

15th Edition

Understanding Computers

Today and Tomorrow

Comprehensive

Chapter 1

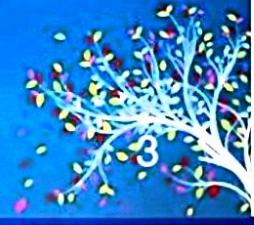
Introduction to the World of Computers

Deborah Morley
Charles S. Parker

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Introduction

- ▶ Assessment
- ▶ Mid 1 = 20%
- ▶ Mid 2 = 20%
- ▶ Sessional (Quiz, Assignments, CP) =20%
- ▶ Finals = 40%
- ▶ Course website: <https://sites.google.com/a/iba-suk.edu.pk/shafaq-computer-science/fall-2017/ict-fall-2017>
- ▶ Contact: shafaq.siraj@iba-suk.edu.pk

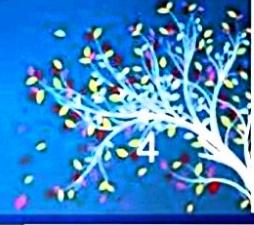


Learning Objectives

1. Explain why it is essential to learn about computers today and discuss several ways computers are integrated into our business and personal lives.
2. Define a computer and describe its primary operations.
3. List some important milestones in computer evolution.
4. Identify the major parts of a personal computer, including input, processing, output, storage, and communications hardware.
5. Define software and understand how it is used to instruct the computer what to do.

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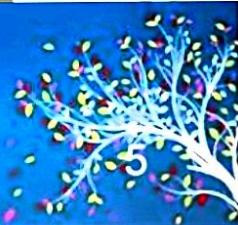
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Learning Objectives

6. List the six basic types of computers, giving at least one example of each type of computer and stating what that computer might be used for.
7. Explain what a network, the Internet, and the World Wide Web are, as well as how computers, people, and Web pages are identified on the Internet.
8. Describe how to access a Web page and navigate through a Web site.
9. Discuss the societal impact of computers, including some benefits and risks related to their prominence in our society.

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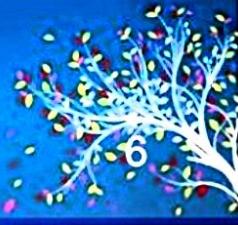


Overview

- ▶ This chapter covers:
 - ▶ What computers are, how they work, and how they are used
 - ▶ Computer terminology
 - ▶ An overview of the history of computers
 - ▶ The basic types of computers in use today
 - ▶ How to access resources on the Internet
 - ▶ Societal impacts of computers

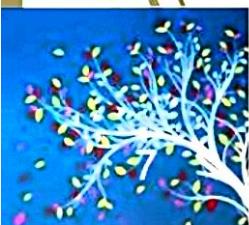
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Computers in Your Life

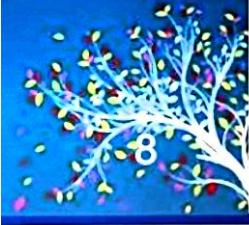
- ▶ Why learn about computers?
 - ▶ Pervasive computing
 - ▶ Also known as ubiquitous computing
 - ▶ Computers have become an integral part of our lives
 - ▶ Basic computer literacy
 - ▶ Understanding what a computer is and how it works



Computers in Your Life

- ▶ Before 1980
 - ▶ Computers were large and expensive
 - ▶ Very few people had access to them
 - ▶ Computers were mostly used for high-volume processing tasks
- ▶ Microcomputers in the early 1980s
 - ▶ Inexpensive personal computers
 - ▶ Computer use increased dramatically

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Computers in Your Life

- ▶ Today
 - ▶ Nearly 90% of US households include a computer, and most use computers at work
 - ▶ Electronic devices are converging into single units with multiple capabilities
 - ▶ Check e-mail on living room television
 - ▶ View Internet content on mobile devices
 - ▶ Computer literacy is an essential skill for everyone

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Computers in Your Life

 **FIGURE 1-1**

Convergence.

Many devices today include computing or telecommunications functions.



TELEVISIONS

Can be used to access Web pages, e-mail, streaming movies, and other Internet content, in addition to viewing TV content.



SMARTPHONES

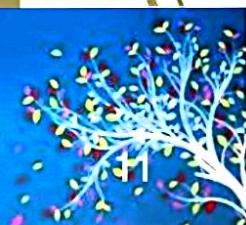
Can be used to access Internet content, play music and games, take photos, watch TV shows, and more, in addition to making phone calls.

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Computers in the Home

- Computers used for a variety of tasks:
 - Looking up information and news
 - Exchanging e-mail
 - Shopping and paying bills
 - Watching TV and videos
 - Downloading music and movies
 - Organizing digital photographs
 - Playing games
 - Making vacation plans

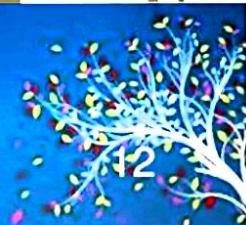
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Computers in the Home

- ▶ Used for reference, productivity, and entertainment
- ▶ Wireless networking
 - ▶ Computers can be used in nearly any location
- ▶ Smart appliances
 - ▶ Traditional appliances with built-in computer or communication technology
- ▶ Smart homes
 - ▶ Household tasks are monitored and controlled by a main computer in the house

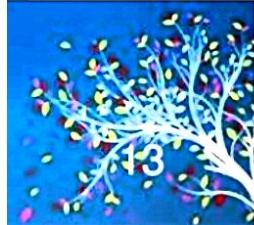
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Computers in Education

- ▶ Youth today: the computing generation
- ▶ Computer labs and classrooms
 - ▶ Most students today have access to computers at school
 - ▶ Some schools integrate e-books into the curriculum
- ▶ Wireless hotspots
 - ▶ Colleges and universities are even more integrated
 - ▶ Some have computer requirements for enrollment
 - ▶ Supplied or Bring Your Own Device (BYOD)
- ▶ Distance learning
 - ▶ Students participate from locations other than the traditional classroom setting using computers and Internet access

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Computers in Education



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Damon Mab / 7th Army, MIC

COMPUTER LABS AND CLASSROOMS

Many schools today have computers and Internet access available in the classroom and/or a computer lab for student use.

CAMPUS WIRELESS HOTSPOTS

Many students can access the Internet from anywhere on campus to do research, check e-mail, and more, via a campus hotspot.

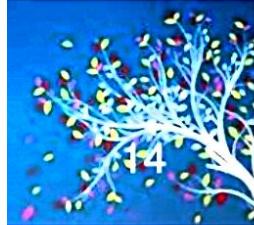
DISTANCE LEARNING

With distance learning, students—such as these U.S. Army soldiers—can take classes from home or wherever they happen to be at the moment.



FIGURE 1-3
Computer use in education.

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Computers on the Job

- Computers have become a universal on-the-job tool for decision-making, productivity, and communication
 - By all types of employees
 - For access control and other security measures
 - For service professional use
 - Extensively by the military
 - Requires continually refreshing computer skills
- Common uses:
 - Decision making, productivity, off-site communications, and authentication

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Computers on the Job

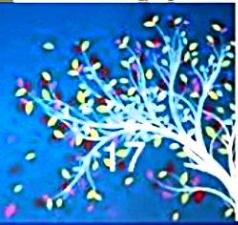


FIGURE 1-4

Computer use on the job.

Computers on the Go

- ▶ Computers are encountered in nearly every aspect of daily life
 - ▶ Consumer kiosks
 - ▶ ATM transactions
 - ▶ POS systems at retail stores
 - ▶ Self-checkout systems
 - ▶ Consumer authentication systems
 - ▶ Portable computers or mobile devices
 - ▶ GPS systems



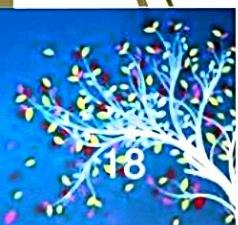
Technology and You Box

Restaurant iPad Ordering Systems

- ▶ Used in conjunction with e-menus
- ▶ Customers can place and pay for orders
- ▶ Can provide more resources to customers



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What Is a Computer and What Does It Do?

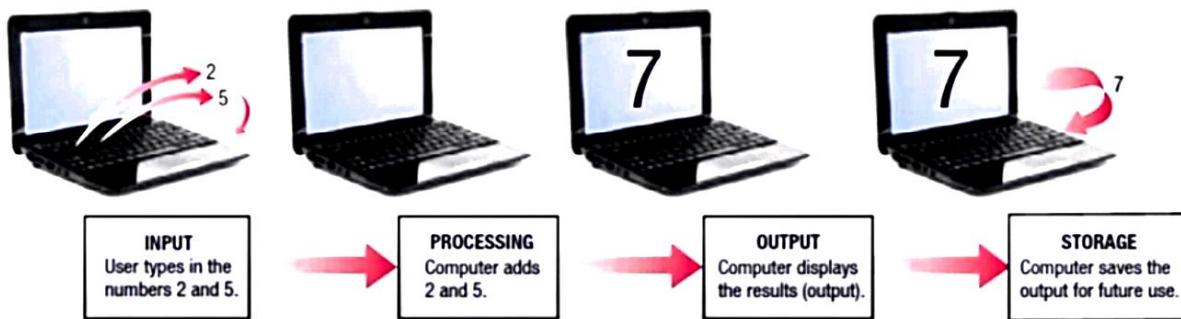
- ▶ Computer
 - ▶ A programmable, electronic device that accepts data, performs operations on that data, and stores the data
 - ▶ Follows instructions, called programs, which determine the tasks the computer will perform
- ▶ Basic Operations
 - ▶ Input: Entering data into the computer
 - ▶ Processing: Performing operations on the data
 - ▶ Output: Presenting the results
 - ▶ Storage: Saving data, programs, or output for future use
 - ▶ Communications: Sending or receiving data

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What Is a Computer and What Does It Do?

$$2 + 5 = 7$$



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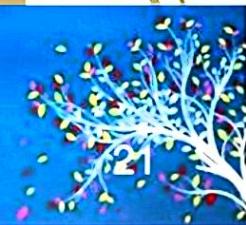
FIGURE 1-6

The information processing cycle.

