The Instructor file contains records about current instructors.
- The Schedule of Classes file contains records about class offerings in a particular semester.
- The Student Schedule file contains records about the classes in which a student is enrolled for a given semester.

Figure 11-2 A sample school database with four data files: Student, Instructor, Schedule of Classes, and Student Schedule. The sample Instructor file contains four records. Each record contains six fields. The Instructor ID field can contain a maximum of six characters (bytes).

© Cengage Learning; Source: Microsoft



Instructor File	
Instructor ID	Text
First Name	Text
Last Name	Text
Extension	Number
Office	Text
Email Address	Hyperlink

Student File	
Student ID	AutoNumber
First Name	Text
Last Name	Text
Address	Text
City	Text
State	Text
Postal Code	Text
Email Address	Hyperlink
Date Admitted	Date/Time
Major	Text
Photo	Attachment

Characters As discussed in Chapter 6, a bit is the smallest unit of data the computer can process. Eight bits grouped together in a unit constitute a byte. In the ASCII coding scheme, each byte represents a single **character**, which can be a number (4), letter (R), blank space (SPACEBAR), punctuation mark (?), or other symbol (&).

Fields A **field** is a combination of one or more related characters or bytes and is the smallest unit of data a user accesses. A **field name** uniquely identifies each field. When searching for data in a database, you often specify the field name. For example, field names for the data in the Instructor file are Instructor ID, First Name, Last Name, Extension, Office, and Email Address.

A database uses a variety of characteristics, such as field size and data type, to define each field. The field size defines the maximum number of characters a field can contain. For example, the Instructor ID field contains 6 characters and thus has a field size of 6 (shown in Figure 11-2).

The **data type** specifies the kind of data a field can contain and how the field is used. Figure 11-3 identifies the data types for fields in the Instructor and Student files.

Figure 11-3 Data types of fields in the Instructor and Student files.

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CONSIDER THIS

What are common data types?

Common data types include the following:

- Text: Letters, numeric characters, or special characters
- Number (also called numeric values): Positive or negative numbers, and the number zero, with or without decimal points
- AutoNumber: Unique number automatically assigned by the DBMS to each added record, which provides a value that identifies the record (such as a student ID)
- Currency: Dollar and cent amounts or numbers containing decimal values
- Date (also called date/time): Month, day, year, and sometimes time
- Memo (also called long text): Lengthy text entries, which may or may not include separate paragraphs
- Yes/No (also called *Boolean*): Only the values Yes or No (or True or False)
- Hyperlink: Email address or web address that links to a webpage on the Internet or document on a network
- Object (also called *BLOB*, for binary large object): Photo, audio, video, or a document created in other programs or apps, such as word processing or spreadsheet, stored as a sequence of bytes in the database
- Attachment: Document or image that is attached to the field, which can be opened in the program that created the document or image (functions similarly to email attachments)

BTW

Field Names

Some database programs do not allow the use of the space character in field names. For example, you may see the Last Name field name written as LastName or last_name.

Records A **record** is a group of related fields. For example, a student record includes a set of fields about one student. A **primary key** is a field that uniquely identifies each record in a file. The data in a primary key is unique to a specific record. For example, the Student ID field uniquely identifies each student because no two students can have the same student ID. In some files, the primary key consists of multiple fields, called a *composite key*. For example, the primary key for the Schedule of Classes file could consist of the fields Semester Code, Class Code, and Class Section, which together would uniquely identify each class listed in a schedule.

Data Files A **data file**, often simply called a file, is a collection of related records stored on a storage medium, such as a hard drive, or on cloud storage. A Student file at a school might consist of thousands of individual student records. Each student record in the file contains the same fields. Each field, however, contains different data. Figure 11-4 shows a small sample Student file that contains four student records, each with eleven fields. A database includes a group of related data files.

Sample Student File

Student ID	First Name	Last Name	Address	City	State	Postal Code	Email Address	Date Admitted	Major	Photo
2295	Milton	Brewer	54 Lucy Court	Charlestown	IN	46176		6/10/2016	EE	mbrewer.jpg
3876	Louella	Drake	33 Timmons Place	Bonner	IN	45208	lou@world.com	8/9/2016	BIO	ldrake.jpg
3928	Adelbert	Ruiz	99 Tenth Street	Sheldon	IN	46033		10/8/2016	CT	aruiz.jpg
2872	Benjamin	Tu	2204 Elm Court	Rowley	IN	46167	tu@indi.net	9/14/2016	GEN	btu.jpg

Figure 11-4 This sample data file, stored on a hard drive, contains four records, each with eleven fields.

© Cengage Learning

CONSIDER THIS

Why do some fields that store only numbers have a text data type?

Fields that contain numeric characters whose values will not be used in calculations, such as postal codes or phone numbers, usually are assigned a text data type.

File Maintenance

File maintenance refers to the procedures that keep data current. File maintenance includes adding records to, modifying records in, and deleting records from a file. Users add new records to a file when they obtain additional data that should be stored, such as data about a new student admitted to a school. Generally, users modify a record in a file for two reasons: (1) to correct inaccurate data or (2) to update old data with new data, such as replacing a student's address when she moves to a new address. When a record no longer is needed, a user deletes it from a file. For example, if a student was accepted for admission but later notifies the school that he chose to attend another college, the school might delete the student's records from its database. Read Ethics & Issues 11-1 to consider how organizations use data they collect.

ETHICS & ISSUES 11-1



Should Companies Inform Consumers about How Collected Data Is Used?

A department store came under scrutiny recently for using customers' shopping habits and purchases to determine whether a customer was pregnant. The store used the data to send ads for baby products before some customers even announced that they were expecting. If you willingly purchase products at a store, can the business analyze your purchases to create a profile to use for marketing purposes? Can it sell that data to a third party?

Function creep occurs when a company uses the technology intended for one purpose for an entirely different purpose. One example of function creep is when companies use or sell customer data collected through sales transactions using

customer loyalty cards or other customer tracking methods. While some companies use data for their own purposes, such as to plan inventory or identify sales trends, others sell to data brokers or businesses that perform marketing surveys or generate credit reports. Privacy advocates are concerned about any use of personal data for purposes other than what the customer intended.

Online social networks and search engines often use activities, such as posts, pages viewed, and search terms, to suggest sponsored ads. Online vendors state that the data enables them to provide custom product suggestions and streamline ordering processes. Some customers acknowledge that a company has the right to use data to enhance the customers' experience or to make business decisions.

Many consumers would like more control over their data. The FTC Fair Information Practices (FIP) attempt to address data privacy concerns. FIP states that companies must inform customers of their data use and must allow customers to provide or deny consent. Privacy advocates argue further that limits should be imposed regarding the amount and type of data a company can collect and that the customer has a right to access the information.

Consider This: Have you experienced examples of a company using your personal data? For what purpose? Do you read a company's data privacy policy before using its website or service? Why or why not? How should the government enforce data privacy laws?

DBMSs use a variety of techniques to manage deleted or obsolete records. Sometimes, the DBMS removes the record from the file immediately, which means the deleted record cannot be restored. Other times, the record is flagged, or marked, so that the DBMS will not process it again. In this case, the DBMS places an asterisk (*) or some other character at the beginning of the record to indicate that it was deleted. DBMSs that maintain inactive data for an extended period commonly flag records. For example, a school might flag courses no longer offered or former employees no longer employed. When a DBMS flags a deleted record, the record remains physically on the drive. The record, however, is deleted logically because the DBMS will not process it. DBMSs will ignore flagged records unless an instruction is issued to process them.



CONSIDER THIS

Can you permanently delete flagged records?

From time to time, users should run a program that removes flagged records and reorganizes current records. For example, the school may remove from the drive the names of applicants who chose to attend other schools instead. Deleting unneeded records reduces the size of files, thereby freeing up storage space.

Validating Data

Validation is the process of comparing data with a set of rules or values to determine if the data meets certain criteria. Many programs perform a validity check that analyzes data, either as you enter the data or after you enter it, to help ensure that it is valid. For instance, when an admissions department specialist adds or modifies data in a student record, the DBMS tests the entered data to verify it meets certain criteria.

If the data fails a validity check, the computer either should not allow the invalid data to be stored, or it should display an error message that instructs the user to enter the data again. Validity checks, sometimes called validation rules, reduce data entry errors and thus enhance the data's integrity.

Alphabetic/Numeric Check An *alphabetic check* ensures that users enter only alphabetic data into a field. A *numeric check* ensures that users enter only numeric data into a field. For example, data in a First Name field should contain only characters from the alphabet. Data in a Current Enrollment field should contain integers.

Range Check A *range check* determines whether a number is within a specified range. Assume the lowest per credit hour fee at the school is \$75.00 and the highest is \$370.75. A range check for the Credit Hour Fee field ensures it is a value between \$75.00 and \$370.75.

Consistency Check A *consistency check* tests the data in two or more associated fields to ensure that the relationship is logical and their data is in the correct format. For example, the value in a Date Admitted field cannot occur earlier in time than a value in a Birth Date field.

Completeness Check A *completeness check* verifies that a required field contains data. For example, some fields cannot be left blank; others require a minimum number of characters. One completeness check can ensure that data exists in a Last Name field. Another can ensure that a day, month, and year are included in a Birth Date field.

Check Digit A *check digit* is a number(s) or character(s) that is appended to or inserted in a primary key value. A check digit often confirms the accuracy of a primary key value. Bank account, credit card, and other identification numbers often include one or more check digits.


Discover More: Visit this chapter's free resources to learn more about check digits.

Other Checks DBMSs that include the hyperlink and attachment data types can perform validity checks on data entered in those fields. Hyperlink entries (web addresses and email addresses) can be tested to ensure that the address follows the correct format. Similarly, an attachment entry can be validated by confirming that the file exists.

Table 11-1 illustrates some of the validity checks just discussed and shows valid data that passes the check and invalid data that fails the check.

 **Table 11-1 Sample Valid and Invalid Data**

Validity Check	Field(s) Being Checked	Valid Data	Invalid Data
Alphabetic Check	First Name	Karen	Ka24n
Numeric Check	Current Enrollment	24	s8q
Range Check	Per Credit Hour Fee	\$220.25	\$2,120.00
Consistency Check	Date Admitted, Birth Date	9/19/2016 8/27/1998	9/19/2016 8/27/2017
Completeness Check	Last Name	Gupta	
Other Check	Email Address	eg@earth.net	egearth.net

 **Internet Research**
How do you know if a credit card number is valid?
Search for: luhn algorithm

File Processing Systems and Databases

Almost all applications use the file processing approach, the database approach, or a combination of both approaches to store and manage data. The next sections discuss these two approaches.

File Processing Systems

In the past, many organizations exclusively used file processing systems to store and manage data. In a typical **file processing system**, each department or area within an organization has its own set of files. The records in one file may not relate to the records in any other file. Many of these systems have two major weaknesses: redundant data and isolated data.

- **Redundant data:** Because each department or area in an organization has its own files in a file processing system, the same fields are stored in multiple files. If a file processing system is used at a school, for example, the Student file and the Student Schedule file both might store the same students' names and addresses.

Duplicating data in this manner can increase the chance of errors. If a student changes his or her address, for example, the school must update the address in each file in which it appears. If the Address field is not changed in all the files where it is stored or is changed incorrectly in one location, then discrepancies among the files exist. This duplication also wastes resources, such as storage space and time. When new students are added or student data is modified, file maintenance tasks consume additional time because employees must update multiple files that contain the same data.

- **Isolated data:** It often is difficult to access data that is stored in separate files in different departments. Assume, for example, that the student email addresses exist in the Student files and class room numbers (locations) are in the Schedule of Classes file. To send an email message informing students about a room change, data is needed from both the Student file and the Schedule of Classes file. Sharing data from multiple, separate files to generate such a list in a file processing system often is a complicated procedure and usually requires an experienced programmer.

The Database Approach

When an organization uses a database approach, many programs and users share the data in the database. A school's database most likely, at a minimum, contains data about students, instructors, schedule of classes, and student schedules. As shown in Figure 11-5, various areas within the school share and interact with the data in this database. The database does secure its data, however, so that only authorized users can access certain data items. Read Ethics & Issues 11-2 to consider whether criminal databases are useful for law enforcement.

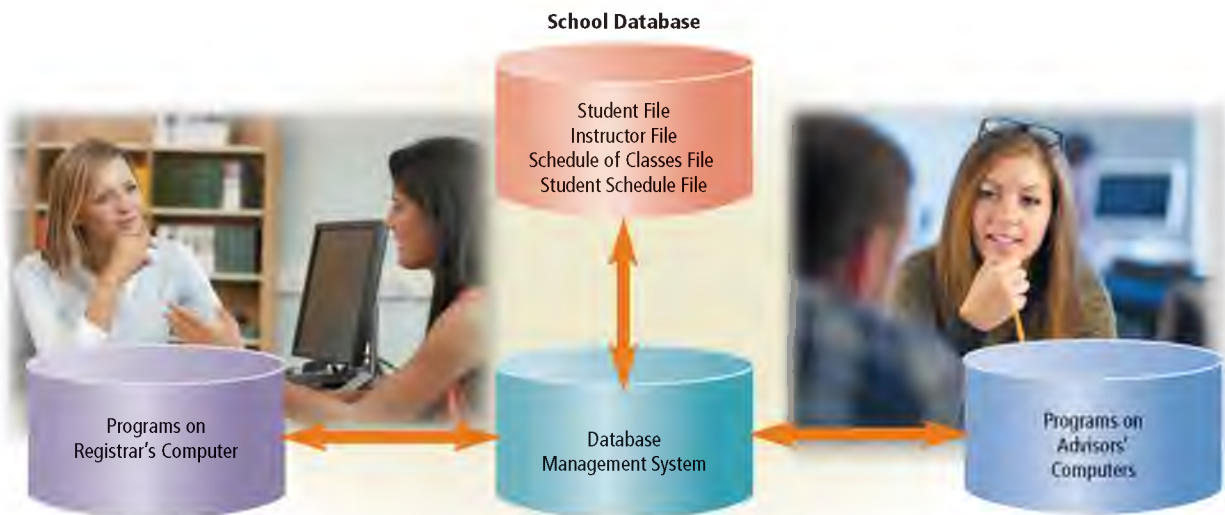


Figure 11-5 In a school's database, the computer used by the registrar and the computers used by advisors access data in the same database through the DBMS.

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ETHICS & ISSUES 11-2

Does the Use of Criminal Databases Help or Hinder Investigations?

On television, detectives use databases to quickly compile a list of suspects for a crime. In these depictions, the list is complete, accurate, and leads to a speedy conviction. In reality, criminal databases are a helpful tool in solving crimes, but they are not without limitations. As with any database, the value depends on the quality of its information. If a criminal database contains data that is incomplete, inaccurate, or outdated, is it useful for law enforcement?

Many criminal databases exist at the county, state, and federal levels. Some information is mandatory, but other contributions to databases are voluntary

or require only periodic updates. States' departments of correction record and share arrest records and jail time, but county or local jail records may not be included. Some courts and law enforcement use these databases for background checks to narrow a list of suspects or when determining sentencing. Others allow the use during an investigation, but findings are not admissible in court.

Megan's Law refers to a group of U.S. laws that require law enforcement agencies to share information in a national database about criminals who commit unlawful acts on children. States decide which information to make public and how to distribute the information. Often, states release criminals' names, photos, addresses, and information

about the crime on a searchable, public website. Some states share information with one another regarding almost all criminals, and a few allow citizens to search for convicted criminals by name. Privacy experts feel that publishing this information makes it impossible for an offender who has served time to lead a normal life. Proponents state that the public's right to know outweighs the rights of privacy of those convicted.

Consider This: Are criminal databases useful in law enforcement? Why or why not? Should information from criminal databases be admissible in court? Why or why not? What information should states provide to the public regarding people convicted of crimes? Why?

While a user is working with the database, the DBMS resides in the computer's memory. Instead of working directly with the DBMS, some users interact with a front end. A *front end* is a program that generally has a more user-friendly interface than the DBMS. For example, a registration department specialist interacts with the Class Registration program by filling out a form. This front-end program interacts with the DBMS, which, in turn, interacts with the database. Many programs today use forms on a webpage as their front end. An application that supports a front-end program by interacting directly with the database sometimes is called the *back end*. In this case, the DBMS is the back end.

Advantages of a Database Approach

The database approach addresses many of the weaknesses associated with file processing systems. Advantages of the database approach include the following:

- **Reduced data redundancy:** Most data items are stored in only one file, which greatly reduces duplicate data. For example, a school's database would record a student's name and address only once. When student data is entered or changed, one employee makes the change once. Figure 11-6 demonstrates the differences between how a file processing application and a database application might store data.



Technology Trend
Discover More: Visit this chapter's free resources to learn about uses of forensic databases.

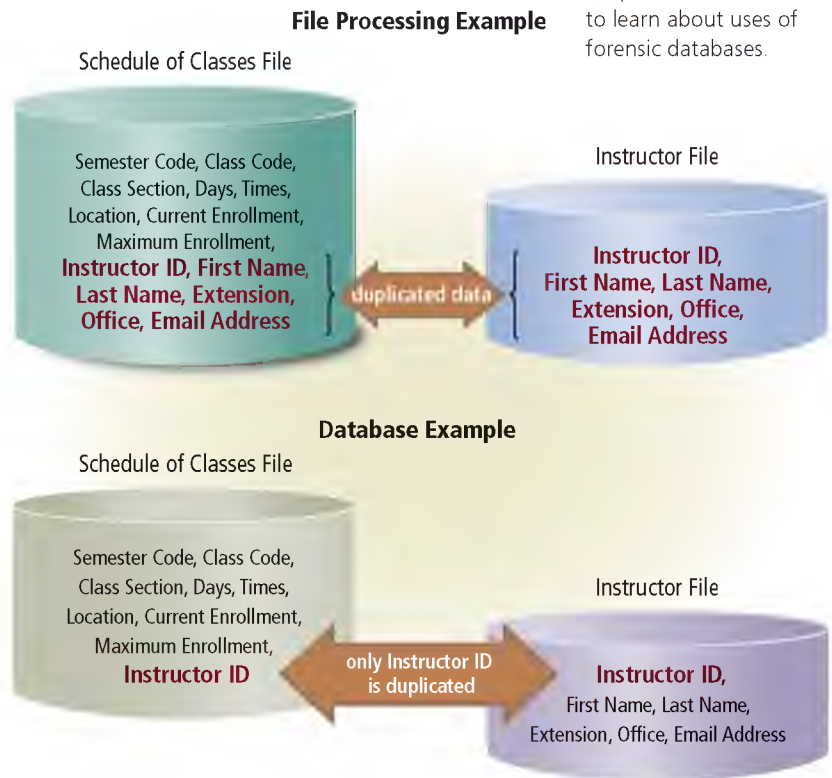


Figure 11-6 With file processing, both files contain all six instructor data fields. With a database, only the Instructor file contains the First Name, Last Name, Extension, Office, and Email Address fields. Other files, such as the Schedule of Classes file, contain only the Instructor ID — which links to the Instructor file when instructor data is needed.

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- **Improved data integrity:** When users modify data in the database, they make changes to one file instead of multiple files. Thus, the database approach increases the data's integrity by reducing the possibility of introducing inconsistencies.
- **Shared data:** The data in a database environment belongs to and is shared, usually over a network, by the entire organization. This data is independent of, or separate from, the programs that access the data. Organizations that use databases typically have security settings to define who can access, add, modify, and delete the data in a database.
- **Easier access:** The database approach allows nontechnical users to access and maintain data, provided they have the necessary privileges. Many computer users also can develop smaller databases themselves, without professional assistance.
- **Reduced development time:** It often is easier and faster to develop programs that use the database approach. Many DBMSs include several tools to assist in developing programs, which further reduces the development time.

CONSIDER THIS

Can a database eliminate redundant data completely?

No. A database reduces redundant data; it does not eliminate it. Key fields link data together in a database. For example, a Student ID field will exist in any database file that requires access to student data. Thus, a student ID is duplicated (exists in more than one file) in the database.

Disadvantages of a Database Approach A database can be more complex than a file processing system. People with special training usually develop larger databases and their associated applications. Databases also require more memory and processing power than file processing systems.

Data in a database can be more vulnerable than data in file processing systems because it can store a lot of data in a single physical file. Many users and programs share and depend on this data. If the database is not operating properly or is damaged or destroyed, users may not be able to perform their jobs. Further, unauthorized users potentially could gain access to a single database file that contains several data files of personal and confidential data. To protect their database resource, individuals and companies should establish and follow security procedures.

Despite these limitations, business and home users often work with databases because of their numerous advantages.

Mini Feature 11-1: Web Databases

The web offers information about jobs, travel destinations, television programming, photos, movies, videos, local and national weather, sporting events, and legislative information. You can shop for just about any product or service, buy or sell stocks, and make airline reservations. Much of this and other information exists in databases that are stored on or are accessible through the web. Some web databases are *collaborative databases*, where users store and share photos, videos, recordings, and other personal media with other registered users.

To access data in a web database, you fill in a form on a webpage. The webpage is the front end to the database. Many search engines use databases to store and index content from websites for rapid retrieval. Thus, the search engine's home page, containing a form in which to type search text, is the front end to the database. To access the search engine's database, you enter search text in a search form and then tap or click a search button that instructs the form to send the search text to the search engine.

A web database for an organization usually resides on a database server. A *database server* is a computer that stores and provides access to a database. For smaller databases, many desktop database programs provide a variety of web publishing tools that enable users without computer programming experience to create a home or small office database. Read Mini Feature 11-1 to learn about types of web databases.

MINI FEATURE 11-1

Web Databases

A database service, or a website that acts as a portal for a database, enables government agencies, schools, and companies to share information with a wide audience. Some web databases are accessible to the public. Examples of public databases include shopping and travel databases. Other databases contain information accessible only to authorized users. Examples of protected databases include certain government databases or entertainment and research databases that are subscription based.

Government

Government web database services can provide access to information about the government, as well as information created and used by government agencies. Some information that government agencies publish in databases is available to the public. Through these database services, for example, users can locate information about current laws. Other database services, such as those for criminal databases, allow access only to those individuals with necessary clearance. Government database services also enable officials around the world to share data.

Entertainment

You can search an entertainment web database service to find out who guest-starred on your favorite television program or locate video or audio clips. Using a subscription-based entertainment web database service allows you to access media content, such as music. These database services often enable you to create and share playlists. Entertainment professionals use subscription-based web databases to view and post casting notices or update artist profiles.

Travel

Booking online travel through a travel web database service enables you to view multiple vendors and options. You can limit a search to desired locations and dates. These database services help you find deals on air travel, car rentals, hotel rooms, and vacation packages. Travel web database services can save your personal data and travel history. These services will send notifications about upcoming travel deals and communicate changes or updates to your travel plans.

Shopping

Shopping web database services enable you to locate the right size and color, sort by price or featured products, and more. Vendors can use a web database service to show photos of items they sell and track

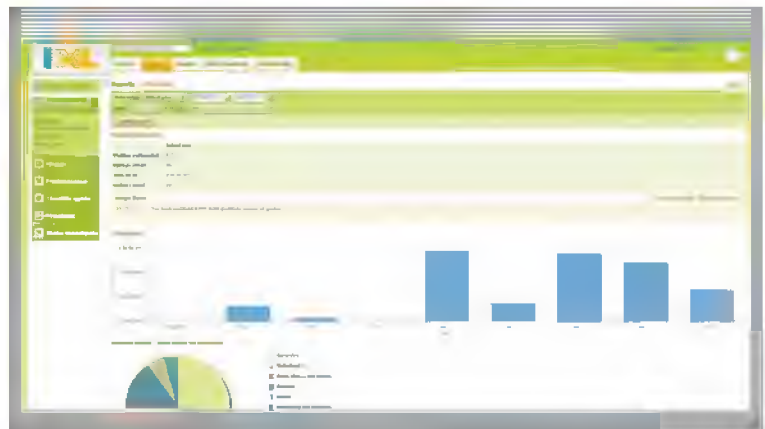
inventory. Some shopping database services search for bargains, presenting a variety of purchasing options so that you can find the lowest price. These database services also use your search and order history to suggest products in their databases that you may be interested in buying.

Research

You can interact with web databases to research product information when shopping for a new appliance or car. Information accessible through these web database services includes costs, safety concerns, and industry and user reviews. Some research web database services provide financial information for potential investors, including company histories and stock analysis. Research web database services are available to help you find a college or university and then provide information about admission requirements, financial information, and application advice.

Education

Teachers can search education web database services to locate and share curricula, worksheets, and lesson plans. Schools use web database services to store and distribute student contact information and grades. Students interact with web database services when signing up for their courses online. Using these services during enrollment helps a school determine when a class has reached its maximum size.



Source: IXL Learning

Discover More: Visit this chapter's free resources to find examples of web databases.

Consider This: Which web database services have you used? How do web databases help you in your daily life? Would you use a web database for research? Why or why not?

Types of Databases

Every database and DBMS is based on a specific data model. A data model consists of rules and standards that define how the database organizes data. A **data model** defines how users view the organization of the data. It does not define how the operating system actually arranges the data on the storage media. A database typically is based on one data model. Three popular data models in use today are relational, object-oriented, and multidimensional.



BTW

Technology Innovator

Discover More: Visit this chapter's free resources to learn about E. F. Codd, the inventor of the relational database model.



BTW

Technology Innovator

Discover More: Visit this chapter's free resources to learn about Oracle and its cofounder Larry Ellison.



BTW

High-Tech Talk

Discover More: Visit this chapter's free resources to learn more about types of databases, relational database design, and the normalization process.



Internet Research

What is data mining?

Search for: data mining

Relational Database A *relational database* is a database that stores data in tables that consist of rows and columns. In addition to storing data, a relational database also stores data relationships. A relationship is a link within the data. Applications best suited for relational databases are those whose data can be organized into a two-dimensional table, that is, tables with rows and columns. Many organizations use relational databases for payroll, accounts receivable, accounts payable, general ledger, inventory, order entry, invoicing, and other business-related functions.

Object-Oriented Database An *object-oriented database (OODB)* stores data in objects. An *object* is an item that contains data, as well as the actions that read or process the data. Examples of applications appropriate for an object-oriented database include media databases that store images, audio clips, and/or video clips; groupware databases that store documents, such as schedules, calendars, manuals, memos, and reports; and CAD (computer-aided design) databases that store data about engineering, architectural, and scientific designs.

Multidimensional and Other Database Types A *multidimensional database* stores data in dimensions. Whereas a relational database is a two-dimensional table, a multidimensional database can store more than two dimensions of data. These multiple dimensions allow users to access and analyze any view of the database data. One application that uses multidimensional databases is a data warehouse. A *data warehouse* is a huge database that stores and manages the data required to analyze historical and current transactions. The database in a data warehouse often is distributed. The data in a *distributed database* exists in many separate locations throughout a network or the Internet. Although the data is accessible through a single server, the physical location of the server on which it is stored is transparent and often unknown, to the user.

Mini Feature 11-2: Big Data

Recent technology trends have resulted in activities that generate large quantities of data. These trends include the following:

- Growth of online commerce, social, and government applications
- Increased use of mobile devices
- Emergence of the Internet of Things
- Development of cloud computing
- Availability of Internet connectivity through wired and wireless networks

Online business transactions, posts on social networks, government agencies, media and text messages from tablets and smartphones, and automated sensors produce data that is stored in databases located stored on servers distributed across the Internet. **Big Data** refers to large-scale data sets that require advanced technologies beyond the capabilities of typical database software to gather, store, process, retrieve, or analyze. Read Mini Feature 11-2 to learn more about characteristics and sources of Big Data, and technologies that facilitate working with large-scale distributed databases.

MINI FEATURE 11-2

Big Data

Through their daily activities, consumers, businesses, and machines produce large quantities of data to be stored on the Internet. Making sense of Big Data can provide valuable information to organizations trying to improve their business processes and make intelligent business decisions.

Characteristics of Big Data

Analysts often refer to the three V's when describing characteristics of Big Data: volume, velocity, and variety. Large-scale data sets grow in volume (how much data is generated), velocity (the rate at which data is generated), and variety (the different formats in which data can appear).

Volume refers to the amount of data that individuals and organizations generate. As data formats expand from text to images, files, audio, and video, it is common to need storage for multiple terabytes (1,000 gigabytes) of data. In the future, some organizations may require storage for petabytes (1,000 terabytes) and exabytes (1,000 petabytes) of data.

Velocity refers to the rate at which data is processed. In one day, for example, Google performs more than 6 billion searches, Facebook records more than 4.5 billion "likes," Twitter receives more than 500 million Tweets, and temperature and barometric sensors located across the world gather and transmit more than 200 million observations. In one minute, YouTube processes 100 hours of uploaded video. In one second, Amazon processes more than 400 transactions from customers during the holiday shopping period.

Variety refers to the different formats to represent or store data for use by humans and computer applications. Some data, such as census records, stock values, and corporate sales, is structured, meaning it can be organized neatly in tables. Unstructured data generally is more complex and may include items such as Tweets, media files, Wikipedia articles, and fingerprints.

Some analysts have expanded the three V's to include veracity (how accurate the data is), value (how organizations use their data), and viability (whether organizations can make predictions based on this data).

Sources and Uses of Big Data

One way businesses generate Big Data is by capturing customer behaviors. For example, in addition to storing information about a customer's purchase, some shopping websites also gather data about how much time customers spend on a webpage, how many items they view before making a purchase, and which pages on the company's website that customers visited, in order to create a more customized experience. Amazon and other retailers compile data from customer purchases in process

called collaborative filtering to recommend related products. For example, Amazon recommends that customers who purchase a digital camera might also want to purchase a storage card or a camera case.

Government agencies generate large amounts of data in real time from satellite images, social media posts, and media. By analyzing this data, they can monitor transportation systems, dispatch first responders in emergencies, and provide consumers with information to make informed choices about health care, schools, and community services.

Temperature and barometric sensors, wearable devices, and buses and trains equipped with GPS capability all transmit data over the Internet to be used in a variety of web and mobile applications.

Data Visualization

Data visualization is the process of presenting data graphically as charts, maps, or other pictorial formats in order to understand the resulting information easily. As the size of databases grows, data visualizations make it possible to interpret complex data sets, find relationships among data items, and discover patterns that can provide useful information. The "Racial Dot Map" shown in the figure is a visualization that displays one dot per person in the United States. Each dot is colored by ethnicity. The figure shows the map zoomed in on the Boston area.

Discover More: Visit this chapter's free resources to learn more about Big Data and the technologies that make it possible to capture, store, and retrieve data from distributed databases.

Consider This: What websites or apps do you use that generate or take advantage of Big Data? How have cloud computing, online social networks, and the Internet of Things contributed to and enabled the growth of Big Data? What visualizations have you seen that help make sense of complex data sets?



Source: Amazon.com, Inc.



Source: Weldon Cooper Center for Public Service, Rector and Visitors of the University of Virginia (Dustin A. Cable, creator)

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the section titled Databases, Data, and Information; and File Processing Systems and Databases as it relates to the chapter objectives.

Now you should know . . .

- How you organize and maintain data (Objective 1)
- Why you would choose a database approach over a file processing approach (Objective 2)
- When you use a web database, relational database, and Big Data (Objective 3)

Discover More: Visit this chapter’s premium content for practice quiz opportunities.

Database Management Systems

Internet Research

Which is the most widely used DBMS?

Search for: dbms share

BTW

Metadata

Because the data dictionary contains details about data, some call it *metadata* (meta means more comprehensive).

As previously discussed, a database management system (DBMS), or database program, is software that allows you to create, access, and manage a database. Managing a company’s databases requires a great deal of coordination. The *database administrator (DBA)* is the person in the organization who is responsible for managing and coordinating all database activities, including development, maintenance, and permissions.

DBMSs are available for many sizes and types of computers. Whether designed for a small or large computer, most DBMSs perform common functions. The following pages discuss these functions.

Discover More: Visit this chapter’s free resources to learn more about specific database management systems.

Data Dictionary

A **data dictionary**, sometimes called a *repository*, contains data about each file in the database and each field in those files. For each file, it stores details such as the file name, a description, the file’s

relationship to other files, and the number of records in the file. For each field, it stores details such as the field name, description, field type, field size, default value, validation rules, and the field’s relationship to other fields. Figure 11-7 shows how a data dictionary might list data for a Student file.

A DBMS uses the data dictionary to perform validation checks to maintain the integrity of the data. When users enter data, the data dictionary verifies that the entered data matches the field’s data type. For example, the data dictionary allows only dates to be entered in a Date Admitted field. The data dictionary also can limit the type of data that can be entered, often allowing a user to select from a list. For example, the data dictionary ensures that the State field contains a valid two-letter state code, such as IN, by presenting a list of valid state codes to the user.

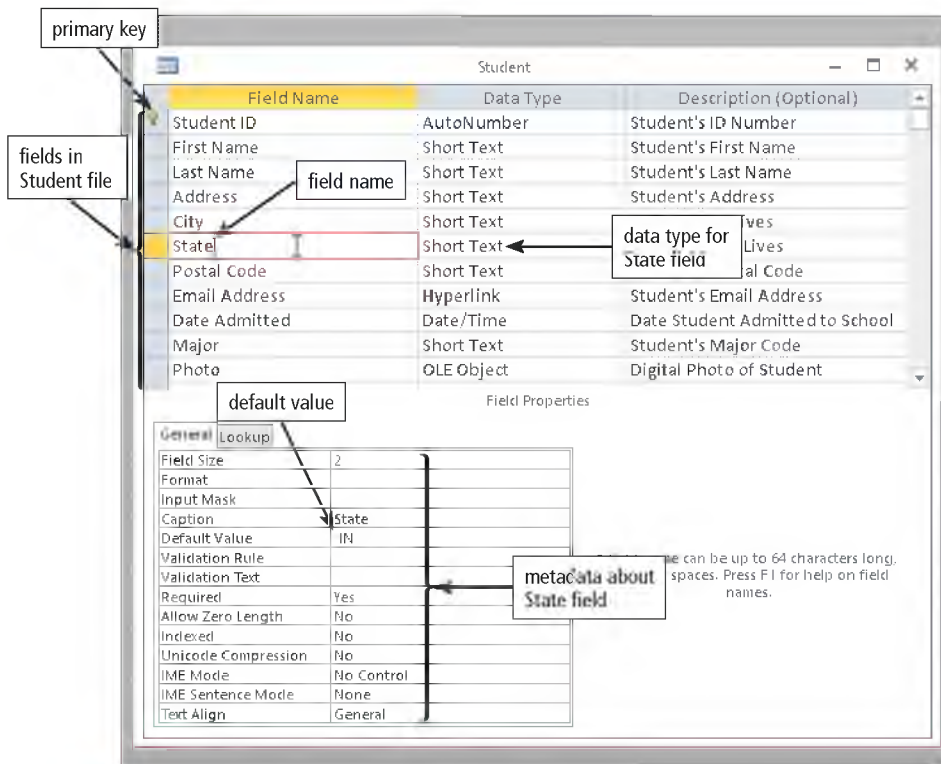


Figure 11-7 A sample data dictionary entry shows the fields in the Student file and the properties of the State field.

Source: Microsoft

File Retrieval and Maintenance

A DBMS provides several tools that allow users and programs to retrieve and maintain data in the database. To retrieve or select data in a database, you query it. A **query** is a request for specific data from the database. Users can instruct the DBMS to return or store the results of a query. The capability of querying a database is one of the more powerful database features.

A DBMS offers several methods to retrieve and maintain its data. The four more commonly used are query languages, query by example, forms, and report writers. Another method is by importing data. Read How To 11-1 for instructions about importing spreadsheet data into a database and vice versa.

HOW TO 11-1

Import Spreadsheet Data into a Database and Export Database Data to a Spreadsheet

If you periodically use spreadsheets and databases, you may find it beneficial to import data from a spreadsheet into a database or export data from a database to a spreadsheet. As mentioned in this book, spreadsheet applications and database applications each have unique advantages; therefore, you may need to convert the data from one application's format to use in the other. For example, if you have a spreadsheet with many rows of customer data, you might want to import the data from the spreadsheet into a database so that you can perform simple or complex queries on the data. If you have a database with many records and you want to perform calculations or a statistical analysis of the data, you might export data from the database to a spreadsheet. If you are exporting data from a relational database to a spreadsheet, the relationships will not be reflected in the spreadsheet. The following steps describe how to accomplish these tasks.

Import Data from a Spreadsheet into a Database


1. Run the spreadsheet application. Open the spreadsheet you want to import to the database and make sure your data is organized properly. For example, each column should represent a field, and each row should represent a record. The first row in the spreadsheet should contain the field names for each respective column. Make the necessary changes to the spreadsheet.

2. Save and close the spreadsheet.

3. Run the database application.
4. Create a new database or open the database to which you want to import the spreadsheet.
5. Navigate to and then tap or click the command to import data from an external file.
6. Select the type of file you want to import (spreadsheet, in this case). Some database applications may identify types of files by the name of the program that created them. For example, if you are importing an Excel spreadsheet into an Access database, you would select the option in Access to import an Excel file.
7. Navigate through the remaining steps to verify that the data in the spreadsheet will import properly. This includes:
 - Choosing the table into which you want to import the data in the spreadsheet
 - Verifying field names
 - Setting a field to act as a primary key
 - Choosing data types for each field
8. Tap or click the button or command to finish the import.
9. Open the table in the database with the data you just imported, and verify it all was imported properly.

Export Data from a Database to a Spreadsheet

1. Run the database application. Open the database containing the data you want to export.
2. Open the table containing the data you want to export.
3. Navigate to and then tap or click the option to export the data.
4. Select the option to export the database to a spreadsheet. Some database applications might require you to select the name of the spreadsheet application to which you want to export the database. For example, in Microsoft Access, you should specify that you want to export to a Microsoft Excel file.
5. Specify a file name for the spreadsheet.
6. Tap or click the button or command to complete the export.
7. Run the spreadsheet application and open the file you have just created. Verify the data has been exported properly from the database.

 **Consider This:** What are some other reasons why you might want to import data from a spreadsheet into a database or export data from a database to a spreadsheet?

	A	B	C	D	E	F	G	H	I	J	K
1	Student ID	First Name	Last Name	Address	City	State	Postal Code	Email Address	Date Admitted	Major	Photo
2	2295	Milton	Brewer	54 Lucy Court	Charlestown	IN	46176		6/10/2016	EE	mbrewer.jpg
3	3876	Louella	Drake	33 Timmons Place	Bonner	IN	45208	lou@world.com	8/9/2016	BIO	ldrake.jpg
4	3928	Adelbert	Ruiz	99 Tenth Street	Sheldon	IN	46033		10/8/2016	CT	aruiz.jpg
5	2872	Benjamin	Tu	2204 Elm Court	Rowley	IN	46167	tu@indi.net	9/14/2016	GEN	btu.jpg
6											
7											

Source: Microsoft

Figure 11-8a (SQL statement)

```
SELECT CLASS_TITLE, CLASS_SECTION,
MAXIMUM_ENROLLMENT - CURRENT_ENROLLMENT AS SEATS_REMAINING
FROM SCHEDULE_OF_CLASSES, CLASS_CATALOG
WHERE SCHEDULE_OF_CLASSES.CLASS_CODE = CLASS_CATALOG.CLASS_CODE
ORDER BY CLASS_TITLE
```

Figure 11-8b (SQL statement results)

Class Title	Class Section	Seats Remaining
Algebra 1	51	14
Art Appreciation	52	19
English Composition 1	02	5
Introduction to Sociology	01	14

Figure 11-8 A sample SQL statement and its results. Notice that the query results show meaningful column headings instead of the actual SQL field names.

Source: Microsoft; © Cengage Learning

Internet Research
 What is a NoSQL database?
 Search for: nosql database

Query by Example Most DBMSs include *query by example (QBE)*, a feature that has a graphical user interface to assist users with retrieving data. Figure 11-9 shows a sample QBE screen for a query that searches for and lists students majoring in sociology; that is, their Major field value is equal to SOC.

Figure 11-9a (all records in Student table)

Figure 11-9b (query by example screen showing query that will search for students whose Major is equal to SOC, for sociology)

Figure 11-9c (query results list students whose Major is equal to SOC)

Figure 11-9 Shown here is a Microsoft Access QBE, which searches for students whose major is sociology.

Source: Microsoft

BTW
E-Form

A form that sends entered data across a network or the Internet is called an *e-form*, short for electronic form.

Form A **form**, sometimes called a *data entry form*, is a window on the screen that provides areas for entering or modifying data in a database. You use forms (such as the Student Maintenance Form in Figure 11-1 at the beginning of this chapter) to retrieve and maintain the data in a database. To reduce data entry errors, well-designed forms should validate data as it is entered.

Query Language A **query language** consists of simple, English-like statements that allow users to specify the data they want to display, print, store, update, or delete. Each query language has its own formats and vocabulary.

Structured Query Language (SQL) pronounced S-Q-L or sequel) is a popular query language that allows users to manage, update, and retrieve data. SQL has special keywords and rules that users include in SQL statements. Figure 11-8a shows an SQL statement that creates the results shown in Figure 11-8b.

Discover More: Visit this chapter's free resources to learn about query wizards.

Report Writer A **report writer**, also called a *report generator*, allows users to design a report on the screen, retrieve data into the report design, and then display or print the report (Figure 11-10). Unlike a form, you use a report writer only to retrieve data. Report writers usually allow you to format page numbers and dates; titles and column headings; subtotals and totals; and fonts, font sizes, color, and shading; and to include images. Some report writers allow you to create a report as a webpage.

Major	Last Name	Student ID	First Name	Address	City	Date Admitted
BIO						
	Draze	9876	Lochis	55 Thomsen Place	Boston	6/14/2018
GT						
	Road	2908	Acobinet	69 Tenth Street	Boston	6/14/2018
GEN						
	Tu	2908	Esquman	2204 Elm Court	Rosley	6/14/2018
SOC						
	Brewer	2208	Mills	54 Larp Court	Charleston	6/14/2018
	Dahta	9876	Elera	2 East Penn Drive	Rosley	6/14/2018

Figure 11-10 This report, created in Microsoft Access, displays student information by major.

Source: Microsoft

Data Security

Most organizations and people realize that data is one of their more valuable assets. To ensure that data is accessible on demand, an organization must manage and protect its data just as it would any other resource. Thus, it is vital that the data is kept secure. For example, data in a database often is encrypted to prevent unauthorized users from reading its contents, and its access is restricted to only those who need to process the data.

A DBMS provides means to ensure that only authorized users can access data. In addition, most DBMSs allow different levels of access privileges to be identified for each field in the database. Access privileges define the actions that a specific user or group of users can perform on the data. For example, in the Schedule of Classes file, the student would have read-only privileges. That is, the student could view the list of classes offered in a semester but could not change them. A department head, by contrast, would have full-update privileges to classes offered during a particular semester, meaning he or she can view and modify the data. Finally, some users have no access privileges to the data; that is, they cannot view or modify any data in the database. Read How To 11-2 for ways to secure and maintain a database. Read Ethics and Issues 11-3 to consider issues surrounding users who accidentally access confidential data. Read Secure IT 11-1 for steps to take if you become a victim of identity theft due to your personal data being compromised.

Internet Research

What are recent data security breaches?

Search for: security breaches news

BTW

Principle of Least Privilege

Many organizations adopt a *principle of least privilege policy*, where users' access privileges are limited to the lowest level necessary to perform required tasks to prevent accidental or intentional misuse of the data.

HOW TO 11-2

Secure and Maintain a Database

As you add and delete tables and records from your database, you should secure and maintain the database so that it can continue operating securely and efficiently. If you neglect to secure and maintain a database, chances increase that the data can become compromised or inaccessible. The following guidelines describe how to secure and maintain a database.

Secure the Database

- Each person accessing the database should have a profile that includes a user name, a strong password that must be changed frequently, and limits on database system-level access.
- Only administrators should have access to create and delete tables.

- Consider allowing typical users only to view or modify records.
- Restrict users to accessing only database tables and records that are necessary to perform their job function(s).
- Limit the number of unsuccessful sign-in attempts in a specified period, and record when users access the database.


Maintain the Database

- If the database contains a table that you do not need (and you do not foresee a future need for the data in that table), remove the table from the database.
- Evaluate the fields in all remaining tables and make sure they are assigned the proper data type. Make any necessary adjustments.

- Remove fields you no longer need from the tables in your database.
- If the database contains a large number of records, consider deleting records you no longer need.
- Navigate to and then tap or click the command to compact and repair the database (if available).
- If you want to protect the data in the database, consider selecting the option to encrypt the database.

Consider This: What problems may arise from individuals or companies failing to properly secure and maintain their databases?

 ETHICS & ISSUES 11-3

 **What Should the Consequences Be If a User Accidentally Accesses Confidential Data?**

A student discovered private student data on a publicly accessible area of a university computer. Instead of notifying authorities, he took the information to the student newspaper. The newspaper advisor authorized the publication of an article about the situation. Although the article did not include any student names or personal information, the administration fired the newspaper's adviser for violating the university's computer policies and nearly expelled the student. Was the student obligated to report the vulnerability to the administration? Was the school right to fire the advisor for not reporting the breach?

In another case, a student accessed personal data for school employees from the school's network. In this instance, the student allegedly attempted to profit from the data. Administrators charged the high school student with criminal trespassing. Other examples include students attempting to alter grades, access test questions, or disrupt or trace a school's network activity.

Institutions often attempt to resolve security breaches quietly. Some fear that publicity may cause financial loss and may encourage hackers to target the institution. In some cases, an institution may file lawsuits against those who make security breaches public, including reporters. Some

feel that protecting data privacy partially is the responsibility of the person who uncovers the breach. Others feel that it is the responsibility of the institution or organization to secure its servers and educate employees about protection of confidential data.

Consider This: Is an institution responsible for unauthorized access of its personal data, or is the person who accessed it responsible? Why? Even if a person is not trying to profit from a data breach, is he or she still responsible for the discovery? Why or why not? Are journalists wrong to expose breaches, even if they do not publish the accessed data? Why or why not?

 SECURE IT 11-1

 **Recovering from Identity Theft**

In the past 10 years, more than 640 million Americans fell victim to identity theft, according to the Identity Theft Resource Center. Data breaches in businesses, banks, medical centers, and schools have affected nearly 39 percent of Americans. This crime is the complaint most often reported to the Federal Trade Commission (FTC).


On average, victims of identity theft spend 25 hours settling the resulting issues. Experts recommend that people who have experienced identity theft should follow this advice as part of their resolution efforts:

- **Request a fraud alert.** Contact the fraud department at the three national credit reporting companies: Experian, Equifax, and TransUnion. (Refer to the How To: Your Turn student assignment in this chapter for details about contacting these agencies.) One agency should report the theft to the other two companies, but you might want to contact all three to be certain the fraud has been noted. Request that a fraud alert be placed on your accounts to help prevent credit accounts from being opened in your name. This free service requires lenders to contact the

account owners if a new request for credit is submitted. This fraud alert must be renewed every 90 days.

- **Order credit reports.** Once you file a fraud alert, you are entitled to receive a free credit report. Wait at least 30 days from the theft to obtain the report, however, because creditors may report activity on a monthly basis, and your most current report may not include current information. Request that only the last four digits of your Social Security number are shown on the report.
- **Obtain an FTC affidavit and file it with law enforcement agencies.** The FTC's Identity Theft Victim's Complaint and Affidavit is accepted as proof of your identity. Download the form from the FTC's website and then file it with the police. The form also can be used to dispute claims with creditors.
- **Report Internet crime to the Internet Crime Complaint Center.** Report stolen finances or identities and other cybercrime to the Internet Crime Complaint Center. This organization is a partnership between the Federal Bureau of Investigation and the National White Collar Crime Center.

- **Keep records of your actions.** Create a journal that records the names of people you called, phone numbers, dates, and correspondence sent.
- **Review financial accounts.** Look for unusual activity, and check to see if any accounts were opened recently. Continue reviewing the accounts even if you do not see any questionable transactions.
- **Enroll in a credit monitoring service.** Each of the three national credit reporting agencies and many credit card companies provide this service. The companies send messages to subscribers when unusual activity is detected on a credit card account to alert consumers to possible identity theft. This service can be useful for people who have large balances in savings and checking accounts, travel frequently, or fail to check their bank statements and credit reports regularly.

 **Consider This:** Do you know someone who has been a victim of identity theft? If so, which type of fraud occurred? What activity did this person take to report this crime and to restore personal records and accounts?

Backup and Recovery

Occasionally, a database is damaged or destroyed because of hardware failure, a problem with the software, human error, or a catastrophe, such as fire or flood. A DBMS provides a variety of techniques to restore the database to a usable form in case it is damaged or destroyed.

- A backup, or copy, of the entire database should be made on a regular basis. Some DBMSs have their own built-in backup tools. Others require users to purchase a separate backup program, or use one included with the operating system.
- More complex DBMSs maintain a **log**, which is a listing of activities that modify the contents of the database. If a registration department specialist modifies a student's address, for example, the change appears in the log.
- A DBMS **recovery utility** uses logs and/or backups, and either a rollforward or a rollback technique, to restore a database when it becomes damaged or destroyed. In a *rollforward*, also called *forward recovery*, the DBMS uses the log to reenter changes made to the database since the last save or backup. In a *rollback*, also called *backward recovery*, the DBMS uses the log to undo any changes made to the database during a certain period. The rollback restores the database to its condition prior to the failure. Depending on the type of failure, the DBMS determines which type of recovery technique to use.
- **Continuous backup** is a backup plan in which changes are backed up as they are made. This backup technique can cost more than other backup strategies but is growing in popularity for businesses whose data must be available at all times, because it provides recovery of damaged data in a matter of seconds. Organizations such as hospitals, communications companies, and financial institutions often use continuous backup.

Discover More: Visit this chapter's free resources to learn more about database recovery utilities.

System Development

An *information system* is a collection of hardware, software, data, people, and procedures that work together to produce information. As a user of technology in a business, you someday may participate in the modification of an existing information system or the development of a new one. Thus, it is important that you understand system development.

System development is a set of activities used to build an information system. System development activities often are grouped into larger categories called *phases*. This collection of phases sometimes is called the **system development life cycle (SDLC)**. Many traditional SDLCs contain five phases (Figure 11-11):

1. Planning
2. Analysis
3. Design
4. Implementation
5. Support and Security

Each system development phase consists of a series of activities, and the phases form a loop. In theory, the five system development phases often appear sequentially, as shown in Figure 11-11. In reality, activities within adjacent phases often interact with one another, making system development a dynamic, iterative process.

Discover More: Visit this chapter's free resources to learn more about system development life cycles.



System Development



Figure 11-11 System development often consists of five phases that form a loop. Several ongoing activities also take place throughout system development.

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System Development Guidelines

System development should follow three general guidelines: group activities into phases, involve users, and define standards.

1. **Group activities into phases.** Many SDLCs contain the same phases shown in Figure 11-11. Others have more or fewer phases. Regardless, all system development cycles have similar activities and tasks.
2. **Involve users.** Users include anyone for whom the system is being built. Customers, employees, students, data entry specialists, accountants, sales managers, and owners all are examples of users. Users are more apt to accept a new system if they contribute to its design.
3. **Define standards.** *Standards* are sets of rules and procedures an organization expects employees to accept and follow. Standards help people working on the same project produce consistent results.

Who Participates in System Development?

System development should involve representatives from each department in which the proposed system will be used. This includes both nontechnical users and IT professionals. Although the roles and responsibilities of members of the system development team may change from organization to organization, this chapter presents general descriptions of tasks for various team members.

During system development, the systems analyst meets and works with a variety of people. A **systems analyst** is responsible for designing and developing an information system. The systems analyst is the users' primary contact person. Depending on the size of the organization, the tasks performed by the systems analyst may vary. Smaller organizations may have one systems analyst or even one person who assumes the roles of both systems analyst and software developer. Larger organizations often have multiple systems analysts who discuss various aspects of the development project with users, management, other analysts, database analysts, database administrators, network administrators, web developers, software developers, vendors, and the steering committee.

For each system development project, an organization usually forms a *project team* to work on the project from beginning to end. The project team consists of users, the systems analyst, and other IT professionals.

Discover More: Visit this chapter's free resources to learn more about skills required for a systems analyst.

Project Management

Project management is the process of planning, scheduling, and then controlling the activities during system development. The goal of project management is to deliver an acceptable system to the user in an agreed-upon time frame, while maintaining costs.

In smaller organizations or projects, one person manages the entire project. For larger projects, the project management activities often are separated between a project manager and a project leader. In this situation, the *project leader* manages and controls the budget and schedule of the project, and the *project manager* controls the activities during system development. Project leaders and/or project managers are part of the project team. If the systems analyst is not the project manager, he or she works closely with the project manager.

To plan and schedule a project effectively, the project leader identifies the following elements:

- Goals, objectives, and expectations of the project, collectively called the *scope*
- Required activities
- Time estimates for each activity
- Cost estimates for each activity
- Order of activities
- Activities that can take place at the same time



Steering Committee
A steering committee is a decision-making body in an organization.

After these items are identified, the project leader usually records them in a project plan. Project leaders can use **project management software** to assist them in planning, scheduling, and controlling development projects. One aspect of managing projects is to ensure that everyone submits deliverables on time and according to plan. A *deliverable* is any tangible item, such as a chart, diagram, report, or program file.

Gantt and PERT Charts Popular tools used to plan and schedule the time relationships among project activities are Gantt and PERT charts (Figure 11-12).

- A *Gantt chart*, developed by Henry L. Gantt, is a bar chart that uses horizontal bars to show project phases or activities. The left side, or vertical axis, displays the list of required activities. A horizontal axis across the top or bottom of the chart represents time.
- Developed by the U.S. Department of Defense, a *PERT chart*, short for Program Evaluation and Review Technique chart, analyzes the time required to complete a task and identifies the minimum time required for an entire project.