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Data vs. Information

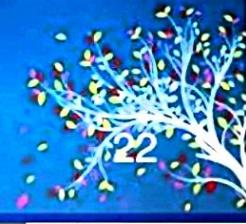
- ▶ **Data**
 - ▶ Raw, unorganized facts
 - ▶ Can be in the form of text, graphics, audio, or video
- ▶ **Information**
 - ▶ Data that has been processed into a meaningful form
- ▶ **Information Processing**
 - ▶ Converting data into information



Computers Then and Now

- ▶ The computer as we know it is a fairly recent invention
- ▶ The history of computers is often referred to in terms of generations
- ▶ Each new generation is characterized by a major technological development
- ▶ Precomputers and early computers (before approx. 1946)
 - ▶ Abacus, slide rule, mechanical calculator
 - ▶ Punch Card Tabulating Machine and Sorter

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Computers Then and Now

- ▶ First-generation computers (1946-1957)
 - ▶ Enormous and powered by vacuum tubes
 - ▶ Used a great deal of electricity and generated a lot of heat
 - ▶ ENIAC and UNIVAC
- ▶ Second-generation computers (1958-1963)
 - ▶ Used transistors
 - ▶ Computers were smaller, more powerful, cheaper, more energy-efficient, and more reliable
 - ▶ Punch cards and magnetic tape were used to input and store data

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Computers Then and Now

- ▶ Third-generation computers (**1964–1970**)
 - ▶ replacement of the transistor with *integrated circuits (ICs)*
 - ▶ allowing third-generation computers to be even smaller and more reliable
 - ▶ keyboards and monitors were introduced for input and output
- ▶ Fourth-generation computers (1971–present)
 - ▶ invention of the microprocessor in 1971
 - ▶ Keyboard, mouse, monitor, printer, output, hard drives, flash memory media, and optical discs.
 - ▶ development of computer networks, wireless technologies, and the Internet

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Computers Then and Now

- Fifth-generation (now and the future)
 - Infancy stage
 - May be based on artificial intelligence (AI)
 - Will likely use voice and touch input
 - May be based on optical computers and utilize nanotechnology

Computers Then and Now



Courtesy IBM Corporate Archives (Jeopardy! © 2011 S. Arthurs' Productions, LLC) (fotolia.com)

FIGURE 1-7
A brief look
at computer
generations.

FIFTH-GENERATION COMPUTERS

Some aspects of fifth-generation computers, such as the natural language input and artificial intelligence used by the IBM Watson computer shown competing on *Jeopardy!* here, already exist.

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Hardware

- Hardware: The physical parts of a computer
 - Internal hardware
 - Located inside the main box (system unit) of the computer
 - External hardware
 - Located outside the system unit
 - Connect to the computer via a wired or wireless connection
 - Hardware devices are associated with all five computer operations

Hardware

- Input Devices
 - Used to input data into the computer
 - Keyboards, mice, scanners, cameras, microphones, touch pads, touch screens, fingerprint readers, etc.
- Processing Devices
 - Perform calculations and control computer's operation
 - Central processing unit (CPU) and memory
- Output Devices
 - Present results to the user
 - Monitors, printers, speakers, projectors, etc.

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Hardware

- ▶ Storage Devices
 - ▶ Used to store data on or access data from storage media
 - ▶ Hard drives, CD/DVD discs and drives, USB flash drives, etc.
- ▶ Communications Devices
 - ▶ Allow users to communicate with others and to electronically access remote information
 - ▶ Modems, network adapters, routers, etc.

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Hardware

**FIGURE 1-9**

Typical computer hardware.

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Software

► Software

- The programs or instructions used to tell the computer hardware what to do

► System Software

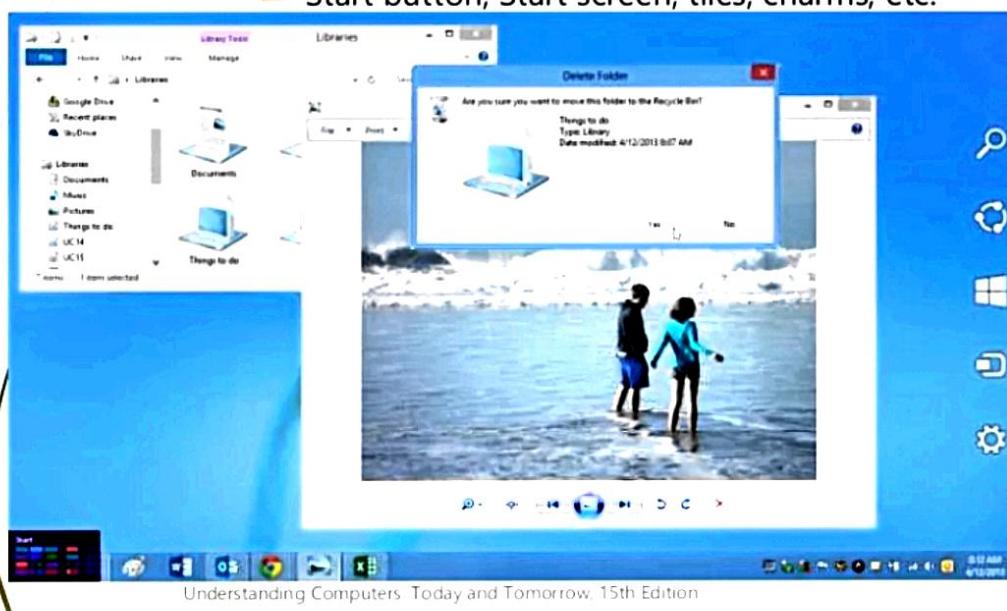
- Operating system starts up the computer and controls its operation
- Without OS, computer cannot function
- Boots the computer and launches programs at the user's direction
- Most use a GUI to interact with the user via icons, buttons, tiles, etc.
- Windows, Mac OS, Linux, Android, etc.

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Software

► Windows 8 interface

- Start button, Start screen, tiles, charms, etc.



Used with permission from Microsoft Corporation

FIGURE 1-10
The Windows desktop.

Application Software

► Application Software

- Performs specific tasks or applications

- Creating letters, budgets, etc.
- Managing inventory and customer databases
- Editing photographs
- Scheduling appointments
- Viewing Web pages
- Exchanging e-mail
- Burning DVDs
- Designing homes
- Playing games

Application Software

► Examples of application software

- Word processing
- Multimedia prog
- Web browsers
- E-mail programs

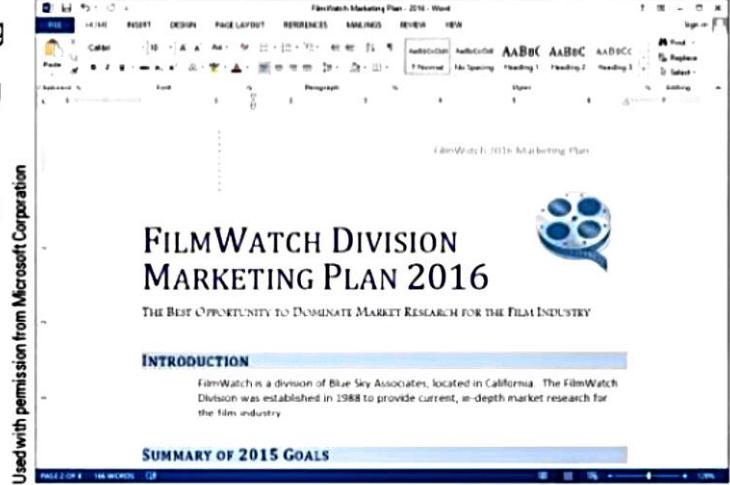


FIGURE 1-11

Examples of application software.

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WORD PROCESSING PROGRAMS
Allow users to create written documents, such as reports, letters, and memos.

Computer Users and Professionals

► Computer Users (end users)

- People who use a computer to obtain information

► Computer professionals include:

- Programmers

► Write programs computers use

- Systems analysts

► Design computer systems

- Computer operations personnel

► Manage day-to-day computer operations

- Security specialists

► Secure computers and networks against hackers

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Quick Quiz

1. Which of the following was not a first generation computer?
 - a. IBM PC
 - b. UNIVAC
 - c. ENIAC
2. True or False: A window displayed when the computer needs more information from the user is called a dialog box.
3. Speakers are an example of a(n) _____ device.

Answers:

1) a; 2) True; 3) output

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Computers To Fit Every Need

- Six basic categories of computers:
 - Embedded computers
 - Mobile devices
 - Personal computers
 - Servers
 - Mainframe computers
 - Supercomputers

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Embedded Computers

► Embedded Computers

- Embedded into a product and designed to perform specific tasks or functions for that product
- Cannot be used as general-purpose computers
- Often embedded in:
 - Household appliances
 - Thermostats
 - Sewing machines
 - Treadmills
 - Answering machines
 - Cars



Courtesy Volvo Cars of North America

A camera located under the mirror detects moving vehicles in the driver's blind spot.

A light indicates that a moving vehicle is in the driver's blind spot.

FIGURE 1-12
Embedded computers. This car's embedded computers control numerous features, such as notifying the driver when a car enters his or her blind spot.

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Trend Box

Tiny PCs

- Can look like a USB flash drive or small circuit board
- Typically connect your TV to the Internet to display Web content
- Some are full computers



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Mobile Devices

► Mobile Device

- ▶ A very small device with some Internet capability
- ▶ Typically has a small screen and keyboard
- ▶ Examples:
 - ▶ Smartphones
 - ▶ Handheld gaming devices
 - ▶ Portable digital media players
 - ▶ Media tablets



SMARTPHONES



MEDIA TABLETS

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FIGURE 1-13
Mobile devices.

Personal Computers (PCs)

► Personal Computer (PC)

- ▶ Small computer designed to be used by one person at a time
- ▶ Also called a microcomputer
- ▶ Available in different sizes and shapes

► Desktop Computers

- ▶ On or next to a desk
- ▶ Tower case, desktop or all-in-one
- ▶ PC or Macintosh
- ▶ Not portable

FIGURE 1-14
Desktop computers.



TOWER COMPUTERS



ALL-IN-ONE COMPUTERS

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Portable Computers

► Portable Computers

- ▶ Designed to be carried around easily
- ▶ Fully functional computers
- ▶ Notebook (laptop) computers
 - ▶ Typically use a clamshell design
- ▶ Tablet computers
 - ▶ Usually use a digital pen/stylus or touch screen
 - ▶ No physical keyboard; can use on-screen or attached keyboard
- ▶ Hybrid notebook-tablet computers
- ▶ Netbooks
 - ▶ Smaller and have more limited features than conventional notebooks

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Portable Computers

Courtesy Dell Inc.



NOTEBOOKS



TABLETS



HYBRID NOTEBOOK-TABLETS

Courtesy Lenovo

 **FIGURE 1-15**
Portable computers.

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Thin Client and Internet Appliances

- ▶ Thin Client

- ▶ Designed to utilize a network for much of its processing
- ▶ Lower cost, increased security and easier maintenance
- ▶ Limited or no local storage
- ▶ Not able to function as a computer if network is down

- ▶ Internet Appliance

- ▶ Specialized network computer designed for Internet access
- ▶ Some use apps to deliver news, sports scores, weather, music, and other Web-based information

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Inside the Industry Box

Tech Clothing

- ▶ Allows you to carry multiple devices safely
- ▶ Can use devices while they are being worn
- ▶ Make airport checkpoints easier



Scott West

REGULAR APPEARANCE

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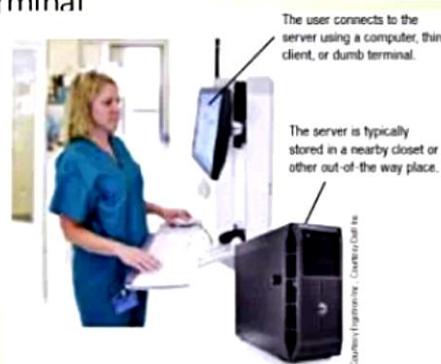
Servers

► Server

- ▶ A medium-sized computer used to host programs and data for a small network
- ▶ Sometimes referred to as a minicomputer
- ▶ Users connect via a network with a computer, thin client, or dumb terminal
- ▶ Virtualization
 - ▶ Creating virtual rather than actual environments (often used to share a server for increased efficiency)

FIGURE 1-17

Servers. Servers are used to host data and programs on a small network, such as a school computer lab or medical office network.



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Mainframe Computers

► Mainframe Computer

- ▶ Powerful computer used by many large organizations to manage large amounts of centralized data
- ▶ Standard choice for hospitals, universities, large businesses, banks, government offices
- ▶ Located in climate-controlled data centers and connected to the rest of the company computers via a network
- ▶ Larger, more expensive, and more powerful than servers
- ▶ Usually operate 24 hours a day
- ▶ Also called high-end servers or enterprise-class servers

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Mainframe Computers



FIGURE 1-18

Mainframe computers.
Mainframes are used
to perform large
processing tasks for
businesses.



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Supercomputers

- ▶ Supercomputer
 - ▶ Fastest, most expensive, most powerful type of computer
 - ▶ Generally run one program at a time, as fast as possible
 - ▶ Can cost several million dollars each
 - ▶ Tend to be very large and contain a large number of CPUs
 - ▶ Titan is one of the fastest computers in the world

Supercomputers



FIGURE 1-19

The Titan supercomputer. Supercomputers are used for specialized situations in which immense processing speed is required.

Courtesy of Oak Ridge National Laboratory

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Quick Quiz

1. A tablet PC is an example of a(n) _____.
 - a. Desktop computer
 - b. Portable PC
 - c. Internet appliance
2. True or False: The terms mainframe computer and supercomputer are interchangeable; both refer to the largest, most powerful computers.
3. A smartphone is an example of a(n) _____.

Computer Networks and the Internet

► Computer Network

- A collection of hardware and other devices that are connected together
- Users can share hardware, software, and data
- Users can communicate with each other

► Network Servers

- Manage resources on a network

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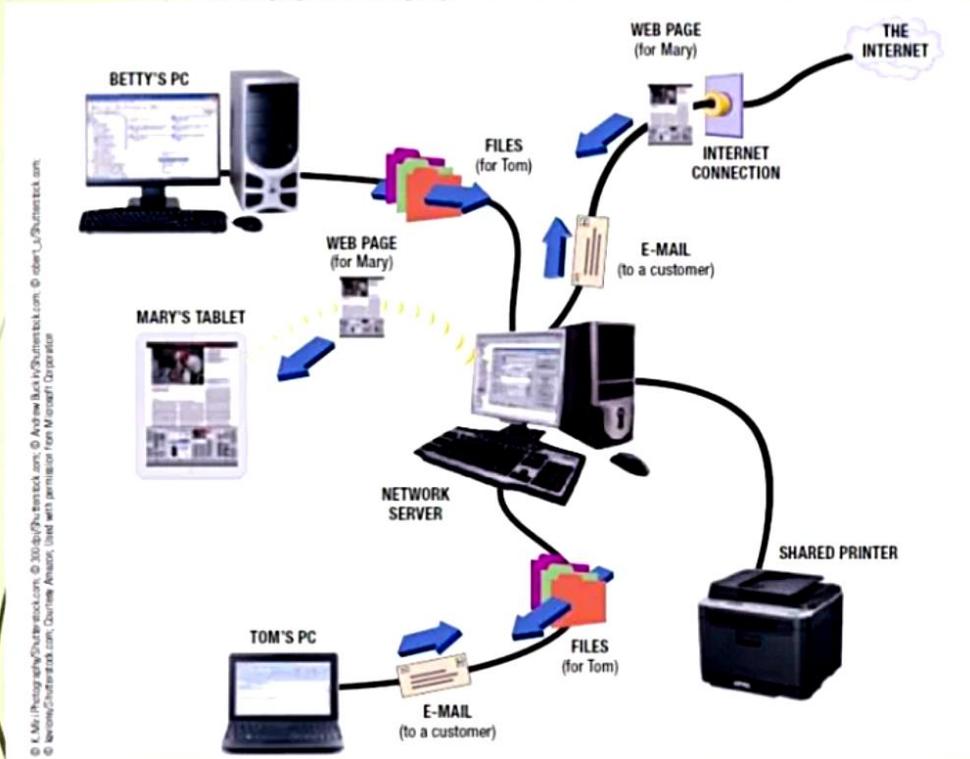
Computer Networks and the Internet

► Computer networks exist in many sizes and types

- Home networks
- School and small office networks
- Large corporate
- Public wireless networks
- Mobile telephone networks

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Computer Networks and the Internet

**FIGURE 1-20**

Example of a computer network.

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What Are the Internet and the World Wide Web?

- ▶ **Internet**
 - ▶ The largest/most well-known computer network in the world
 - ▶ Individuals connect using an Internet service provider (ISP)
- ▶ **World Wide Web**
 - ▶ One resource (a vast collection of Web pages) available through the Internet
 - ▶ Web sites contain Web pages stored on Web servers
 - ▶ Viewed using a Web browser (Internet Explorer, Chrome, Safari, Firefox, Opera, etc.)
 - ▶ Offers a wide variety of information

What Are the Internet and the World Wide Web?

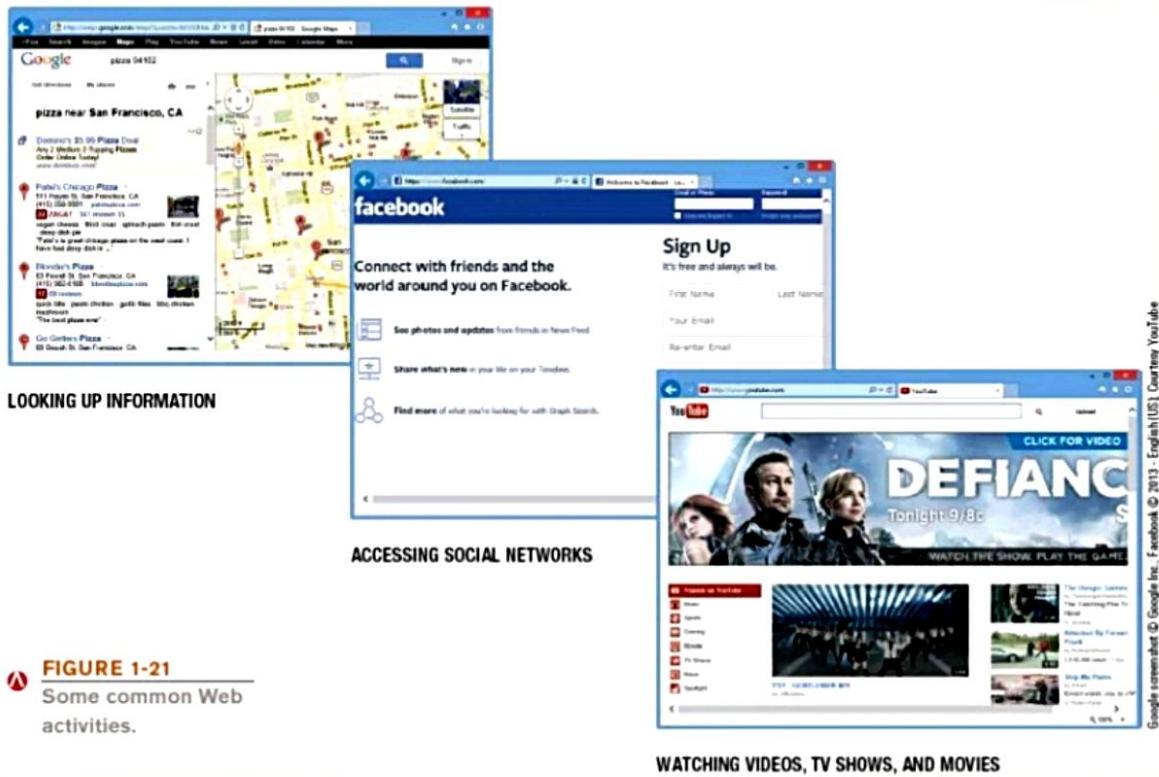


FIGURE 1-21

Some common Web activities.

Accessing a Network or the Internet

- ▶ Need a modem or network adapter to connect
- ▶ Some networks require a username and password
- ▶ Internet connections can be:
 - ▶ Direct (always-on) connections
 - ▶ Dial-up connections
- ▶ Internet addresses are used to access resources on the Internet
 - ▶ IP (Internet Protocol) address
 - ▶ Numeric address that identifies computers (207.46.197.32)

IP Addresses and Domain Names

- ▶ IP Addresses
 - ▶ Are numeric and unique
- ▶ Domain Names
 - ▶ Correspond to IP addresses
 - ▶ Top-level domains (TLDs)
 - ▶ Identifies type of organization or its location

ORIGINAL TLDs		INTENDED USE
.com		Commercial businesses
.edu		Educational institutions
.gov		Government organizations
.int		International treaty organizations
.mil		Military organizations
.net		Network providers and ISPs
.org		Noncommercial organizations

NEWER TLDs		INTENDED USE
.aero		Aviation industry
.biz		Businesses
.fr		French businesses
.info		Resource sites
.jobs		Employment sites
.mobi		Sites optimized for mobile devices
.name		Individuals
.pro		Licensed professionals
.uk		United Kingdom businesses

FIGURE 1-22

Sample top-level domains (TLDs).