PERT charts, sometimes called network diagrams, can be more complicated to create than Gantt charts, but are better suited than Gantt charts for planning and scheduling large, complex projects.

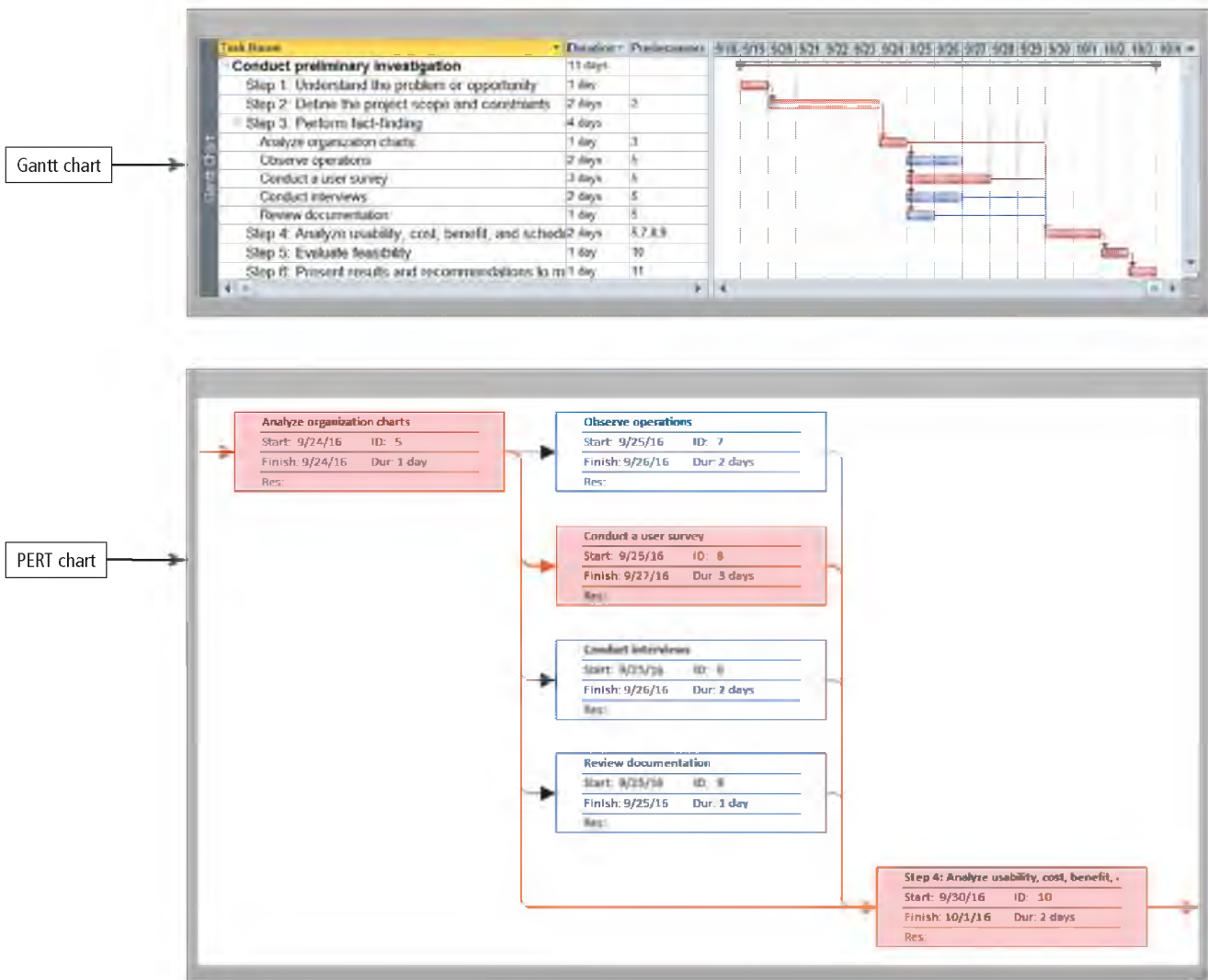


Figure 11-12 Project managers use software to create Gantt charts, PERT charts, and other charts and diagrams.
© Cengage Learning

CONSIDER THIS

How do project leaders adjust when a project changes?

After the project features and deadlines have been set, the project leader monitors and controls the project. Some activities take less time than originally planned. Others take longer. The project leader may realize that an activity is taking excessive time or that scope creep has begun. *Scope creep*, also called *feature creep*, occurs when one activity has led to another that was not planned originally; thus, the scope of the project now has grown.

Project leaders should use *change management*, which is the process of recognizing when a change in the project has occurred, taking actions to react to the change, and planning for opportunities because of the change. For example, the project leader may recognize the team will not be able to meet the original deadline of the project due to scope creep. Thus, the project leader may extend the deadline or may reduce the scope of the system development. If the latter occurs, the users will receive a less comprehensive system at the original deadline. In either case, the project leader revises the first project plan and presents the new plan to users for approval. It is crucial that everyone is aware of and agrees on any changes made to the project plan.

Feasibility Assessment

Feasibility is a measure of how suitable the development of a system will be to the organization. A project that is feasible at one point during system development might become infeasible at a later point. Systems analysts, therefore, frequently reevaluate feasibility during the system development project.

A systems analyst typically uses at least four tests to evaluate feasibility of a project: operational feasibility, schedule feasibility, technical feasibility, and economic feasibility.

- *Operational feasibility* measures how well the proposed information system will work. Will the users like the new system? Will they use it? Will it meet their requirements? Will it cause any changes in their work environment? Is it secure?
- *Schedule feasibility* measures whether the established deadlines for the project are reasonable. If a deadline is not reasonable, the project leader might make a new schedule. If a deadline cannot be extended, then the scope of the project might be reduced to meet a mandatory deadline.
- *Technical feasibility* measures whether the organization has or can obtain the computing resources, software services, and qualified people needed to develop, deliver, and then support the proposed information system. For most information system projects, hardware, software, and people typically are available to support an information system. An organization's choice for using computing resources and software services in-house or on the cloud may impact a system's technical feasibility.
- *Economic feasibility*, also called *cost/benefit feasibility*, measures whether the lifetime benefits of the proposed information system will be greater than its lifetime costs. A systems analyst often consults the advice of a business analyst, who uses many financial techniques, such as return on investment (ROI) and payback analysis, to perform a cost/benefit analysis.

Documentation

During system development, project members produce a large amount of documentation. *Documentation* is the collection and summarization of data, information, and deliverables. It is important that all documentation be well written, thorough, consistent, and understandable. The final information system should be reflected accurately and completely in documentation developed throughout the development project. Maintaining up-to-date documentation should be an ongoing part of system development. Too often, project team members put off documentation until the end of the project because it is time consuming, but these practices typically result in lower-quality documentation.

CONSIDER THIS

How do team members collaborate?

Conferencing software includes tools that enable users to share documents via online meetings and communicate with other connected users. When a meeting takes place on the web, it is called a *web conference*. In an online meeting, the facilitator may share a document for all participants to see at the same time. This allows the participants to edit a document and see the changes being made. Many conferencing software apps allow the facilitator to share his or her computer's desktop screen to demonstrate software apps or show webpages in real time to meeting participants. During the online meeting, participants have the ability to open a chat window and type messages to one another. Conferencing software also usually includes audio and video capabilities.

Discover More: Visit this chapter's free resources to learn more about conferencing software.

Data and Information Gathering Techniques

During system development, members of the project team gather data and information. They need accurate and timely data and information for many reasons. They must keep a project on schedule, evaluate feasibility, and be sure the system meets requirements. Systems analysts and other IT professionals use several techniques to gather data and information. They review documentation, observe, survey, interview, conduct joint-application design sessions, and research.

- **Review documentation:** By reviewing documentation such as organization charts, memos, and meeting minutes, systems analysts learn about the history of a project. Documentation also provides information about the organization, such as its operations, weaknesses, and strengths.
- **Observe:** Observing people helps systems analysts understand exactly how they perform a task. Likewise, observing a machine allows you to see how it works.
- **Survey:** To obtain data and information from a large number of people, systems analysts distribute surveys.
- **Interview:** The interview is the most important data and information gathering technique for the systems analyst. It allows the systems analyst to clarify responses and probe during face-to-face feedback.

Internet Research

Does the Hawthorne Effect apply to development projects?

Search for: hawthorne effect



Figure 11-13 During a JAD session, the systems analyst is the moderator, or leader of the discussion. Another member, called the *scribe*, records facts and action items assigned during the session.

© Nyul / Dreamstime.com

- **JAD sessions:** Instead of a single one-on-one interview, analysts often use joint-application design sessions to gather data and information. A *joint-application design (JAD) session*, or *focus group*, consists of a series of lengthy, structured group meetings in which users and IT professionals work together to design or develop an application (Figure 11-13).
- **Research:** Newspapers, technology magazines and journals, reference books, trade shows, the web, vendors, and consultants are excellent sources of information. These sources can provide the systems analyst with information, such as the latest hardware and software products and explanations of new processes and procedures. In addition, systems analysts often collect website statistics, such as the number of visitors and most-visited webpages, etc., and then evaluate these statistics as part of their research.

 **CONSIDER THIS**

What circumstances initiate system development?

A user may request a new or modified information system for a variety of reasons. The most obvious reason is to correct a problem, such as an incorrect calculation or a security breach. Another reason is to improve the information system. Organizations may want to improve hardware, software, or other technology to enhance an information system.

Sometimes, situations outside the control of an organization require a modification to an information system. Corporate management or some other governing body may mandate a change. Mergers, reorganizations, and competition also can lead to change.

A user may request a new or modified information system verbally in a phone conversation or written as an email message. In larger organizations, users write a formal request for a new or modified information system, which is called a *project request* or *request for system services*. The project request becomes the first item of documentation for the project. It also triggers the first phase of system development: planning.

Discover More: Visit this chapter's free resources for the introduction to a system development case study, along with an example of a project request.

Planning Phase

The planning phase for a project begins when the steering committee receives a project request. This committee usually consists of five to nine people and typically includes a mix of vice presidents, managers, nonmanagement users, and IT personnel.

During the **planning phase**, four major activities are performed: (1) review and approve the project requests, (2) prioritize the project requests, (3) allocate resources, such as money, people, and equipment to approved projects, and (4) form a project development team for each approved project.

 **CONSIDER THIS**

How are projects prioritized?

The projects that receive the highest priority are those mandated by management or some other governing body. These requests are given immediate attention. The steering committee evaluates the remaining project requests based on their value to the organization. The steering committee approves some projects and rejects others. Of the approved projects, it is likely that only a few will begin system development immediately. Others will have to wait for additional funds or resources to become available.

Discover More: Visit this chapter's free resources for a discussion of the planning phase in a system development case study.

Analysis Phase

The **analysis phase** consists of two major activities: (1) conduct a preliminary investigation and (2) perform detailed analysis.

The Preliminary Investigation The main purpose of the **preliminary investigation**, sometimes called the *feasibility study*, is to determine the exact nature of the problem or improvement and decide whether it is worth pursuing. Should the organization continue to assign resources to this project? To answer this question, the systems analyst conducts a general study of the project.

The first task in the preliminary investigation is to interview the user who submitted the project request. Depending on the nature of the request, project team members may interview other users, too. In addition to interviewing, members of the project team may use other data gathering techniques, such as reviewing existing documentation. Often, the preliminary investigation is completed in just a few days.

Upon completion of the preliminary investigation, the systems analyst writes the feasibility report. This report presents the team's findings to the steering committee.

Discover More: Visit this chapter's free resources for a discussion of the preliminary investigation process in the analysis phase in a system development case study, along with an example of a feasibility report.

 **CONSIDER THIS**
Does the feasibility report always recommend that the project be continued?

In some cases, the project team may recommend to cancel the project. If the steering committee agrees, the project ends at this point. If the project team recommends continuing and the steering committee approves this recommendation, then detailed analysis begins.

Detailed Analysis *Detailed analysis* involves three major activities: (1) study how the current system works, (2) determine the users' wants, needs, and requirements, and (3) recommend a solution. Detailed analysis sometimes is called *logical design* because the systems analysts develop the proposed solution without regard to any specific hardware or software. That is, they make no attempt to identify the procedures that should be automated and those that should be manual.

While studying the current system and identifying user requirements, the systems analyst collects a great deal of data and information. A major task for the systems analyst is to document these findings in a way that can be understood by everyone. Systems analysts use diagrams to describe the processes that transform inputs into outputs and diagrams that graphically show the flow of data in the system. Both users and IT professionals refer to this documentation.

The System Proposal After the systems analyst has studied the current system and determined all user requirements, the next step is to communicate possible solutions for the project in a system proposal. The purpose of the system proposal is to assess the feasibility of each alternative solution and then recommend the most feasible solution for the project, which often involves modifying or expanding the current system. The systems analyst presents the system proposal to the steering committee. If the steering committee approves a solution, the project enters the design phase.

When the steering committee discusses the system proposal and decides which alternative to pursue, it considers whether to modify the existing system, buy retail software from an outside source, use web apps, build its own custom software, and/or outsource some or all of its IT needs to an outside firm. The final decision often is a mix of these options. Read Secure IT 11-2 for issues related to outsourcing.

Discover More: Visit this chapter's free resources for a discussion of the detailed analysis process in a system development case study, along with an example of a feasibility report.

**High-Tech Talk**

Discover More: Visit this chapter's free resources to learn about process and object modeling.

**Internet Research**

What is the difference between horizontal and vertical market software?

Search for: horizontal and vertical market software

**BTW****Technology Trend**

Discover More: Visit this chapter's free resources to learn about custom crime fighting software.

**SECURE IT 11-2****Security Issues Arising from Outsourcing**


Businesses outsource noncore functions because third-party vendors may be more efficient and more cost effective than the businesses trying to perform the functions on their own. Noncore functions often include general business tasks, such as maintaining and supporting an organization's information systems and processing customer payments on websites.

Sometimes, however, when a business outsources, the external vendors are not as careful with security and customer information as the business itself might be. The business that outsources this task has spent time

and effort to cultivate and then forge a relationship with its customers, and it is in the company's best interest to treat its customers well. The outside vendor, however, has no such bond with the customers.

Security breaches might occur when work is contracted to third parties. For example, personal and confidential information about customers and employees, payroll, credit card numbers, and health records can be transferred to external hard drives or other storage media and taken outside the building. Companies should develop a computer security plan that requires safeguards on the part of the outside vendors. These procedures might include running background checks

on personnel, closely monitoring the level of database access and email messages, replacing Social Security numbers with another unique identifier, and conducting security audits. The plan also should include penalties if a security breach occurs.

 **Consider This:** Does outsourcing lead to a lower level of security and privacy for customers? Why or why not? What can an organization do to ensure that vendors practice the same level of care with customer information as the organization practices? Should customers hold organizations or their vendors responsible for leaks of private customer information? Why?

Design Phase

The **design phase** consists of two major activities: (1) if necessary, acquire hardware and software and (2) develop all of the details of the new or modified information system. The systems analyst often performs these two activities at the same time instead of sequentially.

When the steering committee approves a solution, the systems analyst begins the activity of obtaining additional hardware or software or evaluating cloud providers that offer the computing services to meet the organization's needs. The systems analyst may skip this activity if the approved solution does not require new hardware or software. If this activity is required, it consists of four major tasks: (1) identify technical specifications, (2) solicit vendor proposals, (3) test and evaluate vendor proposals, and (4) make a decision.

Discover More: Visit this chapter's free resources to learn more about cloud providers.

Identify Technical Specifications The first step in acquiring necessary hardware and software is to identify all the hardware and software requirements of the new or modified system. To do this, systems analysts use a variety of research techniques. They talk with other systems analysts, visit vendors' stores, and search the web. Many trade journals, newspapers, and magazines provide some or all of their printed content online.

After the systems analyst defines the technical requirements, the next step is to summarize these requirements for potential vendors. The systems analyst can use three basic types of documents for this purpose: an RFQ, an RFP, or an RFI.

- A *request for quotation (RFQ)* identifies the required product(s). With an RFQ, the vendor quotes a price for the listed product(s).
- With a *request for proposal (RFP)*, the vendor selects the product(s) that meets specified requirements and then quotes the price(s).
- A *request for information (RFI)* is a less formal method that uses a standard form to request information about a product or service.

Solicit Vendor Proposals Systems analysts send the RFQ, RFP, or RFI to potential hardware and software vendors. Another source for hardware and software products is a value-added reseller. A *value-added reseller (VAR)* is an organization that purchases products from manufacturers and then resells these products to the public — offering additional services with the product (Figure 11-14).

Instead of using vendors, some organizations hire an IT consultant or a group of IT consultants. An *IT consultant* is a professional who is hired based on technical expertise, including service and advice.

Test and Evaluate Vendor Proposals After sending RFQs, RFPs, or RFIs to potential vendors, the systems analyst will receive completed quotations and proposals. Evaluating the proposals and then selecting the best one often is a difficult task.

Systems analysts use many techniques to test the various software products from vendors. They obtain a list of user references from the software vendors. They also talk to current users of the software to solicit their opinions. Some vendors will provide a demonstration of the product(s) specified. Others supply demonstration copies or trial versions, allowing the organizations to test the software themselves.



Internet Research

What are popular online technology magazines?

Search for: online technology magazines



BTW

Technology Innovator

Discover More: Visit this chapter's free resources to learn about Lenovo (personal computer vendor).



Figure 11-14 Many VARs provide complete systems, often called turnkey solutions. Source: Magal Security Systems Ltd.

Internet Research

What are the best benchmark tests for evaluating personal computers?

Search for: best pc benchmark tests

Sometimes it is important to know whether the software can process a certain volume of transactions efficiently. In this case, the systems analyst conducts a benchmark test. A *benchmark test* measures the performance of hardware or software. For example, a benchmark test could measure the time it takes a payroll program to print 50 paychecks. Comparing the time it takes various accounting programs to print the same 50 paychecks is one way of measuring each program's performance.

Make a Decision Having rated the proposals, the systems analyst presents a recommendation to the steering committee. The recommendation could be to award a contract to a vendor or to not make any purchases at this time.

Discover More: Visit this chapter's free resources for a discussion of the hardware acquisition process in the design phase in a system development case study.

The screenshot shows a window titled "Instructor Maintenance" with a form titled "Instructor Maintenance Form". The form contains the following data:

Instructor ID	380182
First Name	Bethany
Last Name	Ames
Extension	493
Office	D210
Email Address	b.ames@hickory.edu

At the bottom of the form, there is a status bar that reads "Record: 1 of 4" and a search field.

Figure 11-15 Users provide their approval on inputs and outputs. This input screen is a mock-up (containing actual sample data) for users to review. Source: Microsoft

The screenshot shows a technical view of the "Instructor Maintenance Form" mock-up. The form is displayed in a window titled "Instructor Maintenance". The form is divided into sections, with the top section labeled "Form Header" containing the title "Instructor Maintenance Form". Below this, the form fields are listed in a table:

Instructor ID	Instructor ID
First Name	First Name
Last Name	Last Name
Extension	Extension
Office	Office
Email Address	Email Address

The form is shown with a grid overlay, indicating its technical structure.

Figure 11-16 Shown here is a technical view in Access of the mock-up in Figure 11-15. Source: Microsoft

Detailed Design The next step is to develop detailed design specifications for the components in the proposed solution. The activities to be performed include developing designs for the databases, inputs, outputs, and programs.

- During database design, the systems analyst works closely with the database administrators to identify those data elements that currently exist within the organization and those that are new. The systems analyst also addresses user access privileges.
- During detailed design of inputs and outputs, the systems analyst carefully designs every menu, screen, and report specified in the requirements. The outputs often are designed first because they help define the requirements for the inputs.

The systems analyst may develop a mock-up and/or a layout chart for each input and output. A *mock-up* is a sample of the input or output that contains actual data (Figure 11-15). The systems analyst shows mock-ups to users for their approval. After users approve the mock-up, the systems analyst develops a layout chart for the software developer. A layout chart is more technical and contains programming-like notations. Many database programs provide tools for technical design (Figure 11-16).

Other issues that must be addressed during input and output design include the types of media to use (paper, video, or audio); formats (graphical or narrative); and data entry validation techniques, which include making sure the entered data is correct (for example, a state code has to be one of the fifty valid two-letter state abbreviations).

- During program design, the systems analyst prepares the *program specification package*, which identifies required programs and the relationship among each program, as well as the input, output, and database specifications.

CONSIDER THIS

How can systems analysts build relationships with users?

Systems analysts have much more credibility with users if the analysts understand user concerns and have empathy for how the workers are feeling. If users are involved, they are more likely to accept and use the new system — called *user buy-in*. One reason systems fail is because some systems analysts create or modify systems with little or no user participation.

Prototyping Many systems analysts today use prototypes during detailed design. A **prototype**, sometimes called a *proof of concept*, is a working model of the proposed system's essential functionality. The systems analyst actually builds a functional form of the solution during design. The main advantage of a prototype is users can work with the system before it is completed to make sure it meets their needs. As soon as users approve a prototype, systems analysts can implement a solution more quickly than without a prototype.

CONSIDER THIS

Who reviews the detailed design?

Many people should review the detailed design specifications before they are given to the programming team. The purpose of their review is to ensure the design represents a finished product that will work for the user and the development is feasible. Reviewers should include users, systems analysts, managers, IT staff, and members of the system development team. If the steering committee decides the project still is feasible, which usually is the case, the project enters the implementation phase.

Discover More: Visit this chapter's free resources for a discussion of the detailed design process in a system development case study.

Implementation Phase

The purpose of the **implementation phase** is to construct, or build, the new or modified system and then deliver it to the users. Members of the system development team perform four major activities in this phase: (1) develop programs and apps, (2) install and test the new system, (3) train users, and (4) convert to the new system.

Develop Programs and Apps If the organization purchases retail software or no modifications to existing custom software are required, the development team may skip this activity. For custom software that is new or requires modification, however, programs and apps are developed or modified either by an outside firm or in-house.

Software developers write or modify programs and apps from the program specification package created during the analysis phase. Just as system development follows an organized set of activities, so does program development. These program development activities are known as the *program development life cycle*.



High-Tech Talk

Discover More: Visit this chapter's free resources to learn about programming logic.

CONSIDER THIS

What is a sandbox?

A *sandbox* is an environment that allows software developers to test their programs with fictitious data without adversely affecting other programs, information systems, or data. Sandboxes are used for testing purposes both by developers and users. Users often work with a sandbox to familiarize themselves with a new program or information system before they use it.

Install and Test the New System If the organization acquires new hardware or software, someone must install and test it. The systems analysts should test individual programs. They also should be sure that all the programs work together in the system.

Systems analysts and users develop test data so that they can perform various tests.

- A *unit test* verifies that each individual program or object works by itself.
- A *systems test* verifies that all programs in an application work together properly.
- An *integration test* verifies that an application works with other applications.
- An *acceptance test* is performed by end users and checks the new system to ensure that it works with actual data.



Figure 11-17 Organizations must ensure that users are trained properly on the new system. One training method uses hands-on classes to learn the new system.

© Goodluz / Shutterstock.com

Train Users **Training** involves showing users exactly how they will use the new hardware and software in the system. Some training takes place as one-on-one sessions or classroom-style lectures (Figure 11-17). Other organizations use web-based training, which is a self-directed, self-paced online instruction method. Whichever technique is used, it should include hands-on sessions with realistic sample data. Users should practice on the actual system during training. Users also should be provided access to printed or online user manuals for reference. It is the systems analyst's responsibility to create user manuals.

Convert to the New System The final implementation activity is to change from the old system to the new system. This change can take place using one or more of the following conversion strategies: direct, parallel, phased, or pilot.

- With *direct conversion*, the user stops using the old system and begins using the new system on a certain date. The advantage of this strategy is that it requires no transition costs and is a quick implementation technique. The disadvantage is that it is extremely risky and can disrupt operations seriously if the new system does not work correctly the first time.
- *Parallel conversion* consists of running the old system alongside the new system for a specified time. Results from both systems are compared. The advantage of this strategy is that you can fix any problems in the new system before you terminate the old system. The disadvantage is that it is costly to operate two systems at the same time.
- In a *phased conversion*, each location converts at a separate time. For example, an accounting system might convert its accounts receivable, accounts payable, general ledger, and payroll sites in separate phases. Each site can use a direct or parallel conversion. Larger systems with multiple sites may use a phased conversion.
- With a *pilot conversion*, only one location in the organization uses the new system — so that it can be tested. After the pilot site approves the new system, other sites convert using one of the other conversion strategies.

Discover More: Visit this chapter's free resources for a discussion of the implementation phase in a system development case study.

Support and Security Phase

The purpose of the **support and security phase** is to provide ongoing assistance for an information system and its users after the system is implemented. The support and security phase consists of three major activities: (1) perform maintenance activities, (2) monitor system performance, and (3) assess system security.

Information system maintenance activities include fixing errors in, as well as improving, a system's operations. To determine initial maintenance needs, the systems analyst should meet with users. The purpose of this meeting, often called the *post-implementation system review*, is to discover whether the information system is performing according to the users' expectations. In some cases, users would like the system to do more. Maybe they have enhancements or additional requirements that involve modifying or expanding an existing information system.

During this phase, the systems analyst monitors performance of the new or modified information system. The purpose of performance monitoring is to determine whether the system is inefficient or unstable at any point. If it is, the systems analyst must investigate solutions to make the information system more efficient and reliable — back to the planning phase.

Most organizations must deal with complex technology security issues. All elements of an information system — hardware, software, data, people, and procedures — must be secure from threats both inside and outside the enterprise. Read Secure IT 11-3 for information about an organization's technology security plan.

SECURE IT 11-3




Technology Security Plan Components

If an organization experiences a major information system disaster, a computer security plan will guide the recovery process. The document should identify all the security risks that may cause an information system asset loss and include all possible safeguards to detect, prevent, and recover from losses. It should identify all of the organization's information assets, which include hardware, software, documentation, procedures, people, data, facilities, and supplies. Key components should include securing equipment, especially laptops and mobile devices, creating a strong disaster recovery

strategy, developing a security breach detection and response plan, and providing for ongoing training.

One of the responsibilities of a chief security officer (CSO) is to protect the organization's information assets. The goal of the computer security plan is to match an appropriate level of safeguards against the identified risks. The CSO must realize that some degree of risk is unavoidable and that the more secure a system is, the more difficult it is for everyone to use. The security plan should be evaluated annually, or more frequently if information assets have changed dramatically. Microsoft has

developed a Security Development Lifecycle to guide the development, implementation, and review process. Its seven security practices phases — training, requirements, design, implementation, verification, release, and response — help increase security while reducing costs.

 **Consider This:** What method should be used to communicate the plan to all employees and provide adequate training to ensure continued compliance? How can a CSO be assured that employees will comply with the computer security plan?



NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Database Management Systems and System Development, as it relates to the chapter objectives.

Now you should know . . .

- How you use a data dictionary, retrieve data in a database, keep data secure in a database, and back up a database (Objective 4)
- Which three guidelines typically are part of system development life cycles? (Objective 5)
- How users are involved with project management, feasibility assessment, documentation, and data and information gathering tasks in a system development project (Objective 6)
- What tasks are performed during the planning, analysis, design, implementation, and support and security phases of system development (Objective 7)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Application Development Languages and Tools

The previous sections discussed the system development phases. One activity during the implementation phase is to develop programs and apps. Although you may never write a program or app, information you request may require a software developer to create or modify a program or app. Thus, you should understand how software developers, sometimes called programmers, create programs and apps to meet information requirements.

To create a program, software developers sometimes write a program's instructions using a programming language. A **programming language** is a set of words, abbreviations, and symbols that enables a software developer to communicate instructions to a computer or mobile device. Other times, software developers use a program development tool to create a program or app. Software that provides a user-friendly environment for building programs and apps often is called an *application development tool*. An application development tool provides a means for creating, designing, editing, testing, and distributing programs and apps. Software developers use a variety of programming languages and application development tools to create programs and apps.

Several hundred programming languages exist today. Each language has its own rules, or *syntax*, for writing the instructions. Languages often are designed for specific purposes, such as scientific applications, business solutions, or webpage development. When solving a problem or building a solution, software developers often use more than one language; that is, they integrate the languages. Read Ethics & Issues 11-4 to consider whether programming courses should teach students how hackers write programs.

ETHICS & ISSUES 11-4

Should Colleges Teach Hacking?

Investigators often try to understand criminal minds in an attempt to identify what motivates criminals to commit crimes. Similarly, to allow students to experience the mind-set of a hacker, some colleges teach students how to write computer viruses and other malware. Hacking sometimes is taught as part of an advanced programming course or as a stand-alone course. One instructor teaches students how to thwart antivirus software and how to generate anonymous email spam. He claims that if college students easily bypass antivirus software, then the products clearly are deficient. Does any benefit exist from teaching students to hack?

Proponents of such courses claim that these hacking skills enable the next generation of security experts to think like malicious hackers, thereby helping to stop the spread of malware. They liken the gained skills to physics students who learn about atomic weapons or biology students who learn how poisons work. One software company supports teaching hacking to help software developers evaluate code for security risks.

Critics claim that this practice only encourages more virus authoring and hacking. Some developers of malware detection software have said they would not hire a student who had taken a hacking course. Others claim that knowing how to

write malware does not make someone more capable of stopping malware. Questions remain about who is responsible legally, financially, and morally if a student uses the knowledge acquired in the course to release malicious code to the Internet or purposely infect other computers.

Consider This: Should colleges teach hacking? Why or why not? Should companies hire people who are trained in creating malware and computer hacking? Why or why not? What precautions should schools take if they plan to offer such courses? Who is responsible if a student in such a course releases malware? Why?

Procedural Languages

With a **procedural language**, a software developer writes instructions using English-like words that tell the computer what to accomplish and how to do it. For example, ADD stands for addition, or PRINT means to print. Many procedural languages also use arithmetic operators, such as * (asterisk) for multiplication and + (plus sign) for addition. Hundreds of procedural languages exist. Only a few, however, are used widely enough for the industry to recognize them as standards.

One example of a widely used procedural language is C. The C programming language, developed in the early 1970s by Dennis Ritchie at Bell Laboratories, originally was designed for writing system software. Today, many programs are written in C (Figure 11-18). C runs on almost any type of computer with any operating system, but it is used most often with the UNIX and Linux operating systems.

Discover More: Visit this chapter's free resources to learn more about the generations of programming languages, including machine languages, assembly languages, and procedural languages.

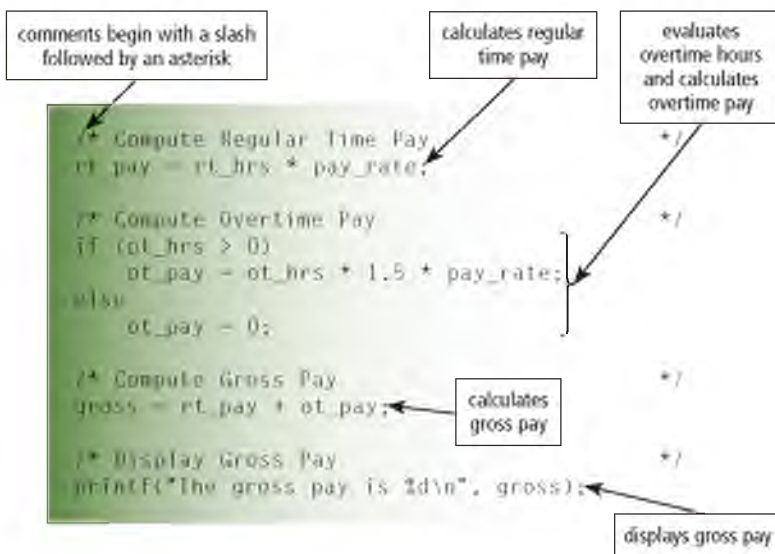


Figure 11-18 An excerpt from a C payroll program. The code shows the computations for regular time pay, overtime pay, and gross pay; the decision to evaluate the overtime hours; and the output of the gross pay.

© Cengage Learning

Compilers and Interpreters Before a computer or mobile device can run (execute) a program or app created with a procedural language, system developers must convert the program into *machine language*, which is the only language the computer directly recognizes. That is, the computer cannot execute the procedural language source program. A *source program* contains the language instructions, or *code*, to be converted to machine language. For procedural languages, software developers typically use either a compiler or an interpreter to perform the conversion.

- A *compiler* is a separate program that converts the entire source program into machine language before executing it. The machine language version that results from compiling the procedural language is called the *object program* or *object code*. The compiler stores the object program on storage media for execution later.

While it is compiling the source program into the object program, the compiler checks the source program for errors. The compiler then produces a program listing that contains the source code and a list of any errors. This listing helps the software developer make necessary changes to the source code and correct errors in the program.

Figure 11-19 shows the process of compiling a source program.

- An *interpreter*, by contrast, translates and executes one instruction at a time. An interpreter reads an instruction, converts it to one or more machine language instructions, and then executes those machine language instructions. It does this all before moving to the next instruction in the program. Each time the source program runs, the interpreter translates and executes it, instruction by instruction. An interpreter does not produce an object program. Figure 11-20 shows the process of interpreting a program.

One advantage of an interpreter is that when it finds errors, it displays feedback immediately. The software developer can correct any errors before the interpreter translates the next instruction. The disadvantage is that interpreted programs do not run as fast as compiled programs.

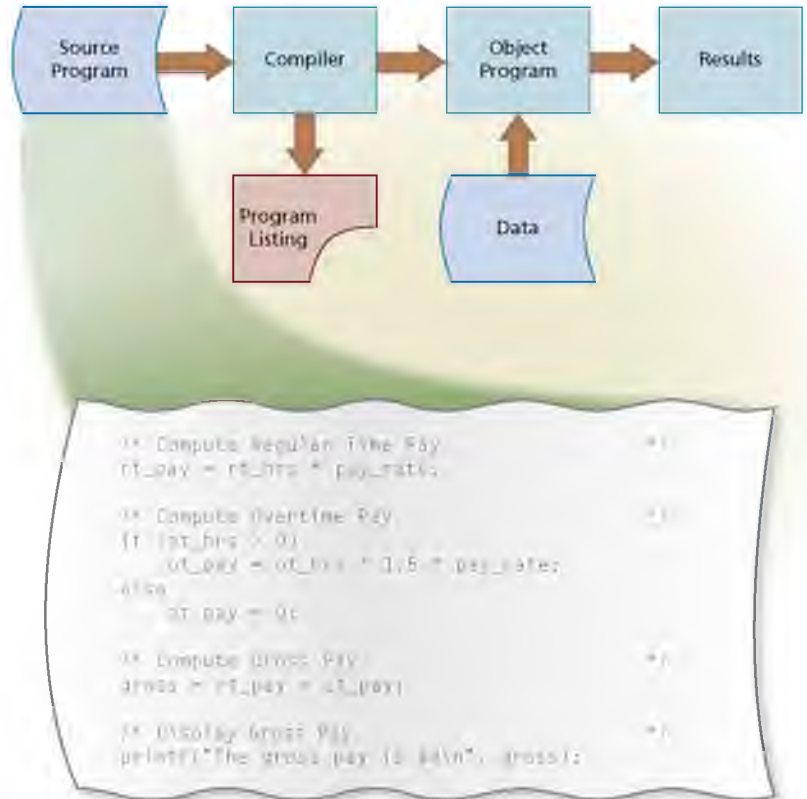


Figure 11-19 A compiler converts the source program (C, in this example) into a machine language object program.
© Cengage Learning

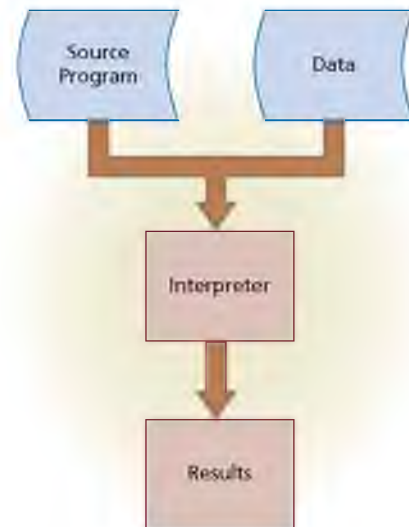


Figure 11-20 With an interpreter, one instruction of the source program at a time is converted into machine language and then immediately executed by the computer or mobile device.
© Cengage Learning

Object-Oriented Programming Languages and Application Development Tools

System developers use an **object-oriented programming (OOP) language** or object-oriented application development tool to implement objects in a program. Recall that an object is an item that can contain both data and the procedures that read or manipulate that data. An object represents a real person, place, event, or transaction.

A major benefit of OOP is the ability to reuse and modify existing objects. For example, once a system developer creates an Employee object, it is available for use by any other existing or future program. Thus, system developers repeatedly reuse existing objects. For example, a payroll program and health benefits program both would use an Employee object. That is, the payroll program would use it to process employee paychecks, and the health benefits program would use it to process health insurance payments.

Programs developed using the object-oriented programming languages and application development tools have several advantages. The objects can be reused in many systems, are designed for repeated use, and become stable over time. In addition, developers create applications faster because they design programs using existing objects. Programming languages, such as Java and C++, and the latest versions of Visual Basic are complete OOP languages. Most object-oriented application development tools, such as Visual Studio, are referred to as an *integrated development environment (IDE)* because they include tools for building graphical interfaces, an editor for entering program code, a compiler and/or interpreter, and a debugger (to remove errors). Some work with a single programming language, and others support multiple languages. Read How To 11-3 for instructions about selecting the object-oriented programming language and application development tools best suited to your needs.



BTW

Technology Innovator

Discover More: Visit this chapter's free resources to learn about Electronic Arts (entertainment software developer).

HOW TO 11-3

Determine Which Object-Oriented Programming Language or Application Development Tool to Use

Software developers can choose from a variety of object-oriented programming languages and application development tools to write a program or app for a computer or mobile device. The following guidelines describe how to determine which language or tool to use:

- Determine the types of devices on which your program or app will run. For example, if you are writing an app for a mobile device, limited languages and tools may be available for you to use.
- Determine the capabilities of the programming languages you are considering using. Some programming languages have greater capabilities than others.
- Consider the speed at which programs and apps run that are written in a particular programming language. For example, a program or app might run faster if it is written in one language as opposed to another.
- Consider whether you want to write a program using a text editor or an IDE. If you want to use an IDE, your choices of programming languages may be limited.
- Solicit recommendations from other developers. Explain the type of program or app you plan to write, and consider suggestions they might offer.

Consider This: If you are forced to write a program or app using a programming language with which you are not very familiar, what resources can you utilize to obtain assistance?

Discover More: Visit this chapter's free resources to learn more about object-oriented programming languages and application development tools.

CONSIDER THIS

What is rapid application development?

RAD (rapid application development) is a method of developing software in which the software developer writes and implements a program in segments instead of waiting until the entire program is completed. An important concept in RAD is the use of prebuilt components. For example, software developers do not have to write code for buttons and text boxes on Windows forms because they already exist in the programming language or application development tools provided with the language. Object-oriented programming languages and application development tools work well in a RAD environment.

Java Java is an object-oriented programming language developed by Sun Microsystems. Figure 11-21 shows a portion of a Java program and the window that the program displays. When software developers compile a Java program, the resulting object program is machine independent. Software developers use various Java Platform implementations, which provide application development tools for creating programs for all sizes of computers and mobile devices.



Figure 11-21 A portion of a Java program and the window the program displays.

© Cengage Learning

C++ Developed in the 1980s by Bjarne Stroustrup at Bell Laboratories, C++ (pronounced SEE-plus-plus) is an object-oriented programming language that is an extension of the C programming language. C++ includes all the elements of the C language, plus it has additional features for working with objects. Software developers commonly use C++ to develop database and web applications.

Visual Studio Developed by Microsoft, Visual Studio contains a suite of object-oriented application development tools that assists software developers in building programs and apps for Windows or any operating system that supports the Microsoft .NET Framework. Visual Studio also includes a set of tools for developing programs and apps that work with Microsoft's Office suite. OOPs included in the Visual Studio suite are Visual Basic, Visual C++, and Visual C#.

Internet Research

What are examples of C++ applications?

Search for: c++ applications

Internet Research

What is Visual Studio Express?

Search for: visual studio express

 **CONSIDER THIS****What is .NET?**

The Microsoft .NET Framework, or *.NET* (pronounced dot net), is a set of technologies that allows almost any type of program to run on the Internet or an internal business network, as well as stand-alone computers and mobile devices. Similarly, *ASP.NET* is a web application framework that provides the tools necessary for the creation of dynamic websites.

**Visual Basic**

Visual Basic is based on the BASIC programming language, which was developed by Microsoft Corporation in the early 1960s. Because this language is easy to learn and use, beginning programmers often use it.

 **CONSIDER THIS****What is a visual programming language?**

A *visual programming language* is a language that uses a visual or graphical interface for creating all source code. The graphical interface, called a *visual programming environment (VPE)*, allows system developers to drag and drop objects to build programs and apps.

Discover More: Visit this chapter's free resources to learn more about visual programming languages.

Other Languages and Application Development Tools

The following sections discuss a variety of other programming languages and application development tools.

4GLs A **4GL** (*fourth-generation language*) is a nonprocedural language that enables users and software developers to access data in a database. With a *nonprocedural language*, the software developer writes English-like instructions or interacts with a graphical environment to retrieve data from files or a database. Many object-oriented application development tools use 4GLs. One popular 4GL is SQL. As discussed earlier in this chapter, SQL is a query language that allows users to manage, update, and retrieve data in a relational DBMS.

Classic Programming Languages In addition to the programming languages discussed on the previous pages, software developers sometimes use the languages to maintain legacy systems. These languages, which include BASIC, COBOL, FORTRAN, and RPG, were more widely used in the past than they are today.

Discover More: Visit this chapter's free resources to learn more about classic programming languages.

Application Generators An application generator is a program that creates source code or machine code from a specification of the required functionality. When using an application generator, a software developer or user works with menu-driven tools and graphical user interfaces to define the desired specifications. Application generators most often are bundled with or are included as part of a DBMS. An application generator typically consists of a report writer and forms (discussed earlier in this chapter), and a menu generator. A menu generator enables you to create a menu for the application options.

Macros A **macro** is a series of statements that instructs a program or app how to complete a task. Macros allow users to automate routine, repetitive, or difficult tasks in application software, such as word processing, spreadsheet (Figure 11-22), or database programs. That is, users can create simple programs within the application by writing macros. You usually create a macro in one of two ways: (1) record the macro or (2) write the macro.

**Technology Trend**

Discover More: Visit this chapter's free resources to learn about programs behind Mars Rover.

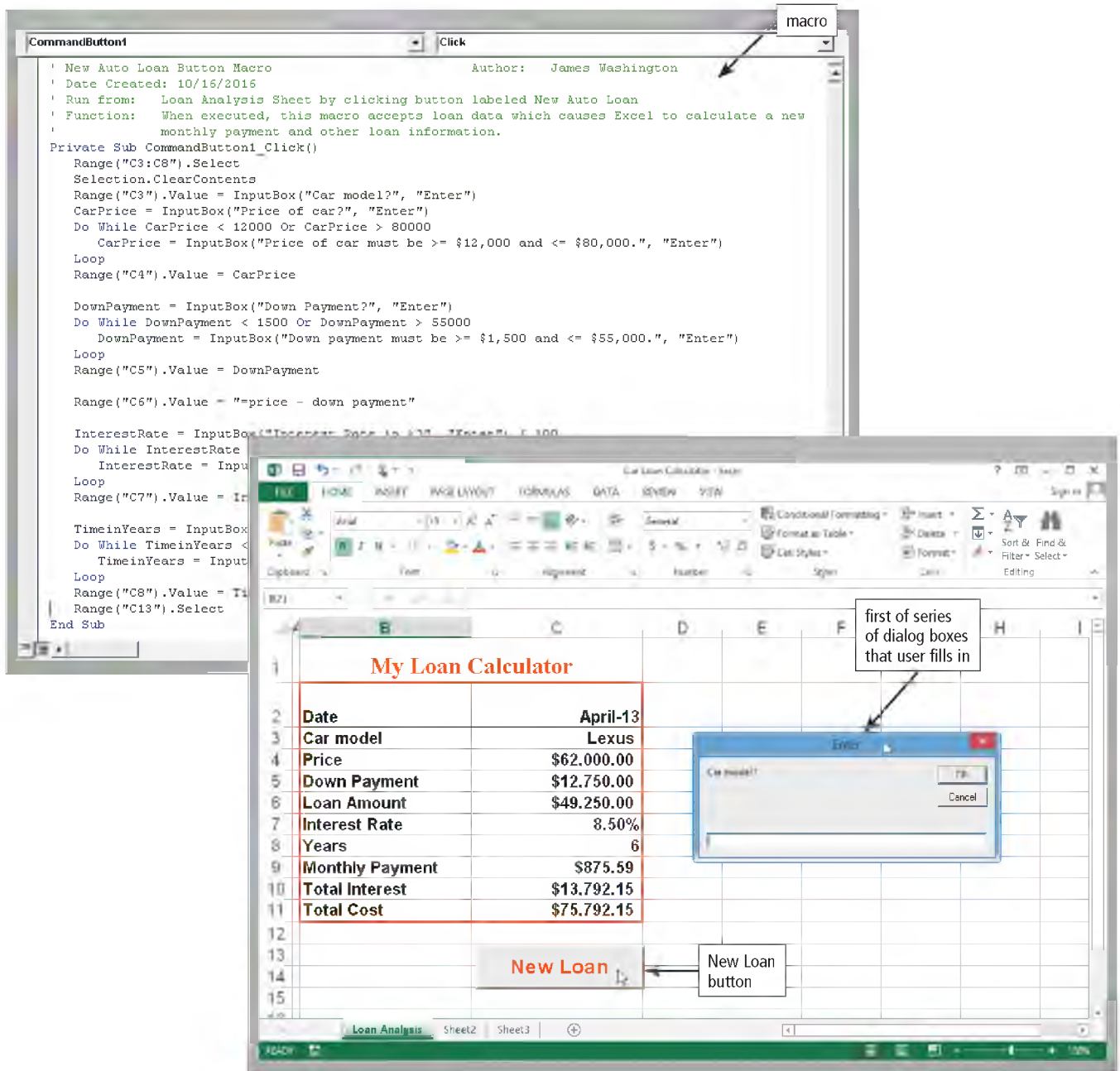


Figure 11-22 The top screen shows a macro used to automate an auto loan. After this macro is written, the user taps or clicks the New Loan button to run the macro. The bottom screen shows the macro guiding the user through part of the data entry process.

Source: Microsoft

CONSIDER THIS

Why and how would you record a macro?

If you want to automate a routine or repetitive task such as formatting or editing, you would record a macro. A *macro recorder* is similar to a movie camera because both record all actions until turned off. To record a macro, start the macro recorder in the software. Then, perform the steps to be part of the macro, such as taps, clicks, or keystrokes. Once the macro is recorded, you can run it any time you want to perform that same sequence of actions. For example, if you always print three copies of certain documents, you could record the actions required to print three copies. To print three copies, you would run the macro called PrintThreeCopies. When you become familiar with programming techniques, you can write your own macros instead of recording them. Read Secure IT 11-4 for security issues related to macros.

SECURE IT 11-4



Protection from Macro Viruses


More than 20 years ago, the first macro viruses wreaked havoc with personal computers. Now, the same macro coding techniques are being used to create malware infecting smartphones. For example, the Selfmite worm sends text messages with malicious links to the owner's contacts.

As the name implies, a macro virus hides in a program's macro language. Malware authors find that one of the easiest methods of spreading viruses and worms is by distributing apps and files containing macro viruses. This type of virus is easy to write, and the damage that results from infecting smartphones and computers can exceed millions of dollars.

Because many computers and smartphones have acquired damaging macro viruses, antivirus and productivity software companies have strengthened their efforts to prevent this malware from infecting their products. One method, for example, disables the macros, which prohibits users from running once-automated tasks on their computers. The users, however, are frustrated when they now must perform routines manually. Other prevention measures include setting the software's macro security level to high, not installing apps from unknown sources, not opening unexpected file attachments, and holding down the SHIFT key when opening

a file that may be infected by a macro virus so that any automatic macros are prevented from running.

Many smartphone and computer users claim the software companies should make it impossible for malware authors to take advantage of security problems in the software. The software companies, however, place the blame on users who install apps and open files from unknown sources.

 **Consider This:** Should users or software companies be held accountable for macro security threats? Why? How can smartphone and computer users best be educated about opening text messages and documents from unknown sources?

Web Development

The designers of webpages, known as *web developers*, use a variety of techniques to create and publish webpages. The following sections discuss these techniques. Read How To 11-4 for instructions about publishing webpages.

HOW TO 11-4



Publish a Webpage


After creating a webpage, you will need to publish it on a web server so that it is accessible online. The method you use to publish a webpage can vary, depending upon a number of factors. For example, if you created a webpage using a content management system or web app, the webpage may be available online automatically, or you may be able to use a feature in the content management system or web app to publish the webpage. If you created the webpage using a program or app on your computer, the following sections describe various ways to publish the webpage.

1. Identify the web hosting company you want to use.
2. Navigate to and review the documentation explaining how to publish your webpage. Some web hosting companies require you to publish the webpage using a specific set of steps, while others are more flexible.
3. Publish the webpage using one of the web hosting company's recommended methods:

- Some web hosting companies will allow you to publish your webpage using a web app or file transfer program that is part of their website. Select the files you want to transfer from your computer, select the destination (if necessary), and then tap or click the appropriate button or link that will initiate the transfer.
- Some web hosting companies, businesses, or universities allow you to publish webpages using FTP or SFTP (secure FTP). Download and install a program or app that supports the required protocol (FTP or SFTP). Run the program and enter the required information to connect to the web hosting company's server. (The required information, such as the server address, user name, and password, is available from the web hosting company.) Next, connect to the server, select the file(s) you want to transfer from your computer

and the location on the web hosting company's server where you want to transfer the files, and then initiate the transfer.

4. Once the transfer has completed, run a browser.
5. Navigate to your webpage. Your web hosting company should have provided the web address for accessing the webpage.
6. If your webpage does not display properly, verify that you entered the correct web address and ensure the web server is functional. Lastly, consider contacting your web hosting company's technical support staff for additional assistance.

 **Consider This:** Does one method of publishing webpages have any advantages over another? Which method described previously in Step 3 appears to be the easiest?

HTML *HTML (Hypertext Markup Language)* is a special formatting language that software developers use to format documents for display on the web. You view a webpage written with HTML in a browser, such as Internet Explorer, Safari, Firefox, Opera, or Chrome. Figure 11-23a shows part of the HTML code used to create the webpage shown in Figure 11-23b.

Figure 11-23a (portion of HTML code)



```

</div>
<div class="col one" style="min-height: 340px;">
<div id="ct100_homecontentintro" class="col one textcolorbasedark">
<div id="ct100_ct118_divIntroText"><p></p>
<h3 style="font-size: 16pt; color: #2d86aa; text-align: left;"><span style="font-size: 18pt;">Welcome to CengageBrain</span></h3>
<h2 style="font-size: 24pt; color: #2d86aa; text-align: right;">
<p style="margin: 0px; text-align: left;"><span style="font-size: 36pt;"><br />
</span></p>
<p style="margin: 0px; text-align: left;"><span style="font-size: 36pt;">Extra Credit</span></p>
<p style="margin: 0px; text-align: left;"><br />
</p></h2>
<p style="margin: 0px; text-align: left;"></p>
<p style="color: #404040; font-family: verdana,sans-serif; font-size: 13px; font-weight: normal;"><span style="font-size: 12.5pt;
line-height: 16px; font-family: arial,sans-serif; color: #555555; font-weight: bold;">Donate to the charity of your choice, either
charity: water or Student Conservation Association, by helping college students save on textbooks! It's as easy as...</span><br />
</p>
<p></p>
<div class="col cta" style="color: #404040; font-family: verdana,sans-serif; font-size: 13px; font-weight: normal;">
<div class="textcolortwo stepnumber" style="text-align: center;">1</div>
<p style="margin: 0px; text-align: left;"></p>
<h3 class="textcolortwo" style="text-align: left;">Share Your Coupon</h3>
<p style="margin: 0px; text-align: left;"></p>
<p>Help your friends, family, and classmates save 10% off on textbooks, rentals, and more at <a href="http://cengagebrain.com/?
utm_source=CEC&utm_medium=SPARK&utm_campaign=ExtraCreditHome" target=" blank">CengageBrain.com</a></p> <br />
<p></p></div>
<div class="col cta" style="color: #404040; font-family: verdana,sans-serif; font-size: 13px; font-weight: normal;">
<div class="textcolortwo stepnumber" style="text-align: center;">2</div>
<p style="margin: 0px; text-align: left;">
<h3 class="textcolortwo" style="text-align: left;">
<p style="margin: 0px; text-align: left;">

```



Figure 11-23b
(portion of resulting
webpage)

Figure 11-23 The portion of the HTML code in Figure 11-23a generates a portion of the Cengage Learning CengageBrain webpage shown in Figure 11-23b.

Source: Cengage Learning

 **CONSIDER THIS**
Is HTML a programming language?

HTML is not actually a programming language. It is, however, a language that has specific rules for defining the placement and format of text, graphics, video, and audio on a webpage. HTML uses tags or elements, which are words, abbreviations, and symbols that specify links to other documents and indicate how a webpage is displayed when viewed on the web.

XML **XML** (*Extensible Markup Language*) is an increasingly popular format for sharing data that allows web developers to create tags that describe the structure of information. XML separates the webpage content from its format, allowing the browser to display the contents of a webpage in a form appropriate for the display device. For example, RSS feeds (web feeds) are represented as XML. A webpage can read the feed's content as described by XML and then apply styles and consistent formatting to each element (title, link, description) to display it within a browser.

Wireless devices use a subset of XML called WML. *WML* (*wireless markup language*) allows web developers to design pages specifically for microbrowsers. Many smartphones and other mobile devices use WML as their markup language.

 **CONSIDER THIS**
What are some applications of XML?

Two applications of XML are the RSS 2.0 and ATOM specifications. *RSS 2.0*, which stands for Really Simple Syndication, and *ATOM* are specifications that content aggregators use to distribute content to subscribers. The online publisher creates an RSS or ATOM document, called a web feed, that is made available to websites for publication. News websites, blogs, and podcasts often use web feeds to publish headlines and stories. Most browsers can read web feeds, meaning they can display titles, links, descriptions, and other information about pages identified in the feed.

 **Internet Research**

What is Ruby on Rails?

Search for: ruby on rails

Scripting and Other Web Development Languages To add interactivity on webpages and to add special media effects, such as animated graphics, scrolling messages, calendars, and advertisements, web developers write small programs called scripts using a variety of scripting languages. Although some use languages previously discussed, such as Java and C++, many developers instead use scripting languages. A *scripting language* is an interpreted language that typically is easy to learn and use. Popular scripting and other web development languages include JavaScript (Figure 11-24), Perl, PHP, Python, and Ruby.

Discover More: Visit this chapter's free resources to learn more about scripting and other web development languages.

Mini Feature 11-3: Web Application Development

Three technologies form the foundation for many web applications: HTML5 specifies the structure of content displayed on a webpage; CSS (cascading style sheets) describes the design and appearance of information on a webpage; and JavaScript is a scripting language that allows users to interact with a webpage's content. Many web applications also access applications running on a server, connect to a database, or access third-party content from online sources. Together, these technologies enable developers to create browser-independent web applications that run on a variety of devices.

As discussed in an earlier chapter, the W3C (World Wide Web Consortium) is an international organization that sets the standards for the technologies and operation of the web. In addition, it defines the standards for HTML5 and CSS. Read Mini Feature 11-3 to learn about technologies that enable developers to create browser-independent web applications.

Figure 11-24a (JavaScript code)

```

189
190
191 <script language="JavaScript" type="text/javascript">
192   jQuery(function() {
193     jQuery(".slidetabs").tabs(".images > div", {
194       effect: 'fade',
195       fadeOutSpeed: 1200,
196       fadeInSpeed: 1200,
197       rotate: true
198       // use the slideshow plugin. It accepts its own configuration
199     }).slideshow({autoplay: true, interval: 6000, clickable: false});
200
201     // Get access to the API - This has to be done after your Tabs instance is created
202     var api = jQuery(".slidetabs").data("tabs");
203
204     api.onBeforeClick(function() {
205       jQuery('.descriptor').hide();
206     });
207
208     //when the slidesl
209     api.onClick(function() {
210       if (jQuery.
211         jQuery.
212       }
213       jQuery('.de
214     });
215
216   });
217 </script>
218

```

Figure 11-24b (webpage)

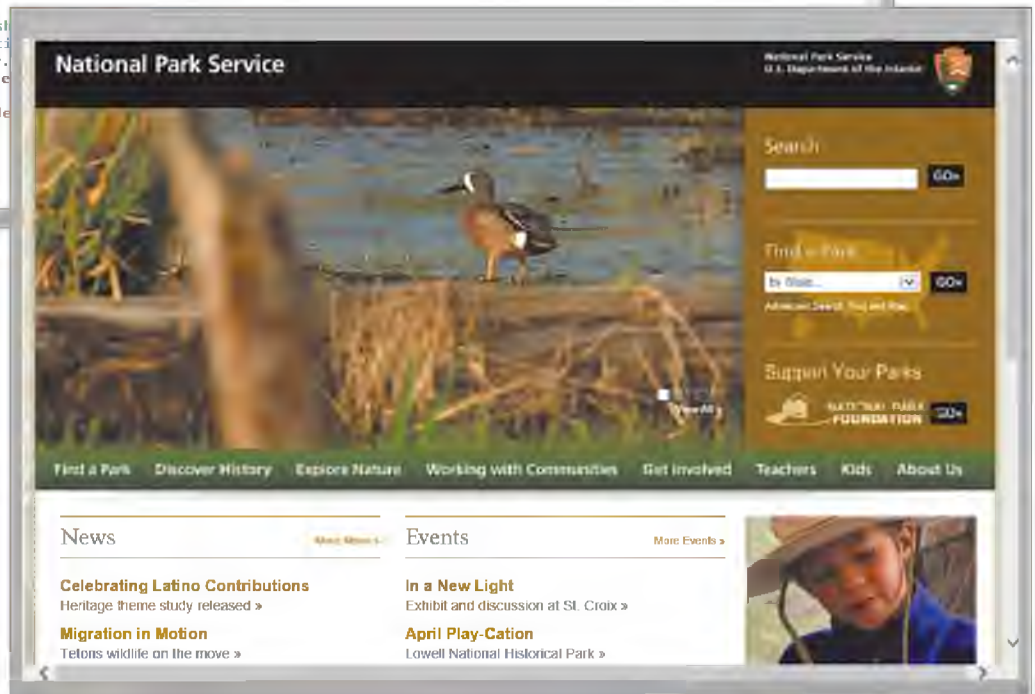


Figure 11-24 Shown here is a portion of the JavaScript code and its associated National Park Service webpage.
Source: National Park Service U.S. Department of the Interior

MINI FEATURE 11-3

Web Application Development

To develop a web application, web developers use HTML5, CSS, and JavaScript.

HTML5

HTML5 is the current HTML standard for creating websites and applications. HTML uses a set of codes called tags to instruct a browser how to structure a webpage's content. HTML tags specify the structure of content on a webpage, such as headings, paragraphs, links, or images. HTML5 includes tags for playing audio and video files without relying on the use of third-party plug-ins or modules, such as Adobe Flash, to perform these tasks. Some mobile devices and computers, such as Apple's iPhone and iPad, do not

support displaying media content that requires Flash. Instead, they rely on HTML5-compliant browsers, which are capable of interpreting HTML5 tags, to handle these tasks.

Additional HTML5 features include recognizing gestures, such as swipe or drag-and-drop, on mobile devices; dynamically creating graphics, such as progress bars, charts, and animations; *geolocation* (determining a user's location based on a device's GPS or connection to a cell tower); and offline storage. For example, Google Drive uses HTML5's drag-and-drop feature so that you can organize documents and uses its offline storage feature to allow you to work with your documents when you do not have an Internet connection. Twitter makes use of HTML5's geolocation feature when users search for Tweets that originate near a specific location.



(continued)

These HTML5 features enable web developers to build applications that address the needs of how people use the web today and provide richer user experiences. Each browser implements the HTML5 specification differently and may not support all of its features.

CSS

While HTML describes the structure of a webpage's content as a collection of elements (such as headings, paragraphs, images, and links), CSS allows web designers to separate the code that specifies a webpage's content from the code that specifies the webpage's appearance. For example, a webpage may contain two paragraphs of text that are presented using a variety of fonts and sizes, styles, colors, borders, thicknesses, columns, or backgrounds. CSS provides web designers with precise control over a webpage's layout and allows the designers to apply different layouts to the same information for printing or for viewing in browsers on smartphones, tablets, or computers with varying screen sizes. The current version of CSS is known as CSS3 (cascading style sheets, version 3).

JavaScript


JavaScript is a programming language that adds interactivity to webpages. It often is used to check for appropriate values on web forms, display alert messages,

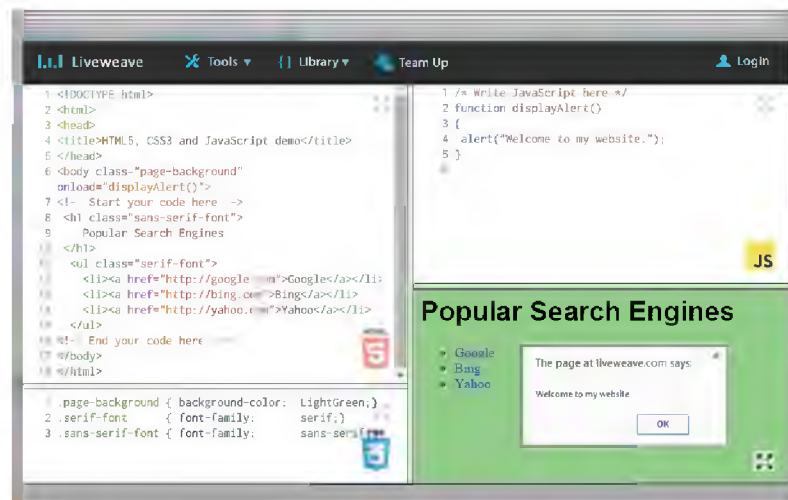
display menus on webpages, control the appearance of a browser window, read and write cookies, display alert boxes, and detect the browser version in order to display a webpage especially designed for that browser. JavaScript code is loaded with a webpage and runs in the browser.

Developing Websites and Applications with HTML5, CSS, and JavaScript

Web developers often use tools, such as the one shown in the figure, to create their code and visualize what it will look like in a browser. In this example, HTML5 specifies a heading, a paragraph, and a link; CSS specifies the page background color and fonts, while JavaScript instructs the page to display an alert box when it loads.

Discover More: Visit this chapter's free resources to learn more about web development using HTML5, CSS3, and JavaScript.

 **Consider This:** What are two advantages and two disadvantages of writing mobile apps using HTML5, CSS, and JavaScript? Before HTML5's geolocation features, how might a web app have determined a user's approximate location? Some web-based email services, such as Gmail, use HTML5, CSS, and JavaScript. Name a feature of Gmail that might demonstrate a characteristic of each of these technologies.



NOW YOU SHOULD KNOW

Be sure you understand the material presented in the section titled Application Development Languages and Tools, as it relates to the chapter objectives.

Now you should know . . .


- How your computer works with low-level and procedural languages (Objective 8)
- Why you would use an OOP language or application development tool (Objective 9)
- How you can develop webpages and web apps (Objective 10)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter discussed the hierarchy of data, ways to validate data, the advantages of the database versus the file processing approach, and characteristics of database management systems. It also discussed the system development phases and the guidelines for system development, along with activities that occur during system development, including project management, feasibility assessment, documentation, and data and information gathering. This chapter also reviewed various programming languages and application development tools used to create and modify computer programs. Finally, it described a variety of web development tools.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: E. F. Codd, Oracle/Larry Ellison, Lenovo, and Electronic Arts; Technology Trends: Forensic Databases, Custom Crime Fighting Software, and Programs behind Mars Rover; and High-Tech Talks: Types of Databases, Database Design, and the Normalization Process; Process and Object Modeling; and Programming Logic.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Sports

While watching your local football team play an out-of-state game on television, you notice various player and game statistics appear on the screen, alerting you to how many yards the offense must travel before making a first down. The camera then focuses on the large, colorful, high-resolution scoreboard at the stadium. While sports, such as football, have been around for many decades, the integration of technology has added significantly to the viewing experience.

While watching a baseball game, you notice that the scoreboard shows the number of balls and strikes for the player at bat, as well as other statistics. Behind home plate, an electronic radar gun calculates and records the speed of each pitch. This recorded data, along with the umpire's call (ball or strike) and the player's performance at bat (hit, home run, strike out, etc.) are entered in a computer, which updates the player's batting average automatically. A database stores information about the individual players and other aspects of the baseball game. During this entire time, the video display on the stadium's scoreboard plays audio and video to entertain the fans. The computer storing the player and game statistics, audio, and video communicates with the scoreboard and video display using either a wired or wireless connection. At the

same time, these computers send updated scores and statistics to webpages and mobile devices.

Technology not only is used to keep track of athlete statistics and communicate with scoreboards, but also in racing to help measure a vehicle's performance before a race. Sensors installed on a vehicle can measure throttle inputs, airflow over the body, the distance between the vehicle's frame and the track, and more. The racing teams then can modify the vehicle so that

it achieves maximum performance during a race.

Overall, technology adds enjoyment to various sporting events for many individuals. While waiting for a pitcher to throw the next ball or for a football team to start its next play, keep in mind that the integration of technology entertains you with interesting statistics and replays between the action.

 **Consider This:** How else might computers and technology be used in sports?



Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to test your knowledge of digital content associated with this chapter and access the Study Guide resource from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- Define the terms, database and database software. Identify the role of a file, record, and field in database hierarchy.
- Define these terms: field, field name, and data type. List common data types.
- Identify what is stored in a record. Explain the importance of a primary key.
- Define the term, data file. Identify what is involved in file maintenance.
- Explain the issues surrounding companies using customer data.
- Explain how a DBMS might manage deleted or obsolete records.
- Define the term, validation. List types of validity checks and explain what occurs in each.
- Explain the disadvantages of typical file processing systems. Describe the database approach to storing data.
- Explain the issues surrounding use of criminal databases.
- Differentiate between a front-end and back-end program. Explain the advantages and disadvantages of the database approach.
- Explain how you access data in a web database. Describe the role of a database server.
- Identify uses of web databases for government, entertainment, travel, shopping, research, and education.
- A(n) _____ defines how users view the organization of the data. List four popular data models.
- List possible uses of an object-oriented database.
- Explain the characteristics, sources, and uses of Big Data. Describe what occurs during data visualization.
- Describe the role of the database administrator.
- Define the term, data dictionary. Explain how a data dictionary helps ensure data integrity.
- A(n) _____ is a request for specific information from a database.
- List steps to import and export data between a spreadsheet and a database.
- Define the terms query language, SQL, and QBE.
- Define the terms, form and report writer.
- Explain how access privileges contribute to data security. List steps to secure and maintain a database.
- Explain issues surrounding accidental access of confidential data. List methods to recover from identity theft.
- List methods to restore or backup a database. Differentiate between rollforward and rollback recovery.
- Identify the five phases in the SDLC. Name three guidelines for system development.
- Identify who participates in system development. Describe the responsibilities of a systems analyst.
- Define the term, project management. List elements the project leader must identify.
- Define the function of project management software. A(n) _____ is any tangible item, such as a chart, diagram, report, or program file.
- Describe how Gantt and PERT charts are used.
- Define the terms, scope creep and change management.
- Identify tests used to evaluate feasibility of a project. Explain the importance of documentation.
- Describe ways that team members collaborate.
- Identify data and information gathering techniques. A(n) _____ session also is called a focus group.
- Describe circumstances that can initiate system development.
- List the four activities of the planning phase. Explain how projects are prioritized.
- Describe the activities of the analysis phase. List the three activities of the detailed analysis phase.
- Explain security issues surrounding outsourcing.
- List the two activities of the design phase. Describe how a systems analyst obtains hardware or software.
- Differentiate among an RFQ, RFP, and RFI. Describe the roles of VARs and IT consultants when soliciting vendor proposals.
- Explain what occurs when vendor proposals are tested and evaluated. A(n) _____ test measures the performance of hardware or software.
- Explain the activities and users involved in the detailed design phase. Define the term, prototype.
- List the four activities of the implementation phase.
- List the three activities of the support and security phase. Describe components of a technology security plan.
- Define the following terms: programming language, application development tool, and syntax.
- Explain issues surrounding colleges teaching students how to hack.
- Define the terms, procedural language, compiler, machine language, and interpreter. List benefits of OOP languages.
- Describe the following: 4GLs, classic programming languages, application generators, and macros. Explain how to protect yourself from macro viruses.
- List steps to publish a webpage. Explain how web developers use HTML5, XML, WML, CSS, and JavaScript.
- Explain how the sports industry uses technology.

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

Discover More: Visit this chapter's premium content to view definitions for each term and to access the Flash Cards resource from your smartphone, tablet, laptop, or desktop.

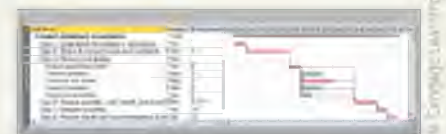
Key Terms

Primary Terms (shown in bold-black characters in the chapter)

4GL (532)	feasibility (519)	planning phase (521)	recovery utility (515)
analysis phase (521)	field (500)	preliminary investigation (521)	report writer (513)
Big Data (508)	field name (500)	primary key (501)	Structured Query Language (SQL) (512)
C (528)	file maintenance (502)	procedural language (528)	support and security phase (526)
C++ (531)	file processing system (504)	programming language (527)	system development (515)
character (500)	form (512)	project management (517)	system development life cycle (SDLC) (515)
continuous backup (515)	HTML (535)	project management software (518)	systems analyst (517)
data dictionary (510)	implementation phase (525)	prototype (525)	training (526)
data file (501)	Java (531)	query (511)	validation (503)
data model (508)	log (515)	query language (512)	Visual Studio (531)
data type (500)	macro (532)	record (501)	XML (536)
database (498)	object-oriented programming (OOP) language (530)		
database management system (DBMS) (498)			
database software (498)			
design phase (523)			

Secondary Terms (shown in italic characters in the chapter)

<i>.NET (532)</i>	<i>e-form (512)</i>	<i>object program (529)</i>	<i>rollback (515)</i>
<i>acceptance test (525)</i>	<i>Extensible Markup Language (536)</i>	<i>object-oriented database (OODB) (528)</i>	<i>rollforward (515)</i>
<i>alphabetic check (503)</i>	<i>feasibility study (521)</i>	<i>operational feasibility (519)</i>	<i>RSS 2.0 (536)</i>
<i>application development tool (527)</i>	<i>feature creep (519)</i>	<i>parallel conversion (526)</i>	<i>sandbox (525)</i>
<i>ASP.NET (532)</i>	<i>focus group (520)</i>	<i>PERT chart (518)</i>	<i>schedule feasibility (519)</i>
<i>ATOM (536)</i>	<i>forward recovery (515)</i>	<i>phased conversion (526)</i>	<i>scope (517)</i>
<i>back end (505)</i>	<i>fourth-generation language (532)</i>	<i>phases (515)</i>	<i>scope creep (519)</i>
<i>backward recovery (515)</i>	<i>front end (505)</i>	<i>pilot conversion (526)</i>	<i>scribe (520)</i>
<i>benchmark test (524)</i>	<i>function creep (502)</i>	<i>post-implementation system review (526)</i>	<i>scripting language (536)</i>
<i>BI.OB (501)</i>	<i>Gantt chart (518)</i>	<i>principle of least privilege policy (513)</i>	<i>source program (529)</i>
<i>Boolean (501)</i>	<i>geolocation (537)</i>	<i>program development life cycle (525)</i>	<i>standards (517)</i>
<i>change management (519)</i>	<i>HTML5 (537)</i>	<i>program specification package (524)</i>	<i>steering committee (517)</i>
<i>check digit (503)</i>	<i>Hypertext Markup Language (535)</i>	<i>project leader (517)</i>	<i>syntax (528)</i>
<i>code (529)</i>	<i>information system (515)</i>	<i>project manager (517)</i>	<i>systems test (525)</i>
<i>collaborative databases (506)</i>	<i>integrated development environment (IDE) (530)</i>	<i>project request (521)</i>	<i>technical feasibility (519)</i>
<i>compiler (529)</i>	<i>integration test (525)</i>	<i>project team (517)</i>	<i>unit test (525)</i>
<i>completeness check (503)</i>	<i>interpreter (529)</i>	<i>proof of concept (525)</i>	<i>user buy-in (524)</i>
<i>composite key (501)</i>	<i>IT consultant (523)</i>	<i>query by example (QBE) (512)</i>	<i>value-added reseller (VAR) (523)</i>
<i>conferencing software (520)</i>	<i>JavaScript (537)</i>	<i>RAD (rapid application development) (530)</i>	<i>visual programming environment (VPE) (532)</i>
<i>consistency check (503)</i>	<i>joint-application design (JAD) session (520)</i>	<i>range check (503)</i>	<i>visual programming language (532)</i>
<i>cost/benefit feasibility (519)</i>	<i>logical design (522)</i>	<i>relational database (508)</i>	<i>web conference (520)</i>
<i>CSS (cascading style sheets) (537)</i>	<i>machine language (529)</i>	<i>report generator (513)</i>	<i>web developers (534)</i>
<i>data entry form (512)</i>	<i>macro recorder (533)</i>	<i>repository (510)</i>	<i>WMI, (wireless markup language) (536)</i>
<i>data warehouse (508)</i>	<i>metadata (508)</i>	<i>request for information (RFI) (523)</i>	
<i>database administrator (DBA) (510)</i>	<i>mock-up (524)</i>	<i>request for proposal (RFP) (523)</i>	
<i>database server (506)</i>	<i>multidimensional database (508)</i>	<i>request for quotation (RFQ) (523)</i>	
<i>deliverable (518)</i>	<i>nonprocedural language (532)</i>	<i>request for system services (521)</i>	
<i>detailed analysis (522)</i>	<i>numeric check (503)</i>		
<i>direct conversion (526)</i>	<i>object (508)</i>		
<i>distributed database (508)</i>	<i>object code (529)</i>		
<i>documentation (519)</i>			
<i>economic feasibility (519)</i>			



Gantt chart (518)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. In a data hierarchy, each higher level of data contains one or more items from the lower level. (500)
- _____ 2. A check digit often confirms the accuracy of a primary key value. (503)
- _____ 3. In a typical database system, each department or area within an organization has its own set of files. (504)
- _____ 4. In a file processing system, duplicated data can increase the chance of errors. (504)
- _____ 5. Many programs today use forms on a webpage as their front end. (505)
- _____ 6. File processing systems require more memory, storage, and processing power than a database. (506)
- _____ 7. To retrieve or select data in a database, you query it. (511)
- _____ 8. Unlike a form, you use a report writer only to retrieve data. (513)
- _____ 9. One way to secure a database is to allow only administrators to have access to create and delete tables. (513)
- _____ 10. In a rollforward, the DBMS uses the log to undo any changes made to the database during a certain period. (515)
- _____ 11. Gantt charts are better suited than PERT charts for planning and scheduling large, complex projects. (518)
- _____ 12. The planning phase begins when the steering committee receives a project request. (521)

Multiple Choice

Select the best answer.

1. A(n) _____ check tests data in two or more associated fields to ensure that the relationship is logical and their data is in the correct format. (503)
 - a. completeness
 - b. consistency
 - c. range
 - d. alphabetic
2. Which of the following is *not* an advantage of a database approach? (506)
 - a. data integrity
 - b. reduced data redundancy
 - c. shared data
 - d. requires less memory, storage, and processing power than file processing systems
3. A _____ defines how users view the organization of data in a database. (508)
 - a. data dictionary
 - b. data mart
 - c. data model
 - d. report writer
4. A(n) _____ database stores data in tables that consist of rows and columns. (508)

a. object-oriented	c. relational
b. multidimensional	d. distributed
5. A _____ contains data about each file in the database and each field in those files. (510)
 - a. query
 - b. form
 - c. data dictionary
 - d. data mart
6. Which of the following is *not* a phase in the SDLC? (515)
 - a. planning
 - b. analysis
 - c. implementation
 - d. converting
7. _____ feasibility measures whether an organization has or can obtain the computing resources, software services, and qualified people needed to develop, deliver, and then support the proposed information system. (519)


a. Operational	c. Economic
b. Technical	d. Schedule
8. Systems analysts use a(n) _____ test to verify that all programs in an application work together properly. (525)

a. unit	c. integration
b. systems	d. acceptance

Checkpoint

Matching Match the terms with their definitions.

- | | |
|---------------------------------|---|
| _____ 1. data type (500) | a. procedures that keep data current |
| _____ 2. primary key (501) | b. item that contains data, as well as the actions that read or process the data |
| _____ 3. file maintenance (502) | c. field that uniquely identifies each record in a file |
| _____ 4. validation (503) | d. process of comparing data with a set of rules or values to determine if the data meets certain criteria |
| _____ 5. check digit (503) | e. language instructions, or code, to be converted to machine language |
| _____ 6. object (508) | f. machine language version of a program that results from compiling the procedural language |
| _____ 7. standards (517) | g. number(s) or character(s) that is appended to or inserted in a primary key value |
| _____ 8. feature creep (519) | h. specifies the kind of data a field can contain and how the field is used |
| _____ 9. object program (529) | i. problem that occurs when one activity has led to another that was not planned originally, causing the project to grow in scope |
| _____ 10. source program (529) | j. sets of rules and procedures an organization expects employees to accept and follow |

 **Consider This** Answer the following questions in the format specified by your instructor.

- Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (502, 505, 514, 528), How To (511, 513, 530, 534), Mini Features (507, 509, 537), Secure IT (514, 522, 527, 534), and Technology @ Work (539).
- What are common data types? (501)
- What is included in file maintenance? (502)
- What is function creep? (502)
- How does a DBMS typically flag deleted records or records that contain inactive data? (502)
- What should a computer do if data fails a validity check? (503)
- What are the different types of validity checks? (503)
- What are two major weaknesses of file processing systems? (504)
- What are the advantages of a database approach to data storage? (505)
- What are three popular data models used today? (508)
- What trends have contributed to Big Data? (508)
- What is stored in the data dictionary? (510)
- What steps can you take to recover from identity theft? (514)
- What are the steps in the SDLC? (515)
- Who should be included on a project team? (517)
- How do the responsibilities of a project manager differ from those of a project leader? (517)
- What four tests does a systems analyst use to evaluate a project's feasibility? (519)
- What techniques do systems analysts use to gather data and information? (520)
- What four major activities take place during the planning phase in the SDLC? (521)
- Why is detailed analysis sometimes called logical design? (522)
- How do RFQs, RFPs, and RFIs differ? (523)
- What does a program specification package identify? (524)
- What are the four major steps in the implementation phase? (525)
- Why might users work with a sandbox? (525)
- What tests might a systems analyst perform on test data? (525)
- How do direct, parallel, phased, and pilot conversion strategies differ? (526)
- How does a compiler differ from an interpreter? (529)
- What are some popular object-oriented programming (OOP) languages? (530)

Problem Solving

The Problem Solving exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The Collaboration exercise should be completed with a team.

instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. No Search Results** While searching a web database for a hotel room for an upcoming trip, a message is displayed stating that no search results match your criteria. What can you do to correct this problem?
- 2. Incorrect Price** You are shopping for groceries and, after loading all items in your cart, it is time to check out. The cashier scans your items, but you realize that the register is not reflecting an advertised discount on one of the items. Why might this be happening?
- 3. Webpage Not Readable** You are attempting to view a webpage on your smartphone, but the text is very small and you are having difficulty reading anything. It is extremely time consuming for you to zoom in and constantly scroll around the webpage to view the contents. What might be causing this?
- 4. Inaccurate Credit Report** You have obtained a free copy of your credit report and notice that multiple companies are accessing your credit report without your knowledge or permission. Your financial records are very important, and it is troubling that other companies are accessing this information. Why might this be occurring?
- 5. Webpage Script** You are viewing a webpage and have just submitted an online form. The browser does not appear to do anything for about one minute, and an error message finally appears stating that a script on the page is taking longer than expected to run. What might be wrong?

Professional

- 6. Data Entry Issues** You are in charge of adding student information to your school's database using a front end. When you attempt to enter the street address for one of the students, the entire street name does not fit in the text box. What are your next steps?
- 7. Incorrect Postal Codes** Your company's database stores information about its customers, including their names, addresses, phone numbers, email addresses, and order history. While reviewing the database to ensure data integrity, you notice that some of the postal codes, which should be five digits, are only four digits. What might be wrong?
- 8. Database Connection Error** While interacting with a web app, an error is displayed informing you that the web app is not able to connect to the database. What might be causing this?
- 9. Database Recovery** Your boss has informed you that the main customer database for your company has become corrupt. Fortunately, you can attempt to use the recovery utility to salvage the data in the database. When you attempt to recover the database, you receive an error message that the recovery has failed. What are your next steps?
- 10. Content Management System Updates** You are attempting to update your company's website using a content management system. When you make the requested changes in the content management system, they are not reflected on the company website. What might be the problem?



Source: Microsoft

Collaboration

- 11. Technology in Sports** You serve as an assistant coach for your former high school's baseball team. The head coach, whose computer is more than five years old, informs you that he would like to create an application that will allow him to keep track of his players' statistics. For instance, he would like to track each player's number of strikeouts, walks, hits, and home runs. Form a team of three people to determine the requirements for implementing his request. One team member will research the types of apps that can track this data, another team member will determine the specifications for a computer or mobile device capable of running the software and storing the data, and the other team member will determine the best way to collect the data during the game.

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

How To: Your Turn

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn exercises**, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Obtain and Verify the Accuracy of a Credit Report

As discussed in this chapter, you might need to obtain or verify the accuracy of your credit report for a variety of reasons. It is important to obtain your credit report at least one time per year to verify its accuracy, as imperfections on a credit report can lead to problems such as financing being declined or higher interest rates on loans. The following steps guide you through the process of obtaining and verifying the accuracy of a credit report.

- Run a browser and then navigate to annualcreditreport.com.
- When you arrive at the website, verify that the browser is using the "https" protocol, indicating a secure connection.
- Tap or click the button to request the report.
- Provide the necessary personal information.
- Select the agency or agencies from which you want a copy of your credit report.
- Tap or click the button to continue to the credit reporting agency's website.
- If necessary, enter the additional requested information to validate your request.
- Follow the remaining instructions on the website to finish obtaining a copy of your credit report.
- Save and/or print a copy of the credit report.

After you have obtained a copy of your credit report, you should verify it for accuracy. The following points describe what to look for when reviewing the report:

- Verify the list of accounts is accurate.
- Verify your payment history.
- Verify current balances are accurate.
- Review your personal information, and report any inconsistencies to the credit reporting agency.
- Review your rights under the Fair Credit Reporting Act.

Exercises

- In addition to the reasons mentioned in this exercise, why else might you want to obtain a copy of your credit report?
- What is a credit score? How can you obtain your credit score? What are the highest and lowest possible credit scores?
- If you find erroneous information on your credit report, what steps can you take to make the necessary corrections?



Source: Central Source, LLC

2 Use a Research Database

Students often use one or more research databases to locate information about a particular topic. Research databases often can be accessed in a public or school library, through a library's website, or through the research database's website. The following steps guide you through the process of using a research database:

- Locate and then navigate to the research database that contains the information you are seeking. Consult a librarian if you need assistance in determining the exact database you should use.
- Determine the location from which you can access the research database. For instance, you may need to access some research databases from a library computer. Other databases are accessible from anywhere if you can verify your identity as a library patron or a student. Some databases are available to the public at no charge or with no other restrictions.

How To: Your Turn

- c. Navigate to the research database you plan to use.
- d. If the research database contains an option to perform an advanced search, tap or click the option to perform the advanced search.
- e. Specify the search criteria. Note that not all research databases will request the same search criteria. The following list contains some common criteria:
 1. Keywords
 2. Author
 3. Publication date
 4. Publication type
 5. Education level
- f. Run the search.
- g. Browse the search results and then tap or click the search result that interests you.

- a. Determine whether your device has a built-in feature or app you can use to locate it in the event it is lost or stolen. If not, locate, install, and run an app that can perform this service. The app you locate and install should meet the following criteria:
 1. The app should be reputable and have good reviews.
 2. Reviews should contain no indication that the app is malicious.
 3. The app should be able to locate, lock, and erase data from your device in the event it is lost or stolen.
 4. You should be able to access or control your phone from a variety of devices (such as smartphones, tablets, laptops, and desktops) and operating systems (such as iOS, Android, Mac OS, and Windows).
 5. The app should be secure so that others cannot inadvertently or maliciously control your device.
- b. From the app's home screen, configure the necessary settings so that you will be able to locate and control your device in the event that it is lost or stolen. Consider configuring the following settings:
 1. Determine which ringer or sound you want to use if you are attempting to locate a lost device.
 2. Specify how to instruct the device to take an appropriate action. For example, you may be able to instruct a device to play a sound (such as a siren) by sending a text message to it with certain wording, or by tapping or clicking a button on a specific website.
 3. Enable the GPS feature on the device so that you will be able to see its location.
- c. Make sure the data on your device is backed up regularly. You can back up your data either to a computer or to the cloud. Some devices have a feature (or apps available) to automatically back up your data in the event it is erased from your device.
- d. Test the features of the app to make sure it works as intended.
- e. In the event the device is lost or stolen, perform the following steps as soon as possible for the best chance at retrieving the device and its data:
 1. Issue a command to the device to lock it.
 2. If you are attempting to locate a phone, call it to see if someone answers. If so, try to retrieve the phone.
 3. If possible, send a text message to the device with your contact information to see if someone contacts you.

Exercises


1. What are some reasons why you might want or need to use a research database?
2. What research databases are available through your school's library?
3. Evaluate three research databases that you may need to use throughout your academic career. Which one do you like the most? Why? Which one do you like the least? Why?



Source: EBSCO Industries, Inc.

3 Protect Your Data If Your Device Is Lost or Stolen

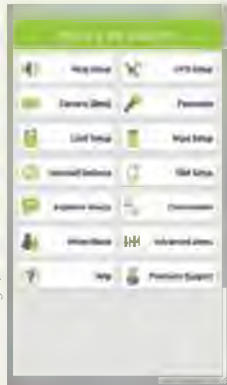
If you misplace your device or it is stolen, you can use another device to help find yours. Certain apps will help you locate your device, cause your phone to ring, display an alert message, take a photo using the front or back camera, or remotely lock the device so that your data will be safe. Some apps require purchasing the full version to access advanced features, such as remotely locking or wiping your device. The following steps guide you through the process of protecting your data if your device is lost or stolen.

How To: Your Turn 


4. Activate the ringer or sound on the device so that you can hear it if it is nearby.
5. If possible, sign in to a web app or access an app on another device to track the device's location using GPS.
6. If possible, take a photo with the device's front and back cameras to see if you can determine where it is located.
7. If you are unsuccessful and you think the data on the device is at risk, issue a command to the device to erase all data. You also might consider contacting law enforcement if you think the device was stolen.

Exercises

1. Have you ever lost or misplaced a device? If so, did you locate it? How?
2. Evaluate at least three apps that can locate and remove data from a lost or stolen device. Which ones did you evaluate? Which is your favorite? Why?
3. Some devices offer a feature that allows you to encrypt the data. Would you encrypt the data on your device? Why or why not? What are the benefits of doing so? What drawbacks exist, if any?



Source: Google, Inc.

 Create and View a Text File

Word processing programs and apps allow you to enter small or large amounts of text into documents; however, these apps apply additional formatting to the document that may not be necessary. For example, if you are writing a program or creating a webpage with HTML, you would not be able to enter the code in a word processing program or app because it would apply additional formatting (such as the font and size used, information about margins, colors, and line spacing) to the file that would interfere with the code you write. A text file stores only the text you write without any additional formatting. For this reason, you are not able to format the text that you enter in a text file. The following steps guide you through the process of creating and viewing a text file.

Creating a Text File

- a. Locate and run a text editor, for example, the Notepad app in Windows or the TextEdit app on a Mac. Some word processing programs and apps can save documents as plain text files.
- b. If necessary, create a new text file.

- c. Enter the desired text, such as HTML or program code, in the file.
- d. When you have finished entering the text, save the file with the appropriate file extension for the type of file you are creating, and verify that you are saving it as a text file. If you used a word processing program or app to create the text file and find that it will not save your file as a plain text file, you can copy the text from the word processing program or app and paste it into a text editor and then save the file from the text editor.
- e. If necessary, exit the text editor.

Viewing a Text File

- a. Run a text editor.
- b. Select the option to open a file.
- c. Navigate to the text file you want to view.
- d. Select the text file you want to view and then tap or click the button to open the file.
- e. When you are done viewing the file, close the file and then exit the text editor.

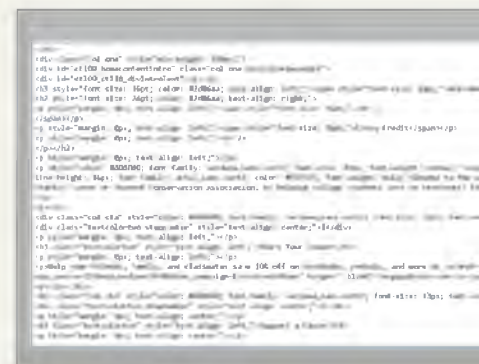
or

- a. Navigate to the text file you want to view.
- b. Press and hold or right-click the text file's icon to display a shortcut menu.
- c. Select the option on the shortcut menu to open the file in the desired text editor.

Note: You should not attempt to view a text file by double-clicking its icon because it may not open in a text editor by default. For example if you create a text file and save it with an .html file extension, double-clicking the file may open it in a browser.

Exercises

1. Have you ever created a file in a text editor? Why? If not, what types of files might you need to create in a text editor?
2. How do file sizes of text files compare with similar files created in a word processing program or app? Why do you think this is the case?
3. Evaluate one third-party text editor that is compatible with your operating system. How does it compare to the one that is included with your operating system? What is the same? What is different?



Source: Cengage Learning

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to challenge yourself with additional Internet Research exercises, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Entertainment

Americans, on average, spend nearly six percent of their income on entertainment, which includes tickets for concerts and movies, electronic equipment, hobbies, and services. They have scaled back their away-from-home activities in favor of in-home entertainment as they have invested in home theaters, high-speed Internet, and game consoles.

Many websites satisfy our cravings for amusement. For example, the Rock and Roll Hall of Fame and Museum has videos, stories, and a comprehensive “The Story of Rock” to enjoy. The Internet Movie Database (IMDb) has facts about more than 2.7 million movies, television shows, and entertainment programs. It also has video highlights, quotes, quizzes, and movie showtimes. Other entertainment websites have a variety of content aimed at amusing visitors and relieving boredom.

Research This: (a) Locate the Rock and Roll Hall of Fame and Museum website and view the information about the latest inductees. What is the total number of inductees? Which artists have been inducted more than once? Describe two upcoming events. Which classes are being offered in the Rock and Roll Night School?

(b) Locate the Internet Movie Database website. Take the IMDb Internet Icon Quiz. What score did you earn? What are three movies opening this week? What is the top news story of the day?

(c) Visit an entertainment website. What content is featured, such as humorous and sports video clips, photos, animations, and audio clips? What categories are available? Are advertisements included in the content? Which content is available at no cost, and which requires a fee to access?



Source: The Rock and Roll Hall of Fame and Museum, Inc.

2 Social Media

Companies collect data as people browse websites. Just seconds after individuals visit a specific webpage, advertisements are displayed matching their shopping patterns and favorite products. This tracking is prevalent in online social networks, too, as marketers match users' profiles and other posted information, such as status updates, with specific businesses. Facebook, for example, allows retailers to upload their databases containing email addresses, phone numbers, and other personal facts. This data then is compared with the Facebook users' data. When a match is found, specific advertisements are displayed. Social media may charge the advertisers each time a user clicks an ad, called CPC (cost per click) or PPC (pay per click), which could range from a few cents to several dollars. Another option is to charge for a specific number of times an ad is displayed, called CPI (cost per impression).

Research This: Locate at least two articles discussing targeting ads on online social networks. How do the businesses place their ads based on the users' online identities and profiles? What steps are taken to ensure the users' privacy? Should users expect companies to collect data about some of their online behaviors in return for using the websites at no charge?

3 Search Skills Verifying Your Search Results

Even though a link to a website or other online resource may appear first in your list of search results, the information it presents may not be accurate. Several strategies exist to help you determine the credibility of search results. Verify the information you read by finding supporting information on other websites or by comparing search results from different search engines. Often authors will provide links to sources within or at the end of an article. Search for information about the author to help determine his or her credibility, authenticity, or objectivity. Some articles may present opinions, not facts.

If you do not recognize or have doubts about the domain name of a website you are reading, type the search text, whois, in a search engine to locate the

Internet Research

WhoIs database. Then type the domain name of the website in question (such as cengagebrain.com) in the WhoIs search box to find its owner. You then can search for more information about the website's owner. If you are looking for time-sensitive information, check the date when the links or pages were updated. If a webpage is filled with ads or pop-ups, it may be a scam.



Source: WhoIs

Research This: Use a search engine to answer these questions and report your findings. (1) Find an article on Wikipedia about relational databases. What references reinforce the statements in the article? (2) Find a popular blog about CRM systems and use WhoIs to determine the blog's owner. (3) Search for a news article about web databases and then find two additional articles by the same author on a similar topic. (4) Search for information about the five most popular content management systems in use today. Do different websites give you different results? How was popularity determined?

4 Security

When you use supermarket loyalty cards, enter contests, complete warranty registrations, apply for credit cards, and subscribe to newsletters, businesses automatically store personal data about you, your transactions, and your preferences in their marketing databases. They often use this data to analyze sales, develop advertising campaigns, and solicit more business from you. Unbeknownst to many consumers, some companies also sell or rent this data to other businesses for the purpose

of developing interest-based or online behavioral advertising. Consumers can refuse to receive targeted email messages and marketing materials, but they often must search the websites or paper forms for check boxes to indicate these opt-out preferences. Some consumer advocates view this practice as an invasion of privacy and urge businesses to default to not adding consumers' information to databases unless the consumer opts in to receive additional materials.

Research This: Visit at least two websites that include opt-in or opt-out provisions and read the disclosure notices. What steps can you take to remove yourself from databases? Which organizations help protect consumers and offer information on maintaining online privacy? Then, search for at least two marketing companies that provide online direct advertising campaigns. How do these companies use databases to match consumers' buying preferences with targeted offers?

5 Cloud Services

Online Databases (DaaS)

Accessing information from online databases is an example of data as a service (DaaS), a service of cloud computing that provides data on demand for use in applications or visualizations. Federal, state, and local governments provide data online to promote transparency and enable users to perform research online. Independent data markets are websites that aggregate and offer data from leading providers, along with web-based tools for exploring, analyzing, and visualizing online data. Data providers make the data available to developers through an API (application programming interface), who incorporate the data in new products, such as web or mobile apps. Users often can explore the data through a web interface.

Research This: (1) Use a search engine to find and visit the open data site for your city, state, or country's government. Select a topic for which data is available, and use the online tools provided to explore a data set and create a visualization in the form of a map or graph. (2) Use a search engine to find and visit an independent data market website, and browse the data sets listed. Select one of the data sets and read about the data it contains. How might an app make use of this data? What pricing models are available for developers who wish to incorporate this data into their apps?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Online Movie Reviews

Information about movie titles and television shows is available from the web database IMDb (Internet Movie Database). Visitors can search IMDb using by title, cast member, year produced, characters, genre, awards, or other criteria. Each movie or show's listing offers a brief description and rating and includes links to such items as summary, trivia, reviews, quotes, and even streaming video options.

Do This: Visit imdb.com and search for both recently released and classic movies. Explain the steps you used to query the movie database. Assess how complete the information provided was. Who would benefit most from using the movie database? Why? Answer the following questions about your experiences. Did the information provided differ when viewing recently released titles versus classic movies? What did you learn from your queries? Can you identify a few fields that are included in the records for each movie? What interactive features can you identify? Can you find any HTML5 features that have been incorporated?

2. Spreadsheets versus Databases

Some individuals and small organizations prefer using spreadsheets instead of databases. People who use spreadsheets might argue that similar to databases, spreadsheets have columns and rows, and you can keep track of different sets of data in individual worksheets. This is similar to how you would use tables in a database to store different data sets. In addition, some find it easier to install, use, and maintain spreadsheet software than database software. After reading this chapter, you are convinced that databases have additional advantages, such as the capability of storing

more data and more quickly searching for data, as well as generating reports.

Do This: Prepare information aimed toward individuals who prefer spreadsheets to databases. Include reasons why it is not advisable to store large amounts of data in spreadsheets, as well as the reporting and querying capabilities of databases. Explain benefits for using a database for collaborating and sharing information among departments in a business.



Source: Microsoft

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The league uses a database to store information about its players, teams, schedules, and statistics. The league's website uses information stored in the database to display team rosters, league standings, and events. The board of directors has asked you to investigate how the league should secure its database.

Do This: Using information learned in the chapter as well as performing additional research, prepare information about securing a database. What risks exist for databases? Who should determine the security measures to take? What should you include in the database security policy? Include recommendations for backing up data, validation, maintenance, and assigning different access levels to employees, coaches, and players. Is the league responsible for security breaches that put players' personal data at risk? Why or why not? Compile your findings.

Collaboration

4. System Development Life Cycle A major retail company has hired your team to create and implement the steps in the system development life cycle (SDLC) to create custom inventory software.

Do This: Assign SDLC steps to different teammates and compile a plan for each step. Share your findings. Does the plan contain gaps? Do any steps or tasks overlap? What guidelines should you follow during system development? What roles are needed? How might you use project management software? As a team, answer the following questions to share with the retail company: Would you use a compiler or an interpreter? Why? Would you use an object-oriented programming language? Why or why not? What types of information gathering techniques would be most effective? Why? Would you recommend outsourcing parts of the process? Why or why not? What is necessary to create a prototype of the project? Search for popular programming languages. Find industry experts' reviews of each language. Can you find an example of a program that uses each language? Which language might be best suited to this project? Why? As a team, compile your findings and share your recommendation with the class.

WORKING IN THE ENTERPRISE: Systems, Certifications, and Careers

12



Various careers are available in the technology field.

“I have enjoyed discovering many facets of the technology field through this course. I would like to continue learning about technology, but I am uncertain of my specific career path. What more do I need to know about the technology field and its careers?”

While you may be familiar with some of the content in this chapter, do you know how to . . .

- Manage information using the five components of information literacy?
- Effectively research and compose a project?
- Set up your home office for telecommuting?
- Explain why those who use unlicensed software may be committing a crime?
- Explain issues surrounding outsourcing of jobs?
- Describe issues that may arise when someone jailbreaks a smartphone or mobile device?
- Start your job search online?
- Create a professional online presence?
- Explain how social media can help your job search?
- Use LinkedIn?
- Create a video resume?
- Create an online survey?

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

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 Objectives

After completing this chapter, you will be able to:

- 1 Identify the qualities of valuable information
- 2 Describe various information systems used in an enterprise
- 3 Identify the components of and steps in information literacy
- 4 Describe career opportunities available in these segments of the computer industry: general business and government organizations and their IT departments; technology equipment field; software and apps field; technology service and repair field; technology sales; technology education, training, and support field; and IT consulting
- 5 Identify job titles and responsibilities for various technology jobs
- 6 Identify mobile app development strategies
- 7 Identify ways to prepare for certification
- 8 Describe the general areas of IT certification
- 9 Identify ways to begin a job search
- 10 Explain how to create a professional online presence

The Technology Industry

Nearly every job requires you to interact with technology to complete projects, exchange information with coworkers, and meet customers' needs. The technology field provides many opportunities for people of all skill levels and interests, and a demand for computer professionals continues to grow. Figure 12-1 identifies some technology-related careers available to today's college graduates. You can use both social media and job search websites to learn about technology careers and to promote yourself to potential employers. By creating a professional online presence, hiring managers can learn more about you beyond what you can convey in a traditional one-page paper resume.

As new technologies emerge, organizations look for potential employees who possess skills and a desire to learn and who are comfortable using all types of technology. This chapter discusses the various types of information systems you may encounter in an organization, as well as technology professionals with whom you might interact. It also explores current technology careers and how you can prepare for them.



Figure 12-1 The technology industry offers many rewarding careers.

© iStockPhoto / jayfish

Information Systems in the Enterprise



Technology Trend

Discover More: Visit this chapter's free resources to learn about crowd sourcing.

Businesses, and their employees, use many types of systems. A system is a set of components that interact to achieve a common goal. A billing system, for example, allows a company to send invoices and receive payments from customers. Through a payroll system, employees receive paychecks — often deposited directly into their bank accounts. A manufacturing system produces the goods that customers order. Very often, these systems also are information systems. Recall from Chapter 11 that an **information system** is a set of hardware, software, data, people, and procedures that work together to produce information. Information systems support daily, short-term, and long-range information requirements of users in a company.

To assist with sound decision making, information must have value. For it to be valuable, information should be accurate, verifiable, timely, organized, accessible, useful, and cost effective.

- Accurate information is error free. Inaccurate information can lead to incorrect decisions. For example, consumers assume their credit reports are accurate. If your credit report incorrectly shows past-due payments, a bank may not lend you money for a vehicle or a house.
- Verifiable information can be proven as correct or incorrect. For example, security personnel at an airport usually request some type of photo identification to verify that you are the person named on the ticket.
- Timely information is useful only within a specific time period. A decision to build additional schools in a particular district should be based on the most recent census report — not on one that is 10 years old. Most information loses value with time. Some information, however, such as information about trends, gains value as time passes and more information is obtained. For example, your transcript gains value as you take more classes.
- Organized information is arranged to suit the needs and requirements of the decision maker. Two different people may need the same information presented in a different manner. For example, an inventory manager may want an inventory report to list out-of-stock items first. The purchasing agent, instead, wants the report alphabetized by vendor.
- Accessible information is available when the decision maker needs it. Having to wait for information may delay an important decision. For example, a sales manager cannot decide which sales representative deserves the award for highest annual sales if the December sales have not been entered in the database yet.
- Useful information has meaning to the person who receives it. Most information is important only to certain people or groups of people. Always consider the audience when collecting and reporting information. Avoid distributing useless information. For example, an announcement of an alumni association meeting is not useful to students who have not graduated yet.
- Cost-effective information should provide more value than it costs to produce. An organization occasionally should review the information it produces to determine if it still is cost effective to produce. Some organizations create information only on demand, that is, as people request it, instead of on a regular basis. Many make information available online so that users can access it as they need it.

Discover More: Visit this chapter's free resources to learn more about daily, short-term, and long-range information requirements of users.

Functional Units

A large organization, commonly referred to as an enterprise, requires special computing solutions because of its size and geographic distribution. A typical enterprise consists of a wide variety of departments, centers, and divisions — collectively known as functional units. Examples of functional units include human resources, manufacturing, and customer service.



Technology Innovator

Discover More: Visit this chapter's free resources to learn about Wikimedia Foundation and its founder, Jimmy Wales.

Some information systems are used exclusively by only one type of functional unit within the enterprise. Table 12-1 lists some of the more common information systems that are used by functional units in a typical enterprise. Other information systems that support activities of several functional units include enterprise resource planning, document management systems, and content management systems.

Table 12-1 Information Systems Used Exclusively by Functional Units in an Enterprise

Functional Unit	Information System
Human Resources (HR)	<ul style="list-style-type: none"> • <i>A human resources information system (HRIS)</i> manages one or more administrative human resources functions, such as maintaining and managing employee benefits, schedules, and payroll.
Engineering or Product Development	<ul style="list-style-type: none"> • <i>Computer-aided engineering (CAE)</i> aids in the development and testing of product designs, and often includes CAD (computer-aided design).
Manufacturing	<ul style="list-style-type: none"> • <i>Computer-aided manufacturing (CAM)</i> controls production equipment, such as drills, lathes, and milling machines. • <i>Material Requirements Planning (MRP)</i> monitors and controls inventory, material purchases, and other processes related to manufacturing operations. • <i>Manufacturing Resource Planning II (MRP II)</i> is an extension of MRP that also includes product packaging and shipping, machine scheduling, financial planning, demand forecasting, tracking labor productivity, and monitoring product quality.
Marketing	<ul style="list-style-type: none"> • Market research systems analyze data gathered from demographics and surveys.
Sales	<ul style="list-style-type: none"> • <i>Salesforce automation (SFA)</i> helps salespeople manage customer contacts, schedule customer meetings, log customer interactions, manage product information, and place customer orders.
Customer Service	<ul style="list-style-type: none"> • <i>Customer relationship management (CRM)</i> manages information about customers, past purchases, interests, and the day-to-day interactions, such as phone calls, email messages, web communications, and Internet messaging sessions.



BTW

Technology Trend

Discover More: Visit this chapter's free resources to learn about how employees and others can monitor their health status.

Enterprise Resource Planning

Enterprise Resource Planning (ERP) integrates MRP II with the information flow across an organization to manage and coordinate the ongoing activities of the enterprise, including product planning, manufacturing and distribution, accounting and finance, sales, human resources, and customer support.

Advantages of ERP include complete integration of information systems across departments, better project management, and improved customer service. Complete integration means information is shared rapidly, and management receives a more complete and timely view of the organization through the information. Project management software often is standardized across an enterprise so that different parts of the enterprise easily can integrate and collaborate on their planning and logistics. Figure 12-2 illustrates how ERP encompasses all major activities of an enterprise.



Figure 12-2 ERP encompasses all of the major activities throughout an enterprise.

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Document Management Systems

Some organizations use document management systems to make collaboration possible among employees. A **document management system (DMS)** allows for storage and management of a company's documents, such as word processing documents, presentations, and spreadsheets. A central library stores all documents within a company or department. The system supports access control, security, version tracking of documents, and search capabilities; it also gives users the ability to check out documents to review or edit them and then check them back in when finished. This information can be used for searches within the document repository. Web-based application document management systems allow individuals and any organization to enjoy the benefits of document management systems as applications running in a browser. Users are granted access to certain parts of the repository, depending on their needs.

Discover More: Visit this chapter's free resources to learn more about web-based application document management systems.

Content Management Systems

A **content management system (CMS)** enables and manages the publishing, modification, organization, and access of various forms of documents and other files, including media and webpages, on a network or the web. CMSs include information about the files and data (metadata). For example, the metadata for a company's employee manual may include the author's name, revision number, a brief summary, and last revision date. A CMS also provides security controls for the content, such as who is allowed to add, view, and modify content and on which content the user is allowed to perform those operations.

Users add content to a CMS through a graphical user interface or webpage. Based on the user's actions, the CMS processes content, categorizes the content, indexes the content so that it later can be searched, and stores the content. Users then access the content stored in the system through a website, company portal, or other application. Read Secure IT 12-1 for security issues related to CMSs.



DMS and CMS

A CMS (content management system) typically includes a DMS (document management system).