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Uniform Resource Locators (URLs)

- ▶ Uniform Resource Locators (URLs)
 - ▶ Uniquely identifies a Web page, including
 - ▶ Protocol or standard being used
 - ▶ Web server hosting the page
 - ▶ Names of folders in which the Web page file is stored
 - ▶ Web page's filename

Uniform Resource Locators (URLs)

► Protocols:

- Hypertext Transfer Protocol (`http://`) is typically used to display Web pages (`https://` is used for secure Web pages)
- File Transfer Protocol (`ftp://`) is often used for file exchange



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E-mail Addresses

- E-mail addresses consist of:
 - Username
 - An identifying name
 - The @ symbol
 - Domain name for the computer that will be handling the person's e-mail (mail server)
- Pronouncing Internet addresses

TYPE OF ADDRESS	SAMPLE ADDRESS	PRONUNCIATION
Domain name	berkeley.edu	berkeley dot e d u
URL	microsoft.com/windows/ie/default.asp	microsoft dot com slash windows slash i e slash default dot a s p
E-mail address	president@whitehouse.gov	president at white house dot gov

FIGURE 1-24
Pronouncing Internet addresses.

How It Works Box

Campus Emergency Notification Systems

- ▶ Enable students and teachers to be notified of dangerous activity, weather, etc. in a timely manner.
- ▶ Can be sent via text messages, e-mail messages, Facebook pages, Twitter feeds, digital signage systems, etc.



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Surfing the Web

- ▶ Web browser
 - ▶ Used to display Web pages
- ▶ Browser starting page or home page
 - ▶ The first page displayed when the browser is opened
- ▶ To navigate to a Web page, you can:
 - ▶ Type a URL in the Address bar
 - ▶ Click a hyperlink – graphics or text linked to other Web pages
 - ▶ Select a Favorite/Bookmark or page from the History list

Searching the Web

- ▶ Search site:

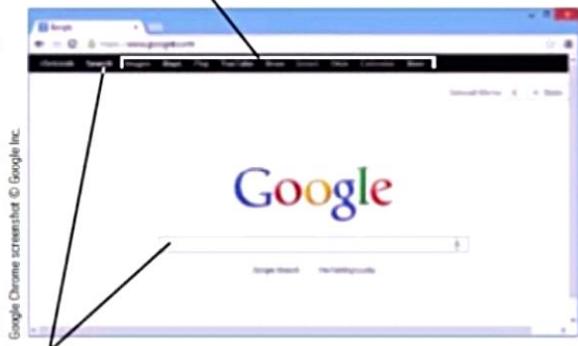
- ▶ Helps you locate what you are looking for
- ▶ Typically search using keywords

- ▶ Reference sites

- ▶ Look up addresses, telephone numbers, ZIP codes, maps, etc.

OTHER SEARCHES

Use these options to search for images, maps, videos, news, video, products for sale, and more, as well as access your Gmail, Google Drive, or Google Calendar.



KEYWORD SEARCHES

Because the Search option is selected, type keywords here and press Enter to see a list of Web pages matching your search criteria.

FIGURE 1-26

The Google search site displayed in the Chrome browser.

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E-Mail

- ▶ Electronic mail (e-mail)

- ▶ Electronic messages exchanged between computers on a network
- ▶ One of the most widely used Internet applications
- ▶ Can be conventional e-mail program, Web-based, or mobile-based

Conventional

Microsoft Outlook

Mac OS X Mail

Web-based

Gmail

Outlook.com

E-Mail

- ▶ Can contain photos, attached files, etc.
- ▶ Mobile e-mail may require a fee
- ▶ Other types of mobile communications
 - ▶ Short Message Service (SMS)
 - ▶ Multimedia Message Service (MMS)

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E-Mail

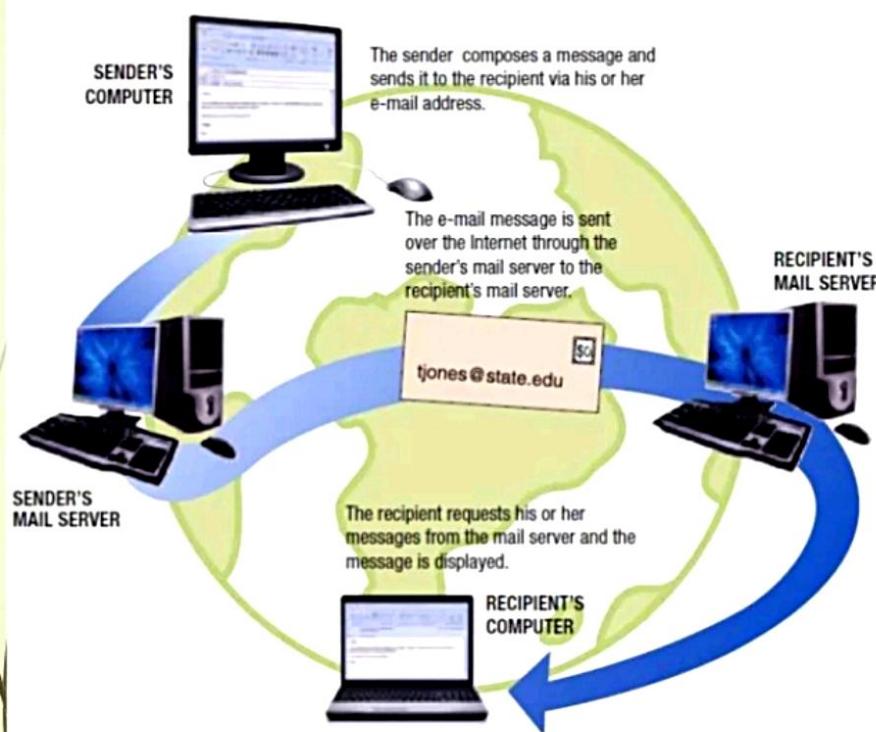


FIGURE 1-27
How e-mail works.

Computers and Society

- ▶ The vast improvements in technology over the past decade have had a distinct impact on daily life, at home and at work
- ▶ Many benefits of a computer-oriented society
 - ▶ Ability to design products before construction leads to safer products
 - ▶ Earlier medical diagnoses and more effective treatment
 - ▶ Devices that allow physically and/or visually challenged individuals to perform job tasks
 - ▶ Documents e-mailed or faxed in moments
 - ▶ Download information, music, programs, movies, and more on demand

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Computers and Society

- ▶ Computer-oriented society also has risks
 - ▶ Stress and health concerns
 - ▶ Spam
 - ▶ Computer viruses and malware
 - ▶ Identity theft and phishing
 - ▶ Privacy issues
 - ▶ How data is collected
 - ▶ How secure is the collected data

Understanding Computers: Today and Tomorrow, 15th Edition

Computers and Society

- ▶ Differences in online communications
 - ▶ Less formal than traditional
 - ▶ Netiquette
 - ▶ Be polite and considerate of others
 - ▶ Refrain from offensive remarks
 - ▶ Abbreviations (acronyms) and emoticons
 - ▶ Acronyms, such as BTW (by the way)
 - ▶ Illustrations of faces, such as ☺

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Computers and Society

RULE

Use descriptive subject lines

Don't shout

Watch what you say

Don't spam your contacts

Be cautious

Think before you send or post

EXPLANATION

Use short, descriptive subject lines for e-mail messages and online posts. For example, "Question regarding MP3 downloads" is much better than a vague title, such as "Question."

SHOUTING REFERS TO TYPING YOUR ENTIRE E-MAIL MESSAGE OR ONLINE POST USING CAPITAL LETTERS. Use capital letters only when it is grammatically correct to do so or for emphasizing a few words.

Things that you say or write online can be interpreted as being sexist, racist, or in just general bad taste. Also check spelling and grammar—typos look unprofessional and nobody likes wading through poorly written materials.

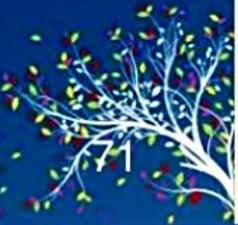
Don't hit *Reply All* to an e-mail when a simple *Reply* will do. The same goes for forwarding e-mail chain letters, *retweeting* every joke you run across, or sending every funny YouTube video you find—to everyone you know.

Don't give out personal information—such as your real name, telephone number, or credit card information—to people you meet online.

Once you send an e-mail or text message or post something online, you lose control of it. Don't include content (such as compromising photos of yourself) that you would not want shared with others, and don't tag people in photos that are unflattering to them. In addition, don't e-mail or post anything if emotions are running high—wait until you calm down.

FIGURE 1-30

Netiquette. Use these netiquette guidelines and common sense when communicating online.



Computers and Society

- ▶ The Anonymity Factor
 - ▶ Gives many individuals a sense of freedom
 - ▶ Can also be abused
- ▶ Information Integrity
 - ▶ Use common sense when evaluating online content
 - ▶ Check your source--not all information on the Internet is accurate

Understanding Computers: Today and Tomorrow, 15th Edition



Quick Quiz

1. Index.html is an example of a(n) _____.
 - a. URL
 - b. IP address
 - c. Web page filename
2. True or False: All information published to Web pages is accurate.
3. In the e-mail address jsmith@abc.com, abc.com is the _____.

Answers:

- 1) c; 2) False; 3) domain name

Summary

- ▶ Computers in Your Life
- ▶ What is a Computer and What Does It Do?
- ▶ Computers to Fit Every Need
- ▶ Computer Networks and the Internet
- ▶ Computers and Society

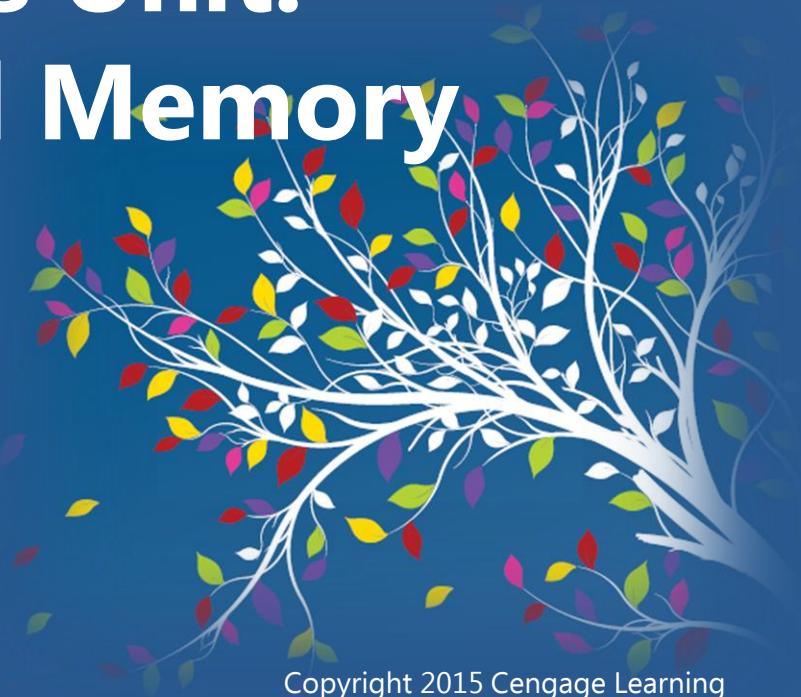
15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 2

The Systems Unit: Processing and Memory



**Deborah Morley
Charles S. Parker**

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Learning Objectives

1. Understand how data and programs are represented to a computer and be able to identify a few of the coding systems used to accomplish this.
2. Explain the functions of the hardware components commonly found inside the system unit, such as the CPU, GPU, memory, buses, and expansion cards.
3. Describe how peripheral devices or other hardware can be added to a computer.
4. Understand how a computer's CPU and memory components process program instructions and data.



Learning Objectives

5. Name and evaluate several strategies that can be used today for speeding up the operations of a computer.
6. List some processing technologies that may be used in future computers.



Overview

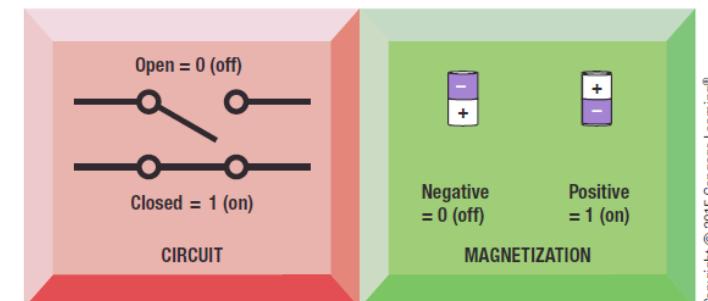
- Explain how computers represent data and program instructions.
- Explain how the CPU and memory are arranged with other components inside the system unit.
- Explain how a CPU performs processing tasks.
- Identify strategies that can be used today to create faster and better computers in the future.



Data and Program Representation

- Digital Data Representation
 - Coding Systems
 - Used to represent data and programs in a manner understood by the computer
 - Digital Computers
 - Can only understand two states, off and on (0 and 1)
 - Digital Data Representation
 - The process of representing data in digital form so it can be understood by a computer

FIGURE 2-1
Ways of representing 0 and 1. Binary computers recognize only two states—off and on—usually represented by 0 and 1.





Digital Data Representation

- Bit
 - The smallest unit of data that a binary computer can recognize (a single 1 or 0)
- Byte = 8 bits
 - Byte terminology used to express the size of documents and other files, programs, etc.
- Prefixes are often used to express larger quantities of bytes: kilobyte (KB), megabyte (MB), gigabyte (GB), terabyte (TB), petabyte (PB), exabyte (EB), zettabyte (ZB), yottabyte (YB).

Abbreviation	Approximate Size
KB	1 thousand bytes
MB	1 million bytes
GB	1 billion bytes
TB	1 trillion bytes
PB	1,000 terabytes
EB	1,000 petabytes
ZB	1,000 exabytes
YB	1,000 zettabytes

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FIGURE 2-2
Bits and bytes.
Document size, storage capacity, and memory capacity are all measured in bytes.



Representing Numerical Data

- The Binary Numbering System
 - Numbering system
 - A way of representing numbers
 - Decimal numbering system
 - Uses 10 symbols (0-9)
 - Binary numbering system
 - Uses only two symbols (1 and 0) to represent all possible numbers
 - In both systems, the position of the digits determines the power to which the base number (such as 10 or 2) is raised



Representing Numerical Data

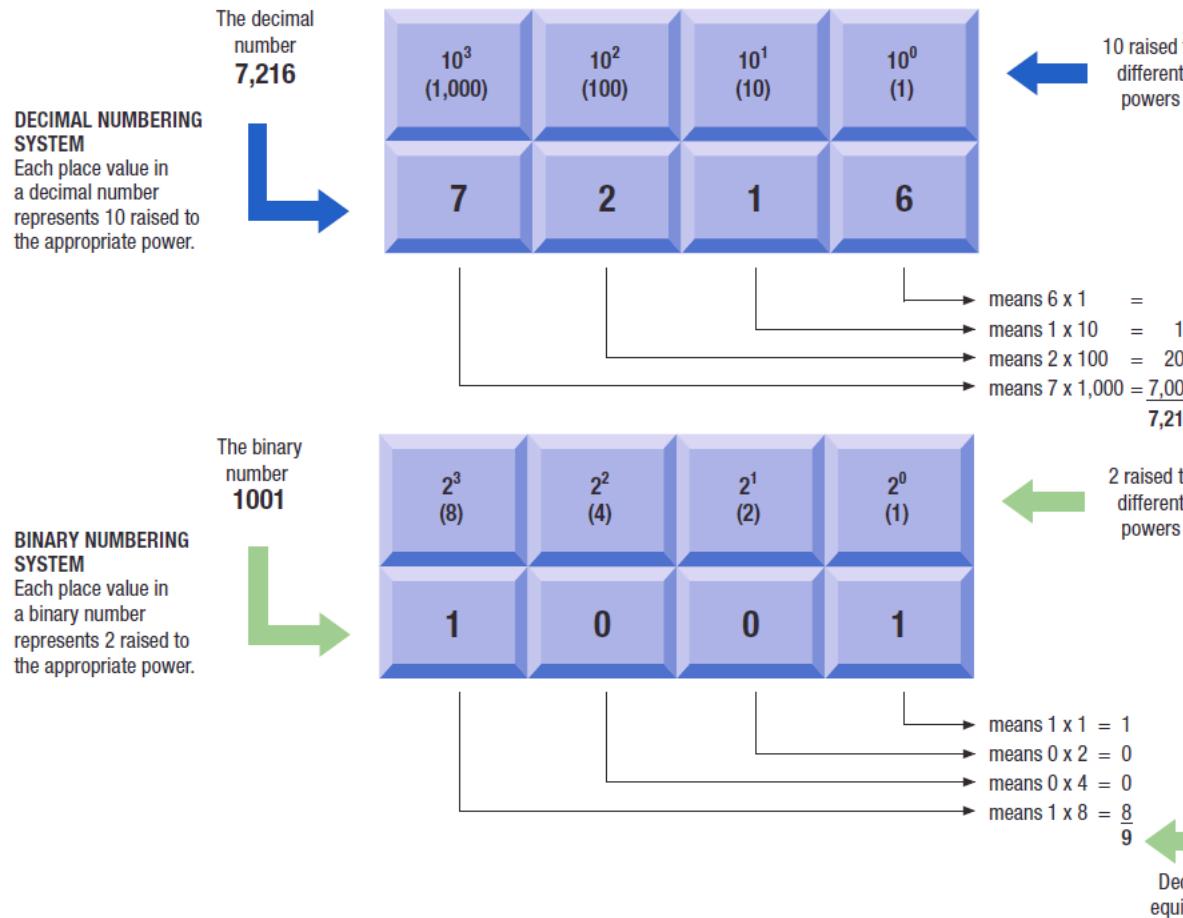


FIGURE 2-3

Examples of using the decimal and binary numbering systems.



Coding Systems for Text-Based Data

- ASCII (American Standard Code for Information Interchange)
 - Coding system traditionally used with personal computers
- EBCDIC (Extended Binary-Coded Decimal Interchange Code)
 - Developed by IBM, primarily for mainframes

CHARACTER	ASCII
0	00110000
1	00110001
2	00110010
3	00110011
4	00110100
5	00110101
A	01000001
B	01000010
C	01000011
D	01000100
E	01000101
F	01000110
+	00101011
!	00100001
#	00100011

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FIGURE 2-4

Some extended ASCII code examples.



Coding Systems for Text-Based Data

- Unicode
 - Newer code (32 bits per character is common)
 - Universal coding standard designed to represent text-based data written in any ancient or modern language
 - Replacing ASCII as the primary text-coding system



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FIGURE 2-5
Unicode. Many characters, such as these, can be represented by Unicode but not by ASCII or EBCDIC.



Coding Systems for Other Types of Data

- Graphics Data (still images such as photos or drawings)
 - Bitmapped images
 - Image made of up of a grid of small dots called pixels
 - Monochrome graphic can only be one of two colors
 - Requires just one bit for color storage
 - Images with more than two colors
 - Can use 4, 8, or 24 bits to store the color data for each pixel
 - More bits = more colors



Coding Systems for Other Types of Data



One sample pixel:
1110

16-COLOR IMAGE

The color of each pixel is represented using one-half byte (4 bits).



One sample pixel:
01110110

256-COLOR IMAGE

The color of each pixel is represented using one byte (8 bits).



One sample pixel:
101001100100110111001011

PHOTOGRAPHIC-QUALITY (TRUE COLOR)

IMAGE (16.8 million colors)

The color of each pixel is represented using three bytes (24 bits).

Courtesy United States Department of Agriculture; Copyright © 2015 Cengage Learning®

FIGURE 2-6

Representing graphics data.

With bitmapped images, the color of each pixel is represented by bits; the more bits used, the better the image quality.



Coding Systems for Other Types of Data

- Audio Data
 - Must be in digital form in order to be stored on or processed by a computer
 - Often compressed when sent over the Internet
 - MP3 files are 10 times smaller than their uncompressed digital versions
 - Download more quickly and take up less storage space
- Video Data
 - Displayed using a collection of frames, each frame contains a still image
 - Amount of data can be substantial, but can be compressed



Representing Software Programs

- Machine language
 - Binary-based language for representing computer programs the computer can execute directly
 - Early programs were written in machine language
 - Today's programs still need to be translated into machine language in order to be understood by the computer



Quick Quiz

1. Another way to say “one million bytes” is
 - a. one kilobyte
 - b. one gigabyte
 - c. one megabyte
2. True or False: MP3 files are stored using 0s and 1s.
3. The _____ numbering system is used by computers to perform mathematical computations.