Internet Research

What are popular content management systems?

Search for: popular content management systems

SECURE IT 12-1



How Secure Are Content Management Systems?

Content management systems (CMSs) control many websites and online applications. Much of their popularity is due to their ease of use, especially because CMS operators need minimal technical skills to organize and update documents and files. This simplicity, however, is one reason cyberthieves can accomplish malicious attacks. The operators' lack of networking and security knowledge exposes the CMSs to security risks, especially distributed denial of service attacks (discussed in Chapter 5).

The United States Computer Emergency Readiness Team (US-CERT) and other organizations assess CMS vulnerabilities and offer specific actions for operators to follow. These practices include limiting the amount of website content that is displayed automatically, installing updates regularly, changing passwords, removing unused files, and using antivirus programs.

Because of the CMS's vulnerabilities, some security experts recommend the alternative of using HTML and uploading webpages to a web server. HTML allows the programmer to specify precisely how the custom page will

be displayed instead of relying on the CMS's templates. It also alleviates the need to install software upgrades and security updates. A person skilled in HTML programming may be able to develop and maintain a small, static website more quickly than having to conquer the steep learning curve that is associated with some CMSs.

Consider This: Under which circumstances would a company consider coding HTML directly, rather than maintaining a CMS to develop its website? How would a company evaluate and select a particular CMS?

CONSIDER THIS

What are uses of a CMS?

Publishing entities, such as news services, use CMSs to keep websites and web feeds up to date. As news or information is published, it is categorized and updated on the appropriate sections of the website. For example, a sportswriter may submit a story to the CMS and add metadata that indicates the story is a headline story. The CMS categorizes the story so that it is displayed as the first item with a large headline on the sports section of the website and included in the sports section's web feed. The CMS indexes the information in the story so that users who search the website based on keywords in the story will find a link to the story. Bloggers use CMSs to post to their blogs without having to format each entry manually in HTML. Blog posts can be categorized so that readers can search by category for posts on the same topic. Blogs also are searchable. Readers can use the CMS to comment on blog posts, and the blog owner may need to approve the comments before they are published.

Other Enterprise-Wide Information Systems

Some enterprise-wide information systems focus on the collection, organization, and sharing of information so that users can make decisions based on an up-to-date and accurate view of the information. The following sections discuss these information systems.

Transaction Processing Systems A *transaction processing system (TPS)* is an information system that captures and processes data from day-to-day business activities. Examples of transactions are deposits, payments, orders, and reservations. When you use a credit card to purchase an item, you are interacting with a transaction processing system.



TPS

Transaction processing systems were among the first computerized systems that processed business data. Many people initially used the term, data processing, to refer to the functions of these systems.

Information systems use batch or online transaction processing systems (Figure 12-3). With *batch processing*, the computer collects data over time and processes all transactions later, as a group. With *online transaction processing (OLTP)*, the computer processes each transaction as it is entered. For example, when you book a flight on the web, the airline probably uses OLTP to schedule the flight, book the flight, and send you a confirmation message.

Most transaction processing systems today use OLTP because users need information immediately. For some routine processing tasks, such as printing monthly invoices or weekly paychecks, they use batch processing.

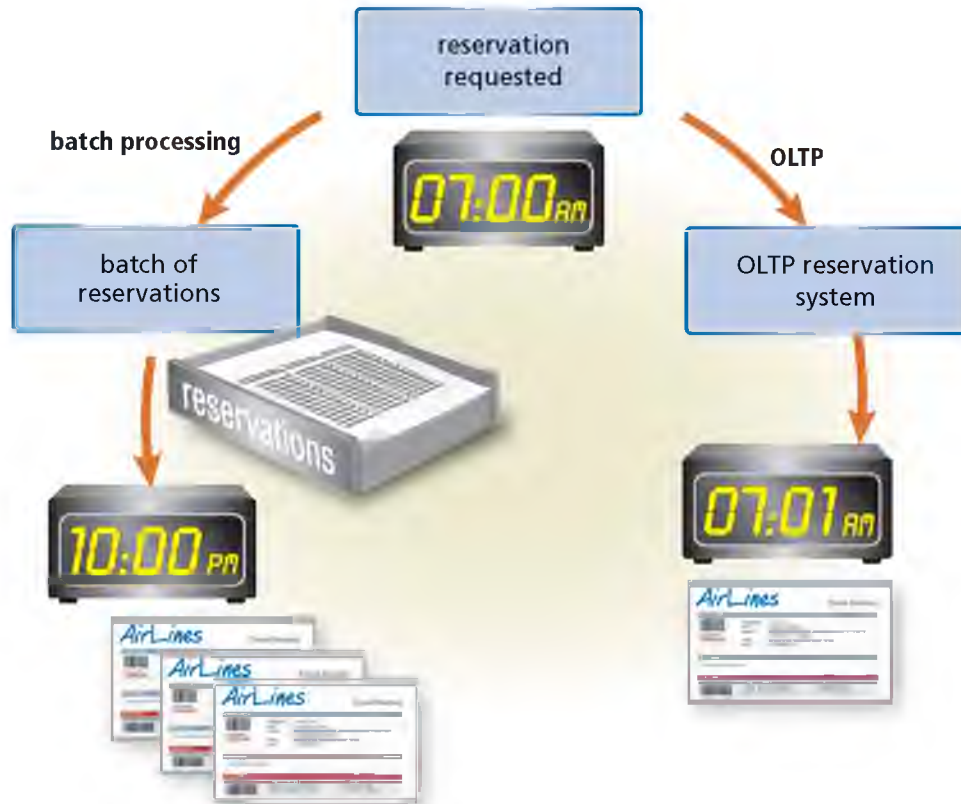


Figure 12-3 With batch processing, all reservations would be processed together at the end of the day. With OLTP, by contrast, reservations are processed immediately.

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Management Information Systems A **management information system (MIS)** is an information system that generates accurate, timely, and organized information, so that managers and other users can make decisions, solve problems, supervise activities, and track progress. Management information systems often are integrated with transaction processing systems and focus on creating information that managers and other users need to perform their jobs.

A management information system creates three basic types of reports: detailed, summary, and exception (Figure 12-4). A *detailed report* usually lists just transactions. For example, a Detailed Flight Report lists the number of passengers booked for a given flight. A *summary report* consolidates data usually with totals, tables, or graphs, so that managers can review it quickly and easily. An *exception report* identifies data outside of a normal condition. These out-of-the-ordinary conditions, called the *exception criteria*, define the normal activity or status range. For example, a Premier Club Booking Exception Report notifies the airline's marketing department that some flights have not met minimum goals for booking Premier Club members.

Discover More: Visit this chapter's free resources to learn more about how managers coordinate resources to make decisions.

Detailed Flight Report for Flight #328				
Passenger Name	Gender	Birthdate	Seat	Premier Club
Adams, Latisha	F	4/25/92	3C	Y
Brewer, Milton	M	10/14/45	22F	N
Cam, Lin	F	12/16/91	2A	Y
Canaan, Lana	F	4/12/90	21A	N
Cole, Kristina	F	5/10/79	16C	N
Drake, Louella	F	3/4/81	4A	Y
Galens, Lynette	F	11/2/75	2C	N
Gilbert, Laura	F	2/20/78	4F	N
Henreich, Max	M	3/10/85	17C	Y
Hidalgo, Ronald	M	10/15/44	3F	Y
Marsh, Constance	F	11/5/82	2C	N
McGill, Teresa	F	2/27/73	16F	Y
Moretti, Leo	M	9/22/90	17A	Y
Nitz, Dawn	F	7/12/65	3F	N
Ruiz, Albert	M	2/13/93	10D	Y
Stein, Michelle	F	8/16/50	3A	N
Tu, Benjamin	M	1/16/77	22C	N
Van Wijk, Fred	M	6/9/89	10A	Y
Warner, Betty	F	7/1/58	16A	N

Summary Flight Report for March 30			
Flight #	Origin/ Destination	Passengers	Premier Club Members
1048	ORD – RSW	108	33
543	ORD – BMI	24	12
715	ORD – LAX	160	62
701	ORD – JFK	26	10

Exception Flight Report for March 30				
Flight #	Class	Origin/ Destination	Premier Club Members	Premier Club Member Goal
1048	A	ORD – RSW	1	4
701	C	ORD – JFK	3	5

Figure 12-4 Three basic types of reports generated in an MIS are detailed, summary, and exception.

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Decision Support Systems A **decision support system (DSS)** helps users analyze information and make decisions (Figure 12-5). Some decision support systems are company specific and designed solely for managers. Others are available to everyone on the web. Programs that analyze data, such as those in a decision support system, sometimes are called *online analytical processing (OLAP)* programs.

A decision support system uses data from internal and external sources. Internal sources of data might include databases, sales orders, MRP and MRP II results, inventory records, or financial data from accounting and financial analyses. Data from external sources could include interest rates, population trends, or raw material pricing.

Some decision support systems include their own query languages, statistical analyses, spreadsheets, and graphics that help users retrieve data and analyze the results. Some also allow managers to create a model of the factors affecting a decision.



Figure 12-5 This decision support system helps managers analyze sales by product and by sales rep.

Courtesy of Dundas Data Visualization, Inc.

**Technology Innovator**

Discover More: Visit this chapter's free resources to learn about Ray Kurzweil (technology inventor and futurist).

Internet Research

What are recent developments in artificial intelligence?

Search for: artificial intelligence applications

Expert Systems An **expert system** is an information system that captures and stores the knowledge of human experts and then imitates human reasoning and decision making (Figure 12-6). Expert systems consist of two main components: a knowledge base and inference rules. A *knowledge base* is the combined subject knowledge and experiences of the human experts. The *inference rules* are a set of logical judgments that are applied to the knowledge base each time a user describes a situation to the expert system.

Expert systems help all levels of users make decisions. Enterprises employ expert systems in a variety of roles, such as answering customer questions, training new employees, and analyzing data. Expert systems also successfully have resolved such diverse problems as diagnosing illnesses, searching for oil, and making soup.



Figure 12-6 This company's restaurant advisor expert system recommends a restaurant based on a user's answers to specific questions.

Courtesy of Exsys

**CONSIDER THIS****How do expert systems relate to artificial intelligence?**

Expert systems are a component of artificial intelligence. **Artificial intelligence (AI)** is the application of human intelligence to computers. Artificial intelligence technology senses a person's actions and, based on logical assumptions and prior experience, takes the appropriate action to complete the task. Artificial intelligence has a variety of capabilities, including speech recognition, logical reasoning, and creative responses.

Mini Feature 12-1: Information Literacy

To adequately manage information, you should know how to use the five components of information literacy and also know the steps in effective research and composition. Read Mini Feature 12-1 to learn about information literacy.

MINI FEATURE 12-1

Information Literacy

Managing the vast amount of information inundating us daily can be an overwhelming task, not only for those involved in technology careers, but also for any digital citizen. This twenty-first century skill set, called *information literacy*, prepares students, employees, and citizens to manage information so that they can be knowledgeable decision makers.

Defining Information Literacy

More than 25 years ago, the American Library Association was the first organization to recognize the importance of information literate citizens. As the web and the Internet became a mainstay in education, business, and home environments, experts realized that the traditional basic literacy skills of reading, writing, and arithmetic were insufficient for living a productive life. According to the Association of College & Research Libraries, also needed are lifelong skills “to locate, evaluate, and use effectively the needed information.”

Information Literacy Components

An individual’s quality of existence depends upon obtaining quality information. Information literate people know how to locate meaningful sources that can be used to solve problems, make decisions, and set goals. The following five categories are recognized as integral literacy components:

- **Digital literacy:** Using computers, mobile devices, the Internet, and related technologies effectively is a necessity in business and society. Also important is an understanding of the general concerns of having computers in the world, including their integration in employment and education and their effects on national and personal security.
- **Library instruction:** Undergraduates rarely seek the help of librarians when performing academic research. This lack of help may be due, in part, to the fact that the students misunderstand the role of the reference librarian. Information literate individuals use the librarians’ expertise in locating relevant sources. They also understand the necessity of using citations, how information is cataloged and organized, search strategies, and the process of locating and evaluating resources.
- **Media literacy:** Skills needed to understand how mass communication and popular culture affect learning and entertainment include the ability to evaluate and analyze how music, film, video, television, and other nonprint media are used effectively to persuade and inform.
- **Numerical literacy:** The ability to use basic math skills and interpret data is essential to solving problems and communicating information. Also important are

understanding how data is gathered and presented in graphs, charts, and other visuals and how to interpret and verify information presented in media.

- **Traditional literacy:** Individuals who can read and understand a variety of documents are likely to complete their educations, obtain employment, and participate in community groups. They also need to think critically about the material they have read and to express their thoughts by writing and speaking coherently.

Steps in Effective Research and Composition

Locating appropriate material, organizing these sources, and producing the final document require effort and careful thought. The following paragraphs discuss steps you should take when crafting research, thinking critically, and drafting strategies:

- **Establish an appropriate topic.** Identify the purpose and audience. Determine an effective method of communicating the information, such as a written paper, oral presentation, or blog. Explore and narrow the topic so that it is manageable within time and logistical constraints. Determine the audience’s familiarity with the topic and the need to find reference materials.
- **Identify sources.** Determine where to locate electronic and print resources, including websites, media, databases, and printed materials. Differentiate between primary and secondary sources, popular and scholarly articles, and current and historical materials.
- **Evaluate materials.** Analyze the sources to determine reliability, accuracy, timeliness, and bias. Compare the materials to determine if the authors agree or disagree with topics.
- **Create the final work.** Organize and integrate the source material using direct quotations, paraphrases, and summaries. Document the work to credit sources and avoid plagiarism. Integrate photos, charts, and graphs when necessary to clarify the message. Use the writing process to create, review, revise, and proofread.

Discover More: Visit this chapter’s free resources to learn more about information literacy components and the steps in effective research and composition.

- **Consider This:** Test your skills at effective research by examining a website for a vehicle you would consider purchasing. Describe the photos, colors, placement of objects, and description. Who is the intended audience? Is any information missing from the website? What message is the company attempting to send? Do you think the message achieves its purpose?



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NOW YOU SHOULD KNOW

Be sure you understand the material presented in the section titled Information Systems in the Enterprise as it relates to the chapter objectives.

Now you should know...

- Whether information is valuable (Objective 1)
- Which enterprise information systems you have used (Objective 2)
- How you can be information literate (Objective 3)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

**New Technologies**

As new technologies and trends emerge, you should stay informed about them to ensure your relevance in the technology market.

Technology Careers

With billions of dollars in annual revenue, the technology industry is a major source of career opportunities worldwide. This industry has created thousands of high-tech career opportunities, even in organizations whose primary business is not technology-related. As technology changes, so do the available careers and requirements. New careers are available in social media and mobile technologies that did not exist a few years ago. For this reason, you should stay up to date with technology developments.

General Business and Government Organizations and Their IT Departments

Business and government organizations of all sizes use a variety of computers, mobile devices, and other technology. Most use networks to ensure seamless communications among employees, vendors, and customers. They also use webpages, email, mobile apps, online social networks, and more to communicate with the public.

Larger organizations use computers and other technology to answer and route phone calls, process orders, update inventory, and manage accounts receivable, accounts payable, billing, and payroll activities. Many use mobile devices, web conferencing, and VPNs (virtual private networks) to stay connected with employees who work in other locations or who telecommute (Figure 12-7). Read How To 12-1 for tips related to setting up a home office for telecommuting. Read Ethics & Issues 12-1 to consider whether telecommuting is good or bad for business.



Figure 12-7 Some organizations allow employees to telecommute.


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HOW TO 12-1

Set Up Your Home Office for Telecommuting

Telecommuting mutually benefits employers and employees. Employers do not have to pay for the physical infrastructure (including office space and parking) for the employee, and telecommuters often work more hours than those who physically commute to an office. Employees benefit from not having to commute and from having a comfortable work environment. The following guidelines describe how to set up your home office for telecommuting:

- Choose a location in your home that is free from noise and distractions. If your home is occupied by others during the hours you plan to telecommute, your office should be located away from potentially noisy areas. For example, an office next to a room where someone else is watching television may not be an ideal choice.
- Make sure your office has a comfortable desk and chair. Although it may be tempting to sit on your couch with your laptop while you work, having a professional workspace will increase productivity.
- Consider acquiring additional furniture, such as a file cabinet and bookshelf, especially if you plan to store files and books for reference.
- If required, verify your office has a sufficient Internet connection. If you are using a wired connection, one should be available near your desk. If you are using a wireless network, make sure the signal strength is sufficient in your office.
- Make sure the office has a phone to place and receive calls. If you will be relying on a mobile phone, verify your phone can receive a strong signal and has a conveniently located charger and power outlet.
- Use a headset with your phone to minimize background noise.
- Obtain supplies that typically are found in an office setting, such as writing utensils, paper, tape, a stapler, paper clips, and sticky notes.
- If your employer does not provide a computer for your use, make sure your computer is sufficiently equipped to complete your job tasks. Make sure you also have accessories, such as USB flash drives and other external storage media, if necessary.
- Consider obtaining an all-in-one printer that can print scan, copy, and fax (if necessary), as well as extra printer cartridges.

 **Consider This:** What other equipment, supplies, and furniture would you prefer to have in an office from where you telecommute?

ETHICS & ISSUES 12-1

Is Telecommuting Good or Bad for Business?

Studies show that nearly 80 percent of workers dream of leaving the confines of an office to work from the comfort of home, at least part of the time. Although employees may view working from home as an ideal situation, some bosses do not agree. An Internet CEO, for example, made news when she reviewed data such as employees' sign-ins to the company's VPN (virtual private network) and discovered that many employees were not working during company hours. As a result, the CEO made the decision to end telecommuting at her company.

Supporters cite reduced pollution and commuting time. Other benefits include increased productivity due to lack of

office gossip and politics. Many feel that they could not be as dedicated to their jobs without telecommuting because of the flexible hours and closeness to home. Others feel that trusted employees should have the privilege if they earn it. Companies benefit by saving on resources, such as office space.

Opponents claim that some lack the self-discipline to work remotely. Employees may be distracted more easily without direct management supervision. Some workers have difficulty setting appropriate boundaries regarding childcare or other family obligations. Additionally, productivity actually may decrease if employees stagger work hours to fit their schedule, limiting times when employees can schedule meetings.

Many experienced workers agree that telecommuting cannot replace valuable face-to-face time with coworkers, vendors, and customers. Some workers fear telecommuting because they feel that the lack of a personal relationship with managers puts them at the top of the list for downsizing.

Consider This: Is telecommuting good or bad for business? Why? Are some businesses or positions better suited for telecommuting? If so, which ones? Do some people lack the self-discipline to be productive while telecommuting? If so, how should managers determine whether to allow this practice and who may participate?

Most medium and large businesses and government organizations have an IT (information technology) department. IT staff are responsible for ensuring that all the computer operations, mobile devices, and networks run smoothly. They also determine when and if the organization requires new hardware, mobile devices, or software. Usually, these jobs are divided into the following areas:

- Management — directs the planning, research, development, evaluation, and integration of technology.
- Research and software development — analyzes, designs, develops, and implements new information technology and maintains and improves existing systems.
- Technical support services — evaluates and integrates new technologies, administers the organization's data resources, and supports the centralized computer operating system and servers.
- Operations — operates the centralized computer equipment and administers the network, including both data and voice communications.
- Training/Support — teaches employees how to use components of the information system or answers specific user questions.
- Information security services — develops and enforces policies that are designed to safeguard an organization's data and information from unauthorized users.
- Marketing/Strategy — directs and implements Internet and social media marketing, and manages customer relationships.



Technology Innovator

Discover More: Visit this chapter's free resources to learn about Meg Whitman (technology business executive).

Technology Equipment

The *technology equipment field* consists of manufacturers and distributors of computers, mobile devices, and other hardware, such as magnetic and optical drives, monitors, printers, and communications and networking devices. In addition to the companies that make end-user equipment, thousands of companies manufacture components used inside a computer or mobile device, such as chips, motherboards, cables and connectors, and power supplies.

Available careers in this field include positions with companies that design, manufacture, and produce computers and input, output, communications, mobile, and networking devices. Careers include designing and fabricating chips, testing internal components (Figure 12-8), assembling computers and devices, and packing finished products.

Discover More: Visit this chapter's free resources to learn about technology equipment manufacturers.



Figure 12-8 This lab technician tests internal computer components.


© iStockPhoto / anyaiavanova

Software and Apps

The *software and apps field* consists of companies that develop, manufacture, and support a wide range of software and apps for computers, the web, and mobile devices. Some companies specialize in a particular type, such as productivity software or tools, or focus on a device type. Other companies — especially larger firms, such as Microsoft — produce and sell many types of software that work with both computers and mobile devices and may use Internet services to sync data among devices or provide collaborative features.

Some employees develop desktop, web, and mobile apps, such as productivity software, games, simulations, and more; others develop operating systems and related tools. Read Secure IT 12-2 to consider how unlicensed software affects software publishers.

Discover More: Visit this chapter's free resources to learn about leading software companies.

 **SECURE IT 12-2** **Using Unlicensed Software Is a Crime**


Software publishers own the copyright to their products. These companies are on the lookout for copies of their software that have been duplicated, distributed, or used without their permission. The pirated software denies these publishers revenue they would have earned from sales, which they could have used to produce new products and improve current products. A recent Business Software Alliance (BSA) Global Software Survey revealed that 43 percent of all software has been installed without proper licensing, including one in five pieces in the United States. This software is valued at more than \$62 billion.

Software may be considered unlicensed in a number of circumstances: it could have been downloaded illegally from file-sharing websites, it could have an expired license, or it could be installed on multiple computers when the license specifies use on only one computer. Using unlicensed software violates copyright laws and is subject to serious

criminal and civil penalties up to \$150,000 for each illegal copy. It is important, therefore, to understand when software can be copied legally. In most circumstances, the software owner can make one copy of the software for backup purposes. Many people make multiple copies, however, either to share or to sell. Often the sharing is done online. In one survey, more than 50 percent of students and 25 percent of instructors admitted that they have copied or would copy software illegally.

People and companies copy software illegally for a variety of reasons, insisting that software prices are too high, that software often is copied for educational or other altruistic purposes, that copied software makes people more productive, that no restrictions should be placed on the use of software after it is purchased, and that software copying is a widespread practice. They also may not be aware that their actions are illegal, but ignorance is not an excuse for illegal actions.

Along with the risk of facing litigation, people and businesses using unlicensed software risk data theft and unauthorized access to their information because they are not receiving program updates and patches that could prevent hacking attempts. If people discover unlicensed software being used on a computer at work or at school, the best practice is to report this situation to managers or IT authorities. The Business Software Alliance encourages people to call its hotline and promises to keep the information confidential.

 **Consider This:** What penalties should be imposed for using unlicensed software? Why? Can you counter the reasons people give for copying software illegally? How? Would you copy software illegally, even if your boss told you to copy it? Why or why not? Should software vendors be allowed to probe your computer secretly for illegally installed software? Why or why not?

Technology Service and Repair

The *technology service and repair field* provides preventive maintenance, component installation, and repair services to customers (Figure 12-9). Some technology service technicians possess general knowledge that enables them to work with a variety of devices from different manufacturers. Other technicians receive training and certifications directly from manufacturers to specialize in devices from that manufacturer. This work is best suited for those individuals who like to troubleshoot and solve problems and who have a strong background in electronics.

Many technology equipment manufacturers include diagnostic software with their computers and devices that assists technicians in identifying problems. Today's technology also allows technicians to diagnose and repair software problems from a remote location; that is, the technician accesses the user's hard drive or smartphone from a different location. Read Ethics & Issues 12-2 to consider the trustworthiness of computer repair services.



Figure 12-9 This repair technician is replacing a laptop hard drive.

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 **ETHICS & ISSUES 12-2**
Can You Trust Data Recovery or Computer Repair Services?

While doing legitimate data recovery and device support tasks, IT workers and computer repair technicians often have access to confidential information. Most often you need to provide your password and access to your network, computer, or device during service. In doing so, you also give access to financial information, confidential records, email and other communications, and passwords. The result could be leaked information or identity theft.

IT workers often sign agreements with organizations stating that they will not access any information that is not critical

to their jobs. Information systems at many government agencies and some organizations log all access to sensitive information. In some high-profile cases, organizations fired or suspended workers after log information proved they violated policies.

In one state, the law requires computer repair technicians who review or analyze data to have a private investigator license. The law implies that the technician is performing an investigation, in a sense, when business managers and parents hire them to analyze the computer usage habits of employees or children.

Privacy experts recommend backing up and wiping all data before turning over your

computer or device to an IT or computer repair technician. You may assume that these professionals likely will follow ethical guidelines. It can be difficult, however, to repair the effects of unauthorized access, use, or distribution of your data.

Consider This: What should the consequences be for IT or computer repair technicians who access unauthorized data? Why? Would licensing and requiring training lessen the impact of unauthorized access? Why or why not? How can you protect your data when repairing or servicing your computer or device?

Technology Sales

Technology salespeople must possess a general understanding of technology and a specific knowledge of the product they are selling. Strong people skills are important, including a keen listening ability and superior verbal communications. Technology salespeople generally determine buyers' needs and direct buyers toward devices, computers, and apps that meet their needs.



Figure 12-10 A salesperson in an electronics store shows a digital camera to customers.
© dotshock / Shutterstock.com

Some salespeople work directly for technology equipment manufacturers, mobile device manufacturers, or software manufacturers. Others work for resellers, including retailers that sell personal computer products. The technology salesperson in a retail store often is a suitable entry-level job for students working toward a certificate or degree in computer-related fields (Figure 12-10). Before consulting the opinion of a salesperson, be sure to independently research the product so that you can better determine whether answers to your questions are unbiased. Read How To 12-2 to learn how to evaluate extended warranty options.

HOW TO 12-2

Evaluate Extended Warranty Options

When you purchase electronic devices, such as computers and mobile devices, retailers and third-party vendors typically offer an extended warranty on the computer or device. These warranties, which are available for a fee, offer services that extend beyond what the device's manufacturer's warranty covers. For example, extended warranties may include replacing parts that break after the manufacturer's warranty expires, accidental damage, or replacing parts that become worn as a result of normal wear and tear. The following guidelines describe how to evaluate extended warranty options:


- Extended warranties can be offered by the manufacturer, retailer, or a third party. Extended warranties offered by a third party sometimes can be less expensive, but it may be more difficult to obtain service for your device. With an extended warranty that is offered by the manufacturer or retailer, it may be easier and faster to obtain service.
- Evaluate the manufacturer's warranty and what it covers. You may find that the additional coverage an extended warranty

provides may not be worth the cost, so do your research first on the manufacturer's warranty. Do not rely on a salesperson to inform you of what a manufacturer's warranty does and does not cover.

- Determine an appropriate length for the extended warranty. For example, if you believe the device will be used for only three years before you will consider replacing it, do not purchase a warranty that extends longer than three years.
- Compare the cost of the warranty with costs associated with repairing or replacing the device. It may be less expensive to pay for one or two repairs instead of purchasing an extended warranty.
- Carefully research devices before you purchase them. Read reviews from people who have purchased the same device, and stay away from devices that are prone to problems. By purchasing a reliable device, you reduce the need for an extended warranty.
- Consider purchasing accidental damage protection. This protection offers either

a repair or replacement of devices that are damaged accidentally. For example, if you drop your phone and the screen cracks, accidental damage protection may cover the repair. The number of repairs or replacements offered through an accidental damage protection plan may be limited, so do your research before purchasing it.

- Do not fall for sales tactics. Salespeople often earn commission or receive incentives for selling extended warranties. For this reason, they will make every effort to convince you of the possibility that something could go wrong. Educating yourself and determining the risk you want to take before purchasing your device will help you make a more informed decision about purchasing an extended warranty.

 **Consider This:** Have you ever purchased an extended warranty? What other factors do you consider when determining whether to purchase an extended warranty?

Technology Education, Training, and Support

Schools, colleges, universities, and private companies all need qualified educators to provide technology-related education and training. The high demand in this field has led to a shortage of qualified instructors at the college level as instructors increasingly move to careers in private industry, which offers the promise of higher pay.

Corporate trainers teach employees how to use software and apps, design and develop systems, write programs, integrate and sync data from apps used on multiple devices, and perform other technology-related activities (Figure 12-11). Many large companies use their own training departments.

Corporations usually require less educational background for trainers than educational institutions require for instructors.

In a more informal setting, a help desk specialist answers hardware, software, and networking questions in person, over the phone, or electronically via email or a chat room. Educational requirements for help desk specialists are less stringent than they are for other careers in the technology field. The help desk specialist position is an ideal entryway into the IT field.



Figure 12-11 A corporate trainer shows employees how to use new software.

© Jenner / Fotolia



Instructors

Your instructors may be helpful resources when you are looking for a job. Because of their professional experience, they may be able to connect you with potential employers, recommend classes you should take, or suggest internship opportunities.

IT Consulting

Technology professionals sometimes become IT consultants after gaining experience in one or more technology-related areas, such as software development, systems analysis and design, network configuration, developing mobile devices, using social media, or web development. An **IT consultant**, typically hired based on expertise, provides technology services to his or her clients. Large enterprises often hire teams of consultants to offer advice about technology-related concerns. IT consultants must possess strong technical skills in their specialized area and must be able to communicate effectively to clients. Read Ethics & Issues 12-3 to consider the effects of outsourcing IT jobs.

ETHICS & ISSUES 12-3



Is Outsourcing Jobs Wrong?

Companies have a long history of outsourcing, or relying on outside companies to perform certain tasks. Outsourcing enables companies to find workers with specialized experience and to control costs. When a company sends jobs overseas, outsourcing becomes offshoring. A skilled computer professional in the United States typically commands a higher salary than an IT worker in other countries. To remain competitive, many companies have chosen to send computer jobs abroad.

Proponents say that the United States has a long history of outsourcing all types of work when the economics of the situation demands it. Companies feel that they have a right to choose to send business tasks abroad if it saves costs. Foreign economies benefit when companies hire and pay

workers a fair wage and provide benefits. American consumers benefit from the reduced cost of goods.

Opponents say that offshoring results in unemployment and harms the economy. Others are concerned that sensitive work, such as health record maintenance or weapons manufacturing, could place U.S. citizens at risk. Some experts state that the work done abroad should be easy to manage and quantifiable in order to ensure it meets company standards. Some companies have received negative press due to inefficiencies in call centers and customer support located abroad.

Government officials and lawmakers struggle with policies regarding offshoring, especially with regard to taxing workers. Politicians debate whether or not companies who keep business in the United States

should receive tax breaks. Many argue that the United States should require companies who hire foreign workers to pay a fair salary and provide benefits comparable to those for American workers.

Consider This: Should the government limit a company's ability to outsource computer jobs to other countries? Why or why not? Should companies receive criticism for outsourcing jobs? Why or why not? What are some possible alternatives to outsourcing that would help to keep a company competitive? What steps can people take in their careers to avoid becoming a victim of outsourcing? Would you pay more money for goods manufactured in the United States? Why or why not?

Putting It All Together — Job Titles and Descriptions

The following sections briefly describe some of the more popular technology-related job titles for several categories of IT careers.

System Development Careers in system development require you to analyze or create software, apps, databases, websites and web-based development platforms, and networks. Some careers are listed in Table 12-2.



Table 12-2 System Development Jobs

Job Title	Job Description
Cloud Architect	Identifies business requirements, strategies, and solutions for cloud storage and services that meet a company's goals or needs
Database Designer	Specifies the structure, interface, and requirements of a large-scale database; determines security and permissions for users
Program and App Developer	Specifies, designs, implements, tests, and documents programs and apps in a variety of fields, including robotics, operating systems, animation, and applications
Systems Analyst	Works closely with users to analyze their requirements, designs and develops new information systems, and incorporates new technologies
Systems Programmer	Installs and maintains operating system software and provides technical support to the programming staff
Web Designer	Designs the layout, navigation, and overall appearance of a website with a focus on user experience; specifies a website's appearance using HTML5, JavaScript, CSS, media, and other web design technologies
Web Developer	Analyzes, develops, and supports the functionality of a website, including applications that often interact with databases or other online resources

Technology Operations Careers in technology operations require you to have knowledge about how hardware, software, and networks function. Some careers are listed in Table 12-3.

 **Table 12-3 Technology Operations Jobs**

Job Title	Job Description
Computer Technician	Installs, maintains, and repairs hardware and servers; installs, upgrades, and configures software; troubleshoots hardware problems
Help Desk Specialist/ Help Desk Technician	Answers technology-related questions in person, on the phone, or via email or an online chat room
Network Administrator/ Engineer	Installs, configures, and maintains LANs, WANs, wireless networks, intranets, Internet systems, and network software; identifies and resolves connectivity issues
Technical Project Manager	Guides design, development, and maintenance tasks; serves as interface between programmers/developers and management

Web Marketing and Social Media Careers in web marketing and social media require you to be knowledgeable about web-based development platforms, social media apps, and marketing strategies. Some careers are listed in Table 12-4.



BTW

Technology Innovator
Discover More: Visit this chapter's free resources to learn about Salesforce (cloud computing company known for its CRM software).

 **Table 12-4 Web Marketing and Social Media Jobs**

Job Title	Job Description
Customer Relationship Management (CRM) Specialist	Integrates apps and data related to customer inquiries, purchases, support requests, and behaviors in order to provide a complete application that manages a company's relationships with its customers
Internet/Social Media Marketing Specialist	Directs and implements an organization's use of Internet and social media marketing, including Facebook pages, Twitter feeds, blogs, and online advertisements
Search Engine Optimization (SEO) Expert	Writes and develops web content and website layouts so that they will appear at the beginning of search results when users search for content
User Experience (UX) Designer	Plans and designs software and apps that consider a user's reaction to a program and its interface, including its efficiency, its effectiveness, and its ease of use

Data Storage, Retrieval, and Analysis Careers in data storage and analysis require you to be knowledgeable about collecting, analyzing, and reporting data from databases or the web. Some careers are listed in Table 12-5.

 **Table 12-5 Data Storage, Retrieval, and Analysis Jobs**

Job Title	Job Description
Data Scientist	Uses analytics and other Big Data tools to compile statistics on data that an organization can use to plan product development or create strategies for marketing
Database Analyst	Uses data modeling techniques and tools to analyze and specify data usage
Database Administrator	Creates and maintains the data dictionary; monitors database performance
Digital Forensics Examiner	Collects and analyzes evidence found on computers, networks, mobile devices, and databases
Web Analytics Expert	Collects and measures Internet data, such as website traffic patterns and advertising, and develops reports that recommend strategies to maximize an organization's web presence

Information and Systems Security Careers in information and systems security require you to be knowledgeable about potential threats to a device or network, including viruses and hacking. Security specialists need to know the tools and techniques to protect against threats. Some careers are listed in Table 12-6.

Table 12-6 Information and Systems Security Jobs

Job Title	Job Description
Computer Security Specialist/ Mobile Security Specialist	Responsible for the security of data and information stored on computers and mobile devices within an organization
Network Security Administrator	Configures routers and firewalls; specifies web protocols and enterprise technologies
Security Analyst	Implements security procedures and methods, looks for flaws in security of a company's devices and networks, works with and trains employees at all levels, and assigns permissions and network settings
Security System Project Manager	Develops and maintains programs and tools designed to provide security to a network
Digital Forensics Analyst	Inspects electronic data to recover documents and files from data storage devices that may have been damaged or deleted, in order to use them as evidence in a crime investigation

App Development and Mobile Technologies Careers in app development and mobile technologies require you to have knowledge about trends in the desktop and mobile app market, as well as the ability to develop secure apps for a variety of computers and mobile devices. Some careers are listed in Table 12-7.

Table 12-7 App Development and Mobile Technologies Jobs

Job Title	Job Description
Desktop or Mobile Application Programmer/ Developer	Converts the system design into the appropriate application development language, such as Visual Basic, Java, C#, and Objective C, and toolkits for various platforms
Games Designer/Programmer	Designs games and translates designs into a program or app using an appropriate application development language
Mobile Strategist	Integrates and expands the company's initiatives for mobile users
Mobile Technology Expert	Develops and directs an organization's mobile strategy, including marketing and app development

Mini Feature 12-2: Mobile App Development

When creating mobile apps, selecting a strategy to develop an app is as important as describing its capabilities. Read Mini Feature 12-2 to learn about three approaches to developing mobile apps.

MINI FEATURE 12-2

Mobile App Development

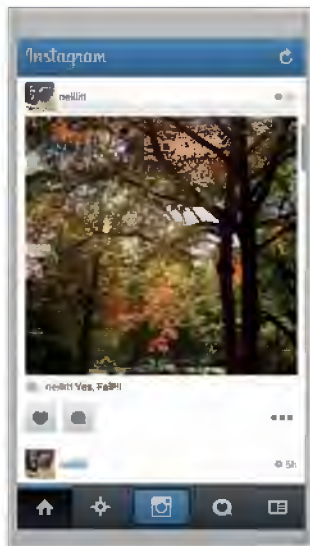
Developers and technology managers should evaluate several possible approaches for creating mobile apps, and make a decision based on both technical and business considerations. Should they invest the time and money it takes to develop high-performing native apps for many different mobile operating systems? Would they be better off creating mobile web apps, written using standard web technologies, to run in a mobile browser? Or should they use a hybrid, or mixed, approach that can simplify the development process and lower development costs at the expense of a possible inconsistent user experience across platforms?

Native Apps

A *native app* is written for mobile devices running a particular mobile phone operating system, such as Google's Android, Apple's iOS, or Microsoft's Windows Phone. They offer fast performance and can store data for offline use. Native apps can access all of a device's content, including its contacts, calendar, and photos, and can interact with its hardware, including the microphone, camera, or accelerometer to measure movement and motion. For example, the native Instagram app shown in the figure below can access the device's camera to take photos.

Apps developed for a specific mobile platform or device generally will not work on another without significant modification. Creating native apps requires programming languages, presentation technologies, and development tools particular to each platform.

After testing to be sure it works properly, developers deploy, or submit, a native app to an app store for approval and distribution. When deploying native apps to Google Play, Apple's App Store, or the Windows Store, developers must ensure that their apps follow rules and conditions that their publishers issue. For example, apps must run properly, may not contain offensive content, and should notify the user when requesting the current location or access to information stored on the device. Developers pay an annual fee to publish apps in an app store. The store retains a percentage of the sales price of any apps sold as a commission.



Mobile Web Apps

Mobile web apps are actually websites that provide a user experience similar to native apps. Developers write them using standard web technologies including HTML5, CSS, and JavaScript. Mobile web apps are not deployed to an app store; rather, they are deployed to a web server and users access them in a mobile browser. Users, therefore, always have access to the most recent version of an app. Creating a shortcut to the app's website and saving it as an icon or tile on a device's home screen provides easy access to the mobile web app. Many mobile web apps have a responsive web design, so that they will be displayed properly on devices with screens of different sizes.

Some companies choose to develop mobile web apps so that they can write one app that works on all devices that is not subject to the rules of an app store. Mobile web apps can access a limited set of device features, such as basic gestures, working offline, tap-to-call, and GPS, but do not have access to native features, such as the camera, microphone, accelerometer, and device notifications. For example, the Instagram mobile web app shown in the figure to the right runs in a browser and only displays photos, but does not allow you to take photos using your device's camera.



Source: Instagram Courtesy of Neil Litt

Hybrid Apps

A *hybrid app* combines features of native and mobile web apps. Like native apps, hybrid apps are developed for specific platforms and deployed to an app store. They can access many of a device's hardware features, such as its camera. Like mobile web apps, they are built with HTML5, CSS, and JavaScript. Developers use development tools to package this code with a browser and prepare it as a native app to deploy to popular app stores. In this way, hybrid apps are cross-platform, meaning the same code can run on many mobile platforms. This approach often saves development time and costs, but may not provide a consistent user experience or fast performance on all devices.

Discover More: Visit this chapter's free resources to learn more about development technologies for creating mobile apps.

Consider This: If an app is available as both a mobile web app and in an app store for you to download, which would you be more likely to use? Why? Suppose you have a great idea for an app, and you raise enough money to hire an experienced developer to build it for you. Would you ask the developer to code it as a web, hybrid, or native app? Why? Does your choice depend on the capabilities and requirements of the app?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the section titled Technology Careers as it relates to the chapter objectives. *Now you should know...*

- Which technology fields you find interesting (Objective 4)
- Which technology jobs you might like to pursue (Objective 5)
- How mobile apps are developed (Objective 6)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Technology Certifications

A certification demonstrates your knowledge in a specific area to employers or potential employers. Organizations often require technology certification to ensure quality standards and to confirm their workforce remains up to date with respect to technology.

Most certification programs do not require academic coursework. Test results alone determine certification. Few professionals, however, have the experience and skill set to take a certification exam without preparation.

To assist in preparing for a certification exam, several training options are available: self-study, online training, instructor-led training, and web resources. Authorized testing centers provide most certification exams for a fee. The exam sponsor's website typically lists testing centers near you. On the website, you can schedule and pay for your exam (Figure 12-12). At a testing center, you may use a computer to take the examination, or you may mark your answers on a form that will be read by a scanner for grading. You likely will know before you leave the testing center whether you passed the examination. Some tests are in a multiple-choice format. Others are skill based. If you do not pass an exam, you may have to pay the fee again to retake it.



Figure 12-12 Certification exam sponsors, such as (ISC)² shown here, provide ways for you to prepare for exams, register and pay for exams, and more.

Source: (ISC)²



Exam Day

Before taking a certification exam, read the instructions provided by the testing center to ensure you bring all necessary supplies, equipment, or technology. Print a copy of the directions in case your GPS device or app fails. Arrive early and silence or turn off your mobile devices. Know approximately how long the exam will take so that you can use your time wisely.

Obtaining a certification requires time and money. Certifications demonstrate your commitment to your chosen area. When deciding whether to obtain a certification, consider your long-term career goals, as well as your current experience. Read evaluations of the certification to determine its value in the industry you have chosen. Examine employment projections and available job opportunities to determine if it is worth obtaining the certification.

Technology certifications are available in many areas, some of which are discussed next.

Application Software Certifications

Although numerous types of application software exist, several programs have achieved national recognition for use as business and graphics tools. Most sponsors of application software certifications have a partner training program and encourage computer-training centers to be authorized training representatives. A popular application software certification includes *Microsoft Office Specialist*, which tests a user's skills of Microsoft Office programs.

As with most other certifications, vendor-authorized testing facilities take registrations and administer the certification test. People with the following jobs may be interested in application software certification:

- Corporate trainers
- Office managers/workers
- Technology teachers
- Help desk specialists
- Technology sales representatives

Discover More: Visit this chapter's free resources to learn more about available application software certifications.

Data Analysis and Database Certifications

Data analysis certifications focus on the discovery, collection, and analysis of evidence on computers and networks. These certifications often contain the word, *forensics*, in their title. Database certifications cover the tasks required to support a database management system. If you are interested in working with data analysis or database certifications, you also may benefit from certifications in hardware, networking, programming, and security.

People with the following jobs may be interested in data analysis and database certification:

- Data scientist
- Database administrators
- Database analysts
- Digital forensics examiners

Discover More: Visit this chapter's free resources to learn more about available data analysis and database certifications.

Hardware Certifications

Hardware certifications vary in scope from a narrow focus with an emphasis on the repair of a specific device to an integrated hardware solution that addresses a company's current and future computing needs. Obtaining an advanced certification in hardware implies that you have achieved a standard of competence in assessing a company's hardware needs, and you can implement solutions to help the company achieve its computing goals. A popular hardware certification includes *A+*, which tests knowledge of computer setup, configuration, maintenance, troubleshooting, basic networking skills, and system software.

People interested in hardware certifications also may benefit from networking and operating system software certifications, which are closely tied to advanced hardware knowledge. People with the following jobs may be interested in hardware certification:

- Cable installation technicians
- Computer repair technicians
- Corporate trainers
- Help desk specialists
- IT consultants
- System engineers and administrators

Discover More: Visit this chapter's free resources to learn more about available hardware certifications.

Networking Certifications

Network expertise is acquired through years of experience and training because so many variables exist for a total network solution. Obtaining an advanced certification in networking implies that you have achieved a standard of competence, enabling you to address the complex issues that arise when planning, installing, managing, and troubleshooting a network. Cisco, Novell, Sun, and others offer certifications that test knowledge of installing, configuring, operating, and administering networks.

People in the following careers may be interested in network certification:

- Hardware service technicians
- IT consultants
- Network managers
- Network engineers
- System administrators

Discover More: Visit this chapter's free resources to learn more about available networking certifications.



BTW

High-Tech Talk

Discover More: Visit this chapter's free resources to learn about bioinformatics (where biologists use technology to analyze, store, and retrieve biological information).

Operating System Certifications

Several options for various knowledge levels are available to those seeking operating system certifications. These certifications focus on particular skills of the user, the operator, the system administrator, and the software engineer. IBM, Microsoft, Novell, RedHat, Sun, and others offer certifications that test knowledge of their operating systems.

If you are interested in an occupation as an operating system administrator or software engineer, you also may benefit from certifications in networking, hardware, and the Internet. These additional certifications are closely linked to the operating system and serve to broaden expertise in that area. (Read Secure IT 12-3 to learn about risks associated with users who make unauthorized modifications to operating systems.) People with the following jobs may be interested in a certification in operating systems:

- Hardware technicians
- Help desk specialists
- Network administrators
- IT consultants
- System administrators

Discover More: Visit this chapter's free resources to learn more about available operating system certifications.

SECURE IT 12-3


Risks of Jailbreaking and Rooting

Copyrights protect creators of original works, and digital rights management (DRM) strategies were developed to prevent people from pirating the owners' digital content. (Refer to Chapter 5 for details about copyrights and piracy.) Hardware manufacturers include DRM software on their products to control the apps and other programs that can be installed. When users want to run unapproved apps and customize their smartphones or mobile devices, they can make unauthorized modifications to the operating system and bypass the DRM

restrictions. This process, called *jailbreaking*, generally refers to hacking into Apple's iPhones and iPads, whereas a similar term, *rooting*, refers to products running Android and other operating systems.

When software developers create apps for Apple's iOS, Apple scrutinizes the software to ensure it adheres to strict guidelines. This review process helps maintain integrity and security. When the phone or mobile device is jailbroken, however, this reliability no longer exists. Apple states that jailbreaking causes these issues: security vulnerabilities,

instability, shortened battery life, unreliable voice and data, disruptions of services, and the inability to apply future software updates. The unauthorized modification violates the end-user license agreement (EULA), so the device may no longer be covered by the manufacturer's warranty.

 **Consider This:** Do you know anyone with a jailbroken smartphone or mobile device? Should Apple ease the limitations that are placed on changing iOS default settings or installing apps and other software from websites other than the App Store?



High-Tech Talk

Discover More: Visit this chapter's free resources to learn how game developers create 3-D graphics, which appear to have height, width, and depth, giving realistic qualities to objects.

Programmer/Developer Certifications

Various certifications are available in the programmer/developer area. These certifications usually are supported with training programs that prepare applicants for the certification test. A popular specific programmer/developer certification includes *Google Apps Certified Specialist*, which tests a user's skills of administering, selling, and deploying Google Apps. A more broad development certification includes *Project Management Professional (PMP)*, which tests knowledge of tasks required during system development.

If you are interested in developing applications, you also may benefit from certifications in networking and web design. These certifications are closely tied to programming and may broaden employment opportunities. People with the following jobs may be interested in a programmer/developer certification:

- Game developers
- IT consultants
- Mobile application developers
- Project leaders/managers
- Systems analyst
- Web developers

Discover More: Visit this chapter's free resources to learn more about available programmer/developer certifications.

Security Certifications

Security certifications measure a candidate's ability to identify and control security risks associated with any event or action that could cause a loss of or damage to computer hardware, software, data, information, or processing capability. (Read Secure IT 12-4 to consider the effects of inadequately protected customer data.) While some security certifications focus solely on network and Internet security, others include measures to secure operating systems, application programs, and information systems, as well as the physical facility and its people. A popular specific security certification includes *Certified Information Systems Security Professional (CISSP)*, which tests in-depth knowledge of access control methods, information systems development, cryptography, operations security, physical security, and network and Internet security. Some security certifications relate specifically to the area of digital forensics.

People in the following careers may be interested in security certification:

- Information security officers and managers
- Law enforcement officials
- Military intelligence officers
- Network administrators
- Wireless network administrators
- Network security specialists
- Security administrators

Discover More: Visit this chapter's free resources to learn more about available security certifications.

SECURE IT 12-4



Protecting Customer Data


Many for-profit and nonprofit companies and organizations have been affected by malware intrusions into their point-of-sale systems. Hackers have broken into retail servers and accessed data for millions of credit and debit card accounts. In one situation, they broke into a large entertainment company's server, disrupting service to its customers and publishing personal data for millions of customers, including passwords and possibly credit card information. The breached company allegedly waited one week to inform customers about the attack. The hackers who exposed this company's data were part of a well-known activist group that routinely targets large corporations and government agencies to expose data vulnerabilities and to protest policies. The group claimed that the company had not encrypted the exposed data

properly. The group's members are unknown, so officials are unable to hold them responsible for their actions.

Customers, however, sued the company for the breach. One lawsuit stated that the company's lack of encryption and adequate firewalls makes it responsible for the hackers' actions. Officials agreed, with one stating, "If you are responsible for so many payment card details and log-in details, then keeping that personal data secure has to be your priority." Customers held the company responsible for the delay in notification. The attack ultimately cost the company an estimated \$170 million. Since the breach, the company changed its user agreement policies. The new policy states that by agreeing to use its products, users give up the right to sue for security breaches.

Thousands of other corporate security breaches have ranged from email phishing

schemes to stolen equipment. Cybersecurity risks affect all businesses because criminals know how to manipulate technology to compromise the networks and install malware. The U.S. Department of Homeland Security, U.S. Secret Service, and the National Cybersecurity and Communications Integration Center work to locate organized criminal groups, warn organizations about potential unauthorized access, and detect intrusions. They provide information about performing risk assessments, installing backup systems, and establishing security policies.

 **Consider This:** Should hackers be punished for exposing customer data? Why or why not? What expectations of security should customers have when they enter personal data on a website or form? Should companies be able to prevent customers from suing them? Why or why not?

**Counselors and Alumni**

If your school has a career center or alumni network, take advantage of these valuable resources. Career counselors and experienced alumni can help you prepare for and secure an interview in your chosen field. They also might provide references to potential employers.

Job Searching and Career Planning

Many job opportunities may exist in your industry, so it is important to narrow down the available jobs to ones for which you are qualified and in which you are interested. Tools at your disposal include the career service department at your school (Figure 12-13), career planning websites, and online social networks. Read How To 12-3 to learn how to start your job search online.

Whether you are seeking a new job or currently are employed, you may find a career planning website useful. Career planning websites often allow you to post your resume online or enter your resume information in a form at the website for potential employers to review. Many also offer mobile apps. Examples of popular career planning websites include CareerBuilder, Dice, and Monster. Use a search engine to locate these career planning websites and their mobile apps.

Discover More: Visit this chapter's free resources to learn more about career planning websites.



Figure 12-13 A college or university career services website, such as the Illinois State University one shown here, provides helpful career planning information.

Source: Illinois State University

HOW TO 12-3

**Start Your Job Search Online**

Starting your job search online will help you locate available jobs and determine whether you are qualified to apply. Performing your research online will save time applying and interviewing for jobs for which you are not qualified. The following steps describe how to start your job search online.

1. Begin your job search by reviewing the information on online social networks, job search websites, and organizations' websites. On these websites, you can learn about career opportunities and prepare for an interview.
2. Follow an organization's activity on Facebook, Twitter, LinkedIn, and other social media channels.
3. Research a company's online activity to become familiar with some of the products, services, and opportunities that they provide.
4. Visit career services websites hosted by your college or university. These websites often contain information about career fairs, resume planning workshops, and campus recruitment activities.
5. Consider visiting a career planning website. These websites offer information about available jobs and local salaries. You
6. Upload your resume to career planning websites and job search websites. Create the resume in a word processing program and then save it in the PDF format so that it has a consistent appearance when viewed on a variety of computers or mobile devices.



Consider This: Have you ever searched for a job online? Why or why not? If so, were you successful in finding a job for which you were qualified?

Mini Feature 12-3: Creating a Professional Online Presence

In addition to the information provided in a job application and resume, many employers will search the web to learn more about job candidates. For this reason, both beginning and established technology professionals promote themselves online. Read Mini Feature 12-3 to learn about creating a professional online presence.

MINI FEATURE 12-3

Creating a Professional Online Presence

An understanding of the web, digital media, and online social networks, such as LinkedIn, is beneficial in creating your online presence.

Recommended Online Strategies

A professional online presence that positively conveys your accomplishments, skills, interests, and personality offers potential employers a more complete picture of you beyond what can be conveyed in a resume.

- Register a form of your name as a domain name and host a blog or website at that web address. If your name is not available or you do not have access to a web server, include your name as part of the web address for your website on a free service, such as Blogger or WordPress.
- Avoid informal or humorous names for your account profiles, blog title, or domain name.
- Include a photo of yourself that presents your best self.
- Use a webcam to create a 30-second video in which you introduce yourself. In the video, summarize your skills and professional interests. Post the video on YouTube or another video sharing site and include a link to it on your blog or website.
- Upload a PDF file of your resume, and include a link to it on your blog or website.
- Include links to your LinkedIn and Twitter profiles on your blog or website.
- Include links to any other publications, articles, videos, or digital content you have created.
- Create consistent accounts on online social networks. Read Ethics & Issues 12-4 to consider ways that social media can help in your job search.
- Post appropriate content to your blog, website, or online social networks regularly.
- Before uploading your resume or publishing your blog or website, ask at least two people to proofread content for any spelling and grammar mistakes. Keep the language professional.