Answers:

1) c; 2) True; 3) binary



Inside the System Unit

- System Unit
 - The main case of a computer
 - Houses the processing hardware for a computer
 - Also contains storage devices, the power supply, and cooling fans
 - Houses processor, memory, interfaces to connect to peripheral devices (printers, etc), and other components
 - With a desktop computer, usually looks like a rectangular box



Inside the System Unit

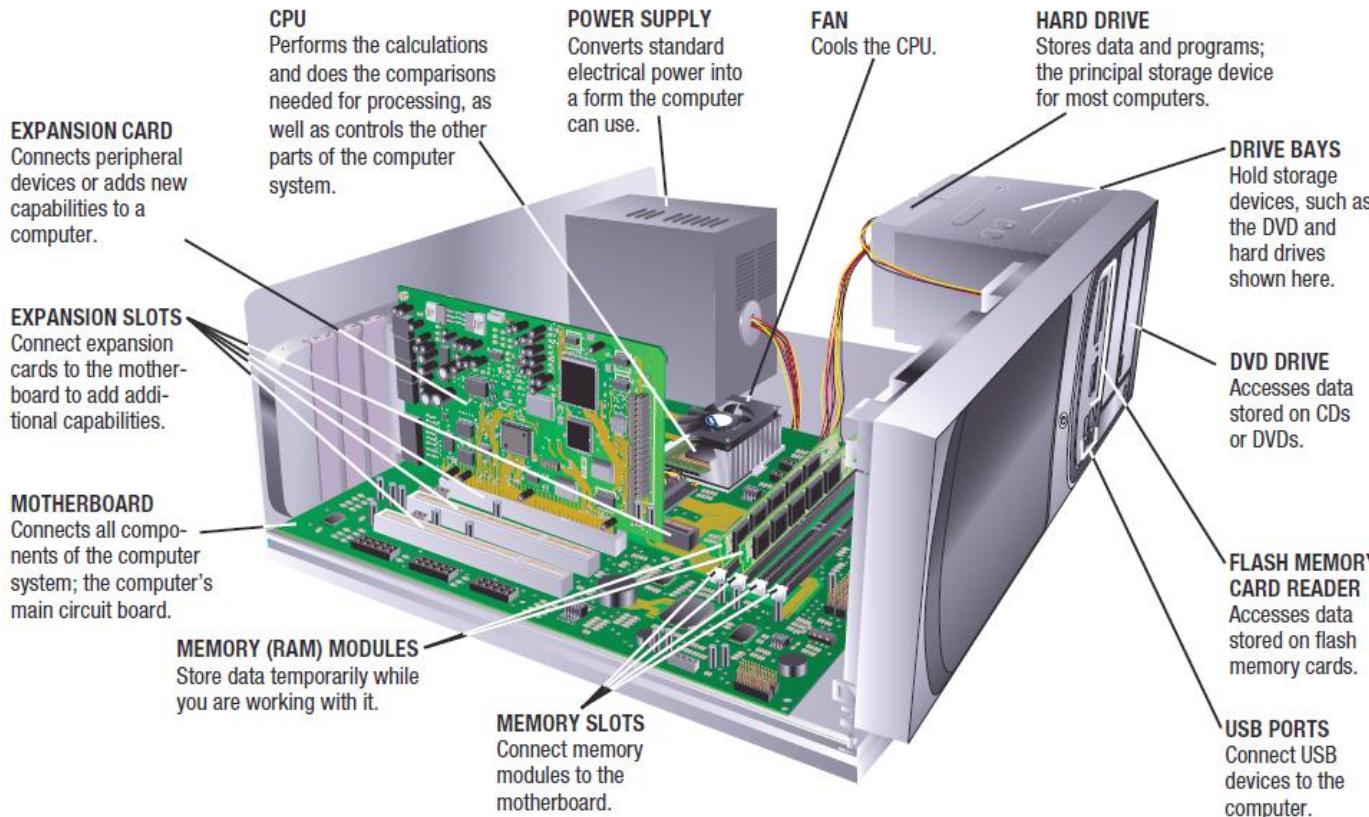


FIGURE 2-7
Inside a typical system unit. The system unit houses the CPU, memory, and other important pieces of hardware.

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Inside the System Unit

- The Motherboard
 - Computer Chip
 - Very small pieces of silicon or other semi-conducting material onto which integrated circuits are embedded
 - Circuit Board
 - A thin board containing computer chips and other electronic components
 - System Board
 - The main circuit board inside the system unit to which all devices must connect



Inside the System Unit

- External devices (monitors, keyboards, mice, printers)
- Wireless devices (e.g., Bluetooth)
- Power Supply
 - Connects to the motherboard to deliver electricity (personal computer)
 - Portable computers use rechargeable battery pack
 - Nonremovable batteries more difficult and expensive to replace



Inside the System Unit

- Drive Bays
 - Rectangular metal racks inside the system unit that house storage devices
 - Hard drive, CD/DVD drive, flash memory card reader
 - Connected to the motherboard with a cable
- Processors
 - The CPU (Central Processing Unit)
 - Circuitry and components packaged together and connected directly to the motherboard
 - Does the vast majority of processing for a computer
 - Also called a processor; called a microprocessor when talking about personal computers

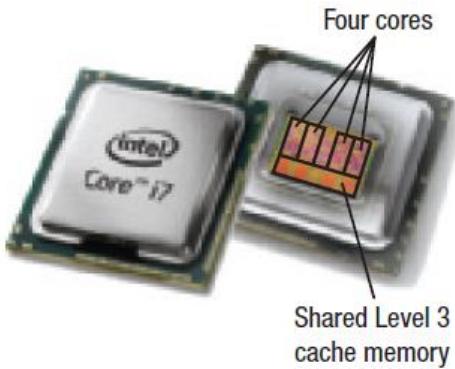


Inside the System Unit

- Dual-core CPU
 - Contains the processing components (cores) of two separate processors on a single CPU
- Quad-core CPU
 - Contains four cores
- Multi-core processors allow computers to work on more than one task at a time
- Typically different CPUs for desktop computers, portable computers, servers, mobile devices, consumer devices, etc.
 - Personal computer CPU often made by Intel or AMD
 - Media tablets and mobile phones use processors made by other companies such as ARM



Inside the System Unit



DESKTOP PROCESSORS



MOBILE PROCESSORS

TYPE OF CPU	NAME	NUMBER OF CORES	CLOCK SPEED	TOTAL CACHE MEMORY
SERVER	Intel Xeon (E7 family)	6–10	1.73–2.66 GHz	18–30 MB
	AMD Opteron (6300 series)	4–16	1.8–3.5 GHz	20–32 MB
DESKTOP	Intel Core i7 (3rd gen)	4–6	2.5–3.6 GHz	8–12 MB
	AMD FX	4–8	3.1–4.2 GHz	8–16 MB
MOBILE (NOTEBOOKS)	Intel Core i7 Mobile (3rd gen)	2–4	1.06–3.0 GHz	4–8 MB
	AMD Athlon II Neo	1–2	1.3–1.7 GHz	1–2 MB
MOBILE (MOBILE DEVICES)	ARM Cortex-A9	1–4	800 MHz–2 GHz	up to 2 MB
	ARM Cortex-A15	1–4+	1–2 GHz	up to 4 MB
	NVIDIA Tegra 4*	4	1.9 GHz	2 MB

* Based on ARM Cortex-A15

Courtesy, Intel Corporation; Courtesy of ARM; Copyright © 2015 Cengage Learning®

 **FIGURE 2-8**
CPU examples and characteristics.



Inside the System Unit

- The GPU (graphics processing unit)
 - Takes care of the processing needed to display images (including still images, animations) on the screen
 - Can be located on the motherboard, on a video graphics board, or in the CPU package



Courtesy NVIDIA

 **FIGURE 2-9**
A GPU.



How It Works Box

GPUs and *Transformers: The Ride 3D* at Universal Studios

- Uses a 2,000 foot-long track, 14 huge screens, and 34 projectors
- Motion is synchronized with the action
- Images are 3D, 4K
- Used GPUs to see 3D animations in real time as they were being developed





Inside the System Unit

- Processing Speed
 - CPU clock speed is one measurement of processing speed
 - Rated in megahertz (MHz) or gigahertz (GHz)
 - Higher CPU clock speed = more instructions processed per second
 - Alternate measure of processing speed is the number of instructions a CPU can process per second
 - Megaflops (millions), gigaflips (billions), teraflops (trillions)
 - Benchmark tests can be used to evaluate overall processing speed



Inside the System Unit

- Word Size
 - The amount of data that a CPU can manipulate at one time
 - Typically 32 or 64 bits
- Cache Memory
 - Special group of very fast memory chips located on or close to the CPU
 - Level 1 is fastest, then Level 2, then Level 3
 - More cache memory typically means faster processing
 - Usually internal cache (built into the CPU)



Inside the System Unit

- Bus Width, Bus Speed, and Bandwidth
 - A bus is an electronic path over which data can travel
 - Found inside the CPU and on the motherboard
 - Bus width is the number of wires in the bus over which data can travel
 - A wider bus allows more data to be transferred at one time



Inside the System Unit

- Bus width and speed determine the throughput or bandwidth of the bus
 - The amount of data that can be transferred by the bus in a given time period

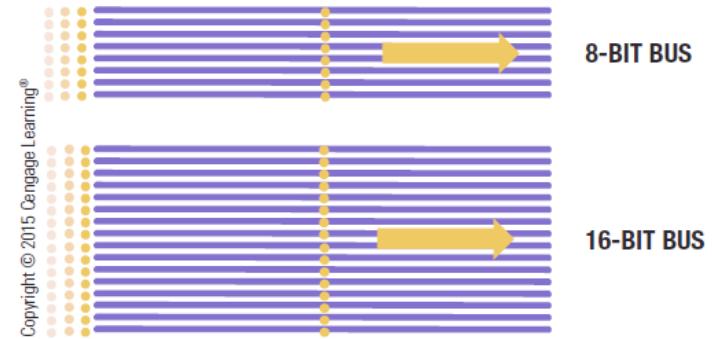


FIGURE 2-10

Bus width. A wider bus can transfer more data at one time than a narrower bus.

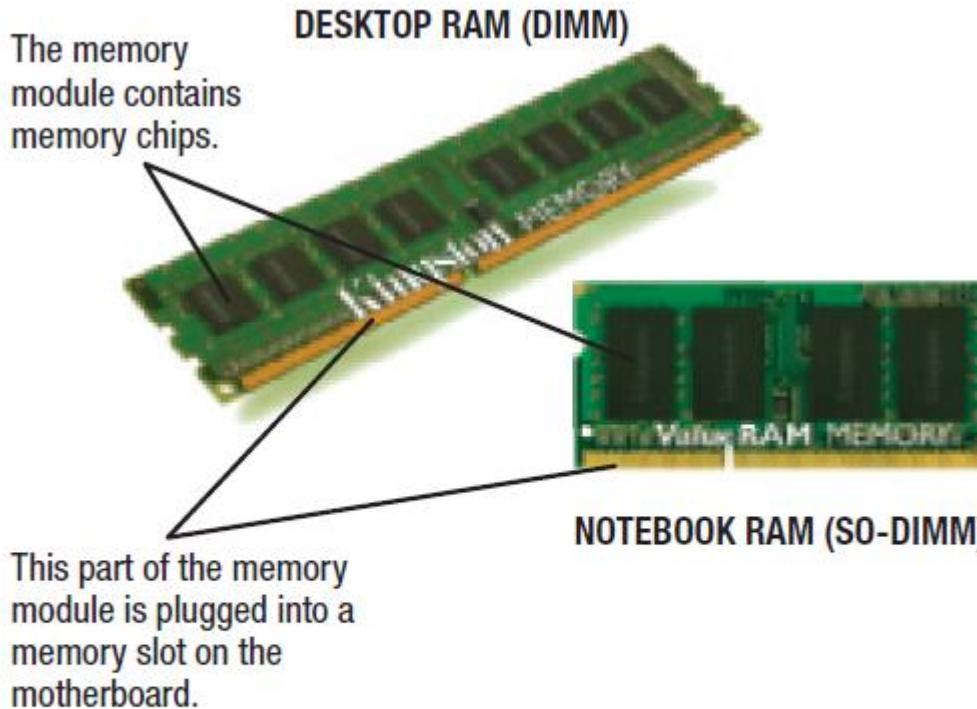


Memory

- Memory
 - Refers to chip-based storage located inside the system unit
 - Storage refers to the amount of long-term storage available to a computer
 - Random Access Memory (RAM)
 - Computer's main memory
 - Consists of chips arranged on a circuit board called a memory module which are plugged into the motherboard
 - Stores essential parts of operating system, programs, and data the computer is currently using



Memory



Courtesy Kingston Technology Company, Inc.