Using LinkedIn

LinkedIn is an online social network where professionals, such as Reid Hoffman, founder of LinkedIn, can create profiles and connect with coworkers and industry colleagues. LinkedIn uses the term, contacts, to describe the individuals in your professional network and also stores your relationship with each contact in your network. Read How To 12-4 for steps to create a LinkedIn profile.

Use LinkedIn to:

- Connect with or stay in touch with current and former coworkers and classmates.
- Follow companies on LinkedIn to stay informed of job openings.
- Use LinkedIn's employment database to learn about career opportunities. View the job listing to find the name of the person who posted the job and to determine the connections between you and those members you might want to contact in order to learn about a company or open jobs.
- Join groups of people with similar interests or experiences. For example, your school's alumni group, people who work at the same company, people looking to share experiences they had when starting their own businesses, and people who use specific apps might be willing to share their expertise.
- Consider expanding your network by connecting with your contacts' connections. If you invite an extended contact to connect, be sure to include a note that introduces yourself and indicates your professional reason for connecting.

Discover More: Visit this chapter's free resources to learn more about maintaining a professional online presence and using LinkedIn.

 **Consider This:** What online resources should you use to create a professional online presence? Why? What groups or companies should you join or follow on LinkedIn? What steps will you take to enhance your professional online presence?

BTW

Online Social Networks

Online social networks revise their privacy settings often. Periodically revisit your privacy settings on all personal social media accounts to ensure you have chosen the most current options that will secure your privacy.



Source: LinkedIn

ETHICS & ISSUES 12-4

How Can Social Media Help Your Job Search?

It is no secret that what you do or say on social media can affect you in the job search. As previously mentioned, many employers check potential employees' social media profiles, including Facebook, Twitter, Google+, and LinkedIn, as part of the screening process. You likely are aware that you should use privacy settings and to be careful what you post, but how can you use social media tools to aid you in your job search?

Employers not only look for red flags (inappropriate or inflammatory posts, typographical errors, poor grammar, or photos that show unsavory or unethical

activities), but also for reasons to offer the candidate a position. A social media profile that presents you as professional and lists your qualifications can lead an employer to put you ahead of others. Employers also use social media to determine if a candidate's personality would fit into the corporate culture.

Instead of hiding all information behind privacy settings, employment experts recommend several social media strategies for job seekers. Create a profile that shows an interest in topics relevant to your profession. Use LinkedIn and other resources to follow companies and industry professionals to be aware of events, news, or job openings. Network with students,

colleagues, and industry contacts. Present consistent information, especially regarding education and experience, across all social media platforms. Consider using Twitter to share industry news, to demonstrate not only your interest, but your enthusiasm for the field.

Consider This: Does your social media presence reflect your interest in your desired field? What changes can you make so that your profile stands out among other job candidates? How does your profile compare to others in your industry? What can you gain by using social media to network or find industry information?

HOW TO 12-4

Create a Professional Presence on LinkedIn

Building a professional profile and network on LinkedIn can help you locate professionals who can introduce you to employees at companies where you might like to work. In addition, LinkedIn also helps prospective employers locate you. Upon joining LinkedIn, you specify a profile that allows contacts, prospective contacts, and others to learn about you. The following steps describe how to create a professional presence on LinkedIn.


1. Include your full name, and avoid using nicknames.
2. Select and upload a professional photo. Consider using a high-quality photo that

clearly shows your face, and make certain you are dressed professionally in the photo.

3. Include comprehensive information about your work experience, education, and skills.
4. If you have any professional publications, websites, or blogs, be sure to list them and provide web addresses.
5. Build your network on LinkedIn by finding other LinkedIn members to add to your network. To see if any of your current acquaintances are on LinkedIn, you can import email addresses from your email address book or import profiles of friends from other online social networks. LinkedIn also may suggest

people you may know from a school you attended or company for which you work(ed).

6. Ask other members to provide recommendations about your skills.
7. Review your extended contacts (the network of your contacts' contacts) and determine whether you should connect directly with any of them.
8. As your work experience, education, or skills change, be sure to promptly update your LinkedIn profile.

 **Consider This:** What professional information is, or will you put, in your LinkedIn profile?

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Technology Certifications, and Job Searching and Career Planning, as it relates to the chapter objectives.

Now you should know . . .

- How you can prepare for a certification (Objective 7)
- Which types of certifications you find interesting (Objective 8)
- How you can begin a job search (Objective 9)
- How you can create a professional online presence (Objective 10)

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Chapter Summary

This chapter discussed information systems used in an enterprise. It also presented various technology career fields and specific technology jobs. It then discussed technology certifications. Finally, it described how to begin a job search and create a professional online presence.

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- Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Architecture and Design

While walking down the city street, you stop to admire a new skyscraper with the most striking architectural features you ever have seen. You think to yourself that those responsible for designing the building are nothing less than brilliant. While a great deal of time is spent by people designing the building, computers and technology also play an important role in making the process more efficient. Today's tools allow architects and designers to see exactly what a finished building will look like before construction even begins.

During the preliminary design process, architects and design firms use CAD software to design the appearance and layout of a new building and can provide clients with a 3-D walk-through of a building so that they can determine whether the proposed design will meet their needs. Later, the program can be used to include the placement of support beams, walls, roof shape, and so on, and also conform to building codes.

CAD software also allows engineers in various fields, such as mechanical and electrical, to design separate layers in a structure. The software then can superimpose the designs to check for interactions and conflicts, such as if a structural beam in one layer interferes with a drain in another layer. The CAD software makes it easy to modify and correct the

structure before it is built, which can save time and money during the construction process. This software also eliminates most, if not all, of the manual drafting required.

Engineers use computers to determine the type of foundation required to support the building and its occupants; the heating, ventilating, and air conditioning (HVAC); the electrical requirements; and how the building may withstand external threats, such as hurricanes and tornadoes.

At the conclusion of the architecture and design process, contractors can use the information from computers to estimate the

total cost to build the structure. If, while construction is ongoing, a need arises to modify the building's design in some way, computers can incorporate a change and quickly provide plans for the new design.

The next time you notice a building under construction, stop to think about how computers and technology have increased the efficiency of the architecture and design process.

Consider This: How else might computers and technology be used in architecture and design?



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Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to test your knowledge of digital content associated with this chapter and access the Study Guide resource from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- A(n) _____ system is a set of hardware, software, data, people, and procedures that work together to produce information.
- List and describe seven criteria that make information valuable.
- Describe how functional units in an enterprise use information systems.
- Define the term, enterprise resource planning (ERP). What are the advantages of ERP?
- Explain the uses of and relationship between a document management system (DMS) and a content management system (CMS).
- Describe security issues surrounding use of a CMS. List uses of a CMS.
- List transactions that may occur when using a transaction processing system (TPS). Differentiate between batch and online transaction processing.
- Define the term, management information system (MIS). Differentiate among the three types of reports an MIS generates.
- Describe how a decision support system (DSS) is used. OLAP stands for _____.
- List types of internal and external sources used in a DSS.
- A(n) _____ system is an information system that captures and stores the knowledge of human experts and then imitates human reasoning and decision making. Define the terms, knowledge base, inference rules, and artificial intelligence (AI).
- Define the components of information literacy. List steps in effective research and composition.
- List guidelines for setting up your home office for telecommuting. Explain issues surrounding telecommuting.
- List and describe the areas typically found in an IT department.
- Describe the technology equipment field, and list possible jobs in this area.
- Explain different types of companies in the software and apps field.
- Explain security issues that arise when using unlicensed software.
- Describe the technology service and repair field. Explain how technicians use diagnostic software.
- Explain the issues surrounding data recovery and computer repair services.
- List criteria needed to be a technology salesperson. Describe various careers in this field.
- Explain how to evaluate extended warranty options for electronic devices.
- Describe the role of a corporate trainer.
- Explain the responsibilities and educational requirements of a help desk specialist.
- Define the roles an IT consultant might fulfill.
- Explain issues surrounding outsourcing and offshoring of jobs.
- List requirements and available careers for the following areas: system development; technology operations; web marketing and social media; data storage, retrieval, and analysis; information and systems security; and app development and mobile technologies.
- Describe three approaches to developing mobile apps.
- Explain how and why an employee or employer might value or require technology certifications. What options are available to prepare for a certification exam?
- Describe the benefits of obtaining an application software certification. List jobs that may require, or jobholders who may benefit from, obtaining this certification.
- Explain the focus of a data analysis certification. List jobs that may require, or jobholders who may benefit from, obtaining this certification.
- Explain why an employee might obtain an advanced hardware certification. _____ is a popular hardware certification.
- List jobs that may require, or jobholders who may benefit from, obtaining a hardware certification.
- Explain the expertise necessary to achieve a networking certification. List jobs that may require, or jobholders who may benefit from, obtaining this certification.
- List options that are available for operating system certification. Name companies that offer operating system certifications.
- List jobs that require, or jobholders who may benefit from, obtaining an operating system certification.
- Explain security issues surrounding jailbreaking and rooting.
- List examples of programmer/developer certifications. List jobs that may require, or jobholders who may benefit from, obtaining this certification.
- Explain what is measured by obtaining a security certification. Name one popular specific security certification.
- Describe how security breaches of customer data might occur. Explain the responsibility of a company to protect its customer data.
- List jobs that may require, or jobholders who may benefit from, obtaining a security certification.
- List steps to start your job search online.
- Explain how a job seeker might use a career planning website. List examples of popular career planning websites.
- List strategies to create a professional online presence. Explain how professionals use LinkedIn.
- Explain how social media can help your job search.
- List steps to create a professional presence on LinkedIn.

You should be able to define the **Primary Terms** and be familiar with the **Secondary Terms** listed below.

Discover More: Visit this chapter's premium content to **view definitions** for each term and to **access the Flash Cards** resource from your smartphone, tablet, laptop, or desktop.

Key Terms

Primary Terms (shown in bold-black characters in the chapter)

artificial intelligence (AI) (560)	decision support system (559)	help desk specialist/help desk technician (569)	search engine optimization (SEO) expert (569)
cloud architect (568)	desktop or mobile application programmer/developer (570)	information system (554)	security analyst (570)
computer security specialist/mobile security specialist (570)	digital forensics analyst (570)	Internet/social media marketing specialist (569)	security system project manager (570)
computer technician (569)	digital forensics examiner (569)	IT consultant (568)	systems analyst (568)
content management system (CMS) (577)	document management system (DMS) (556)	management information system (MIS) (558)	systems programmer (568)
customer relationship management (CRM) specialist (569)	Enterprise Resource Planning (ERP) (555)	mobile strategist (570)	technical project manager (596)
data scientist (569)	expert system (560)	mobile technology expert (570)	user experience (UX) designer (569)
database administrator (569)	games designer/programmer (570)	network administrator/engineer (569)	web analytics expert (569)
database analyst (569)		network security administrator (570)	web designer (568)
database designer (568)		program and app developer (568)	web developer (568)

Secondary Terms (shown in italic characters in the chapter)

<i>A+</i> (573)	<i>hybrid app</i> (571)	<i>salesforce automation (SEA)</i> (555)	<i>technology service and repair field</i> (565)
<i>batch processing</i> (558)	<i>inference rules</i> (560)	<i>software and apps field</i> (564)	<i>transaction processing system (TPS)</i> (557)
<i>Certified Information Systems Security Professional (CISSP)</i> (575)	<i>information literacy</i> (561)	<i>summary report</i> (558)	
<i>computer-aided engineering (CAE)</i> (555)	<i>jailbreaking</i> (574)	<i>technology equipment field</i> (564)	
<i>computer-aided manufacturing (CAM)</i> (555)	<i>knowledge base</i> (560)		
<i>customer relationship management (CRM)</i> (555)	<i>Manufacturing Resource Planning II (MRP II)</i> (555)		
<i>detailed report</i> (558)	<i>Material Requirements Planning (MRP)</i> (555)		
<i>exception criteria</i> (558)	<i>Microsoft Office Specialist</i> (572)		
<i>exception report</i> (558)	<i>native app</i> (571)		
<i>Google Apps Certified Specialist</i> (574)	<i>online analytical processing (OLAP)</i> (559)		
<i>human resources information system (HRIS)</i> (555)	<i>online transaction processing (OLTP)</i> (558)		
	<i>Project Management Professional</i> (574)		
	<i>rooting</i> (574)		



decision support system (559)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. Accessible information has meaning to the person who receives it. (554)
- _____ 2. A typical enterprise consists of a wide variety of departments, centers, and divisions — collectively known as functional units. (554)
- _____ 3. CMSs are popular in large part because of their ease of use; CMS operators need minimal technical skills. (557)
- _____ 4. In most circumstances, the licensed software owner can make multiple copies of software, for back up or to share with other users. (565)
- _____ 5. It is good practice to back up and wipe all data before turning over your computer or device to an IT or computer repair technician. (566)
- _____ 6. With third-party extended warranties, it is easier to obtain quick service for your device than returning it to the retailer. (567)
- _____ 7. Educational requirements for help desk specialists are far more stringent than they are for other careers in the technology field. (567)
- _____ 8. Apps developed for a specific mobile platform or device generally work on any other device without any modification. (571)
- _____ 9. Like native apps, hybrid apps are developed for specific platforms and deployed to an app store. (571)
- _____ 10. Most professionals have the experience and skill set to take a certification exam without preparation. (572)
- _____ 11. Data analysis certifications focus on the discovery, collection, and analysis of evidence on computers and networks. (573)
- _____ 12. Employers often use social media to determine if a candidate's personality would fit into the corporate culture. (578)

Multiple Choice

Select the best answer.

1. _____ information is arranged to suit the needs of the decision maker. (554)

a. Verifiable	c. Timely
b. Organized	d. Cost-effective
2. A(n) _____ allows for storage and management of a company's documents. (556)

a. CMS	c. MRP II
b. DMS	d. ERP
3. With _____, the computer processes each transaction as it is entered. (558)

a. batch processing	c. rooting
b. inference rules	d. online transaction processing
4. A(n) _____ report consolidates data usually with totals, tables, or graphs. (558)

a. detailed	c. exception
b. summary	d. criteria
5. In an expert system, the _____ is the combined subject knowledge and experiences of the human experts. (560)

a. inference rules	c. decision support system
b. artificial intelligence (AI)	d. knowledge base
6. Which of the following skills is *not* necessary for technology salespeople? (566)

a. a general understanding of technology
b. specific knowledge of the product they are selling
c. testing internal components
d. strong people skills
7. A(n) _____ is written for mobile devices running a particular mobile phone operating system. (571)

a. native app	c. DSS
b. hybrid app	d. expert system
8. If you are interested in developing applications, you also may benefit from certifications in _____. (574)

a. hardware	c. networking and web design
b. operating system	d. CISSP

Checkpoint

Matching Match the terms with their definitions.

- | | |
|---|---|
| _____ 1. MRP (555) | a. processing system in which the computer processes each transaction as it is entered |
| _____ 2. CRM (555) | b. application of human intelligence to computers |
| _____ 3. ERP (555) | c. information system that manages information about customers, past purchases, interests, and the day-to-day interactions |
| _____ 4. OLTP (558) | d. program that combines features of native and mobile web apps |
| _____ 5. artificial intelligence (560) | e. process of hacking into iPhones and iPads in order to make unauthorized modifications to the operating system and bypass DRM restrictions |
| _____ 6. inference rules (560) | f. broad development certification that tests knowledge of tasks required during system development |
| _____ 7. hybrid app (571) | g. information systems that monitors and controls inventory, material purchases, and other processes related to manufacturing operations |
| _____ 8. A+ (573) | h. hardware certification that tests knowledge of computer setup, configuration, maintenance, troubleshooting, basic networking skills, and system software |
| _____ 9. jailbreaking (574) | i. set of logical judgments that are applied to the knowledge base each time a user describes a situation to the expert system |
| _____ 10. Project Management Professional (574) | j. integration of MRP II with the information flow across an organization to manage and coordinate the ongoing activities of the enterprise |

Consider This Answer the following questions in the format specified by your instructor.

- Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (563, 566, 568, 578), How To (563, 567, 576, 578), Mini Features (561, 571, 577), Secure IT (557, 565, 574, 575), and Technology @ Work (579).
- What elements are contained in an information system? (554)
- What are the qualities of valuable information? (554)
- What are some common information systems used by functional units in a typical enterprise? (555)
- What are some advantages of ERP? (555)
- In addition to documents, what other items can be included in a CMS? (557)
- What factors make CMSs so popular? (557)
- Who assesses CMS vulnerabilities? (557)
- How does batch processing differ from online transaction processing (OLTP)? (558)
- How do detailed reports, summary reports, and exception reports differ? (558)
- What are some examples of internal and external sources that a decision support system might use? (559)
- How do enterprises use expert systems? (560)
- What are some capabilities of artificial intelligence? (560)
- What are the five categories recognized as integral literacy components? (561)
- What are the benefits of telecommuting? (563)
- What are some responsibilities of IT staff? (564)
- What careers are available in the technology equipment field? (564)
- Under what circumstances is software considered unlicensed? (565)
- What individuals might be best suited for a career in the technology service and repair field? (565)
- How might your information be compromised if a computer repair technician works on your computer or mobile device? (566)
- What skills must an IT consultant have? (568)
- What are some disadvantages of offshoring? (568)
- What knowledge is required to work in a technology operations job? (569)
- What are some typical rules and conditions developers must follow in order to deploy an app to an app store? (571)
- What are the drawbacks of hybrid apps? (571)
- What options are available to help you prepare for a certification exam? (572)
- What is meant by the term, rooting? (574)
- What issues does jailbreaking cause? (574)
- What tools can help you search for a job? (576)

Problem Solving

The **Problem Solving** exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The **Collaboration** exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Keywords for Job Search** After taking your third computer class, you realize that you would like to train people how to use computers and software. You look for a job online and are asked to enter some keywords for your job search. What keywords will you enter to find a job that allows you to train others how to use computers and software?
- 2. Online Job Search** Having decided to work in the computer equipment field, you begin your job search online. In addition to looking on job search websites for available positions, where else might you find job postings?
- 3. Documenting Education and Experience** You are preparing your resume to submit to a computer service and repair company. You have studied computer service and repair in various classes and want to convince your prospective employer that you are the best candidate for the job. What might convince the employer to offer you a job?
- 4. Contemplating a Job Offer** After graduating from college with a degree in computer science, you send your resume to several companies. Almost immediately, you receive a job offer as a technical support representative in a midsized organization. Will you accept this job offer or wait for additional offers? Why?
- 5. Appropriate Certification** Because you hope to pursue a career as a system administrator, you would like



Source: (f)C

to obtain a certification. Many certifications are available, but you want to choose the one(s) that will best prepare you for your future career. Which certification(s) will you consider?

Professional

- 6. Staying Current with Technology** Having accepted a job as a computer salesperson, you now realize the importance of staying up to date with the latest technologies and products. What are three ways that you can stay current in the technology field while working full time?
- 7. Outsourcing IT Positions** As the chief information officer for a large organization, you consider outsourcing various positions within your department to save money. What are some types of positions that can be outsourced easily? What positions might be difficult to outsource? Why?
- 8. Conducting an Interview** You are preparing to conduct several interviews for candidates applying for a job as a senior systems administrator. What types of questions will you ask during the interview to determine whether they have the experience required to fulfill the job responsibilities?
- 9. Tough Decision** Two top candidates who applied for a job within your organization have interviewed well, and you are having difficulty selecting which candidate should be offered the job. One candidate has several certifications and only two years of job-related experience, while the other candidate has six years of experience, but no certifications. What decision will you make, and why?
- 10. Training Decision** Your boss has allocated money to allow everyone in the IT department to attend training related to their job responsibilities. While researching the training available for your job as a system administrator, you learn that you either can take a semester-long course at a local university or attend an accelerated one-week, forty-hour training course. At the end of each training session, you will be ready to become certified. Which type of training will you choose? Why?

Collaboration

- 11. Technology in Architecture and Design** As a student in a drafting class, your instructor has challenged you to design your dream home by using programs and apps wherever possible. Form a team of three people that will determine how to accomplish this objective. One team member should compare and contrast two programs or apps that can be used to create a two-dimensional floor plan, another team member should compare and contrast two computer-aided design programs or apps that can create a more detailed design of the house, and the third team member should compare and contrast two programs or apps that can assist with other aspects of the design process, such as landscaping and interior design.

The How To: Your Turn exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

How To: Your Turn

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn exercises**, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Conduct an Effective Interview

Gathering information is an important task, whether you are trying to assess whether a job candidate would be a good fit for an open position, or if you need to gather feedback about a new system you are developing. An important means of gathering information is the personal interview. Interviews must be thorough and comprehensive. Prior to conducting an interview, you must determine that an interview is the best means for obtaining the information you seek. You have learned a variety of ways to obtain information, and you should use each of them appropriately. Because an interview may interrupt a person's schedule and takes time, you must be sure the information gained in the interview justifies this interruption. Once you have determined you should conduct an interview to gather information, plan to ask questions that will generate useful answers. The following steps guide you through the process of conducting an interview that ultimately will generate useful answers.

- a. Your questions should directly address the goals of the interview. Do not expect the person being interviewed to provide a tutorial. Your questions must generate answers that supply you with the information you need to make a decision.
- b. Your questions should be thought-provoking. In general, do not ask questions requiring a yes or no answer. Your questions should not lead the interviewee to an answer — rather, the questions should be open-ended and allow the person to develop the answer. As an interviewer, never argue with the person being interviewed, do not suggest answers or give opinions, ask straightforward questions rather than compound questions, never assign blame for any circumstance that might come up in the interview, and never interrupt while the person is talking. Finally, you, as the interviewer, should not talk much. Remember, you are conducting the interview to gain information, and it is the person you are interviewing who has that information. Let him or her talk.

- c. Pay attention carefully, with your ears and your eyes. What you hear normally is most important, but body language and other movements often convey information as well. Concentrate on the interviewee — expect that you will make much more eye contact with the person than he or she will with you. Allow silences to linger — the normal impulse in a conversation is to fill the silence quickly; in an interview, however, if you are quiet, the person being interviewed might think of additional information.
- d. As you listen, concentrate on the interviewee. When points are being made, do not take notes because that will distract from what the person is saying; stay focused. Once the information has been conveyed, jot down a note so that you will remember.
- e. Throughout the interview, offer reinforcing comments, such as, “The way I understand what you just said is ...” Make sure when you leave the interview that no misunderstandings exist between you and the person you interviewed.
- f. Before you conclude the interview, be sure all your goals have been met. You may not have another opportunity to interview the person, so ensure you have asked sufficient questions to gain the information you need to make a decision.
- g. After the interview, it is recommended you send a follow-up email message or letter to the person you interviewed to review the information you learned. This message or letter should invite the interviewee to correct any errors you made in summing up your findings. In addition, for all the people you interview, keep a record of the time and place of the interview. In this way, if any questions arise regarding the interview, you will have a record.

Interviewing Online

If you are not in the same physical location as the people you want to interview, it may be better to conduct the interview online. If you plan to conduct the interview online, consider the following advice:

How To: Your Turn

- Plug in the computer or device so that you do not have to rely on battery power. If you must rely on battery power, be sure that the battery is fully charged.
 - Use a wired Internet connection, rather than connecting to a wireless network, to minimize the risk of losing Internet connectivity during the interview.
 - Select a location for the video call that has a neutral background and is free from distractions.
 - Know how to initiate or receive a video call.
 - Exit your email, chat, and other unnecessary applications during the interview so that you are not distracted or interrupted by alerts and notification messages.
 - Test the videoconferencing software in advance to ensure the configuration works.
 - Adjust the microphone, webcam, and speakers before the actual interview to ensure optimum call quality.
 - Practice switching between the videoconferencing app's chat window and your desktop or a browser window, in case you want to share a link, send a file, or type a message during the interview.
 - Keep your eyes focused on the webcam so that you will appear attentive.
- b. Prepare your script. Before you start recording, write and memorize the words you will say in the video. The video should be no longer than one minute, so write your script accordingly. Remember — you are trying to impress your potential employer.
 - c. Set the stage. The lighting and image in the video are critical to making a professional-appearing video. You should use adequate light so that the video is clear. Generally, you should arrange the camera for a head-and-shoulders shot.
 - d. Practice. You must practice your presentation in front of the camera. You can record and play back your practice recordings until you feel confident about your presentation.
 - e. Dress for the part. When on camera, the impression you make will be influenced by your attire and your personal grooming. You should dress as if you were doing a live interview.
 - f. Record the video. Your video should be no longer than one minute, but you might want to divide it into segments. For example, you could separate your statement about why you want to work for a company from your statement about your educational background.

Exercises

1. Think about the last time you were involved in an interview (either as an interviewer or an interviewee). What types of questions were you asked? Do you feel the questions solicited useful answers?
2. If you were to interview a candidate for a technology-related position, what types of questions would you ask?
3. What advantages do open-ended questions have? When might a question requiring a brief answer be appropriate?

Create a Video Resume

Resumes are used to inform potential employers about your experience, education, qualifications, and other important information. When using job search services on the web, such as Monster, CareerBuilder, and Dice, you often will submit your resume electronically.

A video resume contains a video of you speaking to your potential employer, explaining your interest in the job and why you think you are the best qualified candidate. The following steps guide you through the process of creating a video resume.

Record the Video

When you record the video resume, you must be aware of several important elements:

- a. Make sure you have access to a computer with a webcam. Alternatively, you can record the video with a more sophisticated camera.

Capture the Video

After you have recorded the video on a video camera, attach the video camera to the computer or insert the memory card from the camera into the computer and then complete the following steps:

- a. Run a program or app to capture the video.
- b. Select the option to import a video from the location on which it was stored.
- c. If necessary, navigate to the location of and select the video to import.
- d. Specify a name to identify the imported video.
- e. Start the import process. This process may take several minutes to complete.
- f. When the import process is complete, display the contents from the camera and verify the video has imported correctly.

Edit the Video

After recording the video, you normally should edit it and save it in a format that can be placed in your resume. To edit the video, complete the following steps:

- a. Import the video clip(s) that will comprise your video resume into a new project in the program or app you are using to create your video.
- b. If you are working with multiple video clips, arrange them in the correct order.

How To: Your Turn

- View the video clips in the order you desire to make sure the transition from one video clip to the next is not obvious. If it is obvious, you either can use editing features in the program or app to make the transition less obvious, or you may need to record one or more video clips again.
- Review the audio quality to make sure it is clear and that the volume is adequate. If necessary, use editing features in the program or app to reduce or eliminate background noise.
- Avoid using special effects, such as sound effects, transitions, or other visual effects. The purpose of the video resume is to advertise you as a potential employee, so do not include anything that may distract from that.
- After you have edited the video, play the video from beginning to end to make sure you are pleased with it.
- Save, but do not close, the project.
- Export the video to an appropriate format. Because you will be distributing this resume and possibly publishing it on the web, use a format that is of acceptable quality but does not generate an excessively large file.

Share Your Resume

Now that you have edited your resume and exported it, you are ready to share your video resume with potential employers.

Saving in a Document

- Open the document on your computer.
- Use the commands in the word processing program to insert the video resume at the desired location.
- Verify the video plays properly.
- Save the document.
- Open the document on another computer and make sure the video plays properly.

Saving on the Web

- Connect to your web hosting company.
- Upload the video to the folder that contains your website's files.
- Modify the webpage that you want to include the video resume. You either can update the webpage so that the video plays on the page itself, or so that the webpage visitor has to tap or click a link to open and play the video in a new window.
- Save the changes to the webpage.
- Run a browser, navigate to the webpage containing the video resume, and make sure the video resume plays as intended. You should test your video resume from multiple computers and devices using multiple browsers.

Exercises

- What type of information would you include in your video resume?
- Compare and contrast three programs or apps that can edit a video. Which one do you like the most? Why? Which one do you like the least? Why?

Create an Online Survey

If you want to collect information from a group of people, one way is to use an online survey. Online surveys can be sent to many individuals across the globe, allowing you to collect responses in a timely manner. Multiple web apps exist that allow you to create and distribute online surveys either for free or for a fee. Each web app has slightly different features, so evaluate various options before deciding which one to use. The following steps guide you through the process of creating an online survey.

- Navigate to the website you want to use to create the online survey.
- If necessary, create an account on the website hosting the web app.
- Select the option to create a new survey.
- Enter a descriptive title for the survey.
- Add the appropriate instructions to the survey.
- Add the questions to your survey. This includes:
 - Choosing the correct question type
 - Entering a descriptive question
 - If necessary, specifying the answer choices
 - Selecting whether the question is required
 - Specifying whether certain answers should prompt additional questions to appear
- Save the survey.
- Test the survey to make sure it functions as intended.
- Distribute the survey to intended recipients.
- When the due date for the survey passes, collect the survey results.

Exercises

- What are at least three reasons you might need to distribute an online survey in your desired field?
- Compare and contrast at least three online tools that can create and distribute surveys. Which one was your favorite? Why? Which one was your least favorite? Why? What are the differences between their free and fee-based accounts?

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to challenge yourself with additional Internet Research exercises, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Careers and Employment

It is a good idea to acquire information before graduation about the industry in which you would like to work. While your teachers provide valuable training and knowledge to prepare you for a career, they rarely teach you how to begin a job search. You can broaden your horizon by searching online for career information and job openings.

Career websites provide details about training and education requirements, employment outlook, industry trends, and salary data. They also offer advice on writing a cover letter and resume, applying for jobs online, networking, and preparing for an interview. When you are offered a job, turn to these websites to obtain industry salary comparisons and negotiation techniques.

Job seekers can search employment websites, such as CareerBuilder, Dice, and Monster, for specific position openings worldwide. The jobs can be sorted by category, industry, location, date posted, job title, and keywords. Some websites list job fairs and separate the listings by categories, such as entry level, part time, summer, and temporary.



Source: CareerBuilder

Research This: (a) Visit at least two career websites and review the resources. What type of career advice is given? Are aptitude tests available? What tools are provided to manage a job search, such as tips for writing a cover letter and resume, job search mistakes to avoid, search strategies, and online social network tips?

(b) Use at least two employment websites to search for three job openings in your field. Which positions are available? What are their salaries, locations, required education and experience, and job descriptions? Can job seekers post a resume? Are company profiles and salary comparison available? Do these websites have mobile apps?

2 Social Media

Companies have created policies that employees must follow when participating in social media and online social networks. Intel, for example, considers participation in social media to be an opportunity, not a right, and requires its employees to disclose their identity, protect the company's confidential and classified information, and use common sense when writing and airing opinions. Apple employees are urged to use good judgment when using online social networks and are barred from discussing the company on their own websites and from commenting on or posting messages regarding the company and its products on any related websites.

Research This: Locate at least two corporate policies for social media participation and summarize the requirements. Do you agree with the companies' guidelines? Are the policies too lenient or too strict? What actions are taken if an employee fails to abide by the policies? In what ways may policies differ among various fields, such as in health care and education?

3 Search Skills Using the Web for Research

A search engine may provide targeted results from news websites, blogs, corporate websites, and other sources. In addition, research websites, digital libraries, and specialized search engines can provide valuable information when using the web for research.

Your college or university library's website may list links to online journals, magazines, films, and books that will be helpful resources. It may make available links to online research databases, such as Gartner, Factiva, LexisNexis, and ProQuest, that offer IT

Internet Research

professionals' press releases, analysis, and case studies about companies, technologies, and industries. These sources often present valuable background information, and they offer IT professionals relevant business information to guide their decision-making.

Academic search engines, such as Google Scholar, and digital libraries, such as JSTOR (Journal Storage), provide access to academic journals and conference publications that can be useful when doing academic research. Navigating to these websites from campus may give you additional access to online research databases to which your library has a paid subscription.



Source: Gartner

Research This: Complete these tasks and report your findings. (1) Use your school library's website to find articles in online newspapers about information literacy. (2) Use a research database available from your school library's website to find an article about the fastest-growing IT careers. (3) Use a research database available from your school library's website to find an article about a company or technology discussed in this chapter. (4) Use Google Scholar or JSTOR to find a recent scholarly publication about rapid application development.

Security

Microsoft, Apple, Facebook, and Twitter are among the technology companies that have experienced a series of attacks exploiting security flaws in the Java plug-in for browsers. These security intrusions appear to have originated from hackers in China, Russia, or Eastern Europe who were attempting to obtain the companies' intellectual property, sensitive data, and users' personal information. The cyberthieves bypassed Java's built-in protections and installed malware on the compromised computers.

Kaspersky Security estimates that more than one-half of the security threats can originate from Java flaws. Oracle, the company that develops Java, issues patches to address known security vulnerabilities, but the Department of Homeland Security and other experts recommend not using Java until it is needed in browsers because new attacks may occur in the popular programming language.

Research This: Locate at least two articles discussing Java security flaws. How do Oracle and other companies inform users about the need to obtain updates to fix security holes? How many devices worldwide have Java installed? How can users discover if Java is installed on their computer or mobile device and, if it is, learn how to uninstall it?

Cloud Services

Enterprise Software Apps

Many companies make use of enterprise software apps to manage customer relationship management (CRM) and Enterprise Resource Planning (ERP). The rise of cloud computing in the enterprise has resulted in these and other enterprise software apps being hosted and managed on the cloud, rather than being purchased and installed in house. Software as a service (SaaS), a service of cloud computing, provides the delivery of software applications that are stored and deployed from servers on the Internet.

Enterprise software applications are popular SaaS offerings because IT departments do not need to install the software or manage the servers on which they run; instead, they can concentrate on configuring and specifying the services that these apps provide. Their "pay as you go" model, where customers are charged only for the capabilities they use, make SaaS apps attractive from a financial perspective. Users always interact with the most up-to-date version, and because the apps are accessed in a browser, it is easy to maintain the app across large organizations.

Research This: (1) Read about Salesforce, a pioneer in cloud-based CRM applications. What services does Salesforce provide? Find a case study about Salesforce, and describe how Salesforce's cloud solutions met one of its customer's needs. (2) Read about enterprise SaaS offerings to manage business operations and customer relations. Select or compare cloud services from companies such as SAP, Microsoft, and Oracle, and prepare a summary of their offerings. What are advantages and disadvantages to companies running these apps on the cloud?

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Offshoring and Outsourcing

The consulting company where you work as a systems analyst has refused to use offshoring, claiming management prefers to employ homeland citizens. The company's competitors have been using offshoring for some time. Your company's management team wants to discuss outsourcing the company's accounting system to an overseas firm.

Do This: Research laws, guidelines, and opinions regarding outsourcing. Address the following questions: Do you think systems should be developed entirely overseas? Why or why not? What are the major advantages and disadvantages of developing systems offshore? What security issues exist when using offshore developments? Does the United States have an obligation to help with employment overseas or in developing nations? Why or why not? What factors should a company consider when determining whether to use offshore developers?

2. Mobile App Development

Your company creates digital quizzes and study guides for nursing students. Currently you deliver these quizzes and other materials through a subscription-based website. Customers have been asking for an app that is optimized for smartphones and tablets. You have been asked to gather necessary information to start the project.

Do This: Determine which type of mobile app might be best suited to this type of product and explain why. Research other quiz and study guide apps. Read user

reviews to determine what features customers might find valuable. List common features of the most highly-rated apps. What skills, hardware, and software are necessary to develop this type of app? What resources might your company have to purchase or use to develop the app? Research mobile app development jobs on an employment website to find examples of requirements for this type of job. What certifications might you look for when hiring a mobile app developer?

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. Several employees of the league have expressed interest in telecommuting a few days per week. You need to present a telecommuting proposal for the next meeting of the board of directors.

Do This: Research benefits and disadvantages of allowing telecommuting. List requirements for employees to be able to work from home, including types of Internet access and hardware. Discuss security issues with allowing employees to telecommute. How can you address security concerns? List guidelines employees should follow when working from home. Should you implement a method for evaluating employee efficiency or productivity when telecommuting? Why or why not? How would you assess individual employee performance? What jobs are better suited to telecommuting? Why? Would you recommend that the league allow telecommuting? Why or why not?

Collaboration

4. Job Search

You work in the human resources department of a network security company. You currently have several openings for positions, including a network administrator, a security expert, and a help desk technician.

Do This: Form a three-member team and have each team member choose a different position. As a team, discuss any common requirements or background necessary for all of the positions based on the type of company. Each team member should list the educational background, available certifications, and other requirements for the position. Find listings for available jobs in your area. What responsibilities are listed for the position? What salary information can you locate? Create a list of information potential employees should have as part of their online profile. As a team, meet to discuss and compile your findings.



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Technology Acronyms

Acronym	Description	Page
1G	first generation	481
2G	second generation	481
3-D	three-dimensional	15
3G	third generation	481
3GPP	Third Generation Partnership Project	462
4G	fourth generation	481
4GL	fourth-generation language	532
5G	fifth generation	481
AC	alternating current	301
ACPA	Anticybersquatting Consumer Protection Act	64
ADA	Americans with Disabilities Act	353
ADSL	asymmetric digital subscriber line	467
AI	artificial intelligence	560
AIO	all-in-one	114
ALU	arithmetic logic unit	281
AMOLED	active-matrix OLED	342
ANSI	American National Standards Institute	459
API	application programming interface	549
ARPA	Advanced Research Projects Agency	56
ASCII	American Standard Code for Information Interchange	289
ATC	advanced transfer cache	294
ATM	automated teller machine	118
ATM	Asynchronous Transfer Mode	468
AUP	acceptable use policy	106
B2B	business-to-business	82
B2C	business-to-consumer	82
BAN	body area network	456
bcc	blind carbon copy	103
BD	Blu-ray Disc	389
BLOB	binary large object	501
BMP	bitmap	86
BSA	Business Software Alliance	228
BSB	backside bus	300
BSN	body sensor network	456
BTW	by the way	94
BYOD	bring your own device	35

Acronym	Description	Page
C2C	consumer-to-consumer	82
CA	certificate authority	231
CAD	computer-aided design	164
CAE	computer-assisted engineering	555
CAM	computer-aided manufacturing	40
CAPTCHA	Completely Automated Public Turing test to tell Computers and Humans Apart	224
CATV	cable television	466
CBT	computer-based training	184
cc	carbon copy	103
CCFL	cold cathode fluorescent lamp	341
ccTLD	country code top-level domain	63
CD	compact disc	18
CDMA	Code Division Multiple Access	481
CDP	continuous data protection	234
CD-R	CD-recordable	388
CD-ROM	CD-read-only memory	388
CD-RW	CD-rewritable	388
CERT/CC	Computer Emergency Response Team Coordination Center	219
CF	CompactFlash	381
CIPA	Children's Internet Protection Act	247
CISSP	Certified Information Systems Security Professional	575
CMOS	complementary metal-oxide semiconductor	296
CMS	content management system	557
COPPA	Children's Online Privacy Protection Act	246
CPC	cost per click	548
CPI	cost per impression	548
CPU	central processing unit	110
CRM	customer relationship management	287
CRT	cathode-ray tube	344
CSA	Cloud Security Alliance	232
CSC	common short code	124
CSI	Cellular Seizure Investigation	295
CSO	chief security officer	527

Acronym	Description	Page	Acronym	Description	Page
CSS	cascading style sheets	537	eSATA	external SATA	380
CTIA	Cellular Telecommunications Industry Association	315	EULA	end-user license agreement	163
CTS	carpal tunnel syndrome	142	EVDO	Evolution Data Optimized	481
CVS	computer vision syndrome	143	FAQ	frequently asked questions	94
DaaS	data as a service	155	FC	Fibre Channel	390
DBA	database administrator	510	FCC	Federal Communications Commission	315
DBMS	database management system	498	FDDI	Fiber Distributed Data Interface	477
DC	direct current	301	FERPA	Family Educational Rights and Privacy Act	163
DDoS	distributed DoS	217	FIP	Fair Information Practices	502
DDR SDRAM	Double Data Rate SDRAM	292	FLA	Fair Labor Association	295
DIMM	dual inline memory module	293	FOIA	Freedom of Information Act	246
DLP	digital light processing	352	fps	frames per second	331
DMCA	Digital Millennium Copyright Act	246	FSB	front side bus	300
DMS	document management system	556	FTP	File Transfer Protocol	24
DNS	domain name system	64	FTTB	Fiber to the Building	467
DOE	Department of Energy	241	FTTH	Fiber to the Home	467
DoS	denial of service	217	FTTP	Fiber to the Premises	59
dpi	dots per inch	346	FWIW	for what it's worth	94
DRAM	dynamic RAM	292	FYI	for your information	94
DRM	digital rights management	240	GB	gigabyte	61
DSL	Digital Subscriber Line	59	GBps	gigabytes per second	371
DSS	decision support system	559	GHz	gigahertz	283
DTP	desktop publishing	180	GIF	Graphics Interchange Format	86
DTV	digital television	343	GPRS	General Packet Radio Service	481
DV	digital video	330	GPS	global positioning system	70
DVD	digital versatile disc or digital video disc	18	GPU	graphics processing unit	342
DVD+R	DVD-recordable	388	GSM	Global System for Mobile Communications	481
DVD+RAM	DVD-random access memory	388	GUI	graphical user interface	414
DVD+RW	DVD-rewritable	388	HDD	hard disk drive	373
DVD-R	DVD-recordable	388	HDMI	High-Definition Media Interface	343
DVD-ROM	DVD-read-only memory	388	HDTV	high-definition television	15
DVD-RW	DVD-rewritable	388	HIPAA	Health Insurance Portability and Accountability Act	246
DVI	Digital Video Interface	135	HRIS	human resources information system	555
DVR	digital video recorder	474	HTML	Hypertext Markup Language	535
EB	exabyte	370	http	Hypertext Transfer Protocol	69
ECPA	Electronic Communications Privacy Act	246	HVAC	heating, ventilating, and air conditioning	579
EDGE	Enhanced Data GSM Environment	481	IaaS	infrastructure as a service	53
EDI	electronic data interchange	453	ICANN	Internet Corporation for Assigned Names and Numbers	63
EFT	electronic funds transfer	453	ID	identification	222
EIDE	Enhanced Integrated Drive Electronics	380			
EPA	Environmental Protection Agency	241			
ERP	Enterprise Resource Planning	555			

Acronym	Description	Page	Acronym	Description	Page
IDE	integrated development environment	530	MICR	magnetic-ink character recognition	338
IDEA	Individuals with Disabilities Education Act	354	MIS	management information system	558
IEC	International Electronics Commission	299	MMS	multimedia message service	124
IEEE	Institute of Electrical and Electronics Engineers	138	MP	megapixels	127
IMDb	Internet Movie Database	548	MRP	Material Requirements Planning	555
IMEI	International Mobile Equipment Identity	315	MRP II	Manufacturing Resource Planning II	555
IMHO	in my humble opinion	94	ms	millisecond	296
IMSI	International Mobile Subscriber Identity	480	MTSO	mobile telephone switching office	480
IoT	Internet of Things	284	NAS	network attached storage	390
IP	Internet Protocol	62	NFC	near field communications	138
IP	intellectual property	240	NIC	network interface card	472
IPO	initial public offering	396	ns	nanosecond	296
IR	infrared	465	NSA	National Security Agency	480
IrDA	Infrared Data Association	465	NUI	natural user interface	414
IROC2	Institute for Responsible Online and Cell-Phone Communication	246	OCIA	Office of Cyber and Infrastructure Analysis	365
ISDN	Integrated Services Digital Network	467	OCR	optical character recognition	334
ISP	Internet service provider	20	OEM	original equipment manufacturer	421
IT	information technology	310	OLAP	online analytical processing	559
JAD	joint-application design	520	OLED	organic LED	342
JOBS	Jumpstart Our Business Startup	396	OLTP	online transaction processing	558
JPEG	Joint Photographic Experts Group	86	OMR	optical mark recognition	335
KB	kilobyte	370	OODB	object-oriented database	508
KBps	kilobytes per second	371	OOP	object-oriented programming	530
L1	Level 1	294	OS	operating system	410
L2	Level 2	294	P2P	peer-to-peer	457
L3	Level 3	294	PaaS	platform as a service	288
LAN	local area network	453	PAN	personal area network	455
LCD	liquid crystal display	341	PATRIOT	Provide Appropriate Tools Required to Intercept and Obstruct Terrorism	246
LED	light-emitting diode	341	PB	petabyte	370
LTE	Long Term Evolution	462	PC	personal computer	4
M2	Memory Stick Micro	381	PDF	Portable Document Format	86
M2M	machine-to-machine	133	PERT	Program Evaluation and Review Technique	518
MAC	Media Access Control	236	PIN	personal identification number	118
Mac OS	Macintosh operating system	427	PMP	Project Management Professional	574
MAN	metropolitan area network	455	PNG	Portable Network Graphics	86
MB	megabyte	61	POS	point of sale	118
MBAN	medical body area network	456	PPC	pay per click	548
MBps	megabytes per second	371	ppm	pages per minute	345
MDM	mobile device management	433	ps	picosecond	296
MFP	multifunction printer	349	PUE	power usage effectiveness	241
			QBE	query by example	512

Acronym	Description	Page	Acronym	Description	Page
QR	quick response	178	TFT	thin-film transistor	342
RAD	rapid application development	530	TIFF	Tagged Image File Format	86
RAID	redundant array of independent disks	380	TLD	top-level domain	63
RAM	random access memory	290	TPS	transaction processing system	557
RDRAM	Rambus DRAM	292	TTFN	ta-ta for now	94
RFI	request for information	523	TYVM	thank you very much	94
RFID	radio frequency identification	465	UI	user interface	414
RFP	request for proposal	523	UMB	Ultra Mobile Broadband	481
RFQ	request for quotation	523	UMTS	Universal Mobile Telecommunications System	481
ROI	return on investment	519	UPC	Universal Product Code	335
ROM	read-only memory	294	UPS	uninterruptible power supply	115
rpm	revolutions per minute	375	URL	Uniform Resource Locator	68
RSI	repetitive strain injury	142	USB	Universal Serial Bus	17
RSS	Really Simple Syndication	536	US-CERT	United States Computer Emergency Readiness Team	557
RTOS	real-time operating system	436	USPS	United States Postal Service	335
RWD	responsive web design	84	UV	ultraviolet	344
SaaS	software as a service	105	UWB	ultra-wideband	463
SAN	storage area network	391	VAN	value-added network	453
SAS	serial-attached SCSI	380	VAR	value-added reseller	523
SATA	Serial Advanced Technology Attachment	380	VM	virtual machine	431
SCSI	Small Computer System Interface	380	VoIP	Voice over Internet Protocol	24
SDHC	Secure Digital High Capacity	381	VPE	visual programming environment	532
SDLC	system development life cycle	515	VPN	virtual private network	230
SDRAM	Synchronous DRAM	292	VR	virtual reality	87
SDXC	Secure Digital Expanded Capacity	381	W3C	World Wide Web Consortium	58
SEC	Securities and Exchange Committee	295	WAN	wide area network	455
SecaaS	security as a service	259	WAP	wireless access point	236
SFA	salesforce automation	555	WBT	web-based training	184
SFTP	secure file transfer protocol	534	Wi-Fi	wireless fidelity	59
SIMM	single inline memory module	293	WiMAX	Worldwide Interoperability for Microwave Access	463
SLR	single-lens reflex	125	WLAN	wireless local area network	454
SMM	Sustainable Materials Management	122	WML	wireless markup language	536
SMS	short message service	124	WORM	write once, read many	388
SOX	Sarbanes-Oxley	396	WPA2	Wi-Fi Protected Access 2	236
SQL	Structured Query Language	512	WWW	World Wide Web	65
SRAM	static RAM	292	XML	Extensible Markup Language	536
SSD	solid-state drive	17	YB	yottabyte	370
SSID	service set identifier	236	ZB	zettabyte	370
TB	terabyte	290	μs	microsecond	296
Tbps	trillion bits per second	479			
TCP/IP	Transmission Control Protocol/Internet Protocol	461			

Troubleshooting Computer and Mobile Device Problems

While using a computer or mobile device, at some point you probably will experience a technology problem that requires troubleshooting. Technology problems that remain unresolved may impact your ability to use your device. This appendix identifies some common problems you might experience with computers and mobile devices; it also includes some suggestions for correcting these problems. If the recommended solutions in the table below do not solve your problem, or you are uncomfortable performing any of the recommended actions, contact a repair professional (independent computer repair company, technical support department at your job or academic institution, or computer or mobile device manufacturer) for additional options.

This appendix also might assist you with completing some of the Problem Solving exercises found at the end of each chapter in this textbook. Table 1 contains possible solutions for problems that might occur on your computer or mobile device.

Note: The following steps are suggestions; they are not comprehensive solutions. When working with a computer or mobile device, follow all necessary safety precautions before implementing any of these recommended solutions. Contact a professional if you require additional information.

Table 1 Problems and Recommended Solutions

Problem	Desktop	Laptop	Tablet	Phone	Recommended Solution(s)
Computer or device does not turn on.	✓	✓	✓		The computer might be in sleep or hibernate mode; to wake up the computer, try pressing a key on the keyboard, pressing the power button, or tapping the touch screen if applicable.
	✓				Make sure power cables are plugged securely into the wall and the back of the computer.
		✓	✓	✓	Make sure the battery is charged if the computer or device is not connected to an external power source. If the battery is charged, connect the external AC adapter and attempt to turn on the computer or device. If the computer or device still does not turn on, the problem may be with the computer or device.
	✓	✓	✓	✓	If none of the above options resolves the issue, the power supply or AC adapter might be experiencing problems; contact a professional for assistance.
Battery does not hold a charge.		✓	✓	✓	Verify the AC adapter used to charge the battery is working properly. If the mobile computer or device can run from the AC adapter without a battery installed, the AC adapter most likely is working properly. If the AC adapter works, it may be time to replace the battery.
Computer issues a series of beeps when turned on.	✓	✓			Refer to your computer's documentation to determine what the beeps indicate, as the computer hardware may be experiencing a problem.

Problem	Desktop	Laptop	Tablet	Phone	Recommended Solution(s)
Computer or device turns on, but operating system does not run.	✓	✓	✓	✓	<p>Disconnect all nonessential peripheral devices, remove all storage media, and then restart the computer or device.</p> <p>Restart the computer or device; if the problem persists, the operating system might need to be restored. If restoring the operating system does not work, the hard drive might be failing.</p>
Monitor does not display anything.	✓				<p>Verify the monitor is turned on.</p> <p>Verify the video cable is connected securely to the computer and monitor.</p> <p>Make sure the power cables are plugged securely into the wall and the back of the monitor.</p> <p>Make sure the monitor is set to the correct input source.</p> <p>Restart the computer.</p> <p>If you have access to a spare monitor, see if that monitor will work. If so, your original monitor might be faulty. If not, the problem may be with your computer's hardware or software configuration.</p>
Screen does not display anything.		✓	✓	✓	<p>Restart the device.</p> <p>Make sure the device is plugged in or the battery is sufficiently charged.</p>
Keyboard or mouse does not work.	✓	✓	✓		<p>Verify the keyboard and mouse are connected properly to the computer or device.</p> <p>If the keyboard and mouse are wireless, make sure they are turned on and contain new batteries.</p> <p>If the keyboard and mouse are wireless, attempt to pair them again with the computer or wireless receiver. Read How To 3-1 for more information.</p> <p>If you have access to a spare keyboard or mouse, see if it will work. If so, your original keyboard or mouse might be faulty. If not, the problem may be with your computer's hardware or software configuration.</p>
		✓			<p>Make sure the touchpad is not disabled.</p>
Wet keyboard no longer works.	✓	✓			<p>Turn the keyboard upside down to drain the liquid, dab wet areas with a cotton swab, and allow the keyboard to dry.</p>
Speakers do not work.	✓	✓	✓	✓	<p>Verify that headphones or earbuds are not connected.</p> <p>Make sure the volume is not muted and is turned up on the computer or mobile device.</p>
	✓	✓			<p>Verify the speakers are turned on.</p> <p>Make sure the speakers are connected properly to the computer.</p> <p>If necessary, verify the speakers are plugged in to an external power source.</p>
Hard drive makes noise.	✓	✓			<p>If the computer is not positioned on a flat surface, move it to a flat surface.</p> <p>If the problem persists, contact a professional.</p>

Problem	Desktop	Laptop	Tablet	Phone	Recommended Solution(s)
Fan contains built-up dust/ does not work.	✓	✓			If possible, open the system unit and use a can of compressed air to blow the dust from the fan and away from the system unit.
	✓				Remove obvious obstructions that might be preventing the fan from functioning. Verify the fan is connected properly to the motherboard. If the fan still does not work, it may need to be replaced.
Computer or device is too hot.	✓	✓			Verify the fan or vents are not obstructed. If the fan or vents are obstructed, use a can of compressed air to blow the dust from the fan or vent and away from the computer or device or remove other obstructions.
		✓			Purchase a cooling pad that rests below the laptop and protects it from overheating.
			✓	✓	Exit apps running in the background. Search for and follow instructions how to clear the tablet or phone's cache memory. Run an app to monitor the tablet's or phone's battery performance, and exit apps that require a lot of battery power. Decrease the brightness of the display.
Cannot read from optical disc.	✓	✓			Clean the optical disc and try reading from it again. Try reading from another optical disc. If the second optical disc works, the original disc is faulty. If the second disc does not work, the problem may be with the optical disc drive.
External drive (USB flash drive, optical disc drive, or external hard drive) is not recognized.	✓	✓	✓		Remove the drive and insert it into a different USB port, if available. Remove the drive, restart the computer, and insert the drive again. Try connecting the drive to a different computer. If you still cannot read from the drive, it may be faulty.
Program or app does not run.	✓	✓	✓	✓	Restart the computer or device and try running the program or app again. If feasible, uninstall the program or app, reinstall it, and then try running it again. If the problem persists, the problem may be with the operating system's configuration.
Computer or device displays symptoms of a virus or other malware.	✓	✓	✓	✓	Make sure your antivirus software is up to date and then disconnect the computer or device from the network and run antivirus software to attempt to remove the malware. Continue running scans until no threats are detected and then reconnect the computer to the network. If you do not have antivirus software installed, obtain and install a reputable antivirus program or app and then scan your computer in an attempt to remove the malware. You should have only one antivirus program or app installed on your computer or mobile device at one time. If you are unable to remove the malware, take your computer to a professional who may be able to remove the malicious program or app.

Problem	Desktop	Laptop	Tablet	Phone	Recommended Solution(s)
Computer or device is experiencing slow performance.	✓	✓	✓		<p>Defragment the hard disk.</p> <p>Uninstall programs and apps that you do not need.</p> <p>Verify your computer or device meets the minimum system requirements for the operating system and software you are running.</p> <p>If possible, purchase and install additional memory (RAM).</p>
Screen is damaged physically.	✓	✓	✓	✓	<p>Contact a professional to replace the screen; if the computer or device is covered under a warranty, the repair may be free.</p> <p>Replacing a broken screen on a computer or device might be more costly than replacing the computer or device; consider your options before replacing the screen.</p>
Touch screen does not respond.	✓	✓	✓	✓	<p>Clean the touch screen.</p> <p>Restart the computer or device.</p>
Computer or device is wet.		✓	✓	✓	<p>Turn off the computer or device, remove the battery, and dry off visible water with a cloth. Fill a plastic bag or box with rice, submerge the computer or device and battery into the rice so that it is surrounded completely, and then do not turn on the computer or device for at least 24 hours.</p> <p>If the computer or device does not work after it is dry, contact a professional for your options.</p>
Computer or device does not connect to a wireless network.	✓	✓	✓	✓	<p>Verify you are within range of a wireless access point.</p> <p>Make sure the information to connect to the wireless network is configured properly on the computer or device.</p> <p>Make sure the wireless capability on the computer or device is turned on.</p>
Computer or device cannot synchronize with Bluetooth accessories.	✓	✓	✓	✓	<p>Verify the Bluetooth device is turned on.</p> <p>Verify the Bluetooth functionality on your computer or device is enabled.</p> <p>Verify the computer or device has been paired properly with the accessory. Read How To 3-1 for more information.</p> <p>Make sure the Bluetooth device is charged.</p>
Device continuously has poor cell phone reception.			✓	✓	<p>Restart the device.</p> <p>If you have a protective case, remove the case to see if reception improves.</p> <p>If you are using the device inside a building, try moving closer to a window or open doorway.</p> <p>Contact your wireless carrier for additional suggestions.</p>

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- 1G (first generation of cellular transmissions):** First generation of cellular transmissions., 481
- 2G (second generation of cellular transmissions):** Second generation of cellular transmissions., 481
- 3-D printer:** Printer that uses a process called additive manufacturing to create an object by adding material to a three-dimensional object, one horizontal layer at a time. (Or) Printer that can print solid objects such as clothing, prosthetics, eyewear, implants, toys, parts, prototypes, and more., 15, 349
- 3G (third generation of cellular transmissions):** Third generation of cellular transmissions., 481
- 4G (fourth generation of cellular transmissions):** Fourth generation of cellular transmissions., 481
- 4GL:** A nonprocedural language that enables users and programmers to access data in a database., 532. *See also* **fourth-generation language**
- 5G (fifth generation of cellular transmissions):** Fifth generation of cellular transmissions., 481
- 802.11:** A series of network standards that specifies how two wireless devices communicate over the air with each other., 462
- A**
- acceptable use policy (AUP):** Outlines the activities for which a computer and network may and may not be used., 231
- acceptance test:** Test performed by end users during the program development life cycle that checks the new system to ensure that it works with actual data., 525
- access control:** A security measure that defines who can access a computer, device, or network, when they can access it, and what actions they can take while accessing it., 222
- accessories, gaming, 11
- access time:** The amount of time it takes a storage device (1) to locate an item on a storage medium or (2) to deliver an item from memory to the processor., 296, 371
- accounting software:** An application that helps businesses of all sizes record and report their financial transactions., 173
- active-matrix:** LCD display technology that uses a separate transistor to apply charges to each liquid crystal cell and, thus, displays high-quality color that is viewable from all angles., 342. *See also* **TFT**
- activity tracker, 130
- ADA:** Law that requires any company with 15 or more employees to make reasonable attempts to accommodate the needs of physically challenged workers., 353. *See also* **Americans with Disabilities Act**
- adapter board:** A circuit board that enhances the functions of a component of a desktop or server system unit and/or provides connections to peripheral devices., 297. *See also* **adapter card; expansion card**
- adapter card:** A circuit board that enhances the functions of a component of a desktop or server system unit and/or provides connections to peripheral devices., 297–298. *See also* **adapter board; expansion card**
- adapters, 297–299
- address book, 74
- address:** Unique number that identifies the location of a byte in memory., 290
- administrator account:** Type of account typically held by computer owners or network administrators that enables them to access all files and programs, install programs, and specify settings that affect all users on a computer, mobile device, or network., 423
- Adobe Reader, 88, 177
- ADSL:** A type of DSL that supports faster downstream rates than upstream rates., 467. *See also* **asymmetric digital subscriber line**
- Advanced Research Projects Agency (ARPA), 56
- advanced transfer cache:** Type of L2 cache built directly on the processor chip, which increases processor speed., 294. *See also* **ATC**
- adware:** A program that displays an online advertisement in a banner or pop-up window on webpages, email, or other Internet services., 192, 215, 245
- adware remover:** A program that detects and deletes adware., 192
- agriculture, technology and, 485
- A+:** Hardware certification that tests knowledge of computer setup, configuration, maintenance, troubleshooting, basic networking skills, and system software., 573
- AI, 560
- air gestures:** Gestures made by moving your body or a handheld input device through the air., 328
- all-in-one desktop:** Desktop that does not have a tower and instead houses the screen and system unit in the same case., 114

- all-in-one printer:** A single device that looks like a printer or a copy machine but provides the functionality of a printer, scanner, copy machine, and perhaps a fax machine., 349. *See also* **multifunction printer (MFP)**
- alphabetic check:** Validity check that ensures that users enter only alphabetic data into a field., 503
- alphanumeric characters:** Letters and numbers., 289
- ALU:** Component of the processor that performs arithmetic, comparison, and other operations., 281. *See also* **arithmetic logic unit**
- alumni network, 576
- Amazon's storefront, 81
- Americans with Disabilities Act:** Law that requires any company with 15 or more employees to make reasonable attempts to accommodate the needs of physically challenged workers., 353. *See also* **ADA**
- AMOLED (active-matrix OLED):** Screens that use both active-matrix and OLED technologies, combining the benefits of high-quality viewing from all angles with lower power consumption., 342
- analog:** Continuous (wave form) signals., 288
- analysis phase:** Step in the system development life cycle during which two major activities are performed: (1) conduct a preliminary investigation and (2) perform detailed analysis., 521
- Android:** An open source, Linux-based mobile operating system designed by Google for smartphones and tablets., 434
- Animal's identity security, chip implantation, 280
- animation:** The appearance of motion created by displaying a series of still images in sequence., 86
- anonymous FTP:** File transfer method whereby anyone can transfer some, if not all, available files., 92
- Anticybersquatting Consumer Protection Act (ACPA):** Legislation whose goal is to protect trademark owners from being forced to pay a cybersquatter for a domain name that includes their trademark. ACPA for short., 64
- anti-spam program:** A filtering program that attempts to remove spam before it reaches your inbox or forum., 193
- antistatic wristband:** Bracelet designed to protect electronics from an electrostatic discharge by preventing a buildup of static electricity on a user., 304
- antivirus program:** Software that protects a computer against viruses by identifying and removing any computer viruses found in memory, on storage media, or on incoming files., 25, 110, 191, 218
- antivirus software, 423
- app:** Program designed to make users more productive and/or assist them with personal tasks., 27, 158
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- application:** Programs designed to make users more productive and/or assist them with personal tasks., 27, 158
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- archival backup:** Backup method that provides the best protection against data loss because it copies all program and data files., 396. *See also* **full backup**
- arithmetic logic unit:** Component of the processor that performs arithmetic, comparison, and other operations., 281. *See also* **ALU**
- arithmetic operations:** Operations that involve basic calculations such as addition, subtraction, multiplication, and division., 281
- ARPANET:** Agency of the U.S. Department of Defense whose goal was to build a network that (1) allowed scientists at different physical locations to share information and work together on military and scientific projects and (2) could function even if part of the network was disabled or destroyed by a disaster such as a nuclear attack. Short for Advanced Research Projects Agency., 56

- artificial intelligence:** The application of human intelligence to computers., 560. *See also* **AI**
- ASCII:** American Standard Code for Information Interchange; the most widely used coding scheme to represent a set of characters., 289
- aspect ratio:** A display's width relative to its height., 343
- ASP.NET:** A web application framework that provides the tools necessary for the creation of dynamic websites., 532
- asset tags, 279
- assistive technology, 353–354
- asterisk (*), search engine operator, 72
- asymmetric digital subscriber line:** A type of DSL that supports faster downstream rates than upstream rates., 467. *See also* **ADSL**
- asymmetric key encryption:** Encryption method that uses two encryption keys: a public key and a **private key**., 230. *See also* **public key encryption**
- Asynchronous Transfer Mode (ATM):** Short for Asynchronous Transfer Mode; a service that carries voice, data, video, and media at very high speeds., 468
- ATC:** Type of L2 cache built directly on the processor chip, which increases processor speed., 294. *See also* **advanced transfer cache**
- Athletics, motion input in, 329
- ATM:** A self-service banking terminal that connects to a host computer through a network. Short for automated teller machine., 118
- ATM (Asynchronous Transfer Mode):** Short for Asynchronous Transfer Mode; a service that carries voice, data, video, and media at very high speeds, 468
- ATOM:** Specification that content aggregators use to distribute content to subscribers., 536
- at symbol (@), 89
- auction websites, 81–82
- audio:** Music, speech, or any other sound., 86
output, 340
streaming, 187
- audio editing software:** An application that enables users to modify audio clips, produce studio-quality soundtracks, and add audio to video clips., 183
- audio input:** The process of entering any sound into the computer such as speech, music, and sound effects., 330
- audit trail:** Electronic file that records both successful and unsuccessful access attempts., 222
- AUP:** Outlines the activities for which a computer and network may and may not be used., 231. *See also* **acceptable use policy**
- automated teller machine (ATM), 118
- automatic update:** Feature can be configured to download and install updates automatically.(or) Feature that regularly provides new features or corrections to the program., 163, 421, 423
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- automobiles, and embedded computers, 132
- AutoSave feature, 166
- ## B
- back door:** A program or set of instructions in a program that allows users to bypass security controls when accessing a program, computer, or network., 217, 393
- back end:** An application that supports a front-end program., 505
- background:** Programs that are running, but not in use., 415
- backing up
computers, mobile devices, 19
regularly, 25, 233
- backlight:** Light source in a display that often uses CCFL (cold cathode fluorescent lamp) or LED (light-emitting diode) technology., 341
- backside bus:** Bus that connects the processor to cache., 300. *See also* **BSB**
- backup:** A duplicate of content on a storage medium that you can use in case the original is lost, damaged, or destroyed., 233, 422
various methods (table), 234
- backup plans, 19, 235, 395–396
- backups, 18
- backup server, 116
- backup tool:** A program that allows users to copy, or back up, selected files or the contents of an entire storage medium to another storage location, such as another hard disk, optical disc, USB flash drive, or cloud storage., 198
- backward compatible:** Term used to refer to a program's or device's capability of supporting older programs or devices, as well as newer programs or devices., 136, 425
- backward recovery:** Recovery technique where the DBMS uses the log to undo any changes made to the database during a certain period., 515. *See also* **rollback**
- balance board:** Game controller that is shaped like a weight scale and contains sensors that measure a game player's balance and weight., 132

- BAN:** A type of PAN that wireless connects sensors worn by, carried by, implanted in, or attached to a human body., 456. *See also* **body area network**
- bandwidth:** The amount of data, instructions, and information that can travel over transmission media., 61, 476
- bar code:** An identification code that consists of either a set of vertical lines and spaces of different widths or a two-dimensional pattern of dots, squares, and other images., 335
- bar code reader:** An input device that uses laser beams to read bar codes on products., 118, 335. *See also* **bar code scanner**
- bar code scanner:** An optical reader that uses laser beams to read bar codes., 335. *See also* **bar code reader**
- batch processing:** Processing technique in which the computer collects data over time and processes all transactions later, as a group., 558
- Batteries, 301–304
- batteries for mobile computers, 113
- behavioral health risks with using technology, 144
- benchmark test:** Test that measures the performance of hardware or software., 524
- Berners-Lee, Tim, 63
- Big Data:** Large-scale data sets that require advanced technologies beyond the capabilities of typical database software, to gather, store, process, retrieve, or analyze., 508
- characteristics of, 509
- data visualization, 509
- sources and uses of, 509
- binary digit:** The smallest unit of data the computer can process., 288. *See also* **bit**
- binary system: Number system that has just two unique digits, 0 and 1, called bits., 288
- biometric device:** Device that authenticates a person's identity by translating a personal characteristic, such as a fingerprint, into a digital code that is compared with a digital code stored in a computer verifying a physical or behavioral characteristic., 224
- biometric payment:** Payment method where the customer's fingerprint is read by a fingerprint reader that is linked to a payment method such as a checking account or credit card., 226
- bitmaps, 86
- bit:** The smallest unit of data the computer can process. Short for binary digit., 288. *See also* **binary digit**
- Blackberry operating system:** A proprietary mobile operating system that runs on Blackberry smartphones and Blackberry tablets., 434
- blackout:** A complete power failure., 140
- blade server:** A server in the form of a single circuit board, or blade., 116
- bloatware:** Additional programs and apps included with an operating system., 421
- BLOB:** Binary large object., 501
- blog:** An informal website consisting of time-stamped articles, or posts, in a diary or journal format, usually listed in reverse chronological order. Short for weblog., 24, 39, 78
- blogger, 78
- blogging, 188
- blogosphere:** The worldwide collection of blogs., 78
- blog software:** Software needed to create/maintain a blog., 188
- Bluebugging:** Security risk that occurs when cyberthieves exploit Bluetooth devices that have been paired., 464
- Bluetooth:** Wireless communication technology that uses short-range radio signals to transmit data between two Bluetooth-enabled computers or devices to communicate with each other., 32, 137, 463–464
- Bluetooth printing:** Printing that occurs when a computer or other device transmits output to a printer via radio waves., 345
- Bluetooth wireless port adapter:** Adapter that will convert an existing USB port into a Bluetooth port., 137
- Blu-ray:** A more expensive DVD format that has a higher capacity and better quality than standard DVDs, especially for high-definition audio and video., 388
- BMP graphics format, 86
- body area network:** A type of PAN that wirelessly connects sensors worn by, carried by, implanted in, or attached to a human body. Sometimes called a body sensor network (BSN)., 456. *See also* **BAN**
- body sensor network (BSN), 456
- bookmarking site:** A website that enables members to organize, tag, and share links to media and other online content., 75
- bookmarks:** Links to preferred websites., 67. *See also* **favorites**
- Boolean:** Data type consisting of Yes or No, or True or False, values., 501
- Boot Camp:** Apple program that enables you to install Windows on an Apple computer., 432

- boot disk:** Removable media, such as a CD or USB flash drive, that contains only the necessary operating system files required to start the computer., 413
- boot drive:** The drive from which your personal computer starts., 413
- booting:** The process of starting or restarting a computer or mobile device., 413
- boot sector viruses, 190
- bot:** A program that performs a repetitive task on a network., 216
- botnet:** A group of compromised computers or mobile devices connected to a network such as the Internet that are used to attack other networks, usually for nefarious purposes., 216. *See also* **zombie army**
- Braille printer, 354
- brightness:** Term used to describe how light or dark a photo appears., 182
- broadband:** Internet connection with fast data-transfer speeds and an always-on connection. (or) Transmission media that transmits multiple signals simultaneously, 58, 476
- broadband Internet, 60
- broadband modem:** A communications device that sends and receives data and information to and from a digital line., 468. *See also* **digital modem**
- broadband router:** A device that performs the functions of a router and also a broadband modem., 471
- broadband wireless router:** A device that performs the functions of a router, a wireless access point, and a cable or DSL modem., 472
- broadcast radio:** A wireless transmission medium that distributes radio signals through the air over long distances such as between cities, regions, and countries and short distances, such as within an office or home., 479
- brownout:** A prolonged (more than a minute) undervoltage., 140
- browser:** Software that enables users with an Internet connection to access and view webpages on computers or mobile devices., 21, 65
- configuring, 67
- displaying webpages using, 64
- browsing
- communications applications, 188
- safe techniques, 66
- browsing history:** A list of all websites you have visited over a period of time., 257
- BSB:** Bus that connects the processor to cache., 300. *See also* **backside bus**
- buffer:** Segment of memory or storage in which items are placed while waiting to be transferred from an input device or to an output device., 418
- bug:** Error in a program., 421
- building automation systems, 145
- burning:** The process of writing on an optical disc., 388
- bus:** Electrical channel that transfers electronic bits internally within the circuitry of a computer, allowing the devices both inside and attached to the system unit to communicate with each other., 299–300
- bus width, 300
- speed measurement, 300
- types of, 300
- Busey bank, 79
- business
- uses of online social networks, 73
- websites, 77
- business networks, 33
- Business Software Alliance (BSA):** Alliance formed by major worldwide software companies to promote understanding of software piracy., 228
- business-to-business (B2B) e-commerce:** E-commerce transaction that occurs when businesses provide goods and services to other businesses, such as online advertising, recruiting, credit, sales, market research, technical support, and training., 82
- business-to-consumer (B2C) e-commerce:** E-commerce action that involves the sale of goods and services to the general public, such as at a shopping website., 82
- bus width:** The size of a bus, which determines the number of bits that a computer can transmit at one time., 300
- buyer's guides
- for desktops, 115
- for mobile computers, 113
- for mobile devices, 128–129
- BYOD (bring your own device) strategies, 389, 433
- byte (character):** Eight bits grouped together as a unit., 61, 288, 290
- ## C
- cable Internet service:** Broadband Internet access provided through the cable television network via a cable modem., 59, 466, 467

- cable modem:** A broadband modem that sends and receives digital data over the CATV network., 469
- cache:** Area of memory that stores the contents of frequently used data or instructions., 66, 293–294
- CAD (computer-aided design), 180
- calendar and contact management software:** An application that helps you organize your calendar, keep track of contacts, and share this information with other devices or users., 171
- calls, making VoIP, 92
- candela:** The standard unit of luminous intensity., 342
- C++:** An object-oriented programming language developed in the 1980s by Bjarne Stroustrup at Bell Laboratories that is an extension of the C programming language., 531
- capacity:** The number of bytes (characters) a storage medium can hold., 370
- capping:** ISP practice of providing a certain amount of data at the optimal speed; once the customer used his or her allotted amount, Internet access is restricted, slowed, or incurs additional costs., 477
- CAPTCHA:** A program developed at Carnegie Mellon University that displays an image containing a series of distorted characters for a user to identify and enter in order to verify that user input is from humans and not computer programs. Short for Completely Automated Public Turing test to tell Computers and Humans Apart., 224
- Carbonite, 234
- card reader/writer:** A device that reads from and writes on memory cards, 381
- career counselors, 576
- career planning, 576
- career websites, 82
- carpal tunnel syndrome (CTS), 142
- cascading style sheets:** Technology used for web apps that describes the design and appearance of information on a webpage., 536, 538. *See also* **CSS**
- cases
of computer, 276–278
of mobile device, 276–278
- C:** A widely used procedural language developed in the early 1970s by Dennis Ritchie at Bell Laboratories that originally was designed for writing system software., 528
- ccTLD:** A two-letter country code in a web address., 63
- CDP:** Backup method in which all data is backed up whenever a change is made., 234. *See also* **continuous data protection**
- CD-R:** CD-recordable; optical disc on which users can write once, but not erase, their own items, such as text, graphics, and audio., 388
- CD-ROM:** CD-read-only memory; type of optical disc that users can read but not write on (record) or erase., 388
- CD-RW:** CD-rewritable; erasable multisession disc users can write on multiple times., 388
- CDs as optical discs, 18
- cellular radio:** A form of broadcast radio that is in wide use for mobile communications, specifically wireless modems and mobile phones., 480
- Cellular Seizure Investigation stick:** Device used by cyberthieves to download sensitive data from phones and other mobile devices., 295. *See also* **CSI stick**
- central processing unit (CPU):** The electronic component of a computer that interprets and carries out the basic instructions that operate a computer., 110, 280. *See also* **processor**
- CERT/CC, 219
- certificate authority:** Online providers that issue digital certificates., 231
- Certified Information Systems Security Professional:** Security certification that tests in-depth knowledge of access control methods, information systems development, cryptography, operations security, physical security, and network and Internet security., 575. *See also* **CISSP**
- CF:** A type of memory card., 381. *See also* **CompactFlash**
- change management:** Process of recognizing when a change in a project has occurred, taking actions to react to the change, and planning for opportunities because of the change., 519
- character:** A number, letter, punctuation mark, or other symbol that is represented by a single byte in the ASCII coding scheme., 500
- charge-coupled device (CCD), 126
- chassis:** The case that contains and protects the motherboard, hard drive, memory, and other electronic components of the computer from damage., 276. *See also* **System unit**
- chat:** A real-time typed conversation that takes place on a computer or mobile device with many other online users., 91, 188
- chat room:** A location on an Internet server that permits users to chat with others who are online at the same time., 31, 91
- check digit, 503

- Children's Internet Protection Act (CIPA), 248
- child:** Term used in three-generation backups to refer to the most recent copy of the file., 234
- chip:** A small piece of semiconducting material, usually silicon, on which integrated circuits are etched., 278
- chip card:** An alternative to a magnetic stripe card, stores data on an integrated circuit embedded in the card., 393. *See also* **smart card**
- Chromebook:** A specialized laptop that runs Chrome OS., 430
- Chromebox:** A specialized desktop that runs Chrome OS., 430
- Chrome:** Google's browser., 67
- Chrome OS:** Google's Linux-based operating system designed to work primarily with web apps., 430
- ciphertext:** Encrypted (scrambled) data., 230
- CISSP:** Security certification that tests in-depth knowledge of access control methods, information systems development, cryptography, operations security, physical security, and network and Internet security., 575. *See also* **Certified Information Systems Security Professional**
- classic programming languages, 532
- click, 13
- clickjacking:** Scam in which an object that can be clicked on a website, such as a button, image, or link, contains a malicious program., 245
- client operating systems:** Desktop operating systems that work in conjunction with a server operating system., 426
- client/server network:** Network in which one or more computers act as a server, and the other computers on the network request services from the server., 456
- clients:** The other computers and mobile devices on a network that rely on the server for its resources., 456
- clip art:** A collection of drawings, photos, and other images., 166
- clip art/image gallery:** A collection of clip art and photos., 166
- clipboard:** A temporary storage location., 165
- clock cycle:** Each tick of the system clock., 283
- clock speed:** The pace of the system clock., 283, 300
- closed source operating systems
security of, 430
- cloud architect:** Employee who identifies business requirements, strategies, and solutions for cloud storage and services that meet a company's goals or needs., 687
- cloud backup:** Backup method in which files are backed up to the cloud as they change., 234
- cloud computing:** An environment of virtual servers that house and provide access to resources users access through the Internet., 121, 287–288
- cloud data privacy, 232
- cloud storage:** An Internet service that provides remote storage to computer users., 18, 34, 69, 234, 383–385
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upload files, 385
- CMOS:** Complementary metal-oxide semiconductor; technology used by some RAM chips, flash memory chips, and other types of memory chips that provides high speeds and consumes little power by using battery power to retain information even when the power to a computer is off., 296
- coaxial cable:** Physical transmission media that consists of a single copper wire surrounded by at least three layers: (1) an insulating material, (2) a woven or braided metal, and (3) a plastic outer coating., 478. *See also* **coax**
- coax:** Physical transmission media that consists of a single copper wire surrounded by at least three layers: (1) an insulating material, (2) a woven or braided metal, and (3) a plastic outer coating., 478. *See also* **coaxial cable**
- code of conduct:** A written guidelines that helps determine whether a specific action is ethical/unethical or allowed/not allowed., 241
- code:** The program that contains the language instructions, or code, to be converted to machine language., 529. *See also* **source program**
- coding schemes, 289–290
- cold boot:** The process of starting a computer or mobile device from a state when it is powered off completely., 413
- collaborative databases:** Web databases where users store and share photos, videos, recordings, and other personal media with other registered users., 506
- command:** An instruction that causes a program or app to perform a specific action., 318
- command language:** The set of commands used to control actions in a command-line interface., 415
- command-line interface:** User interface in which users type commands represented by short keywords or abbreviations or press special keys on the keyboard to enter data and instructions., 414–415

- common short code (CSC):** A four- or five-digit number assigned to a specific content or mobile service provider, sometimes followed by the message., 124
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 use of technologies (table), 31
- communications channel:** Transmission media on which data, instructions, or information travel in a communications system., 450
- communications device:** Hardware capable of transferring items from computers and devices to transmission media and vice versa., 31, 468
- cable modem, 469
 digital modems, 468
 DSL modem, 469
 hubs and switches, 473
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 wireless access points, 470
 wireless modem, 469
- communications lines
 ATM, 468
 cable, 466
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 ISDN, 467
 T-carrier line, 468
- communications satellite:** A space station that receives microwave signals from an earth-based station, amplifies (strengthens) the signals, and broadcasts the signals back over a wide area to any number of earth-based stations., 482
- communications software:** Programs and apps that (1) help users establish a connection to another computer, mobile device, or network; (2) manage the transmission of data, instructions, and information; and (3) provide an interface for users to communicate with one another., 457
- CompactFlash:** A type of memory card., 381. *See also* **CF**
- compact keyboard:** Keyboard that is smaller than a standard keyboard and usually does not include the numeric keypad., 321
- comparison operations:** Operations that involve comparing one data item with another to determine whether the first item is greater than, equal to, or less than the other item., 281
- compiler:** Separate program that converts an entire source program into machine language before executing it., 529
- completeness check:** Validity check that verifies that a required field contains data., 503
- composite key:** Primary key that consists of multiple fields., 501
- compressed files, 86
 compressing files, folders, 198
- compress:** To decrease a file or photo's file size., 182
- computer:** An electronic device, operating under the control of instructions stored in its own memory, that can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use., 4, 108
- computer-aided design:** A type of application that assists professionals and designers in creating engineering, architectural, and scientific designs and models. CAD for short., 180
- computer-aided engineering:** Information system that aids in the development and testing of product designs, and often includes CAD (computer-aided design)., 555. *See also* **CAE**
- computer-aided manufacturing (CAM):** The use of computers to assist with manufacturing processes such as fabrication and assembly; CAM for short., 40, 555
- computer:** An electronic device, operating under the control of instructions stored in its own memory, that can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use.
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- and transportation, 95
- unauthorized access and use, 221–227
- computer-based training (CBT):** A type of education in which students learn by using and completing exercises with instructional software., 184
- computer crime:** Any illegal act involving the use of a computer or related devices., 212
- Computer Emergency Response Team Coordination Center (CERT/CC):** A federally funded Internet security research and development center., 219
- computer ethics:** The moral guidelines that govern the use of computers, mobile devices, and information systems., 238
- computer repair services, 566
- computer security specialist:** Employee who is responsible for the security of data and information stored on computers and mobile devices within an organization. *See also* **Mobile security specialist**, 570
- computer technician:** Employee who installs, maintains, and repairs hardware and servers; installs, upgrades, and configures software; troubleshoots hardware problems., 569
- computer vision syndrome:** Technology-related health condition that affects eyesight., 143. *See also* **CVS**
- conferencing software:** Software that includes tools that enable users to share documents via online meetings and communicate with other connected users., 520
- confidential data, access of, 514
- connecting
 - peripheral devices, accessories to computers, 136
 - phones to Wi-Fi networks, 138
- connections, ports and, 134–138
- connector:** Device that joins a cable to a port., 135
- popular (table)., 135
- consistency check:** Validity check that tests the data in two or more associated fields to ensure that the relationship is logical and their data is in the correct format., 503
- consumer electronics, and embedded computers, 132
- consumer-to-consumer (C2C) e-commerce:** E-commerce transaction that occurs when one consumer sells directly to another, such as in an online auction., 82
- contact management software:** Folder used in email programs that contains a list of names, addresses, phone numbers, email addresses, and other details about people with whom you communicate., 171
- contacts folder:** Folder used in email programs that contains a list of names, addresses, phone numbers, email addresses, and other details about people with whom you communicate., 89
- content aggregation, 83
- content filtering:** The process of restricting access to certain material., 247
- content management system (CMS):** System that enables and manages the publishing, modification, organization, and access of various forms of documents and other files, including media and webpages, on a network or the web. (or) A program that assists you with creating, editing, and hosting content on a website., 84, 557
- continuous backup:** A backup plan in which changes are backed up as they are made., 515
- continuous data protection (CDP):** Backup method in which all data is backed up whenever a change is made., 234. *See also* **CDP**
- contrast ratio:** The difference in light intensity between the brightest white and darkest black that can be produced on a display., 342
- contrast:** The difference in appearance between light and dark areas of a photo., 182
- controller:** A special-purpose chip and electronic circuits that control the transfer of data, instructions, and information from a drive to and from the system bus and other components in the computer. Formerly called a disk controller., 380
- control unit:** The component of the processor that directs and coordinates most of the operations in the computer., 281
- convenience applications, 186
- convertible tablet:** A tablet that has a screen in its lid and a keyboard in its base, with the lid and base connected by a swivel-type hinge., 112
- cookie:** A small text file that a web server stores on your computer., 192, 243
- cooling pad:** Pad that rests below a laptop and protects the computer from overheating and also the user's lap from excessive heat., 284

- copying
media from websites, 38
- copyright:** Exclusive rights given to authors, artists, and other creators of original work to duplicate, publish, and sell their materials., 240
- cost/benefit feasibility:** Test that measures whether the lifetime benefits of the proposed information system will be greater than its lifetime costs., 519. *See also* **economic feasibility**
- CPU:** The electronic component of a computer that interprets and carries out the basic instructions that operate a computer. Short for central processing unit., 110. *See also* **processor**
- cracker:** Someone who accesses a computer or network illegally with the intent of destroying data, stealing information, or other malicious action., 214
- create:** Process in project development during which you enter text or numbers, insert images, and perform other tasks using a variety of input methods, such as keyboard, a mouse, touch, or voice., 165
- Creative Commons:** Nonprofit organization that provides several standard licensing options that owners of creative works may specify when granting permission for others to use their digital content., 372
- credit cards
protection, 337
safely using, 394
and signature verification system, 225
- crimeware:** Software used by cybercriminals., 212
- criminal databases, 505
- CRM:** Information system that manages information about customers, past purchases, interests, and the day-to-day interactions, such as phone calls, email messages, web communications, and Internet messaging sessions., 555. *See also* **Customer relationship management**
- CRM specialist:** Employee who integrates apps and data related to customer inquiries, purchases, support requests, and behaviors in order to provide a complete application that manages a company's relationships with its customers. *See also* **Customer relationship management specialist**, 577
- crop:** To remove unwanted areas of a photo., 182
- cross-platform application:** An application that runs the same on multiple operating systems., 412
- CSI stick:** Device used by cyberthieves to download sensitive data from phones and other mobile devices., 295. *See also* **cellular seizure investigation stick**
- CSS:** Technology used for web apps that describes the design and appearance of information on a webpage., 536, 538. *See also* **cascading style sheets**
- CT scans, 43
- curation website, 83
- cursor:** A symbol on the screen, usually a blinking vertical bar, that indicates where the next character you type will appear., 320. *See also* **insertion point**
- customer data protection, 575
- customer relationship management:** Information system that manages information about customers, past purchases, interests, and the day-to-day interactions, such as phone calls, email messages, web communications, and Internet messaging sessions., 555. *See also* **CRM**
- customer relationship management specialist:** Employee who integrates apps and data related to customer inquiries, purchases, support requests, and behaviors in order to provide a complete application that manages a company's relationships with its customers. *See also* **CRM specialist**, 569
- customer service software, 177
- custom software:** Software that performs functions specific to a business or industry., 161
- CVS:** Technology-related health condition that affects eyesight., 143. *See also* **computer vision syndrome**
- cyberbullying:** Harassment using technology., 94
- cybercrime:** Online or Internet-based illegal acts such as distributing malicious software or committing identity theft., 212
- cyberextortionist:** Someone who demands payment to stop an attack on an organization's technology infrastructure., 214
- cyberforensics:** The discovery, collection, and analysis of evidence found on computers and networks., 227. *See also* **digital forensics**
- cybersquatters, 64
- cyberterrorist:** Someone who uses the Internet or network to destroy or damage computers for political reasons., 214
- cyberwarfare:** A cybercrime attack whose goal ranges from disabling a government's computer network to crippling a country., 214
- cypher:** A set of steps that can convert readable plaintext into unreadable ciphertext., 230. *See also* **encryption algorithm**
- D**
- DaaS :** Cloud computing service that allows users and applications to access a company's data., 288. *See also* **data as a service**

- dance pad:** Technology-related health condition that affects eyesight., 131. *See also* **computer vision**
- data**
- common data types, 501
 - file maintenance, 502
 - hierarchy of, 500–501
 - validating, 503
- data:** A collection of unprocessed items, which can include text, numbers, images, audio, and video., 12, 318
- how travels on Internet, 62
 - usage examples (table), 61
- data as a service:** Cloud computing service that allows users and applications to access a company's data., 288. *See also* **DaaS**
- data scientist:** Employee who uses analytics and other Big Data tools to compile statistics on data that an organization can use to plan product development or create strategies for marketing., 569
- database:** A collection of data organized in a manner that allows access, retrieval, and use of that data., 170, 498
- maintaining, 513
 - securing, 513
- database administrator:** Person in an organization who is responsible for managing and coordinating all database activities, including development, maintenance, and permissions., 510, 569. *See also* **DBA**
- database analyst:** Employee who uses data modeling techniques and tools to analyze and specify data usage., 569
- database approach, 504–505
- advantages of, 505–506
 - disadvantages of, 506
 - types of, 508
- database data, import/export of, 511
- database designer:** Employee who specifies the structure, interface, and requirements of a large-scale database; determines security and permissions for users., 568
- database management system:** Software that allows users to create a computerized database; add, modify, and delete data in the database; sort and retrieve data from the database; and create forms and reports from the data in the database., 498. *See also* **DBMS**
- backup and recovery, 515
 - data dictionary and, 510
 - data security and, 513–514
 - file retrieval and maintenance, 511–513
- database server:** Dedicated server that stores and provides access to a database., 116, 506
- database software:** An application that allows users to create, access, and manage a database., 170, 498
- data collection device:** Reading device that obtains data directly at the location where the transaction or event takes place., 338
- data dictionary:** A DBMS element that contains data about each file in a database and each field in those files., 510. *See also* **repository**
- data entry form:** A window on the screen that provides areas for entering or modifying data in a database., 512. *See also* **form**
- data file:** A collection of related records stored on a storage medium such as a hard drive or on cloud storage; often simply called a file., 501
- data model:** Rules and standards that define how users view the organization of the data in a database., 508
- data plans, mobile device, 458
- data projector:** A device that projects the text and images displaying on a computer or mobile device screen and projects the images on a larger screen so that an audience can see the image clearly., 352
- data representation, 288–290
- bits and bytes, 288
 - coding schemes, 289–290
- data security, 513–514
- data transfer rates, 460, 479
- data type:** Specifies the kind of data a field in a database can contain and how the field is used., 500
- data visualization, 509
- data warehouse:** Huge database that stores and manages the data required to analyze historical and current transactions., 508
- DBA:** Person in an organization who is responsible for managing and coordinating all database activities, including development, maintenance, and permissions., 510. *See also* **database administrator**
- DBMS:** Software that allows users to create a computerized database; add, modify, and delete data in the database; sort and retrieve data from the database; and create forms and reports from the data in the database., 498. *See also* **database management system**
- DDoS attack:** Type of DoS attack in which a zombie army is used to attack computers or computer networks., 217. *See also* **distributed DoS attack**
- decision support system (DSS):** Information system that helps users analyze information and make decisions; DSS for short., 559

- decoding:** Processor operation in the machine cycle that translates the instruction into signals the computer can execute., 281
- decrypt:** The process of decoding encrypted data., 229
- dedicated line:** A type of always-on physical connection that is established between two communications devices., 466
- dedicated servers (table), 116
- defragmenting:** Reorganizing the contents of a hard disk so that the files are stored in contiguous sectors., 197
hard disks, 197
- deliverable:** Any tangible item, such as a chart, diagram, report, or program file., 518
- denial of service attack (DoS attack):** An assault whose purpose is to disrupt computer access to an Internet service such as the web or email., 251
- density:** The number of bits in an area on a storage medium., 374
- design phase:** Step in the system development life cycle that consists of two major activities: (1) if necessary, acquire hardware and software and (2) develop all of the details of the new or modified information system., 523
- desktop:** A personal computer designed to be in a stationary location, where all of its components fit on or under a desk or table. Also called a desktop computer., 6, 114, 428
buyer's guide for, 115
components in, 278
motherboard of, 279
- desktop app:** Applications stored on a computer., 28
- desktop as a service, 287
- desktop case, fans, 301
- desktop computers, 114–115
- desktop monitors, 325
- desktop operating system:** A complete operating system that works on desktops, laptops, and some tablets., 426–428. *See also* **stand-alone operating system**
Macintosh operating system (Mac OS), 427–428
vs. mobile, 435–436
Windows, 426–427
- desktop or mobile application developer:** Employee who converts the system design into the appropriate application development language, such as Visual Basic, Java, C#, and Objective C, and toolkits for various platforms. *See also* **Desktop or mobile application programmer**, 570
- desktop or mobile application programmer:** Employee who converts the system design into the appropriate application development language, such as Visual Basic, Java, C#, and Objective C, and toolkits for various platforms. *See also* **Desktop or mobile application developer**, 570
- desktop publishing software:** An application that enables designers to create sophisticated publications that contain text, graphics, and many colors. DTP for short., 180
- detailed analysis:** Activity during system development that involves three major activities: (1) study how the current system works, (2) determine the users' wants, needs, and requirements, and (3) recommend a solution., 522. *See also* **logical design**
- detailed report:** Report generated by a management information system that usually lists just transactions., 558
- developing programs, applications, 29
- device-dependent:** A program is one that runs only on a specific type or make of computer or mobile device., 425
- device driver:** A small program that tells the operating system how to communicate with a specific device., 419. *See also* **driver**
- device-independent:** Operating systems that run on computers and mobile devices provided by a variety of manufacturers., 425
- devices
game, 10, 131–132
recycling, refurbishing, 242
- dial-up access:** Internet connection that takes place when a modem in a computer connects to the Internet via a standard telephone line that transmits data and information using an analog (continuous wave pattern) signal., 60
- dial-up modem:** A communications device that converts digital signals to analog signals and analog signals to digital signals, so that data can travel along an analog phone line., 469
- differential backup:** Backup method that copies only the files that have changed since the last full backup. (or) Fast backup method that requires minimal storage space to back up., 234, 396
- digital camera:** A mobile device that allows users to take pictures and store the photographed images digitally., 8, 125–127, 325
vs. smartphones and tablets, 8
- digital certificate:** A notice that guarantees a user or a website is legitimate., 231
verifying authenticity with, 231
- digital communications, 450–451

- digital device convergence**, 10
- digital forensics**: The discovery, collection, and analysis of evidence found on computers and networks., 227. *See also* **cyberforensics**
- digital forensics analyst**: Employee who inspects electronic data to recover documents and files from data storage devices that may have been damaged or deleted, in order to use them as evidence in a crime investigation., 570
- digital forensics examiner**: Employee who collects and analyzes evidence found on computers, networks, mobile devices, and databases., 569
- digital light processing projector**: Data projector that uses tiny mirrors to reflect light, which produces crisp, bright, colorful images that remain in focus and can be seen clearly, even in a well-lit room., 352. *See also* **DLP projector**
- digital literacy**: Having a current knowledge and understanding of computers, mobile devices, the web, and related technologies., 2, 561
- digital media**: Music, photos, and videos., 8
- digital media player, 9
- digital modem**: A communications device that sends and receives data and information to and from a digital line., 468. *See also* **broadband modem**
- digital pen**: An input device, slightly larger than a stylus, that captures and converts a user's handwriting or drawings into a digital format, which users can upload (transfer) to a computer or mobile device., 327
- digital photo printer**: Printer that uses heat to transfer colored dye to specially coated paper., 349. *See also* **dye-sublimation printer**
- digital**: Representation of data using only two discrete states: on (1) and off (0)., 288
- digital rights management (DRM)**: A strategy designed to prevent illegal distribution of movies, music, and other digital content. DRM for short., 240, 574
- digital school, 35–36
- digital security and privacy, 24–26
- digital security risk**: Any event or action that could cause a loss of or damage to computer or mobile device hardware, software, data, information, or processing capability., 212
- digital signature**: An encrypted code that a person, website, or organization attaches to an electronic message to verify the identity of the message sender., 231
- digital subscriber line**: Broadband Internet connection provided through the telephone network via a DSL modem., 59, 467. *See also* **DSL**
- digital television (DTV), 343–344
- digital video (DV) camera**: Camera that records video as digital signals, which you can transfer directly to a computer or mobile device with the appropriate connection., 330
- Digital Video Interface port**: Port that enables digital signals to transmit directly to a monitor., 343. *See also* **DVI port**
- digital video security, 333
- digitizer**: An electronic plastic board that detects and converts movements of a stylus or digital pen into digital signals that are sent to the computer., 328. *See also* **graphics tablet**
- direct access**: Access method where a device can locate a particular data item or file immediately, without having to move consecutively through items stored in front of the desired data item or file., 392. *See also* **random access**
- direct conversion**: Conversion strategy where the user stops using the old system and begins using the new system on a certain date., 526
- disaster recovery plan**: A written plan that describes the steps an organization would take to restore its computer operations in the event of a disaster., 234
- disc burning software**: Software that writes text, graphics, audio, and video files on a recordable or rewritable disc., 185
- discoverable mode**: State of a Bluetooth device when it is waiting for another Bluetooth device to locate its signal., 137
- Discovering Computers Twitter feed, 78
- discussion forum**: An online area in which users have written discussions about a particular subject., 91.
- disc *vs.* disk, 17
- disk cleanup**: Tool that searches for and removes unnecessary files., 196, 422
- disk defragmenter**: A tool that reorganizes the files and unused space on a computer's hard disk so that the operating system accesses data more quickly and programs and apps run faster., 197, 422
- disk *vs.* disc, 17
- display**: An output device that visually conveys text, graphics, and video information., 340–344. *See also* **display device**
- measuring, 341
- quality of, 342–343
- technologies, 341–342
- display device**: An output device that visually conveys text, graphics, and video information., 340. *See also* **display**

- DisplayPort:** Port that is an alternative to DVI and also supports high-definition audio and video., 343
- displays, 15
- distributed database:** Database in which the data exists in many separate locations throughout a network or the Internet., 508
- distributed DoS attack (DDoS attack):** Type of DoS attack in which a zombie army is used to attack computers or computer networks., 217. *See also* **DDoS attack**
- distribution software, 177
- DLP projector:** Data projector that uses tiny mirrors to reflect light, which produces crisp, bright, colorful images that remain in focus and can be seen clearly, even in a well-lit room., 352. *See also* **digital light processing projector**
- DMS:** System that allows for storage and management of a company's documents, such as word processing documents, presentations, and spreadsheets., 556. *See also* **document management system**
- DNS server:** A server on the Internet that usually is associated with an ISP. Short for domain name system., 64
- Dock, 428
- docking station:** An external device that attaches to a mobile computer or device and contains a power connection and provides connections to peripheral devices., 136
- documentation:** The collection and summarization of data, information, and deliverables., 519
- document management software:** An application that provides a means for sharing, distributing, and searching through documents by converting them into a format that can be viewed by any user., 176
- document management system:** System that allows for storage and management of a company's documents, such as word processing documents, presentations, and spreadsheets., 556. *See also* **DMS**
- domain name:** A text-based name that corresponds to the IP address of a server that hosts a website., 63
- domain name server, 116
- domain name system (DNS):** The method that the Internet uses to store domain names and their corresponding IP addresses., 64
- dongle:** Small device that connects to a computer and acts as a modem., 58
- dot pitch:** The distance in millimeters between pixels on a display., 342. *See also* **pixel pitch**
- dots per inch:** One measurement of ink-jet printer resolution., 346. *See also* **dpi**
- double-click, 13
- double-tap:** Touch gesture in which a user quickly touches and releases one finger two times., 5
- downlink:** Transmission from a satellite to an earth-based station, 482
- downloading:** The process of transferring content from the Internet to a computer or mobile device., 21
- applications, 29
- digital media from online services, 87
- software safely, 162
- downstream rate:** The transfer rate that is achieved when data is being sent over a communications channel., 462
- dpi:** One measurement of ink-jet printer resolution., 346. *See also* **dots per inch**
- drag:** Touch gesture in which a user presses and holds one finger on an object and then moves the finger to the new location., 5, 13. *See also* **Slide**
- DRAM:** RAM chips that must be reenergized constantly or they lose their contents., 292. *See also* **dynamic RAM**
- driver:** A small program that tells the operating system how to communicate with a specific device., 419. *See also* **device driver**
- DSL:** Broadband Internet connection provided through the telephone network via a DSL modem., 59, 467. *See also* **digital subscriber line**
- DSL modem:** A broadband modem that sends digital data and information from a computer to a DSL line and receives digital data and information from a DSL line., 469
- DTP software, 180
- DVD kiosk:** A self-service DVD rental machine that connects to a host computer through a network., 120
- DVD+RAM:** DVD-rewritable formats that users can write on multiple times., 388
- DVD+R:** DVD-recordable WORM formats, on which users can write once but not erase their own items, including video, audio, photos, graphics, and text., 388
- DVD-R:** DVD-recordable WORM formats, on which users can write once but not erase their own items, including video, audio, photos, graphics, and text., 388
- DVD-ROM:** DVD-read-only memory; a high-capacity optical disc that users can read but not write on or erase., 388

- DVD+RW:** DVD-rewritable formats that users can write on multiple times., 388
- DVD-RW:** DVD-rewritable formats that users can write on multiple times., 388
- DVDs as optical discs, 18
- DVI port:** Port that enables digital signals to transmit directly to a monitor., 343. *See also* **Digital Video Interface port**
- DV technology:** Technology used with DV (digital video) cameras that allows you to input, edit, manage, publish, and share your videos., 330, 331
- dye-sublimation printer:** Printer that uses heat to transfer colored dye to specially coated paper., 349. *See also* **digital photo printer**
- Dynamic RAM:** RAM chips that must be reenergized constantly or they lose their contents., 292. *See also* **DRAM**
- dynamic webpage:** A webpage on which visitors can customize some or all of the viewed content., 65
- E**
- earbuds:** Small speakers that rest inside each ear canal., 8, 9, 16, 128, 352
- EarPods:** Term used by Apple to refer to earbuds they designed to match the shape of the human ear., 128
- easier access, database approach, 506
- eavesdropping, 395
- e-book:** An electronic version of a printed book, readable on computers and other digital devices. Also called a digital book., 9, 129
- e-book reader:** A mobile device that is used primarily for reading e-books and other digital publications. Short for electronic book reader., 129. *See also* **e-reader**
- vs.* smartphones and tablets, 9
- e-commerce:** A business transaction that occurs over an electronic network such as the Internet. Short for electronic commerce., 82
- economic feasibility:** Test that measures whether the lifetime benefits of the proposed information system will be greater than its lifetime costs., 519. *See also* **cost/benefit feasibility**
- EDI:** Standard that defines how business documents transmit across transmission media., 453. *See also* **electronic data interchange**
- editing
- audio, 183
- photos, 181
- edit:** Process in project development during which you make changes to a project's existing content., 165
- education
- applications, 186
- cyberbullying in schools, 94
- Internet plagiarism, 165
- technology in, 35
- wikis in, 40
- educational websites, 77
- education web database services, 507
- e-filing:** The process of filing your tax forms electronically., 176
- e-form:** Short for electronic form; a form that sends entered data across a network or the Internet., 512
- EFT:** Service in which users connected to a network can exchange money from one account to another via transmission media., 453. *See also* **electronic funds transfer**
- EIDE:** Enhanced Integrated Drive Electronics; interface that uses parallel signals to transfer data, instructions, and information., 380
- Electronic Communications Privacy Act (ECPA), 474
- electronic data interchange:** Standard that defines how business documents transmit across transmission media., 453. *See also* **EDI**
- electronic funds transfer:** Service in which users connected to a network can exchange money from one account to another via transmission media., 453. *See also* **EFT**
- electronic profiles, 242–243
- electronics recycling, 122
- electronic storefront:** In e-commerce applications, webpage that contains product descriptions, images, and a shopping cart., 81
- email:** The transmission of messages and files via a computer network. Short for electronic mail., 24, 31, 88
- address book, 74
- avoiding malware infections, 110
- communications applications, 188
- employers monitoring of, 247
- scams, 245
- suspicious attachments, 25
- viruses, how they spread via, 215
- email address, 88
- email list:** A group of email addresses used for mass distribution of a message. Short for electronic mailing list., 90

- email messages, sending, 103
- email program:** Program used to create, send, receive, forward, store, print, and delete email messages., 88
- email spoofing:** Spoofing that occurs when the sender's address or other components of an email header are altered so that it appears that the email message originated from a different sender., 217
- email:** The transmission of messages and files via a computer network. Short for electronic mail.
sending messages, 103
- embedded computer:** A special-purpose computer that functions as a component in a larger product., 132
- emergency plans, 235
- emoticons:** Symbols used in online communications that express emotion., 94
- employee monitoring:** The use of computers, mobile devices, or cameras to observe, record, and review an employee's use of a technology, including communications such as email messages, keyboard activity (used to measure productivity), and websites visited., 247
- employment websites, 82
- encryption:** The process of converting data that is readable by humans into encoded characters to prevent unauthorized access., 229
- encryption algorithm:** A set of steps that can convert readable plaintext into unreadable ciphertext., 230. *See also cypher*
- encryption key:** A set of characters that the originator of the data uses to encrypt the plaintext and the recipient of the data uses to decrypt the ciphertext., 230
- encryption:** The process of converting data that is readable by humans into encoded characters to prevent unauthorized access., 424
- end-user license agreement (EULA):** License agreement included with software purchased by individual users., 163, 228. *See also single-user license agreement*
- ENERGY STAR program:** Program developed by the United States Department of Energy (DOE) and the United States Environmental Protection Agency (EPA) to help reduce the amount of electricity used by computers and related devices., 241
- enhanced resolution:** Digital camera resolution that uses a special formula to add pixels between those generated by the optical resolution., 127
- enterprise
content management systems, 557
document management systems, 556
functional units of, 554–555
enterprise computing, 177
- Enterprise Resource Planning:** Information system that integrates MRP II with the information flow across an organization to manage and coordinate the ongoing activities of the enterprise, including product planning, manufacturing and distribution, accounting and finance, sales, human resources, and customer support., 555
- enterprise storage, 389–392
network attached storage, 390–392
storage area network, 391–392
- enterprise user:** Each employee or customer who uses computers, mobile devices, and other technology in an enterprise., 41, 42
- entertainment
applications, 186
motion input in, 329
technology in, 38, 199
web database services, 507
websites, 79, 199
- environmental issues of computer use, 26
- e-reader:** A mobile device that is used primarily for reading e-books and other digital publications. short for electronic book reader., 9, 129. *See also e-book reader*
- e-retail:** Process of purchasing products or services on the web. Short for electronic retail., 81
- ergonomic keyboard:** Keyboard design that reduces the chance of repetitive strain injuries (RSIs) of wrist and hand., 322
- ergonomics:** An applied science devoted to incorporating comfort, efficiency, and safety into the design of items in the workplace., 144
- ERP:** Information system that integrates MRP II with the information flow across an organization to manage and coordinate the ongoing activities of the enterprise, including product planning, manufacturing and distribution, accounting and finance, sales, human resources, and customer support., 555. *See also Enterprise Resource Planning*
- eSATA:** External SATA; interface used with external drives and that is much faster than USB., 380
- Ethernet:** A network standard that specifies no central computer or device on the network (nodes) should control when data can be transmitted., 460
- ethics
of altering digital, 182
punishment for webcam spying, 111
and society, 238–242