 **FIGURE 2-11**
RAM memory
modules.



Memory

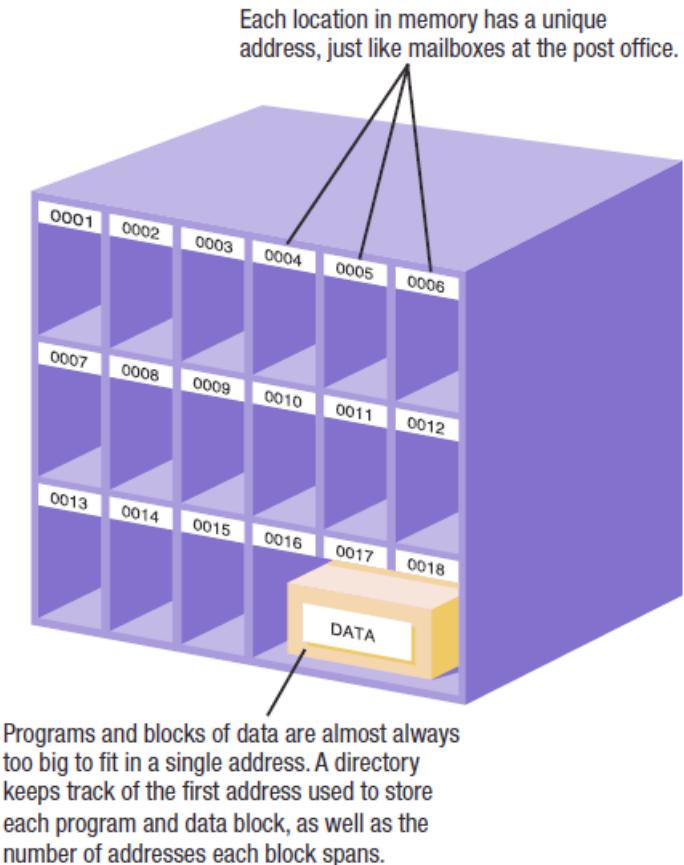
- Volatile
 - RAM content lost when the computer is shut off
 - ROM and flash memory are non-volatile
- Measured in bytes
 - Amount installed depends on the CPU and operating system being used
- Most personal computers use SD-RAM
- MRAM and PRAM - non-volatile RAM under development



Memory

- Each location in memory has an address
 - Each location typically holds one byte
 - Computer system sets up and maintains directory tables to facilitate retrieval of the data

FIGURE 2-12
Memory addressing.





Memory

- Registers
 - High-speed memory built into the CPU
 - Used to store data and intermediary results during processing
 - Fastest type of memory
- ROM (read-only memory)
 - Non-volatile chips located on the motherboard into which data or programs have been permanently stored
 - Retrieved by the computer when needed
 - Being replaced with flash memory



Memory

- Flash Memory
 - Nonvolatile memory chips that can be used for storage
 - Have begun to replace ROM for storing system information
 - Now stores firmware for personal computers and other devices
 - Built into many types of devices (media tablets, mobile phones, and digital cameras) for user storage



Cooling Components

- Fans
 - Fans used on most personal computers to help cool the CPU and system unit
 - Heat is an ongoing problem for CPU and computer manufacturers
 - Can damage components
 - Cooler chips run faster
- Heat Sinks
 - Small components typically made out of aluminum with fins that help to dissipate heat



Cooling Components

- Cooling Systems
 - Liquid cooling systems
 - Cool the computer with liquid-filled tubes
 - Immersion cooling
 - Hardware is actually submerged into units filled with a liquid cooling solution
 - Notebook cooling stand
 - Cools the underside of a notebook computer
 - Other cooling methods, such as ion pump cooling systems, are under development



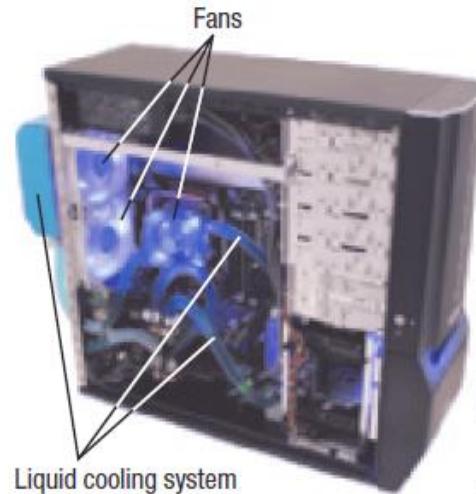
Cooling Components

Courtesy Green Revolution Cooling



SERVERS

Often use liquid cooling systems; an immersion cooling system is shown here.

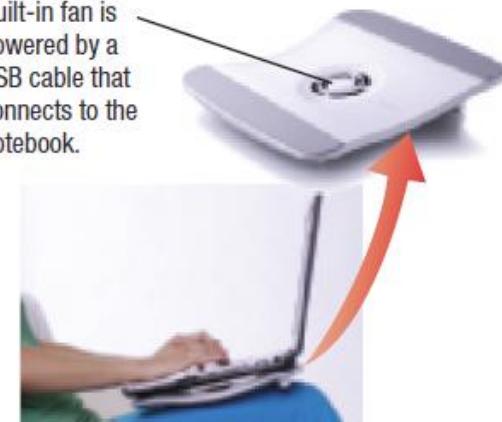


Courtesy of ABS Computer Technologies Inc.

DESKTOP COMPUTERS

Can use fans, heat sinks, and liquid cooling systems to cool the inside of the computer.

Built-in fan is powered by a USB cable that connects to the notebook.



Courtesy Belkin International, Inc.

NOTEBOOK COMPUTERS

Typically have at least one internal fan; notebook cooling stands can be used to cool the underside of the computer.

FIGURE 2-13
Computer cooling methods.



Expansion

- Expansion Slots, Expansion Cards, and ExpressCard Modules
 - Expansion Slot
 - A location on the motherboard into which expansion cards are inserted
 - Expansion Card
 - A circuit board inserted into an expansion slot
 - Used to add additional functionality or to attach a peripheral device
 - ExpressCard Modules
 - Designed to add additional functionality to notebooks



Expansion

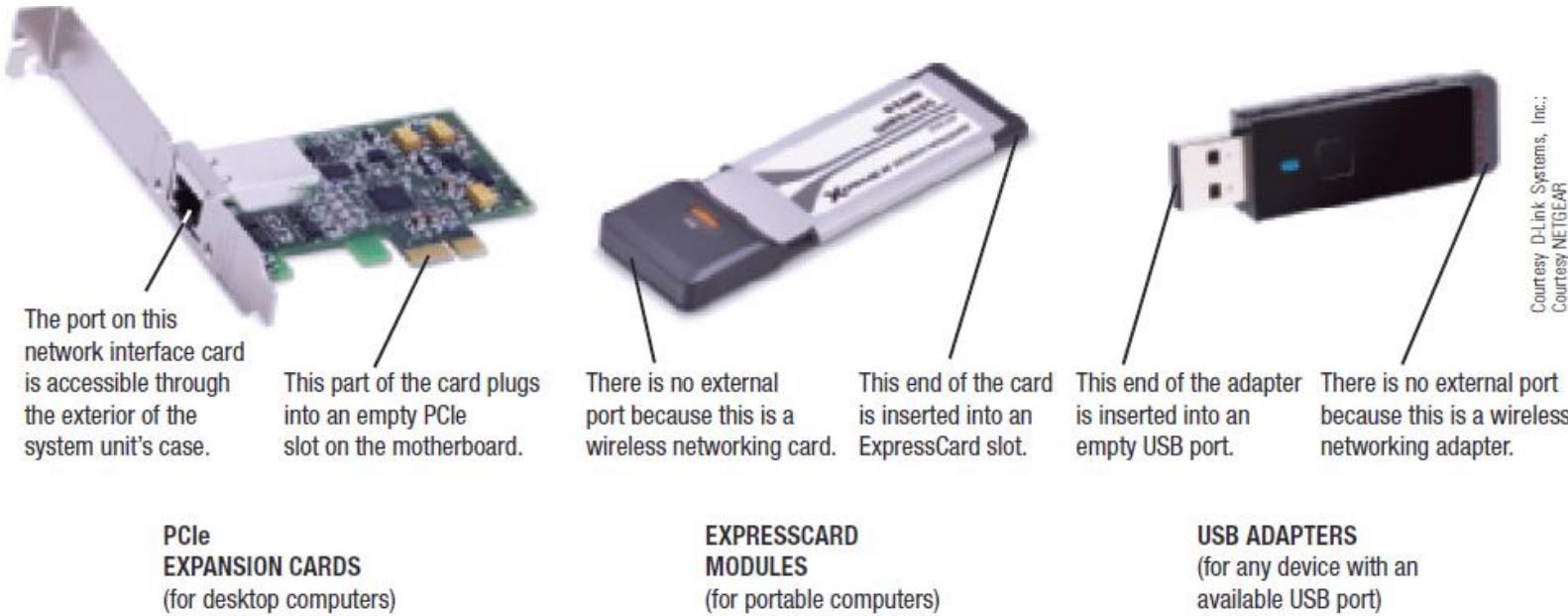


FIGURE 2-14
Types of expansion.