- EULA:** License agreement included with software purchased by individual users., 163, 228.
See also **end-user license agreement; single-user license agreement**
- e-waste:** Discarded computers and mobile devices., 26, 122
- exabyte (EB), 370
- exception criteria:** Out-of-the-ordinary conditions that define the normal activity or status range in an exception report., 558
- exception report:** Report generated by a management information system that identifies data outside of a normal condition., 558
- executing:** Processor operation in the machine cycle that carries out the commands., 281
- expansion bus:** Bus that allows the processor to communicate with peripheral devices., 300
- expansion card:** A circuit board that enhances the functions of a component of a desktop or server system unit and/or provides connections to peripheral devices., 297. *See also* **adapter board; adapter card**
- expansion slot:** A socket on a desktop or server motherboard that can hold an adapter card., 297
- expert system:** An information system that captures and stores the knowledge of human experts and then imitates human reasoning and decision making., 560
- extended contacts, 73
- extended warranty options, 567
- Extensible Markup Language:** Popular format for sharing data that allows web developers to create tags that describe the structure of information., 536. *See also* **XML**
- external displays, connecting laptop, 341
- external hard drive:** A separate freestanding storage device that connects with a cable to a USB port or other port on a computer or mobile device., 17, 378–379
- extranet:** Portion of a company's network that allows customers or suppliers to access part of its intranet., 453
- eyestrain, easing while using computers, 16, 143
- F**
- Facebook, 23, 24, 73, 77, 258
- face recognition system:** Biometric device that captures a live face image and compares it with a stored image to determine if the person is a legitimate user., 225
- failure of hardware, 139–140, 233
- Fair Information Practices (FIP), 502
- Fair Labor Association (FLA), 295
- fair trade practices, 295
- fake cell towers, device tracking, 480
- FAQ, 94
- fault-tolerant computer:** Computer that has duplicate components so that it can continue to operate when one of its main components fails., 141
- favorites:** Links to preferred websites., 67. *See also* **bookmark**
- fax, 31
- FBI's National Crime Information Center (NCIC), 36
- FC:** Interface often used in enterprise storage because it has much faster transmissions rates than SCSI and other interfaces., 390. *See also* **Fibre Channel**
- feasibility:** A measure of how suitable the development of a system will be to the organization., 519
- feasibility study:** Investigation performed in system development that determines the exact nature of the problem or improvement and decide whether it is worth pursuing., 521. *See also* **preliminary investigation**
- feature creep:** Problem that occurs when one activity has led to another that was not planned originally; thus, the scope of the project now has grown., 519. *See also* **Scope creep**
- Federal Communications Commission (FCC), 477, 480
- Federal Trade Commission (FTC), 214
- fetching:** Processor operation in the machine cycle that obtains a program or an application instruction or data item from memory., 281
- fiber-optic cable:** Physical transmission media that consists of dozens or hundreds of thin strands of glass or plastic that use light to transmit signals., 478
- Fiber to the Building:** Dedicated line used by small businesses to access the Internet via fiber-optic cables., 467. *See also* **FTTB**
- Fiber to the Home:** Dedicated line that provides home users with Internet access via fiber-optic cable., 467. *See also* **FTTH**
- Fiber to the Premises:** Broadband Internet connection that uses fiber-optic cable to provide high-speed Internet access via a modem. FTTP for short., 59
- Fiber to the Premises:** Dedicated line that uses fiber-optic cable to provide extremely high-speed Internet access to a user's physical permanent location., 467. *See also* **FTTP**
- Fibre Channel:** Interface often used in enterprise storage because it has much faster transmissions rates than SCSI and other interfaces., 390. *See also* **FC**

- field:** A combination of one or more related characters or bytes and is the smallest unit of data a user accesses., 500
- field name:** Name that uniquely identifies each field in a database., 500
- file, disk, and system management tools, 194–198
- file:** A named collection of stored data, instructions, or information that can contain text, images, audio, and video., 18
- file compression:** Shrink the size of a file(s)., 422
- file compression tool:** Tool that shrinks the size of a file(s)., 198
- file maintenance:** Procedures that keep data current., 502
- file manager:** A tool that performs functions related to displaying files in folders; and copying, renaming, deleting, moving, and sorting files. (or) A tool that performs functions related to file management., 194, 422
- caution about deleting program files, 194
- file processing system:** System used to store and manage data in which each department or area within an organization has its own set of files., 504
- isolated data, 504
- redundant data, 504
- files
- audio, 86–87
 - compressed, 86
 - compressing, uncompressing, 198
 - deleting to uninstall programs, 195
- file server, 116
- file sharing network:** P2P network configuration on which users access each other's hard drives and exchange files directly via a file sharing program., 457
- file viruses, 190
- filters, Internet, 193
- finance websites, 36
- financial apps, 178
- financial information, entering online, 82
- financial websites, 79
- fingerprint reader:** Biometric device that captures curves and indentations of a fingerprint. Also called a fingerprint scanner., 139, 224
- Firefox:** Mozilla Corporation's browser., 67
- Firefox OS:** Linux-based operating system for Amazon Kindle tablets and Amazon Fire phones., 434
- Fire OS:** Linux-based operating system for Amazon Kindle tablets and Amazon Fire phones., 434
- firewall:** Hardware and/or software that protects a network's resources from intrusion by users on another network, such as the Internet., 25, 189, 219–220, 423
- firmware:** ROM chips that contain permanently written data, instructions, or information., 294, 410
- First Amendment, and content filtering, 248
- fitness and health apps, 187
- fixed wireless:** Broadband Internet connection that uses a dish-shaped antenna on a building, such as a house or business, to communicate with a tower location via radio signals., 59, 482
- flagged records, 502
- flames:** Abusive or insulting messages., 94
- flame wars:** Exchanges of flames., 94
- flash memory storage, avoiding malware infections, 110
- flash memory:** Type of nonvolatile memory that can be erased electronically and rewritten., 295
- flat-panel display:** Display device that has a shallow depth and a flat screen., 340
- flat-panel monitors, 332–343
- focus group:** A series of lengthy, structured group meetings in which users and IT professionals work together to design or develop an application., 520. *See also* **Joint-application design (JAD) session**
- folder:** A specific named location on a storage medium that contains related documents., 194
- compressing, uncompressing, 198
- font:** A name assigned to a specific set of characters., 166
- font size:** The size of the characters in a particular font, measured in points., 166
- font style:** Formatting task that adds emphasis to a font, such as bold, italic, underline, and color., 166
- force feedback:** Technology that sends resistance to the device in response to actions of the user., 353
- foreground:** Program with which the user currently is interacting., 415
- format:** Process in project development during which change a project's appearance., 166
- graphics, used on the web (table), 86
- formatting:** The process of dividing the disk into tracks and sectors so that the operating system can store and locate data and information on the disk., 374
- form:** A window on the screen that provides areas for entering or modifying data in a database., 512. *See also* **data entry form**
- formulas in worksheet cells, 169

- forward recovery:** Recovery technique where the DBMS uses the log to reenter changes made to the database since the last save or backup., 515. *See also* **rollforward**
- fourth-generation language:** A nonprocedural language that enables users and programmers to access data in a database., 532. *See also* **4G**
- FoxNews.com, 90
- fractional T1:** T-carrier line that home and small business users purchase, in which they share a connection to a T1 line with other users., 468
- frame rate:** The number of frames per second (fps) in a video, 331
- freeware:** Copyrighted software provided at no cost by an individual or a company that retains all rights to the software., 161
- friends, 73, 74
- front end:** A program that generally has a more user-friendly interface than a DBMS., 505
- front side bus:** Bus that is part of the motherboard and connects the processor to main memory., 300. *See also* **FSB**
- FSB:** Bus that is part of the motherboard and connects the processor to main memory., 300. *See also* **front side bus**
- FTP:** An Internet standard that permits file uploading and downloading to and from other computers on the Internet. Short for File Transfer Protocol., 24, 31, 92, 188
- FTP server:** A computer that allows users to upload and/or download files using FTP., 92, 116
- FTTB:** Dedicated line used by small businesses to access the Internet via fiber-optic cables., 467. *See also* **Fiber to the Building**
- FTTH:** Dedicated line that provides home users with Internet access via fiber-optic cable., 467. *See also* **Fiber to the Home**
- FTTP:** Dedicated line that uses fiber-optic cable to provide extremely high-speed Internet access to a user's physical permanent location., 467. *See also* **Fiber to the Premises**
- full backup:** Backup method that provides the best protection against data loss because it copies all program and data files. (or) Fastest recovery method in which all files are saved., 234, 396. *See also* **archival backup**
- function:** A predefined formula that performs common calculations such as adding the values in a group of cells or generating a value such as the time or date., 169
- function creep:** Problem that occurs when a company uses the technology intended for one purpose for an entirely different purpose., 502
- function keys:** Special keyboard keys, labeled with the letter F followed by a number, programmed to issue commands to a computer., 320
- ## G
- game console:** A mobile computing device designed for single-player or multiplayer video games., 10, 131, 276
- game devices, 131–132
- gamepad:** Game controller, held with both hands, that controls the movement and actions of players or objects in video games or computer games., 131
- game server, 116
- game web and mobile apps, 187
- games designer:** Employee who designs games and translates designs into a program or app using an appropriate application development language. *See also* **Games programmer**, 570
- games programmer:** Employee who designs games and translates designs into a program or app using an appropriate application development language. *See also* **Games designer**, 570
- gaming
- accessories and input techniques, 11
 - in home, 11
 - online, avoiding risks, 216
- gaming desktop:** Desktop that offers high-quality audio, video, and graphics with optimal performance for sophisticated single-user and networked or Internet multiplayer games., 114
- gaming keyboard:** A keyboard designed specifically for users who enjoy playing games on the computer., 322
- Gantt chart:** Bar chart developed by Henry L. Gantt that uses horizontal bars to show project phases or activities., 518
- Gates, Bill, 26
- GBps:** Gigabytes per second., 371, 460
- geofence:** Virtual perimeter or boundary to disable certain apps or cameras in secure areas, such as labs or meeting rooms., 389
- geolocation:** Determining a user's location based on a device's GPS or connection to a cell tower., 537
- geotag, 372
- gesture:** A motion you make on a touch screen with the tip of one or more fingers or your hand., 5, 324
- touch screen (table), 5

gesture recognition: Computer capability that allows users to guide on-screen elements using air gestures., 328. *See also* **motion input**

ghosting, 197

GIF graphics format, 86

gigabyte (GB): One billion characters., 61, 290, 370

gigahertz (GHz): One billion ticks of the system clock per second., 283

global positioning system: A navigation system that consists of one or more earth-based receivers that accept and analyze signals sent by satellites in order to determine the receiver's geographic location., 483. *See also* **GPS**

Google, 63

Google Apps Certified Specialist: Programmer/developer certification that tests a user's skills of administering, selling, and deploying Google Apps., 574

Google Drive: Drive that provides access to email, contacts, calendar, photos, files, and more., 434

Google Maps, 81

Google Play: Google's app store that provides access to apps, songs, books, and movies., 434

Google's Android, 27

Google Street View feature, 111

governmental websites, 77

government web database services, 507

GPRS: General Packet Radio Service; a 2G standard for cellular transmissions., 481

GPS: A navigation system that consists of one or more earth-based receivers that accept and analyze signals sent by satellites in order to determine the receiver's geographic location., 31, 39, 69, 132, 178, 187, 483. *See also* **global positioning system**

GPS receiver: A handheld, mountable, or embedded device that contains an antenna, a radio receiver, and a processor., 69

GPS tracking, disabling, 237

grandparent: Term used in three-generation backups to refer to the oldest copy of the file., 234

graphical user interface (GUI): User interface with which you interact with menus and visual images by touching, pointing, tapping, or clicking buttons and other objects to issue commands., 414. *See also* **video card**

graphics

applications, 27

and media applications, 164

output, 340

graphics card: Adapter card that converts computer output into a video signal that travels through a cable to the monitor, which displays an image on the screen., 298. *See also* **video card**

graphics formats used on the web (table), 86

graphics processing unit (GPU): Chip that controls the manipulation and display of graphics on a display device. Also called GPU., 342

graphics tablet: An electronic plastic board that detects and converts movements of a stylus or digital pen into digital signals that are sent to the computer., 328. *See also* **digitizer**

graphic: Visual representation of nontext information such as a drawing, chart, or photo., 85

green computing: Practices that involve reducing the electricity and environmental waste while using a computers, mobile devices, and related technologies., 26, 241

GSM: Global System for Mobile Communications; a 2G standard for cellular transmissions., 481

GUI (graphical user interface): User interface with which you interact with menus and visual images by touching, pointing, tapping, or clicking buttons and other objects to issue commands., 414

H

hacker: Someone who accesses a computer or network illegally., 193, 214

punishment for cybercrime, 214

hacking, 528

hand geometry system: Biometric device that measures the shape and size of a person's hand., 225

handheld computer: A computer small enough to fit in one hand., 112

handheld game device: A small mobile device that contains a screen, speakers, controls, and game console all in one unit., 131

hands-free device, 8

handwriting recognition software: Software that translates the handwritten letters and symbols created on the screen into typed text or objects that the computer or mobile device can process., 327

hard copy: Information that exists on a physical medium, such as paper., 14, 166. *See also* **hyperlink**

hard disk drive: Storage device that includes one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information., 373. *See also* **hard disk; HDD**

- hard disk:** Storage device that includes one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information., 17, 373–376. *See also* **hard disk drive; HDD**
- access time on, 376
- defragmenting, 197, 376
- hard drive:** Term used to refer collectively to hard disks and SSDs., 17, 373–380
- data and files, encryption, 379
- transfer files, internal, 377
- hardware:** Electric, electronic, and mechanical components contained in a computer., 4
- and operating system, 158
- protecting, 139–141
- hardware firewall:** Device intended to stop network intrusions before they attempt to affect your computer or network malicious., 190, 472
- hardware radiation, 344
- hashtag:** A number sign (#) followed by a keyword that describes and categorizes a Tweet., 73
- HDD:** Storage device that includes one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information., 373. *See also* **hard disk; hard disk drive**
- HDMI port:** Port that combines DVI with high-definition (HD) television and video., 343. *See also* **High-Definition Media Interface port**
- HDTV:** The most advanced form of digital television, working with digital broadcast signals, transmitting digital sound, supporting wide screens, and providing high resolutions., 343. *See also* **high-definition television**
- head crash:** Type of hard disk failure that occurs when a read/write head touches the surface of a platter., 375
- headphones:** Audio output device that cover or are placed outside the ear., 16, 352
- headset:** Input device that you can speak into that contains both a microphone and a speaker., 14, 352
- health and fitness apps, 187
- health care, technology in, 38
- health concerns of using technology, 26, 142–144
- health websites, 79
- heat sink:** Small ceramic or metal component with fins on its surface that absorbs and disperses heat produced by electrical components, such as a processor., 284
- help desk specialist:** Employee who answers technology-related questions in person, on the phone, or via email or an online chat room. *See also* **Help desk technician**, 569
- help desk technician:** Employee who answers technology-related questions in person, on the phone, or via email or an online chat room. *See also* **Help desk specialist**, 569
- help systems, 205
- hertz:** One clock cycle per second, 283
- hibernate mode:** Computer power option that saves any open documents and running programs or apps to an internal hard drive before removing power from the computer or device., 413
- High-Definition Media Interface port:** Port that combines DVI with high-definition (HD) television and video., 343. *See also* **HDMI port**
- high-definition television:** The most advanced form of digital television, working with digital broadcast signals, transmitting digital sound, supporting wide screens, and providing high resolutions., 343. *See also* **HDTV**
- highest priority projects, 521
- hits:** Webpage names displayed by a search engine that contain the search text specified by a user., 71
- home automation, 11
- devices, 132
- home design/landscaping software, 180
- home network:** Multiple computers and devices connected together by home users., 33, 473
- creating, 475
- planning and designing, 474–475
- home page:** The first page that is displayed on a website., 66
- home server, 116
- home user:** Any person who spends time using technology at home., 41, 42, 236
- host:** Any computer that provides services and connections to other computers on a network. Also called a server., 56
- host computer:** Computer that controls access to the hardware, software, and other resources on the network and provides a centralized storage area for programs, data, and information., 456. *See also* **server**
- hot plugging:** Feature that allows you to insert or remove a removable flash memory device and other devices while the computer is running., 298
- hot spot:** A wireless network that provides Internet connections to mobile computers and devices., 32, 59
- HTML5:** Technology used for web apps that specifies the structure of content displayed on a webpage., 537–538

HTML: A special formatting language that software developers use to format documents for display on the web., 535, 536. *See also* **Hypertext Markup Language**

hub: A device that provides a central point for cables in a network., 473. *See also* **switch**

human resources information system (HRIS): Information system that manages one or more administrative human resources functions, such as maintaining and managing employee benefits, schedules, and payroll., 555

human resources software, 177

hybrid app: App that combines features of native and mobile web apps., 571

hyperlink: A built-in connection to other documents, graphics, audio files, videos, other webpages, or websites., 21

Hypertext Markup Language: A special formatting language that software developers use to format documents for display on the web., 535, 536. *See also* **HTML**

Hypertext Transfer Protocol (http), 69

I

IaaS (infrastructure as a service): Cloud computing service that uses software to emulate hardware capabilities, enabling companies to scale, or adjust up or down, storage, processing power, or bandwidth as needed., 287

ICANN: Organization that approves and controls TLDs. Short for Internet Corporation for Assigned Names and Numbers., 63

iCloud: Apple's cloud server., 427

icons, 426

identity theft

protecting yourself from, 80

recovering from, 514

illustration software: An application that allows users to draw pictures, shapes, and other graphics with various on-screen tools such as a pen, brush, eyedropper, and paint bucket., 181. *See also* **paint software**

image editing software: An application that provides the capabilities of paint software and also includes the capability to enhance and modify existing photos and image., 181

image viewer: A tool that allows users to display, copy, and print the contents of a graphics file, such as a photo., 195, 422

impact printer, 351

implementation phase, 525

improved data integrity, 506

inattentive blindness: Problem that occurs when a person's attention is diverted while performing a natural activity, such as walking., 125

incremental backup: Fastest backup method that requires minimal storage space to back up because only most recent changes are saved. (or) Backup method that copies only the files that have changed since the last full or incremental backup., 234, 396

index: Feature of a search tool that stores a variety of information about a file, including its name, date created, date modified, author name, and so on., 195

inference rules: A set of logical judgments that are applied to the knowledge base each time a user describes a situation to the expert system., 560

infographic: A visual representation of data or information, designed to communicate quickly, simplify complex concepts, or present patterns or trends. Short for information graphic., 86

informational websites, 74

information literacy: Skill set that prepares people to manage information so that they can be knowledgeable decision makers., 560–561

components, 561

defining, 561

research and composition, steps in, 561

information privacy: The right of individuals and companies to deny or restrict the collection, use, and dissemination of information about them., 242

information: Processed data that conveys meaning to users., 12

accuracy, 239–240

described, 12

how travels on Internet, 62

information system: A set of hardware, software, data, people, and procedures that work together to produce information., 515, 554

information theft: Illegal act that occurs when someone steals person or confidential information., 229

infrared (IR), 479

infrastructure as a service (IaaS): Cloud computing service that uses software to emulate hardware capabilities, enabling companies to scale, or adjust up or down, storage, processing power, or bandwidth as needed., 287

ink cartridges, 346

- ink-jet printer:** A type of nonimpact printer that forms characters and graphics by spraying tiny drops of liquid ink onto a piece of paper., 345–346
- input devices:** Any hardware component that allows you to enter data and instructions into a computer or mobile device., 12
- input:** Term used to refer to data., 4, 318–319
data, 12
with input devices, 12
techniques for gaming, 12
video and voice, 14
- insertion point:** A symbol on the screen, usually a blinking vertical bar, that indicates where the next character you type will appear., 320. *See also* **cursor**
- Instagram, 182
- installing applications, mobile apps, 29
- instant messaging (IM):** A real-time Internet communications service that notifies you when one or more of your established contacts are online and then allows you to exchange messages or files or join a private chat room with them., 31, 178
- instructors, 567
- integrated circuit:** Circuit that contains many microscopic pathways capable of carrying electrical current., 278
- integrated development environment (IDE):** Object-oriented application development tool that contains tools for building graphical interfaces, an editor for entering program code, a compiler and/or interpreter, and a debugger (to remove errors)., 530
- integration test, 525
- intel-compatible processors:** Processors manufactured by AMD that have an internal design similar to Intel processors, perform the same functions, and can be as powerful, but often are less expensive., 283
- intellectual property rights:** The rights to which creators are entitled for their work., 240
- intellectual property (IP):** Unique and original works such as ideas, inventions, art, writings, processes, company and product names, and logos., 240
- interactive whiteboard:** A touch-sensitive device, resembling a dry-erase board, that displays the image on a connected computer screen, usually via a projector., 353
- interactive whiteboards, 35
- International Electronics Commission (IEC), 299
- International Mobile Subscriber Identity (IMSI):**
Unique identity of every mobile device that allows it to communicate with a cell tower., 480
- Internet:** A worldwide collection of computer networks that connects millions of businesses, government agencies, educational institutions, and individuals., 20, 56
addresses, 62–64
communications, 24
connecting to the, 58–64
evolution of the, 56
filters, 193
how data, information travels on, 62
and network attacks, 215–220
plagiarism, schools dealing with, 165
popular broadband service technologies (table), 59
using in daily activities (fig.), 57
World Wide Web Consortium (W3C), 58
- Internet backbone:** Major carriers of network traffic., 62
- internet communications, 24
- Internet Explorer:** Microsoft's browser., 67, 426
- internet marketing specialist:** Employee who directs and implements an organization's use of Internet and social media marketing, including Facebook pages, Twitter feeds, blogs, and online advertisements. *See also* **Social media marketing specialist**, 569
- internet messaging, 90
- internet messaging services, 458
- Internet of things (IoT):** Term that describes an environment where processors are embedded in every product imaginable (things), and those 'things' communicate with each other via the Internet., 133
- Internet of things (IoT):** Term that describes an environment where processors are embedded in every product imaginable (things), and those 'things' communicate with each other via the Internet., 284–285
discrimination of, 286
privacy and security concerns, 286
- Internet service providers (ISPs):** A business that provides individuals and organizations access to the Internet free or for a fee. Sometimes called an Internet access provider., 20, 61
- internet usage, ISPs controlling, 477
- interpreter:** Program used to convert a source program into machine language by translating and then executing the machine language instructions one instruction at a time., 529
- interview, 520
- intranet:** An internal network that uses Internet technologies, 453

iOS: Proprietary mobile operating system specifically made for Apple's mobile devices., 434

IP address: A sequence of numbers that uniquely identifies the location of each computer or device connected to the Internet. Short for Internet Protocol., 62, 462

IP hijacking: Internet security threat that occurs when cyberthieves tap into home routers or cable modems or other Internet access points to intercept a paid Internet service., 474

iPods with earbuds, 9

IP spoofing: Spoofing that occurs when an intruder computer fools a network into believing its IP address is associated with a trusted source., 217

IP: Unique and original works such as ideas, inventions, art, writings, processes, company and product names, and logos., 240

IrDA: Infrared Data Association; standard for devices to transmit data wirelessly to each other via infrared (IR) light waves., 465

iris recognition system: Biometric device that uses iris recognition technology to read patterns in the iris of the eye., 226

IRS website, 77

ISDN modem: A broadband modem that sends digital data and information from a computer to an ISDN line and receives digital data and information from an ISDN line., 469

ISDN (Integrated Services Digital Network): Short for Integrated Services Digital Network; a set of standards for digital transmission of data over standard copper phone lines., 467

IT consultant: A professional, typically hired based on technical expertise, who provides technology services to his or her clients., 523, 568

iTunes, 38, 87

iTunes Store: Store that provides access to music, books, podcasts, ringtones, and movies., 434

iTunes U, 35, 199

J

jack: Term sometimes used to identify audio and video ports., 134

jailbreaking: Process of making unauthorized modifications to operating systems and bypassing the DRM restrictions on Apple iPhones and iPads in order to run unapproved apps., 574

Java: An object-oriented programming language developed by Sun Microsystems., 531

JavaScript: A scripting language that users to interact with a webpage's content., 538

jewel case: Protective case for storing optical discs., 387

Jobs, Steve, 26

job searching, 576

job search websites, 82

joint-application design (JAD) session: A series of lengthy, structured group meetings in which users and IT professionals work together to design or develop an application., 520. *See also* **focus group**

joystick: A handheld vertical lever, mounted on a base, that you move in different directions to control the actions of the simulated vehicle or player., 131

JPEG: Compressed graphics format that attempts to reach a balance between image quality and file size. Short for Joint Photographic Experts Group., 86

juice jacking, 136

Jumpstart Our Business Startup (JOBS) Act, 396

JustCloud.com, 19

K

KBps: Kilobytes per second., 371

kernel: The core of an operating system that manages memory and devices, maintains the internal clock, runs programs, and assigns the resources, such as devices, programs, apps, data, and information., 412–413

keyboard: Input device that contains keys you press to enter data and information into a computer or mobile device., 13, 320–322

types of, 321

keyboard monitoring software: Software that runs undetected and stores every keystroke in a file for later retrieval., 321. *See also* **keylogging software**

keyboard shortcut: One or more keyboard keys that you press to perform an operating system or application-related task., 320

keygen: Program that creates software registration numbers and sometimes activation codes. Short for key generator., 228

keyloggers: Program often found on public computers that records keystrokes in a hidden file., 80

keylogging software: Software that runs undetected and stores every keystroke in a file for later retrieval., 321. *See also* **keyboard monitoring software**

kill switch, smartphone, 295

kilobyte (KB), 370

- kiosk:** A freestanding terminal that usually has a touch screen for user interaction., 119, 325
- knowledge base:** The combined subject knowledge and experiences of the human experts used in an expert system., 560
- L**
- L1 cache:** Cache built directly on the processor chip., 294
- L2 cache:** Cache that is slightly slower than L1 cache but has a much larger capacity., 294
- L3 cache:** Cache on the motherboard that is separate from the processor chip., 294
- label printer:** A small printer that prints on an adhesive-type material that can be placed on a variety of items such as envelopes, packages, optical discs, photos, and file folders., 350
- landscape orientation:** A project that is wider than it is tall, with information printed across the widest part of the document., 344
- laptop:** Thin, lightweight mobile computer with a screen in its lid and a keyboard in its base, designed to fit on your lap., 4, 111, 276. *See also* **notebook computer**
- components in, 278
 - keyboard, 13
 - motherboard of, 279
 - vs.* tablets, desktops, 6
- large-format printer:** Printer that uses ink-jet technology, but on a much larger scale, to create photo-realistic-quality color prints., 350
- laser mouse:** Mouse that uses laser sensors that emit and sense light to detect the mouse's movement., 322
- laser printer:** Type of high-speed, high-quality nonimpact printer that creates images using a laser beam and powdered ink called toner., 348
- latency:** The time it takes a signal to travel from one location to another on a network., 476
- latest drivers, finding, 419
 - laws, privacy, 246
- LCD:** Display technology that sandwiches a liquid compound between two sheets of material that presents sharp, flicker-free images on a screen when illuminated., 341–342. *See also* **liquid crystal display**
- LCD projector:** Data projector, which uses liquid crystal display technology, that attaches directly to a computer or mobile device and uses its own light source to display the information shown on the computer screen., 352
- LED display:** A display that uses LED for the backlight. Also called an LED LCD display., 342
- LED (light-emitting diode):** Light-emitting diode technology used in monitors., 341–342
- legal software:** An application that assists in the preparation of legal documents and provides legal information to individuals, families, and small businesses, 175
- level 1:** RAID storage design that writes data on two disks at the same time to duplicate the data., 390. *See also* **mirroring**
- libraries
 - and content filtering, 247
 - library instruction, 561
- license agreement:** The right to use a program or app, which provides specific conditions for use of the software and that a user typically must accept before using the software., 163, 228
- lifestyle applications, 185
- like:** Terminology used on social networking sites to recommend content., 73
- line-of-sight transmission:** Requirements that the sending device and the receiving device must be in line with each other so that nothing obstructs the path of the infrared light wave., 465
- link:** A built-in connection to other documents, graphics, audio files, videos, other webpages, or websites., 21. *See also* **hyperlink**
- avoiding clicking unsafe, 238
- LinkedIn, 23, 24, 82, 578
- Linux:** A popular, multitasking UNIX-based operating system that runs on a variety of personal computers, servers, and devices., 429–430
- liquid cooling technology:** Processor cooling method that uses a continuous flow of fluid(s), such as water and glycol, in a process that transfers the heated fluid away from the processor to a radiator-type grill, which cools the liquid, and then returns the cooled fluid to the processor., 284
- liquid crystal display:** Display technology that sandwiches a liquid compound between two sheets of material that presents sharp, flicker-free images on a screen when illuminated., 341–342. *See also* **LCD**
- LISTSERV, 90
 - list server, 116
 - literacy, digital, 2
- Live CD:** CD that can be used to start the computer., 413
- Live USB:** USB flash drive that can be used to start the computer, 413
- loads:** The process of copying software from storage to memory., 28

- local area network (LAN):** A network that connects computers and devices in a limited geographical area such as a home, school, office building., 453
- location sharing:** Browsing option that gives websites access to your current location., 66
- log:** A listing of activities that modify the contents of the database, 515
- logical design:** Activity during system development that involves three major activities: (1) study how the current system works, (2) determine the users' wants, needs, and requirements, and (3) recommend a solution., 522. *See also* **detailed analysis**
- logic bombs, 199
- longitudinal recording:** Storage technique in which magnetic particles are aligned horizontally around the surface of the disk., 374
- LTE (Long Term Evolution):** Short for Long Term Evolution; a network standard that defines how high-speed cellular transmissions use broadcast radio to transmit data for mobile communications., 462–463
- M**
- M2 (Memory Stick Micro):** A type of memory card., 381
- MAC address:** A unique hardware identifier for a computer or device. Short for Media Access Control address., 236
- machine cycle:** Set of four basic operations that a processor repeats for every instruction: (1) fetching, (2) decoding, (3) executing, and, if necessary, (4) storing., 281–282
- machine language:** The only language the computer directly recognizes., 529
- machine-to-machine (M2M) communications, 133
- Macintosh operating system (Mac OS):** Apple's operating system., 427–428
- macro:** A series of statements that instructs a program or app how to complete a task., 532
- macro recorder:** A program used with macros that records all actions until turned off., 533
- macro viruses, 190
- malware:** Adware on mobile phones. Short for mobile adware., 245
- magnetic stripe card:** A credit card, entertainment card, bank card, or other similar card with a stripe that contains information identifying you and the card., 393
- magnetic stripe card reader:** Reading device that reads the magnetic stripe on the back of credit cards, entertainment cards, bank cards, identification cards, and other similar cards., 337. *See also* **Magstripe reader**
- magnetic tape, 392
- magstripe reader:** Reading device that reads the magnetic stripe on the back of credit cards, entertainment cards, bank cards, identification cards, and other similar cards., 337–338. *See also* **Magnetic stripe card reader**
- mail server, 116
- mainframe:** A large, expensive, powerful server that can handle hundreds or thousands of connected servers simultaneously., 117
- main memory:** Memory chips that can be read from and written to by the processor and other devices., 290. *See also* **RAM; Random access memory**
- malicious software:** Programs that act without a user's knowledge and deliberately alter the operations of computers and mobile devices. Short for malicious software., 215. *See also* **malware**
- malware:** Programs that act without a user's knowledge and deliberately alter the operations of computers and mobile devices. Short for malicious software., 24, 215
- avoiding infections, 110
- common types of (table), 215
- if you can't remove, 216
- and viruses, 190–191
- management information system (MIS):** information system that generates accurate, timely, and organized information, so that managers and other users can make decisions, solve problems, supervise activities, and track progress., 558
- manufacturing, technology in, 40–41
- Manufacturing Resource Planning II (MRP II):** Information system that is an extension of MRP that also includes product packaging and shipping, machine scheduling, financial planning, demand forecasting, tracking labor productivity, and monitoring product quality., 555
- manufacturing software, 177
- mapping apps, 187
- mapping websites, 80–81
- mashups:** Applications that incorporate data from multiple providers into a new application., 288
- mass media websites, 76
- Material Requirements Planning (MRP):** Information system that monitors and controls inventory, material purchases, and other processes related to manufacturing operations., 555
- MBps:** Megabytes per second., 371, 460
- m-commerce:** E-commerce that takes place using mobile devices. Short for mobile commerce., 82

- media
 - applications, 27
 - downloading digital, from online services, 87
 - on the web, 76
- media and graphics applications, 179–185
- media library:** A collection of stored digital media., 128
- media literacy, 561
- media player:** Special A program that allows you to view images and animations, listen to audio, and watch video files on your computer or mobile device., 87, 185
 - buyer's guide for, 129
- media sharing, 371–372
- media sharing mobile apps, 187
- media sharing site:** A website that enables members to manage and share media such as photos, videos, and music., 75
- medical applications, 185
- Medical field, motion input in, 329
- megabyte (MB):** One million characters., 61, 370
- megahertz, 296
- Megan's Law, 505
- megapixel (MP), 127
- memory:** Electronic components that store instructions waiting to be executed and the data needed by those instructions., 16, 110
- memory cache:** Cache that helps speed the processes of a computer by storing frequently used instructions and data., 294
- memory card:** Removable flash memory, usually no bigger than 1.5 inches in height or width, that you insert and remove from a slot in a computer, mobile device, or card/reader writer., 18, 381–382
 - life span of, 382
 - slots, in computer, 381
 - working of, 382
- memory:** Electronic components that store instructions waiting to be executed and the data needed by those instructions., 290
 - access times, 296
 - bytes and addressable, 290
 - cache, 294
 - CMOS, 296
 - flash memory, 295
 - modules, 293
 - RAM (random access memory), 290–292
 - read-only memory (ROM), 294
 - requirements, determining, 292
 - types of, 290
- memory modules, 293
- memory resident:** Instructions that remain in memory while the computer or mobile device is running., 413
- Memory Stick PRO Duo:** A type of memory card., 381
- metadata:** Details about data., 510
- meteorology, computers and, 437
- metropolitan area network (MAN):** A high-speed network that connects local area networks in a metropolitan area, such as a city or town, and handles the bulk of communications activity across that region., 455
- MICR devices:** Magnetic-ink character recognition; reading devices that read text printed with magnetized ink., 338
- microblog:** Blog that allows users to publish short messages, usually between 100 and 200 characters, for others to read., 78
- microchip, 280
- microphones:** Input device that enables you to speak into a computer or mobile device., 14
- microprocessor: Term used by some computer and chip manufacturers to refer to a personal computer processor chip., 280
- microSDHC:** A type of memory card., 381
- microSDXC:** A type of memory card., 381
- Microsoft, 27
- Microsoft Office Specialist:** Application software certification that tests a user's skills of Microsoft Office programs., 572
- Microsoft's Windows, 27
- microwaves:** Radio waves that provide a high-speed signal transmission., 482
- microwave station:** An earth-based reflective dish that contains the antenna, transceivers, and other equipment necessary for microwave communications., 482
- Military, motion input in, 329
- mini disc:** Optical disc used in some game consoles and mobile devices that has a diameter of 3 inches or less., 386
- mini keyboards, 13
- miniSD, 381
- mirroring:** RAID storage design that writes data on two disks at the same time to duplicate the data., 390. *See also level 1*

- MMS (multimedia message service):** Smartphone and mobile device service that allows you to send picture/video messages., 124
- mobile app:** An application you download from a mobile device's application store or other location on the Internet to a smartphone or other mobile device., 28, 69, 161
 locating, installing, running, 29
 for personal, business productivity, 177
 mobile app development, 570–571
- mobile broadband:** Broadband Internet connection that uses the cellular radio network to connect computers and devices with built-in compatible technology (such as 3G, 4G, or 5G) or a wireless modem or other communications device., 59
- mobile broadband wireless router, 472
- mobile browser:** A special type of browser designed for the smaller screens and limited computing power of Internet-capable mobile devices such as smartphones., 65, 67
- mobile communications, 457–458
- mobile computer:** A portable personal computer designed so that a user easily can carry it from place to place., 4, 108
- mobile device
 removing programs and apps, 416
- mobile device:** A computing device small enough to hold in your hand., 108–145
 backing up, 19
 buyer's guide for, 128–129
 categories of (table), 134
 computers and, 7, 108
 connecting peripheral devices, accessories to, 136
 described, 7
 malware risks to, 193
 security in public places, 125
 transferring photos to computers, 153
 transportation and, 95
- mobile device cooling, 284
- mobile device input, in vehicle, 326
- mobile device management (MDM):** Company policy that outlines and educates employees about safe mobile device use., 433
- mobile devices:** A computing device small enough to hold in your hand.
 care for, 302–303
 cases for, 276–278
 entering data and instructions in, 319
 ports for, 297
 securing, 279
- mobile hot spot:** Smartphones that can function as a wireless modem when tethered to a personal computer or mobile device., 469, 470
- mobile operating system:** The operating system on mobile devices and many consumer electronics., 186, 433–436
vs. desktop, 435–436
- mobile payments, 36
- mobile phone memory, wiping of, 295
- mobile phone usage, ethics and issues, 302
- mobile printer:** A small, lightweight, battery-powered printer that allows a mobile user to print from a laptop, smartphone, or other mobile device while traveling., 350
- mobile security, 237
- mobile security specialist:** Employee who is responsible for the security of data and information stored on computers and mobile devices within an organization.
See also **Computer security specialist**, 570
- mobile service provider:** An ISP that offers wireless Internet access to computers and mobile devices with the necessary built-in wireless capability, wireless modems, or other communications devices that enable wireless connectivity. Sometimes called a wireless data provider., 61
- mobile strategist:** Employee who integrates and expands the company's initiatives for mobile users., 570
- mobile technology expert:** Employee who develops and directs an organization's mobile strategy, including marketing and app development., 570
- mobile user:** Any person who works with computers or mobile devices while away from a main office, home, or school., 41, 42
- mobile web app:** A web app that is optimized for display in a browser on a mobile device, regardless of screen size or orientation., 161, 571
- mock-up:** A sample of the input or output that contains actual data., 524
- modems, 31, 58
- monitor:** A display that is packaged as a separate peripheral device., 340
- morphing:** Video editing technique that transforms one video image into another image over the course of several frames of video., 331
- motherboard:** The main circuit board of the personal computer. Also called a system board., 110, 278, 472

- motion input:** Computer capability that allows users to guide on-screen elements using air gestures., 328–329.
See also gesture recognition
- motion-sensing controllers, 131, 132
- motion-sensing devices, 329
- motion-sensing game controllers:** Game controllers that allow the user to guide on-screen elements with air gestures, that is, by moving their body or handheld input device through the air., 132
- mouse:** A pointing device that fits under the palm of your hand comfortably., 13, 322
- operations (table), 13
- MP3:** Audio format that reduces an audio file to about one-tenth its original size, while reserving much of the original quality of the sound., 87
- MSN portal, 83
- multi-core processor:** A single chip with two or more separate processor cores., 280
- multidimensional database:** A database that stores data in dimensions., 508
- multifunction printer (MFP):** A single device that looks like a printer or a copy machine but provides the functionality of a printer, scanner, copy machine, and perhaps a fax machine., 349. *See also all-in-one printer*
- multimedia:** Any application that combines text with media., 85
- multimedia authoring software:** Software that allows users to combine text, graphics, audio, video, and animation in an interactive application., 184
- multiple desktop operating systems, 431
- multiplexing:** ISDN line technique of carrying three or more signals at once through the same line., 467
- multipurpose operating systems:** Operating systems that can function as both desktop and server operating systems., 432
- multisession:** Optical disc that can be written on more than once, allowing users to save additional data on the disc at a later time., 388
- multitasking:** An operating system that allows two or more programs or apps to reside in memory at the same time., 415
- multi-touch:** Capability of touch screens that recognize multiple points of contact at the same time., 324
- multiuser:** Operating system that enables two or more users to run programs simultaneously., 416
- music sharing sites, 75
- N**
- nanosecond (ns):** One billionth of a second., 296
- National Park Service home page, 68
- native apps:** Apps written for mobile devices running a particular mobile phone operating system., 571
- native resolution:** The specific resolution for which displays are optimized., 342
- natural user interface (NUI):** User interface with which users interact with the software through ordinary, intuitive behavior., 414
- navigation systems, 325
- near field communications:** Type of wireless connection that uses close-range radio signals to transmit data between two NFC-enabled devices., 138, 466. *See also NFC*
- .NET:** A set of technologies that allows almost any type of program to run on the Internet or an internal business network, as well as stand-alone computers and mobile devices., 532
- netiquette:** The code of acceptable behaviors users should follow while on the Internet. Short for Internet etiquette., 94
- net neutrality, 477
- network:** A collection of computers and mobile devices connected together, often wirelessly, via communications devices and transmission media., 32, 452–453
- architectures, 456–457
- to facilitate communications, 452
- home, business, 33
- local area network, 453
- metropolitan area network, 455
- personal area network, 455–456
- securing wireless, 236
- to share data and information, 453
- to share hardware, 452
- to share software, 453
- to transfer funds, 453
- unauthorized access and use, 221–227
- wide area network, 455
- wireless LAN, 454
- network administrator:** The person overseeing network operations., 423, 569
- network and Internet attacks, 215–220
- network architecture:** The configuration of computers, devices, and media in a network., 456–457

- network attached storage (NAS):** A server that is placed on a network with the sole purpose of providing storage to users, computers, and devices attached to the network., 390–392. *See also* **storage appliance**
- network card:** A communications device that enables a computer or device that does not have built-in networking capability to access a network., 472. *See also* **Network interface card (NIC); NIC (network interface card)**
- network engineer:** Employee who installs, configures, and maintains LANs, WANs, wireless networks, intranets, Internet systems, and network software; identifies and resolves connectivity issues. *See also* **Network administrator**, 569
- networking, defined, 426
- network interface card (NIC):** A communications device that enables a computer or device that does not have built-in networking capability to access a network., 472. *See also* **network card**
- network license:** A legal agreement that allows multiple users to access software on the server simultaneously., 229
- network monitoring software:** Software that constantly assesses the status of a network and sends an email or text message, usually to the network administrator, when it detects a problem., 462
- network security administrator:** Employee who configures routers and firewalls; specifies web protocols and enterprise technologies., 570
- network server, 116
- network standard:** Guidelines that specify the way computers access the medium to which they are connected, the type(s) of medium used, the speeds used on different types of networks, and the type(s) of physical cable and/or the wireless technology used., 459
- neural network:** A system that attempts to imitate the behavior of the human brain., 39
- news feed:** Terminology used on social networking sites to refer to activity updates from your friends that appear on a separate page associated with your account., 73
- newsgroups, 31
- news mobile apps, 187
- news websites, 76
- NFC chips:** Chip in a smartphone or mobile device that enables communication with other devices simply by being in proximity., 394–395
- NFC tags:** Tag that contains a chip and an antenna that contains information to be transmitted., 394–395
- NFC transactions, security of, 395
- NFC:** Type of wireless connection that uses close-range radio signals to transmit data between two NFC-enabled devices., 138, 466. *See also* **near field communication**
- NIC (network interface card):** A communications device that enables a computer or device that does not have built-in networking capability to access a network., 472. *See also* **network card**
- Nintendo, 131
- nit:** A unit of visible light intensity equal to one candela (formerly called candlepower) per square meter., 342
- node, 453
- No Fly List, 249
- noise:** An electrical disturbance that can degrade communications., 477
- noise cancelling, 143
- nonimpact printer:** A printer that forms characters and graphics on a piece of paper without actually contacting the paper., 345
- nonprocedural language:** A programming language in which the software developer writes English-like instructions or interacts with a graphical environment to retrieve data from files or a database., 532
- nonresident:** Instructions that remain on a storage medium until they are needed, at which time they transfer into memory (RAM), 413
- nonvolatile memory:** Memory that does not lose its contents when power is removed from the computer., 290
- notebook computer:** Thin, lightweight mobile computer with a screen in its lid and a keyboard in its base, designed to fit on your lap., 4, 111. *See also* **laptop computer**
- notes taking, hand and digital device, 327
- note taking software:** An application that enables users to enter typed text, handwritten comments, drawings, sketches, photos, and links anywhere on a page and then save the page as part of a notebook., 171
- numerical literacy, 561
- numeric check:** Validity check that ensures that users enter only numeric data into a field., 503

O

- object:** An item that can contain both data and the procedures that read or manipulate that data., 508
- object code:** The machine language version of a program that results from compiling the procedural language., 529. *See also* **Object program**

- object-oriented database (OODB):** A database that stores data in objects., 508
- object-oriented programming (OOP) language:** Programming language used to implement objects in a program., 530
- object program:** The machine language version of a program that results from compiling the procedural language., 529. *See also* **object code**
- observing people, system analysts, 520
- OCR devices:** Devices that usually include a small optical scanner for reading characters and sophisticated software to analyze what is read., 335
- OCR software:** Optical character recognition; software that can read and convert text documents into electronic files., 334
- office network, wireless printer addition, 479
- off-site:** A location separate from the computer or mobile device site., 233
- OLED:** Organic LED; display technology that uses organic molecules that are self-illuminating and, thus, do not require a backlight., 342
- OMR devices:** Devices that read hand-drawn marks, such as small circles or rectangles., 335
- onboard navigation systems, 39
- OneDrive:** Microsoft's cloud server., 426
- online analytical processing (OLAP):** Programs that analyze data, such as those in a decision support system., 559
- online auction:** Auction in which users bid on an item being sold by someone else on the web., 82
- online gaming, avoiding risks, 216
- online help, 205
- online photo storage, 182
- online security service:** A web app that evaluates our computer or mobile device to check for Internet and email vulnerabilities., 219
- online services, downloading digital media from, 87
- online social network:** A website that encourages its members in its online community to share their interests, ideas, stories, photos, music, and videos with other registered users., 23, 72, 73. *See also* **social networking site**
- privacy, 74
- security, 74
- uses of, 73
- online:** Term used to refer to a the state of a computer or device being connected to a network., 6
- online transaction processing (OLTP):** Processing technique in which the computer processes each transaction as it is entered., 558
- on-screen keyboard:** Smartphone feature where you press keys on the screen using a fingertip or a stylus., 5, 12, 13, 123
- The Open Group:** Industry standards organization that now owns UNIX as a trademark., 429
- open source software:** Software provided for use, modification, and redistribution and has no restrictions from the copyright holder regarding modification of the software's internal instructions and its redistribution., 161, 429
- security of, 430
- Opera:** Browser used on both computers and mobile devices., 67
- operating system (OS):** A set of programs that coordinates all the activities among computer or mobile device hardware., 27, 158, 410–412
- functions of, 411, 412–424
- types of, 425
- operating system functions, 411, 412–424
- administering security, 423–424
- built-in security tools, using and evaluating, 423
- configuring devices, 419
- coordinating tasks, 418–419
- establishing Internet connections, 420–421
- managing memory, 416–418
- managing programs, 415–416
- network, controlling, 423
- performance monitor, 420
- product liability laws, security flaws, 424
- shutting down, computers and mobile devices, 413
- starting, computers and mobile devices, 412–413
- updating operating system software, 421–422
- user interface, providing, 414–415
- operational feasibility:** Test that measures how well the proposed information system will work., 519
- operators, search engine (table), 72
- optical disc:** Type of storage medium that consists of a flat, round, portable disc made of metal, plastic, and lacquer that is written and read by a laser., 18, 386–389
- characteristics of, 386–387
- cleaning and fixing scratches on, 387
- life span of, 387
- optical fiber:** Each strand of a fiber-optic cable., 478
- optical mouse:** Mouse that uses optical sensors that emit and sense light to detect the mouse's movement., 322

optical readers, 335

optical resolution: The actual photographed resolution of a photo taken with a digital camera., 127

OR (search engine operator), 72

organizational websites, 77

OS X: Latest version of Apple's operating system., 427

output: Data that has been processed into a useful form., 4, 339–340

information as, 12

on output devices, 14

output device: Any hardware component that conveys information from a computer or mobile device to one or more people., 14

outsourcing: The practice of off-loading some or all storage management to an outside organization or a cloud storage provider., 390

jobs, 568

security issues and, 522

overvoltage: Electrical disturbance that occurs when the incoming electrical supply or voltage increases above the normal volts., 140. *See also* **power surge**

P

PaaS (platform as a service): Cloud computing service that allows developers to create, test, and run their solutions on a cloud platform without having to purchase or configure the underlying hardware and software., 288

packet sniffer software: Software that monitors and logs packet traffic for later analysis., 462

packets: Small pieces into which messages are divided by TCP/IP., 461

packet switching: Technique of breaking a message into individual packets, sending the packets along the best route available, and then reassembling the data., 461

page: The amount of data and program instructions that can swap at a given time., 418

paging: Technique of swapping items between memory and storage., 418

paint software: An application that allows users to draw pictures, shapes, and other graphics with various on-screen tools such as a pen, brush, eyedropper, and paint bucket., 181. *See also* **illustration software**

pairing: The process of initiating contact between two Bluetooth devices and allowing them to communicate with each other., 137

parallel conversion: Conversion strategy that consists of running the old system alongside the new system for a specified time., 526

parentheses (()), search engine operator, 72

parent: Term used in three-generation backups to refer to the second oldest copy of the file., 234

partial backup: Backup method that allows the user to choose specific files to back up, regardless of whether or not the files have changed since the last incremental backup., 396. *See also* **selective backup**

partitioning: Dividing a hard drive in separate logical storage areas (partitions) that appear as distinct drives., 431

passkeys, 137

passphrase: Similar to a password; several words separated by spaces., 25, 223

password: A private combination of characters associated with the user name that allows access to certain computer, mobile device, or network resources., 222, 424

creating strong, 25

default, 223

payload: The destructive event or prank a virus was created to deliver., 190, 215

payment apps, 179

PC: Computer that can perform all of its input, processing, output, and storage activities by itself and is intended to be used by one person at a time., 426

PC maintenance, 422

PC maintenance tool: A program that identifies and fixes operating system problems, detects and repairs disk problems, and includes the capability of improving a computer's performance., 198

PDF: An electronic image file format by Adobe Systems that mirrors the appearance of an original document. Short for Portable Document Format., 86, 176

peer: Each computer on a peer-to-peer network., 457

peer-to-peer (P2P) network: A simple, inexpensive network architecture that typically connects fewer than 10 computers., 457

pen input: Touching a stylus or digital pen on a flat surface to write, draw, or make selections., 326–328

performance monitor: A program that assesses and reports information about various computer resources and devices., 420

peripheral device: A device you connect to a computer or mobile device to expand its capabilities., 108

connecting to computer, mobile device, 136

- permissions:** Settings used to define who can access certain resources and when they can access those resources., 423
- perpendicular recording:** Storage technique in which magnetic particles are aligned vertically, or perpendicular to the disk's surface, making much greater storage capacities possible., 374
- personal area network (PAN):** A network that connects computers and devices in an individual's workspace using wired and wireless technology., 455–456
- personal cloud:** Networked hard drive connected directly to a router, allowing access to files over the Internet., 384
- personal computer:** Computer that can perform all of its input, processing, output, and storage activities by itself and is intended to be used by one person at a time., 4, 108, 426. *See also* **PC**
- personal finance software:** A simplified accounting application that helps home users and small office/home office users balance their checkbooks, pay bills, track personal income and expenses, verify account balances, transfer funds, track investments, and evaluate financial plans., 174
- personal firewall:** A security tool that detects and protects a personal computer and its data from unauthorized intrusions., 189, 220
setting up, 220, 221
- personal interest applications, 27, 185–187
- personal safes, 279
- personal VoIP call, making, 92
- PERT charts:** Short for Program Evaluation and Review Technique chart; chart developed by the U.S. Department of Defense that analyzes the time required to complete a task and identifies the minimum time required for an entire project., 518
- petabyte (PB), 370
- phablet:** A device that combines the features of a smartphone with a tablet., 7, 112
- phased conversion:** Conversion strategy where each location converts at a separate time., 526
- phases:** Larger categories of system development activities., 515
- phishing:** A scam in which a perpetrator sends an official looking email message that attempts to obtain your personal and/or financial information., 66, 193, 244
- phishing filter:** A program that warns or blocks you from potentially fraudulent or suspicious websites., 66, 193, 244
- phishing websites, 245
- phones
connecting to Wi-Fi networks, 138
typing text messages without numeric keypad, 123
- phone scams, 245
- photo CD:** CDs that contain only photos., 388
- photo editing software:** A type of image editing software that allows users to edit and customize digital photos., 181
- photographs
editing, 181
transferring from mobile devices to computers, 153
- photo management software:** Software that allows you to view, organize, sort, catalog, print, and share digital photos., 182
- photo printer:** A color printer that produces lab-quality photos., 347
- photo sharing sites, 75
- physical transmission media
coaxial cable, 478
fiber-optic cables, 478
twisted-pair cable, 477
- PictBridge: A standard technology that allows you to print photos directly from a digital camera by connecting a cable from the digital camera to a USB port on the printer., 347
- picture message:** A photo or other image, sometimes along with sound and text, sent to or from a smartphone or other mobile device., 7
- picture/video message services, 124
- pilot conversion:** Conversion strategy where only one location in the organization uses the new system — so that it can be tested., 526
- PIN:** A numeric password, either assigned by a company or selected by a user., 118, 223. *See also* **personal identification number**
- pinch:** Touch gesture in which a user moves two fingers together., 5
- piracy:** The unauthorized and illegal duplication of copyrighted software., 228. *See also* **software piracy**
- pixel pitch:** The distance in millimeters between pixels on a display., 342. *See also* **dot pitch**
- pixel:** The smallest element in an electronic image. Short for picture element., 127, 342
- plaintext:** Unencrypted, readable data., 230

- planning phase:** Step in the system development life cycle during which four major activities are performed: (1) review and approve the project requests, (2) prioritize the project requests, (3) allocate resources such as money, people, and equipment to approved projects, and (4) form a project development team for each approved project., 521
- plasma display:** Display that uses gas plasma technology to sandwich a layer of gas between two glass plates., 344
- platform as a service (PaaS):** Cloud computing service that allows developers to create, test, and run their solutions on a cloud platform without having to purchase or configure the underlying hardware and software., 288
- platform:** Term used to refer to the operating system that a computer uses, because applications are said to run “on top of” it, or because the it supports the applications., 412
- platter:** Component of a hard disk that is made of aluminum, glass, or ceramic and is coated with an alloy material that allows items to be recorded magnetically on its surface., 374
- plotters:** Sophisticated printers used to produce high-quality drawings such as blueprints, maps, and circuit diagrams., 350
- plug and play:** Technology that gives a computer the capability to recognize peripheral devices as you install them., 298, 419
- plug-in:** A program that extends the capability of a browser. Also called an add-on., 88
- PNG:** Patent-free compressed graphics format that restores all image details when the file is viewed. Short for Portable Network Graphics., 86
- podcast:** Recorded media that users can download or stream to a computer or portable media player., 40, 187
- point, 13
- point-and-shoot camera:** An affordable and lightweight digital camera with lenses built into it and a screen that displays an approximation of the image to be photographed., 125
- pointer:** A small symbol on the screen whose location and shape change as a user moves a pointing device., 322
- pointing devices, 13
mouse, 322–323
touchpad, 323
trackball, 324
- pointing stick, 323
- point of sale (POS), 118
- points (font size), 166
- polymorphic viruses, 190
- pop-under ad, 66
- pop-under blocker, 66
- pop-up ad:** An Internet advertisement that suddenly appears in a new window on top of a webpage displayed in a browser., 66, 194
- pop-up blocker:** A filtering program that stops pop-up ads from displaying on webpages., 66, 194
- pop-up windows, avoiding malware infections, 110
- Portable Document Format (PDF), 86
- portable keyboard:** A full-sized keyboard that communicates with a smartphone., 124
- portable media player:** A mobile device on which you can store, organize, and play or view digital media., 8, 10, 127, 325.
- portal:** A website that offers a variety of Internet services from a single, convenient location., 82
- portrait orientation:** A project that is taller than it is wide, with information printed across the shorter width of the document., 344
- port replicator:** An external device that provides connections to peripheral devices through ports built into the device., 136
- port:** The point at which a peripheral device attaches to or communicates with a computer or mobile device so that the peripheral device can send data to or receive information from the computer., 134
and connections, 134–138
popular (table), 135
- POS terminal:** Terminal used by most retail stores to record purchases, process credit or debit cards, and update inventory. Short for point of sale., 118
- post-implementation system review, 526
- power supply:** Component of the system unit that converts wall outlet AC power to the DC power that is used by a computer., 301–304
- power surge:** Electrical disturbance that occurs when the incoming electrical supply or voltage increases above the normal volts., 140. *See also* **overvoltage**
- power usage effectiveness (PUE):** A ratio that measures how much power enters the computer facility or data center against the amount of power required to run the computers and devices., 241
- power user:** User who requires the capabilities of a powerful computer., 41, 42

- predictive text input:** Phone technology that allows you to press one key on the keyboard or keypad for each letter in a word, and software on the phone predicts the word you want., 123
- preliminary investigation:** Investigation performed in system development that determines the exact nature of the problem or improvement and decide whether it is worth pursuing., 521. *See also* **feasibility study**
- presentation software:** An application that allows users to create visual aids for presentations to communicate ideas, messages, and other information to a group., 168
- press and hold:** Touch gesture in which a user presses and holds one finger until an action occurs., 5
- primary key:** A field that uniquely identifies each record in a file., 501
- principle of least privilege policy:** Policy adopted by some organizations, where users' access privileges are limited to the lowest level necessary to perform required tasks to prevent accidental or intentional misuse of the data., 513
- printer:** An output device that produces text and graphic on a physical medium such as paper or other material., 14, 344–351
- printer resolution, 346
- printout:** Information that exists on a physical medium, such as paper., 14, 344. *See also* **hard copy**
- print server, 116
- print spooler, 418
- print:** To generate a hard copy of a project., 166
- privacy, 24–25
- described, 24
- digital security and, 24–26
- information, 242–248
- laws, 246
- and online social networks, 74
- private clouds, 122
- private key encryption:** Encryption method where both the originator and the recipient use the same secret key to encrypt and decrypt the data., 230. *See also* **symmetric key encryption**
- procedural language:** Programming language in which the software developer writes using English-like words that tell the computer what to accomplish and how to do it., 528
- processor cooling, 284
- processor:** The electronic component of a computer that interprets and carries out the basic instructions that operate a computer., 111, 280–286. *See also* **CPU**
- arithmetic logic unit (ALU) of, 281
- control unit of, 281
- cooling of, 284
- machine cycle, 281–282
- mobile device, 283–284
- personal computer, 283–284
- registers in, 282
- selection, 283
- system clock in, 282–283
- product activation:** Process in which users, either online or on the phone, provide the software product's identification number to associate the software with the computer or mobile device on which the software is installed., 162, 228
- product development software, 177
- productivity applications:** Software that can assist you in becoming more effective and efficient while performing daily activities at work, school, and home., 27, 165
- types of, 165–179
- professional online presence, 577
- profiles, electronic, 242–243
- program:** A series of related instructions, organized for a common purpose, that tells the computer what tasks to perform and how to perform them., 26, 158. *See also* **software**
- antivirus, 191–192
- and apps, 26–30
- categories of (table), 164
- developing, 29
- generally, 163
- specifications, 29
- uninstalling, 196
- program and app developer:** Employee who specifies, designs, implements, tests, and documents programs and apps in a variety of fields, including robotics, operating systems, animation, and applications., 568
- program development life cycle:** An organized set of activities performed during program development., 525
- programming language:** Set of words, abbreviations, and symbols that enables a software developer to communicate instructions to a computer or mobile device., 527
- program specification package:** Item prepared during program design that identifies the required programs and the relationship among each program, as well as the input, output, and database specifications., 524

project leader: Person who manages and controls the budget and schedule of a system development project., 517

Project Management Professional (PMP): Broad development certification that tests knowledge of tasks required during system development; PMP for short., 574

project management software: An application that allows a user to plan, schedule, track, and analyze the events, resources, and costs of a project., 172, 518

project management: The process of planning, scheduling, and then controlling the activities during system development., 517

project manager: Person who controls the activities during system development., 517

project request: A formal, written request for a new or modified information system., 521. *See also* **request for system service**

projects, saving regularly, 166

project team: Group formed for each system development project, usually consisting of users, the systems analyst, and other IT professionals., 517

proof of concept: A working model of the proposed system's essential functionality., 525. *See also* **prototype**

proprietary connector, 299

proprietary software: Software that is privately owned and limited to a specific vendor or computer or device model., 425

protecting

hardware, 139–141

against unauthorized access and use, 221–227

protocol: A standard that outlines characteristics of how two devices communicate on a network., 460

prototype: A working model of the proposed system's essential functionality., 525. *See also* **proof of concept**

proxy server: A server outside the organization's network that controls which communications pass into the organization's network., 66, 219

public clouds, 122

public-domain software: Software that has been donated for public use and has no copyright restrictions., 161

public key encryption: Encryption method that uses two encryption keys: a public key and a private key., 230. *See also* **asymmetric key encryption**

publishing, technology in, 39–40

PUE: A ratio that measures how much power enters the computer facility or data center against the amount of power required to run the computers and devices., 241

pull notification, 124

pull: Request information from a web server., 69

push notification, 124

Q

QR code reader: App that scans a QR code and then displays the corresponding webpage in a browser., 178

QR code (quick response code): Square-shaped graphic that corresponds to a web address or other information. Short for quick response code., 178, 335, 336

quarantine: A separate area of the hard disk that holds infected files until the infection can be removed., 191

query: A request for specific data from a database., 511

query by example (QBE): DBMS feature that has a graphical user interface to assist users with retrieving data., 512

query language: Language used with databases that consists of simple, English-like statements that allows users to specify the data they want to display, print, store, update, or delete., 512

queue: Group of files waiting in the buffer to be printed., 418

quotation marks (“), search engine operator, 72

QWERTY keyboard, 321

R

rack server: A server that is housed in a slot (bay) on a metal frame (rack). Also called a rack-mounted server., 116

RAD (rapid application development): A method of developing software in which the software developer writes and implements a program in segments instead of waiting until the entire program is completed., 530

radio frequency identification: Technology that uses radio signals to communicate with a tag placed in or attached to an object, an animal, or a person., 336, 465. *See also* **RFID**

radiology, technology in, 43

RAID: Redundant array of independent disks; a group of two or more integrated hard drives., 380, 390

RAM (random access memory): Memory chips that can be read from and written to by the processor and other devices., 290–293. *See also* **main memory**
types of, 292

random access: Access method where a device can locate a particular data item or file immediately, without having to move consecutively through items stored in front of the desired data item or file., 392. *See also* **direct access**

- random access memory (RAM):** Memory chips that can be read from and written to by the processor and other devices., 290-293. *See also* **main memory**
- range check:** Validity check that determines whether a number is within a specified range., 503
- rapid application development (RAD) :** A method of developing software in which the software developer writes and implements a program in segments instead of waiting until the entire program is completed., 530
- reading:** The process of transferring these items from a storage medium into memory., 368
- read-only memory (ROM):** Memory chips that store permanent data and instructions., 294
- read/write head:** The mechanism that reads items and writes items in the drive as it barely touches the disk's recording surface., 375
- real-time clock:** A separate battery-backed chip that keeps track of the date and time in a computer., 283
- real-time operating system (RTOS):** Operating system used by an embedded computer., 436
- real time:** Term used with online communications that means you and the people with whom you are conversing are online at the same time., 90
- receiving device:** Device that accepts the transmission of data, instructions, or information., 450
- rechargeable batteries, 302
- record:** A group of related fields., 501
- recovery media:** Tool that uses logs and/or backups, and either a rollforward or a rollback technique, to restore a database when it becomes damaged or destroyed., 413
- recovery plan, 235
- recovery utility, 515
- Recycle Bin, 427
- recycling
- of electronics, 122
 - of old computers, devices, 242
- red-eye:** The appearance of red eyes caused by a camera's flash., 182
- reduced data redundancy, 505, 506
- reduced development time, database approach, 506
- redundancy:** Built-in levels of duplicate components used in enterprise hardware that ensures that if one component fails or malfunctions, another can assume its tasks., 389
- reference apps, 178
- registers:** Small, high-speed storage locations that temporarily hold data and instructions., 282
- relational database:** A database that stores data in tables that consist of rows and columns., 508
- remote controls for home systems, 11
- removing apps, 196
- repetitive strain injury (RSI):** An injury or disorder of the muscles, nerves, tendons, ligaments, and joints., 142
- report generator:** DBMS feature that allows users to design a report on the screen, retrieve data into the report design, and then display or print the report., 513. *See also* **report writer**
- report writer:** DBMS feature that allows users to design a report on the screen, retrieve data into the report design, and then display or print the report., 513. *See also* **report generator**
- repository:** A DBMS element that contains data about each file in a database and each field in those files., 510. *See also* **data dictionary**
- request for information (RFI):** A less formal document that uses a standard form to request information about a product or service., 523
- request for proposal (RFP):** Document sent to a vendor during the system development cycle where the vendor selects the product(s) that meets specified requirements and then quotes the price(s)., 523
- request for quotation (RFQ):** Document sent to a vendor during the system development cycle that identifies required products., 523
- request for system services:** A formal, written request for a new or modified information system., 521. *See also* **project request**
- research, web database services, 507
- research websites, 74
- resize:** To change the physical dimensions of a photo., 182
- resolution:** The number of horizontal and vertical pixels in a display device., 127, 342
- resources:** Hardware, software, data, and information., 32 in the cloud, 121
- response time:** The time in milliseconds (ms) that it takes to turn a pixel on or off., 342
- restore:** Copying backed up files to their original location on a computer or mobile device., 233, 422
- restore tool:** Program that reverses the backup process and returns backed up files to their original form., 198
- retail, 36
- retail apps, 179
- retail software:** Mass-produced, copyrighted software that meets the needs of a wide variety of users, not just a single user or company., 161

retail websites, 81–82

Retina Display: LCD technology developed by Apple that produces vibrant colors and supports viewing from all angles because the LCD technology is built into the screen instead of behind it and contains more pixels per inch of display., 342

review documentation, 520

revolutions per minute (rpm): The number of times per minute that a hard disk platter rotates., 375

RFI (request for information) : A less formal document that uses a standard form to request information about a product or service., 523

RFID: Radio frequency identification; technology that uses radio signals to communicate with a tag placed in or attached to an object, an animal, or a person., 336, 465. *See also* **radio frequency identification**

RFID reader: Reading device that reads information on an RFID tag via radio waves., 336

RFID tag: Tag that includes an antenna and a memory chip that contains the information to be transmitted via radio waves., 394

RFP (request for proposal): Document sent to a vendor during the system development cycle where the vendor selects the product(s) that meets specified requirements and then quotes the price(s)., 523

RFQ (request for quotation): Document sent to a vendor during the system development cycle that identifies required products., 523

ribbon, 427

right-click, 13

ripping: The process of copying audio and/or video data from a purchased disc and saving it on your own media., 388

rollback: Recovery technique where the DBMS uses the log to undo any changes made to the database during a certain period., 515. *See also* **backward recovery**

rollforward: Recovery technique where the DBMS uses the log to reenter changes made to the database since the last save or backup., 515. *See also* **forward recovery**

ROM (read-only memory): Memory chips that store permanent data and instructions., 294

rooting: Process of making unauthorized modifications to operating systems and bypassing the DRM restrictions on devices running Android (or other operating systems) in order to run unapproved apps., 574

rootkit: A program that hides in a computer or mobile device and allows someone from a remote location to take full control of the computer or device, often for nefarious purposes., 190, 215

router: A communications device that connects multiple computers or other routers together and transmits data to its correct destination on a network., 471

routers, 31, 190, 220, 236, 237

rpm (revolutions per minute): The number of times per minute that a hard disk platter rotates., 375

RSS 2.0: Short for Really Simple Syndication; specification that content aggregators use to distribute content to subscribers., 536

RSS: A popular specification used to distribute content to subscribers. Short for Really Simple Syndication., 31

running applications, mobile apps, 29

S

SaaS (software as a service): Computing environment where an Internet server hosts and deploys applications., 287–288

Safari: Apple's browser., 67, 427

salesforce automation (SFA): Information system that helps salespeople manage customer contacts, schedule customer meetings, log customer interactions, manage product information, and place customer orders., 555

sales software, 177

Samsung, 111

SAN (storage area network): A high-speed network with the sole purpose of providing storage to other attached servers., 391–392

sandbox: An environment that allows software developers to test their programs with fictitious data without adversely affecting other programs, information systems, or data., 525

San Diego Zoo webpage, 85

Sarbanes-Oxley (SOX) Act: Law that provides financial reporting requirements and guidelines for public companies' retention of business records., 390, 396

SAS (serial-attached SCSI): A type of SCSI that uses serial signals to transfer data, instructions, and information., 380

SATA (Serial Advanced Technology Attachment): Serial Advanced Technology Attachment; interface that uses serial signals to transfer data, instructions, and information., 380

satellite Internet service: Broadband technology that provides Internet connections via satellite to a satellite dish that communicates with a satellite modem., 59

satellite speakers: Speakers in a surround sound system that are positioned so that sound emits from all directions., 351

- save:** Process of the computer transferring a project from memory to a local storage medium or cloud storage., 165
- scams, avoiding, 245
- scanner:** A light-sensing input device that reads printed text and graphics and then translates the results into a form the computer can process., 14, 178, 334
- schedule feasibility:** Test that measures whether the established deadlines for the project are reasonable., 519
- science, technology in, 38–39
- science websites, 79
- scope, 517
- scope creep:** Problem that occurs when one activity has led to another that was not planned originally; thus, the scope of the project now has grown., 519. *See also* **feature creep**
- screen protector, 304
- screen saver:** A tool that causes a display device's screen to show a moving image or blank screen if no keyboard or mouse activity occurs for a specified time., 197, 422
- scribe:** Member of a joint-application design session who records facts and action items assigned during the session., 520
- scripting language:** An interpreted language that typically is easy to learn and use., 536
- script kiddie:** Cybercriminal who has the same intent as a cracker but does not have the technical skills and knowledge., 214
- scroll bars, 427
- SCSI (Small Computer System Interface):** Small Computer System Interface; interface that uses parallel signals and can support up to 8 or 15 peripheral devices., 380
- SDHC (Secure Digital High Capacity):** A type of memory card., 381
- SDLC (system development life cycle):** Collection of phases in system development., 515
- SDXC (Secure Digital Expanded Capacity):** A type of memory card., 381
- search:** A tool, usually included with an operating system, that attempts to locate a file on your computer or mobile device based on criteria you specify., 422
- search engine operators (table), 72
- search engine:** Software that finds websites, webpages, images, videos, news, maps, and other information related to a specific topic., 22, 71
- search engine optimization expert:** Employee who writes and develops web content and website layouts so that they will appear at the beginning of search results when users search for content. *See also* **SEO expert**, 569
- searching
with search engines, 71–72
web, 22
- search text:** Word or phrase entered in a search engine to describe the word you want to find., 71
- search tool:** A program, usually included with an operating system, that attempts to locate a file on your computer or mobile device based on criteria you specify., 195
- secondary storage:** The physical material on which a computer keeps data, information, programs, and applications., 368
- sectors:** The small arcs into which tracks on a disk are divided., 374
- Secure Digital Expanded Capacity (SDXC):** A type of memory card., 381
- Secure Digital High Capacity (SDHC):** A type of memory card., 381
- secure site:** A website that uses encryption techniques to secure its data., 231
- security
applications, 28
ATM, 118
avoiding malware infections, 110
digital security risks, 212–214
Internet and network attacks, 215–220
in-vehicle technology, 133
mobile, 237
mobile devices in public areas, 125
and online social networks, 74
payment apps, 179
protecting against scams, 245
protecting yourself from identify theft, 80
safe browsing techniques, 66
safeguarding against Internet and network attacks, 218
systems in the home, 11
technology in national and local, 249
tools, 189–194
wireless, 236–237
of wireless networks, 236

- security analyst:** Employee who implements security procedures and methods, looks for flaws in security of a company's devices and networks, works with and trains employees at all levels, and assigns permissions and network settings., 570
- security suite:** A collection of individual security tools available together as a unit. These programs often are called Internet security programs., 189
- security system project manager:** Employee who develops and maintains programs and tools designed to provide security to a network., 570
- selective backup:** Backup method that allows the user to choose specific files to back up, regardless of whether or not the files have changed since the last incremental backup., 396. *See also* **partial backup**
- selective backup:** Fast backup method that provides great flexibility., 234
- self-service kiosks, 119
- sending device:** Device that initiates an instruction to transmit data, instructions, or information., 450
- sending email messages, 103
- SEO expert:** Employee who writes and develops web content and website layouts so that they will appear at the beginning of search results when users search for content. *See also* **Search engine optimization expert**, 569
- sequential access:** Access method where data is read or written consecutively., 392
- serial-attached SCSI (SAS):** A type of SCSI that uses serial signals to transfer data, instructions, and information., 380
- server:** A computer dedicated to providing one or more services to other computers or devices on a network. (or) Computer that controls access to the hardware, software, and other resources on the network and provides a centralized storage area for programs, data, and information., 6, 116, 456. *See also* **host computer**
- dedicated (table), 116
- and networks, 32
- server farm:** A network of several servers together in single location., 117
- server operating system:** A multiuser operating system that organizes and coordinates how multiple users access and share resources on a network., 432–433
- server virtualization:** Technique that uses software to divide a physical server logically into many virtual server., 117
- service pack:** Free downloadable updates provided by software makers for users who have registered and/or activated their software., 422
- session cookie:** A file used by online shopping sites to keep track of items in a user's shopping cart., 243
- SFA (salesforce automation):** Information system that helps salespeople manage customer contacts, schedule customer meetings, log customer interactions, manage product information, and place customer orders., 555
- shared data, 506
- shareware:** Copyrighted software that is distributed at no cost for a trial period., 161
- downloading safely, 161
- sharpness:** Term used to refer to the crispness of objects in photos., 182
- shopping cart:** Component of an electronic storefront that allows the customer to collect purchases., 81
- shopping web database services, 507
- shopping websites, 82
- signature capture pad:** Pen input device that captures handwritten signatures with a stylus that is attached to the device., 326
- signature verification system:** Biometric device that recognizes the shape of your handwritten signature, as well as measures the pressure exerted and the motion used to write the signature., 225
- sign in:** To access resources on a network or computer., 423
- simulation, gaming category, 35
- single-core processors, 280
- single-session disc:** CD-ROM on which manufacturers write all items at one time., 388
- single-user license agreement:** License agreement included with software purchased by individual users., 228. *See also* **end-user license agreement**
- Siri:** iOS voice recognition app that enables you to speak instructions or questions to which it takes actions or responds with speech output., 434
- site license:** A legal agreement that permits users to install software on multiple computers—usually at a volume discount., 229
- skimmer:** Virtually undetectable, a device that is placed directly on top of an ATM face and captures credit card numbers and pins., 119
- skimming:** Crime in which thieves use a handheld device to swipe someone's credit or smart card and then obtain and store account details., 394
- slate computers, 5

- slate tablet:** A type of tablet that does not contain a physical keyboard., 112, 276
- sleep mode:** Computer power option that saves any open documents and running programs or apps to RAM, turns off all unneeded functions, and then places the computer in a low-power state., 413
- slide show:** Presentations that are viewed as slides, usually on a large monitor or projection screen., 168
- slide:** Touch gesture in which a user presses and holds one finger on an object and then moves the finger to the new location., 5. *See also* **Drag**
- SLR camera:** A high-end digital camera that has interchangeable lenses and uses a mirror to display on its screen an exact replica of the image to be photographed. Short for single-lens reflex camera., 125
- small/home office user:** Employees of companies with fewer than 50 employees and the self-employed who work from home., 41, 42
- smart card:** An alternative to a magnetic stripe card, stores data on an integrated circuit embedded in the card., 338, 393. *See also* **chip card**
- smart digital camera, 125
- smart eyewear, 130
- smartglasses, 130
- smartphone:** An Internet-capable phone that usually also includes a calendar, an appointment book, an address book, a calculator, a notepad, games, browser, and numerous other apps., 7, 123, 325
- buyer's guide for, 128
- with digital cameras, 125
- guarding your, 174
- low memory of, 418
- mobile security, 237
- payment apps, 179
- phablets, 112
- printing from, 347
- typing options on, 123
- Smart TV:** Television containing an embedded computer that enables you to browse the web, stream video from online media services, listen to Internet radio, communicate with others on social media sites, play online games, and more - all while watching a television show., 15, 133, 343
- smartwatch, 130
- SMS (short message service):** Short text messages, typically fewer than 300 characters., 124
- social engineering:** Scam in which perpetrators gain unauthorized access to or obtain confidential information by taking advantage of the trusting human nature of some victims and the naivety of others., 245
- social media, 76, 110
- social media, in job search, 578
- social media marketing specialist:** Employee who directs and implements an organization's use of Internet and social media marketing, including Facebook pages, Twitter feeds, blogs, and online advertisements. *See also* **Internet marketing specialist**, 569
- social networking apps, 178
- social networking sites:** A website that encourages members in its online community to share their interests, ideas, stories, photos, music, and videos with other registered users., 23, 72. *See also* **online**
- soft copy:** Information on a display that exists electronically and appears for a temporary period., 340
- software and apps field:** Specialty area consisting of organizations and individuals who develop, manufacture, and support a wide range of software and apps for computers, the web, and mobile devices., 564
- software as a service (SaaS):** Computing environment where an Internet server hosts and deploys applications., 287–288
- software:** A series of related instructions, organized for a common purpose, that tells the computer what tasks to perform and how to perform them., 26, 158, 318. *See also* **program**
- availability, 161
- avoiding malware infections, 110
- bundled, 115
- in enterprise computing, 177
- license agreement, 163
- theft, 228
- software developer:** Someone who develops programs and apps or writes the instructions that direct the computer or mobile device to process data into information; sometimes called an application developer or computer programmer., 29
- software piracy:** The unauthorized and illegal duplication of copyrighted software., 228. *See also* **piracy**
- software registration:** Optional process that usually involves submitting your name and other personal information to the software manufacturer or developer in order to receive product support., 162

- software suite:** A collection of individual applications available together as a unit., 172
- software theft:** Illegal act that occurs when someone steals software media, intentionally erases programs, illegally registers and/or activates a program or illegally copies a program., 228
- solid-state drive (SSD):** A storage device that typically uses flash memory to store data, instructions, and information, and that contains no moving parts. (or) Flash memory storage device that contains its own processor to manage its storage., 17, 376–378
- solid-state media:** Media that consist entirely of electronic components, such as integrated circuits, and contain no moving parts., 376
- sound card:** Adapter card that enhances the sound-generating capabilities of a personal computer by allowing sound to be input through a microphone and output through external speakers or headphones., 297
- sound configurations, numbers in, 351
- source document:** Document that contains the original form of data to be processed., 334
- source:** Original location on a storage device., 34
- source program:** The program that contains the language instructions, or code, to be converted to machine language., 529
- space (search engine operator), 72
- spam:** An unsolicited email message or posting sent to many recipients or forums at once., 193
- speakers, 16
- speakers:** Audio output devices that generate sound., 351
- speech recognition:** A computer or mobile device's capability of distinguishing spoken words., 330. *See also* **voice recognition**
- speech-to-text:** Feature that recognizes a user's spoken words and enters them into email messages, text messages, or other applications that support typed text entry., 330
- spelling checkers, 168
- spike:** Electrical disturbance that occurs when the increase in power lasts for less than one millisecond (thousandth of a second), 140
- spoofing:** A technique intruders use to make their network or Internet transmission appear legitimate to a victim computer or network., 217
- spooling:** The process of sending documents to be printed to a buffer instead of sending them immediately to the printer., 418
- sports mobile apps, 187
- sports websites, 76
- spreadsheet data, import/export of, 511
- spreadsheet software:** An application that allows users to organize data in rows and columns and perform calculations on the data., 168
- spyware and malware detection software, 423
- spyware:** A program placed on a computer or mobile device without the user's knowledge that secretly collects information about the user and then communicates the information it collects to some outside source while the user is online., 192, 215
- spyware remover:** A program that detects and deletes spyware and similar programs., 192
- spyware windows, 25
- SQL (Structured Query Language):** A popular query language that allows users to manage, update, and retrieve data., 512
- SRAM:** RAM chips that are faster and more reliable than and do not have to be reenergized as often as DRAM chips., 292. *See also* **Static RAM**
- SSD (solid-state drive):** A storage device that typically uses flash memory to store data, instructions, and information, and that contains no moving parts. (or) Flash memory storage device that contains its own processor to manage its storage., 376–378
- SSID:** A network name. Short for service set identifier., 236
- stand-alone operating system:** A complete operating system that works on desktops, laptops, and some tablets., 426. *See also* **desktop operating system**
- standards:** Sets of rules and procedures an organization expects employees to accept and follow., 517
- Static RAM:** RAM chips that are faster and more reliable than and do not have to be reenergized as often as DRAM chips., 292. *See also* **SRAM**
- static webpage:** A fixed webpage where all visitors see the same content., 65
- status bar, 427
- status update:** Terminology used on social networking sites to inform friends about your activities., 73
- steering committee:** Decision-making body in an organization., 517
- storage
- access time, 371
 - capacity, 370
 - enterprise, 389–392
 - vs.* memory, 370
 - options of, 369
 - processor speed of, computer and, 368

- storage and processes of data, 12
- storage appliance:** A server that is placed on a network with the sole purpose of providing storage to users, computers, and devices attached to the network., 390. *See also* **network attached storage (NAS)**
- storage area network (SAN):** A high-speed network with the sole purpose of providing storage to other attached servers., 391–392
- storage as a service, 287
- storage device:** Device that records (writes) and/or retrieves (reads) items to and from storage media., 17, 340, 368
- storage media:** Media, such as hard disks, solid-state drives, USB flash drives, memory cards, and optical discs, on which a computer keeps data, instructions, and information., 17
- storage server, 116
- stored program concept:** Concept of using memory to store both data and programs., 290
- storing:** Processor operation in the machine cycle that writes the result to memory (not to a storage medium)., 281
- streaming:** The process of transferring data in a continuous and even flow, which allows users to access and use a file while it is transmitting., 38, 79
- audio and video, 187
- streaming cam:** Camera that has the illusion of moving images because it sends a continual stream of still images., 333
- streaming media player:** Device, typically used in a home, that streams digital media from a computer or network to a television, projector, or some other entertainment device., 9, 128. *See also* digital media player
- stretch:** Touch gesture in which a user moves two fingers apart., 5
- striping, 390
- strong passwords, 25
- Structured Query Language (SQL):** A popular query language that allows users to manage, update, and retrieve data., 512
- stylus:** Input device that looks like a small ink pen that you can use instead of a fingertip to enter data, make selections, or draw on a touch screen., 112, 326
- subject directory:** Search tool that classifies webpages in an organized set of categories and related subcategories., 72
- subscribe:** Adding your email address to a mailing list., 90
- subwoofer:** Audio output device that boosts low bass sounds in a surround sound speaker system., 351
- summary report:** Report generated by a management information system that consolidates data usually with totals, tables, or graphs, so that managers can review it quickly and easily., 558
- supercomputer:** The fastest, most powerful computer and the most expensive., 120
- superscalar:** Processors that can execute more than one instruction per clock cycle., 283
- support and security phase:** Step in the system development life cycle whose purpose is to provide ongoing assistance for an information system and its users after the system is implemented, and consists of three major activities: (1) perform maintenance activities, (2) monitor system performance, and (3) assess system security., 526
- surfing the web:** Term used to refer to the activity of using links to explore the web., 21
- surge protector:** Device that uses electrical components to provide a stable current flow and minimize the chances of an overvoltage reaching the computer and other electronic equipment., 140
- surge suppressor:** Device that uses electrical components to provide a stable current flow and minimize the chances of an overvoltage reaching the computer and other electronic equipment., 140
- survey distribution, system analysts, 520
- swap file:** Area of the hard drive used for virtual memory., 418
- swipe keyboard app, 123
- swipe:** Touch gesture in which a user presses and holds one finger and then moves the finger horizontally or vertically on the screen., 5
- switch:** A device that provides a central point for cables in a network., 473. *See also* **hub**
- symmetric key encryption:** Encryption method where both the originator and the recipient use the same secret key to encrypt and decrypt the data., 230. *See also* **private key encryption**
- synchronize:** Process of matching the files on computers or mobile devices in two or more locations with each other., 34. *See also* **sync**
- sync:** Process of matching the files on computers or mobile devices in two or more locations with each other ; short for synchronize., 34. *See also* **synchronize**
- syntax, 528
- system board, 278
- system bus, 300

system clock: Small quartz crystal circuit that controls the timing of all computer operations., 282–283

system development: A set of activities used to build an information system., 515

- analysis phase, 521–522
- circumstances initiating, 521
- data and information gathering techniques, 520
- design phase, 523–525
- documentation, 519
- feasibility assessment in, 519
- general guidelines of, 517
- implementation phase, 525–526
- participation in, 517
- planning phase, 521
- support and security phase, 526–527

system development life cycle (SDLC): Collection of phases in system development., 515

system proposal, 522

systems analyst: Person responsible for designing and developing an information system., 517, 568

systems programmer: Employee who installs and maintains operating system software and provides technical support to the programming staff., 568

system software: Term used to refer to the operating system and other tools that consist of the programs that control or maintain the operations of the computer and its devices., 158

systems test: Test performed during the program development life cycle that verifies all programs in an application work together properly., 525

system unit: The case that contains and protects the motherboard, hard disk drive, memory, and other electronic components of the computer from damage., 114, 276. *See also* **chassis**

T

T1 line: The most popular T-carrier line., 468

T3 line: T-carrier line that is equal in speed to 28 T1 lines., 468

tabbed browsing: Browsing technique where the top of the browser shows a tab (similar to a file folder tab) for each webpage you display., 66

tables, 500

tablet: Thin, lighter weight mobile computer that has a touch screen, usually smaller than a laptop but larger than a phone., 4, 112

vs. laptops, desktops, 6

printing from, 347

tactile output: Feature included with some input devices that provides the user with a physical response from the device., 353

tag: A short descriptive label that you assign to webpages, photos, videos, blog posts, email messages, and other digital content so that it is easier locate at a later time., 75

tape: A magnetically coated ribbon of plastic that is capable of storing large amounts of data and information at a low cost., 392

tape cartridge: A small, rectangular, plastic housing for tape., 392

tape drive: Drive that reads from and writes on a magnetic tape., 392

tape library: Facility where individual tape cartridges are mounted in a separate cabinet., 392

tap: Touch gesture in which a user quickly touches and releases one finger one time., 5

target: Destination location on a storage device., 34

taskbar, 427

tax preparation software: An application that can guide individuals, families, or small businesses through the process of filing federal taxes., 176

TB (terabyte): 1 trillion bytes, 290, 370

Tbps (terabits per second), 479

T-carrier line: Any of several types of long-distance digital phone lines that carry multiple signals over a single communications line., 468

TCP/IP: Network protocol that defines how messages (data) are routed from one end of a network to the other, ensuring the data arrives correctly. Short for Transmission Control Protocol/Internet Protocol., 461

technical feasibility: Test that measures whether the organization has or can obtain the computing resources, software services, and qualified people needed to develop, deliver, and then support the proposed information system., 519

technical specifications, identification, 523

technical project manager: Employee who guides design, development, and maintenance tasks; serves as interface between programmers/developers and management., 569

technology

- in entertainments, 199
- health concerns of using, 142–144
- national and local security, 249

technology addiction: Behavioral health risk that occurs when the technology consumes someone's entire social life., 144

- technology careers, 562–571
 - app development and mobile technologies, 570
 - business and government organizations, 562–564
 - information and systems security, 570
 - IT consulting, 568
 - software and apps field, 564
 - system development, 568
 - technology education, training, and support, 567
 - technology equipment field, 564
 - technology operations, 569
 - technology sales, 566
 - technology service and repair field, 565
- technology certifications
 - application software certifications, 572–573
 - data analysis and database certifications, 573
 - hardware certifications, 573
 - networking certifications, 573
 - operating system certifications, 574
 - programmer/developer certifications, 574–575
 - security certifications, 575
- technology equipment field:** Specialty area consisting of manufacturers and distributors of computers, mobile devices, and other hardware, such as magnetic and optical drives, monitors, printers, and communications and networking devices., 564
- technology industry, 552–553
- technology overload:** Behavioral health risk that occurs when people feel distressed when deprived of technology, even for a short length of time, or feel overwhelmed with the amount of technology they are required to manage., 144
- technology-related tendonitis, 142
- technology security plan components, 527
- technology service and repair field:** Specialty area that focuses on providing preventive maintenance, component installation, and repair services to customers., 565
- telecommuting, home office for, 563
- telematics, 133
- telemedicine:** The use of communications and information technology to provide and assist with medical care., 459
- tendonitis, 142
- terabyte (TB):** 1 trillion bytes, 290, 370
- terminal:** A computer, usually with limited processing power, that enables users to send data to and/or receive information from a server, or host computer., 117
- test plan, 235
- tethering:** Technique used to configure a smartphone or Internet-capable tablet to act as a portable communications device that shares its Internet access with other computers and devices wirelessly., 60
- text, output, 340
- text message:** A short note, typically fewer than 300 characters, sent to or from a smartphone or other mobile device., 7
- text message services, 124
- text/picture/video messaging services, 458
- text-to-speech feature, 129
- TFT:** Thin-film transistor. LCD display technology that uses a separate transistor to apply charges to each liquid crystal cell and, thus, displays high-quality color that is viewable from all angles., 342
- theft
 - of hardware, 139, 233
 - of information, 229–233
 - of software, 228–229
- thermal printer:** Printer that generates images by pushing electrically heated pins against heat-sensitive paper., 349
- thermostats, programmable, 11
- thin client:** A terminal that looks like a desktop but has limited capabilities and components., 117
- thrashing:** Occurs when an operating system spends much of its time paging, instead of executing application software., 418
- thread:** In discussion forums, consists of the original article and all subsequent related replies. Also called a threaded discussion., 91
- throttling:** ISP practice of reducing upload and download speeds of certain high-data users at peak times in order not to tie up network resources for a small pool of users., 477
- thumb drive:** A portable flash memory storage device that you plug in a USB port., 382. *See also* **USB flash drive**
- thumbnail:** A small version of a larger object that you usually can tap or click to display a larger image or object., 85
- Thunderbolt ports, 135
- TIFF graphics format, 86
- tiles, 426
- time bombs, 190
- toggle key:** A key that switches between two states each time a user presses the key., 320
- token:** A special series of bits that functions like a ticket., 460

- token ring:** Standard that specifies that computers and devices on the network share or pass a special signal, called a token, in a unidirectional manner and in a preset order., 460
- toll fraud, 238
- toll fraud malware:** Malicious mobile app that uses a variety of fraudulent schemes to charge unsuspecting users for premium messaging services., 193
- toner:** Type of powdered ink that is used by some laser printers and copy machines to produce output., 348
- tools:** Programs that enable you to perform maintenance-type tasks usually related to managing devices, media, and programs used by computers and mobile devices., 158. *See also* **utilities**
- top-level domain:** The suffix of the domain name in a web address., 63
original (table), 63
- touch input, 324–325
- touch mouse:** Touch-sensitive mouse that recognizes touch gestures, in addition to detecting movement of the mouse and traditional click and scroll operations., 323
- touchpad:** A small, flat, rectangular pointing device that is sensitive to pressure and motion., 13, 323
- touch screen:** A touch-sensitive display device., 324–326
gestures (table), 5
on smartphones, 7
- touch-sensitive pad:** An input device that contains buttons and/or wheels you operate with a thumb or finger., 128, 326
- touch user interface, 414
- tourism websites, 80
- tower:** A frame made of metal or plastic that houses the system unit on a desktop., 114
- tower server:** A server built into an upright cabinet (tower) that stands alone., 116
- Toys “R” Us, 243
- trackball:** A stationary pointing device with a ball on its top or side., 324
- tracking software, 279
- track:** Narrow recording band that forms a full circle on the surface of the disk., 374
- trackpad:** Term used by Apple to refer to the touchpad on its laptops., 323
- traditional literacy, 561
- traffic:** Communications activity on the Internet., 62
- training:** Showing users exactly how they will use the new hardware and software in the system., 526
- transaction processing system (TPS):** An information system that captures and processes data from day-to-day business activities; TPS for short., 557
- transactions, verifying, 174
- transfer rate:** The speed with which data, instructions, and information transfer to and from a device., 371
- transferring media from mobile devices to computers, 153
- transistor:** Element of an integrated circuit that can act as an electronic switch that opens or closes the circuit for electrical charges., 278
- transmission media:** Materials or substances capable of carrying one or more communications signals., 450, 476–477
- transportation, and computers, mobile devices, 95
- travel, technology in, 39
- travel apps, 178
- travel web database services, 507
- travel websites, 80
- trial version:** An application you can use at no charge for a limited time, to see if it meets your needs., 161
- trojan horse:** A destructive program that hides within or looks like a legitimate program., 190, 215
- twisted-pair cable:** Physical transmission media that consists of one or more twisted-pair wires bundled together., 477
- twisted-pair wire:** Two separate insulated copper wires that are twisted together., 477
- Twitter, 23, 24, 78
- two-step verification process, 226–227
- typing on phone with numeric keypad, 123
- ## U
- UI (user interface):** Portion of software that controls how you enter data and instructions and how information is displayed on the screen., 414
- ultrabook, 111
- ultrasonic sensors, 279
- ultra-wideband (UWB):** A network standard that specifies how two UWB devices use short-range radio waves to communicate at high speeds with each other., 464
- UMB (Ultra Mobile Broadband):** Ultra Mobile Broadband; a 4G standard for cellular transmissions, 481
- UMTS (Universal Mobile Telecommunications System):** Universal Mobile Telecommunications System; a 3G standard for cellular transmissions, 481

- unauthorized access and use, 221
- unauthorized access:** The use of a computer or network without permission., 221
- unauthorized use:** The use of a computer or its data for unapproved or possibly illegal activities., 221
- uncompress:** To unzip or expand a zipped (compressed) file, which restores it to its original form., 198
- undervoltage:** Electrical disturbance that occurs when the electrical supply or voltage drops below the normal volts., 140
- uninstaller:** A tool that removes a program, as well as any associated entries in the system files., 195, 422
- uninstalling programs, 195
- uninterruptible power supply (UPS):** A device that contains surge protection circuits and one or more batteries that can provide power during a temporary or permanent loss of power., 141
- United States Computer Emergency Readiness Team (US-CERT), 557
- unit test:** Test performed during the program development life cycle that verifies each individual program or object works by itself., 525
- Universal Product Code (UPC):** Bar code used by retail and grocery stores., 335
- UNIX:** A multitasking operating system developed in the early 1970s by scientists at Bell Laboratories., 429
- unlicensed software, 565
- unsubscribe:** Removing your email address from a mailing list., 90
- UPC (Universal Product Code):** Bar code used by retail and grocery stores., 335
- updates for desktop and mobile apps, 157
- uplink:** Transmission from an earth-based station to a satellite., 482
- uploading:** The process of transferring files from your computer or mobile device to a server on the Internet., 92
- upstream rate:** The transfer rate that is achieved when data is being received on a communications channel., 463
- upward compatible:** Applications that may not run on new versions of an operating system., 425
- URL:** Unique address of a webpage. Short for Uniform Resource Locator., 68. *See also* **web address**
- USA TODAY website, 76
- USB adapters:** A dongle that plugs into a USB port, enhances functions of a mobile computer and/or provides connections to peripheral devices., 298–299
- USB cable, transferring photos to computers using, 153
- USB flash drive:** A portable flash memory storage device that you plug in a USB port., 18, 382–383. *See also* **thumb drive**
- safely removing, 383
- USB hub, 136
- USB port:** Port that can connect up to 127 different peripheral devices together with a single connector. Short for universal serial bus port., 136
- U.S. Department of Homeland Security, 36
- user:** Anyone who interacts with a computer or mobile device, or utilizes the information it generates., 4
- categories of (table), 41, 42
- user buy-in:** A measure of how likely users are to accept and use a new system., 524
- user experience designer:** Employee who plans and designs software and apps that consider a user's reaction to a program and its interface, including its efficiency, its effectiveness, and its ease of use. *See also* **UX designer**, 569
- user ID:** A unique combination of characters, such as letters of the alphabet or numbers, that identifies one specific user. Short for user identification., 222. *See also* **user name**
- user interface (UI):** Portion of software that controls how you enter data and instructions and how information is displayed on the screen., 29, 414
- user name:** A unique combination of characters, such as letters of the alphabet or numbers, that identifies one specific user. Also called log on name or sign on name., 88, 242, 423. *See also* **user ID**
- user response:** An instruction a user issues by responding to a message displayed by a program or app., 318
- U.S. Securities and Exchange Committee (SEC), 295
- utilities:** Programs that enable you to perform maintenance-type tasks usually related to managing devices, media, and programs used by computers and mobile devices., 158. *See also* **tools**
- UWB (ultra-wideband):** A network standard that specifies how two UWB devices use short-range radio waves to communicate at high speeds with each other., 464
- UX designer:** Employee who plans and designs software and apps that consider a user's reaction to a program and its interface, including its efficiency, its effectiveness, and its ease of use. *See also* **user experience designer**, 569

V

- validation:** The process of comparing data with a set of rules or values to determine if the data meets certain criteria., 503
- value-added network (VAN):** A third-party business that provides networking services, such as EDI services, secure data and information transfer, storage, or email., 453
- value-added reseller (VAR):** An organization that purchases products from manufacturers and then resells these products to the public — offering additional services with the product., 523
- VAN (value-added network):** A third-party business that provides networking services, such as EDI services, secure data and information transfer, storage, or email., 453
- vandalism of hardware, 139, 233
- VAR (value-added reseller):** An organization that purchases products from manufacturers and then resells these products to the public — offering additional services with the product., 523
- vendor proposals, 523
- verification process, two-step, 226–227
- video, output, 340
- video blog (vlog), 78
- video call:** Call in which all parties see one another as they communicate over the Internet., 332
- video card:** Adapter card that converts computer output into a video signal that travels through a cable to the monitor, which displays an image on the screen., 298.
See also graphics card
- videoconference:** A meeting between two or more geographically separated people who use a network or the Internet to transmit audio and video data., 31, 188, 333
- video editing software:** An application that allows professionals to modify a segment of a video, called a clip., 183
- video games, 132
- video:** Images displayed in motion and voice input., 14, 87
streaming, 187
- video message:** A short video clip, usually about 30 seconds, sent to or from a smartphone or other mobile device., 7
- video projectors, 113
- video sharing sites, 75
- virtualization:** The practice of sharing or pooling computing resources, such as servers and storage devices., 117, 432
- virtual keyboard:** Phone technology that projects an image of a keyboard on a flat surface., 124
- virtual keyboards, 13
- virtual machine (VM):** Environment on a computer in which you can install and run an operating system and programs., 431
- virtual memory:** A portion of a storage medium, such as a hard drive or USB flash drive, that the operating system allocates to function as additional RAM., 417
- virtual private network (VPN):** Network that provides a mobile user with a secure connection to a company network server, as if the user has a private line., 230
- virtual reality (VR):** The use of computers to simulate a real or imagined environment that appears as a three-dimensional (3-D) space., 87
- virus:** A potentially damaging computer program that affects, or infects, a computer negatively by altering the way the computer works without the user's knowledge or permission., 190, 215
- detecting, 192
- hoaxes, recognizing, 192
- how they spread via email, 215
- and malware, 190
- protection from, 25
- signs of infection, 191
- virus signature:** A known specific pattern of virus code., 192
- Visual Basic, 29, 532
- visual programming environment (VPE):** A graphical interface in a visual programming language that allows system developers to drag and drop objects to build programs and apps., 532
- visual programming language:** A language that uses a visual or graphical interface for creating all source code., 532
- Visual Studio:** A suite of object-oriented application development tools that assists software developers in building programs and apps for Windows or any operating system that supports the Microsoft .NET Framework., 531
- visual voice mail:** A voice mail feature that allows you to view message details such as the length of calls and, in some cases, read message contents instead of listening to them., 125
- VM (virtual machine):** Environment on a computer in which you can install and run an operating system and programs., 431

- voice commands
 gaming, 11
 and video input, 11
- voice input:** The process of entering input by speaking into a microphone., 330
- voice mail, 31, 125
- voice mail message:** Short audio recording sent to or from a smartphone or other mobile device., 7
- voice recognition:** A computer or mobile device's capability of distinguishing spoken words., 330. *See also* **speech recognition**
- voice recognition application:** Application that allows users to dictate text and enter instructions by speaking into a microphone., 330
- voice verification system:** Biometric device that compares a person's live speech with their stored voice pattern., 225
- VoIP:** Technology that uses the Internet (instead of the public switched telephone network) to connect a calling party to one or more local or long-distance called parties and enables users to speak to other users via their Internet connection. Short for Voice over IP (Internet Protocol)., 24, 31, 92, 188
- volatile memory:** Memory that loses its contents when the computer's power is turned off., 290
- volatility, illustration of, 371
- VPE (visual programming environment):** A graphical interface in a visual programming language that allows system developers to drag and drop objects to build programs and apps., 532
- VPN:** Network that provides a mobile user with a secure connection to a company network server, as if the user has a private line., 230
- VR world:** Three-dimensional (3-D) environment that contains infinite space and depth., 88
- W**
- W3C:** Group that oversees research and sets standards and guidelines for many areas of the Internet whose mission is to ensure the continued growth of the web., 58
- Wallet:** Windows app that provides a centralized location for coupons, credit cards, loyalty cards, and memberships in a single, easily accessible location., 435
- WAN (wide area network):** A network that covers a large geographic area (such as a city, country, or the world) using a variety of wired and wireless transmission media., 455
- warm boot:** The process of restarting a computer or mobile device while it remains powered on., 413
- wearable device:** Small mobile computing consumer device designed to be worn and that often communicate with a mobile device or printer., 9, 130, 325. *See also* **wearable**
- wearable:** Small mobile computing consumer device designed to be worn and that often communicate with a mobile device or printer, 9. *See also* **wearable device**
- wearable technology, 285
- weather forecasts, 124
- weather websites, 76
- Web 2.0:** Term to refer to websites that provide a means for users to share personal information, allow users to modify website content, and provide applications through a browser., 65
- web address:** Unique address of a webpage., 68. *See also* **URL**
- web analytics expert:** Employee who collects and measures Internet data, such as website traffic patterns and advertising, and develops reports that recommend strategies to maximize an organization's web presence., 569
- web app:** An application stored on a web server that you access through a browser., 28, 69, 161
 email, 103
 for personal, business productivity, 178
- web:** A worldwide collection of electronic documents; short for World Wide Web., 21, 65
 graphics formats used on (table), 86
 media on the, 76
 searching the, 22
- web-based training (WBT):** A type of computer-based training that uses Internet technology to deliver the training., 184
- webcam:** A digital video camera that allows you to capture video and usually audio input for your computer or mobile device., 14, 332
 spying, punishment for, 111
- web conference:** A meeting that takes place on the web., 520
- web creation and management, 84
- web designer:** Employee who designs the layout, navigation, and overall appearance of a website with a focus on user experience; specifies a website's appearance using HTML5, JavaScript, CSS, media, and other web design technologies., 568

- web databases, 170, 506–507
- web developers:** Designers of webpages., 534, 568
- web development, 534–538
- web feed:** Content that has changed on a website that you can display in your browser., 69, 188
- web filtering software:** A program that restricts access to certain material on the web., 193, 248
- web hosting service:** Service on the web that provides a program that assists you with creating, editing, and hosting content on a website., 64
- web maps, 81
- WebMD, 74
- webpage:** Each electronic document on the web; can contain text, graphics, audio, and video., 21, 65
- web publishing:** The development and maintenance of websites., 84
- web server:** A computer that delivers requested webpages to your computer or mobile device., 21, 65, 116
- website:** A collection of related webpages and associated items stored on a web server., 21, 65
- website authoring software:** Software that helps users of all skill levels create webpages that include graphics, video, audio, animation, and special effects with interactive content., 184
- websites
- avoiding malware infections, 110
 - and cookies, 244
 - copying media from, 38
 - displaying CAPTCHA, 224
 - downloading software safely, 162
 - finance, 36
 - government, 36
 - portals, 82
 - types of, 71–85
 - verifying safety of, 66
 - whether correct or accurate, 85
- website scams, 245
- wheel:** A steering-wheel-type input device that users turn to simulate driving a car, truck, or other vehicle., 131
- wide area network (WAN):** A network that covers a large geographic area (such as a city, country, or the world) using a variety of wired and wireless transmission media., 455
- widescreen monitor:** Monitor that is wider than it is tall., 343
- Wi-Fi (wireless fidelity):** Broadband Internet connection that uses radio signals to provide connections to computers and devices with built-in Wi-Fi capability or a communications device that enables Wi-Fi connectivity., 31, 59, 138, 462
- Wi-Fi network
- adding computer or mobile device to, 455
- wiki:** A collaborative website that allows users to create, add to, modify, or delete the content via their browser., 40, 78
- Wikipedia, 40, 78
- Windows Media Player, 87
- Windows Phone:** A proprietary mobile operating system that runs on some smartphones., 435
- Windows Phone Store:** Store that provides access to additional Windows apps and software updates, 435
- wireless
- device connections, 137
 - Internet access points, 31
 - messaging services, 31
 - security, 236–237
- wireless access point (WAP):** A central communications device that allows computers and devices to transfer data wirelessly among themselves or to a wired network using wireless technologies, such as Wi-Fi., 236, 470
- wireless Ethernet:** Term sometimes used to refer to Wi-Fi because it uses techniques similar to the Ethernet standard to specify how physically to configure a wireless network., 462
- wireless keyboard:** A battery-powered device that transmits data to the computer or mobile device using wireless technology., 322
- wireless LAN (WLAN):** A LAN that uses no physical wires., 454
- wireless markup language (WML):** Subset of XML that allows web developers to design pages specifically for microbrowsers., 536
- wireless modem:** Modem that uses a wireless communications technology (such as cellular radio, satellite, or Wi-Fi network) to connect to the Internet., 58, 469
- wireless mouse:** A battery-powered device that transmits data using wireless technology., 323
- wireless router:** A device that performs the functions of a router and also a wireless access point., 471
- wireless signal, strengthening, 471
- wireless transmission media, 478–479
- broadcast radio, 479

- cellular radio, 480–481
 - communications satellite, 482–483
 - GPS (global positioning system), 483–484
 - infrared (IR), 479
 - microwaves, 482
 - WLAN (wireless LAN):** A LAN that uses no physical wires., 454
 - WML (wireless markup language):** Subset of XML that allows web developers to design pages specifically for microbrowsers., 536
 - word processing software:** An application that allows users to create and manipulate documents containing mostly text and sometimes graphics. Sometimes called a word processor., 167
 - word size:** The number of bits the processor can interpret and execute at a given time., 300
 - wordwrap feature, 167
 - worksheet:** Rows and columns used to organize data in a spreadsheet., 168
 - creating, 168–169
 - workstation:** High-end desktop that is designed to handle intense calculations and sophisticated graphics., 114
 - World Wide Web (WWW):** A worldwide collection of electronic documents., 20, 21, 65
 - worm:** Malware that resides in active memory and replicates itself over a network to infect machines, using up the system resources and possibly shutting down the system., 190, 215
 - WORM:** Write once, read many, 388
 - Wozniak, Steve, 26
 - writing:** The process of transferring data, instructions, and information from memory to a storage medium., 368
- X**
- xD Picture Card:** A type of memory card., 381
 - XML:** Popular format for sharing data that allows web developers to create tags that describe the structure of information., 536
- Y**
- yottabyte (YB), 370
 - YouTube, 75
- Z**
- zettabyte (ZB), 370
 - zipped files:** Name sometimes used to refer to compressed files., 198
 - zombie:** A compromised computer or device whose owner is unaware the computer or device is being controlled remotely by an outsider., 216
 - zombie army:** A group of compromised computers or mobile devices connected to a network such as the Internet that are used to attack other networks, usually for nefarious purposes., 216. *See also* **botnet**
 - Zuckerberg, Mark, 23