Buses

- Bus
 - An electronic path within a computer over which data travels
 - Located within the CPU and etched onto the motherboard
 - Expansion Bus
 - Connects the CPU to peripheral (typically input and output) devices
 - Memory Bus
 - Connects CPU directly to RAM
 - Frontside Bus (FSB)
 - Connects CPU to the chipset that connects the CPU to the rest of the bus architecture



Buses

- PCI and PCI Express (PCIe) Bus
 - PCI has been one of the most common types
 - Today, PCI Express bus, which is extremely fast, has replaced the PCI bus
- Universal Serial Bus (USB)
 - Extremely versatile
 - Allows 127 different devices to connect to a computer via a single USB port
- FireWire Bus
 - Developed by Apple to connect multimedia devices to a computer



Ports and Connectors

- Port
 - A connector on the exterior of a computer's system unit to which a device may be attached
 - Typical desktop computer ports include:
 - Power connector, Firewire, VGA monitor, Network, USB, Audio, and HDMI
 - Others include IrDA and Bluetooth ports, eSATA ports, Thunderbolt ports (Apple devices)
 - Most computers support the Plug and Play standard



Ports and Connectors

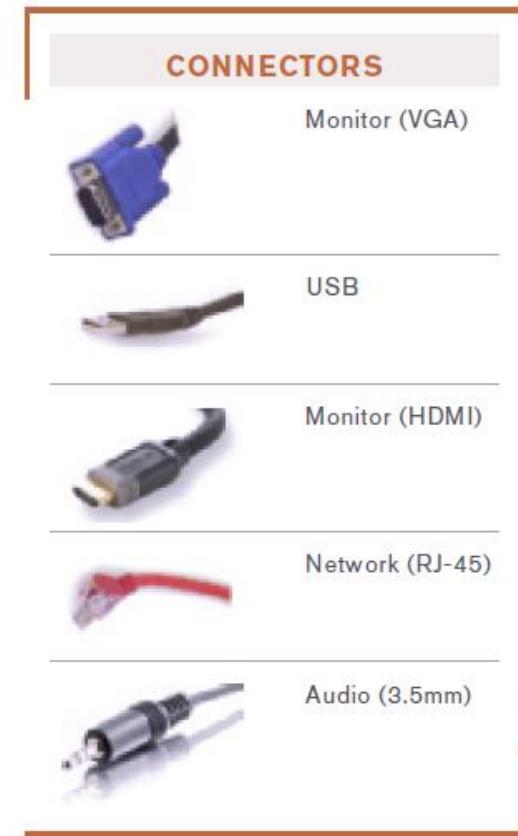
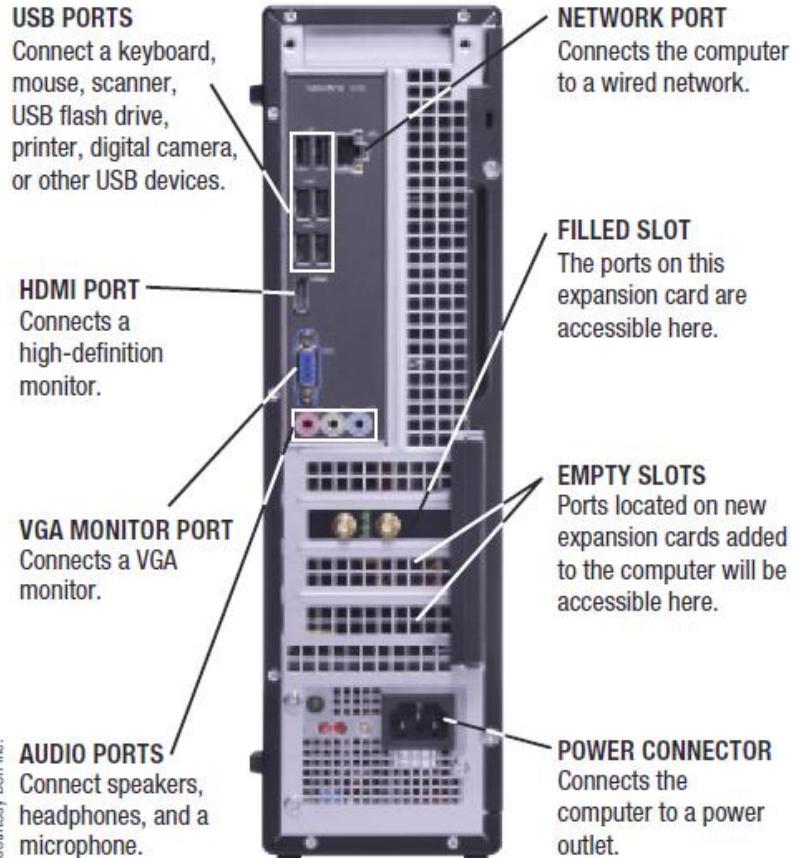


FIGURE 2-16
Typical ports for desktop computers and examples of connectors.

Courtesy Belkin International, Inc.



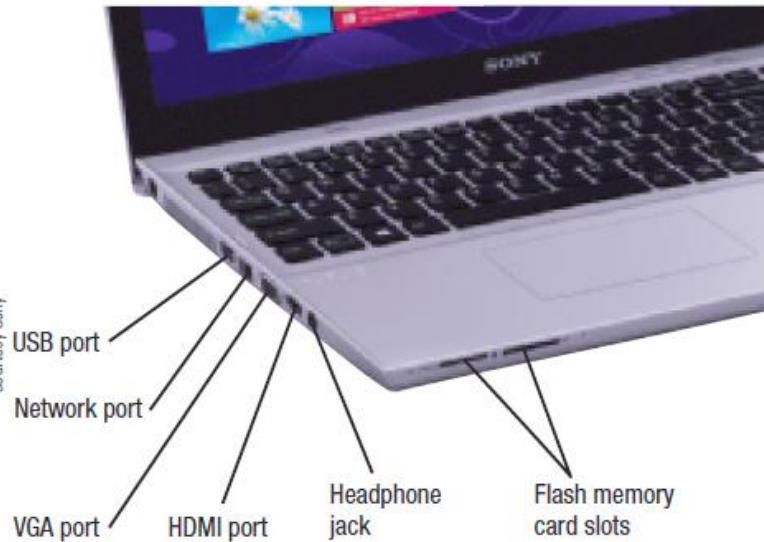
Ports and Connectors

- Portable computers have ports similar to desktop computers, but often not as many
- Smartphones and mobile devices have more limited expansion capabilities
 - Usually have a USB port, HDMI port, and/or flash memory card slot
 - Flash memory cards often use the Secure Digital (SD) format
 - MiniSD and microSD cards are smaller than regular SD cards



Ports and Connectors

Courtesy Sony



NOTEBOOK COMPUTERS

Courtesy Lenovo



MOBILE DEVICES

FIGURE 2-18
Typical ports for
portable computers.



Trend Box

Tablet Docks

- Used to help with tablet productivity
- Some are just a stand
- Many include a keyboard
- Some include ports (USB, monitor, etc.) to connect peripherals
- Some contain a battery



Courtesy ASUSTeK Computer Inc.



Quick Quiz

1. Which type of memory is erased when the power goes out?
 - a. ROM
 - b. RAM
 - c. flash memory
2. True or False: The CPU can also be called the motherboard.
3. A(n) electronic path within a computer over which data travels is called a(n) _____.

Answers:

- 1) b; 2) False; 3) bus



How the CPU Works

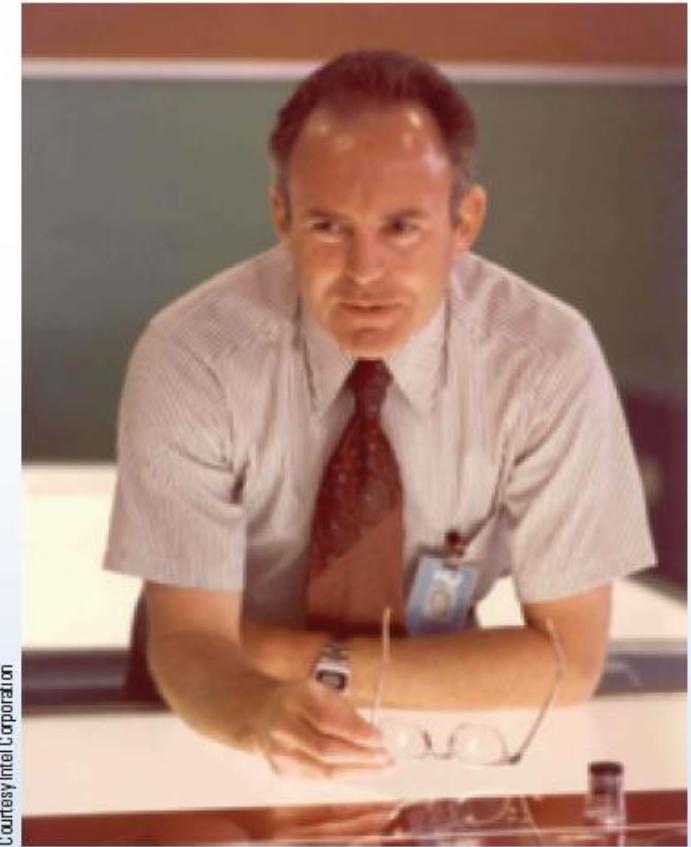
- CPU (Central Processing Unit)
 - Consists of a variety of circuitry and components packaged together
 - Transistor: Key element of the microprocessor
 - Made of semi-conductor material that acts like a switch controlling the flow of electrons inside a chip
 - Today's CPUs contain hundreds of millions of transistors; the number doubles about every 18 months (Moore's Law)



Inside the Industry Box

Moore's Law

- In 1965, Gordon Moore predicted that the number of transistors per square inch on chips had doubled every two years and that trend would continue
- Moore's Law is still relevant today for processors as well as other computer components



Courtesy Intel Corporation

Gordon Moore (1970).



How the CPU Works

- Typical CPU Components
 - Arithmetic/Logic Unit (ALU)
 - Performs arithmetic involving integers and logical operations
 - Floating Point Unit (FPU)
 - Performs decimal arithmetic
 - Control Unit
 - Coordinates and controls activities within a CPU core
 - Prefetch Unit
 - Attempts to retrieve data and instructions before they are needed for processing in order to avoid delays



How the CPU Works

- Decode Unit
 - Translates instructions from the prefetch unit so they are understood by the control unit, ALU, and FPU
- Registers and Internal Cache Memory
 - Store data and instructions needed by the CPU
- Bus Interface Unit
 - Allows the core to communicate with other CPU components



How the CPU Works

CONTROL UNIT

Is in charge of the entire process, making sure everything happens at the right time. It instructs the ALU, FPU, and registers what to do, based on instructions from the decode unit.

PREFETCH UNIT

Requests instructions and data from cache or RAM and makes sure they are in the proper order for processing; it attempts to fetch instructions and data ahead of time so that the other components don't have to wait.

ARITHMETIC/LOGIC UNIT AND FLOATING POINT UNIT

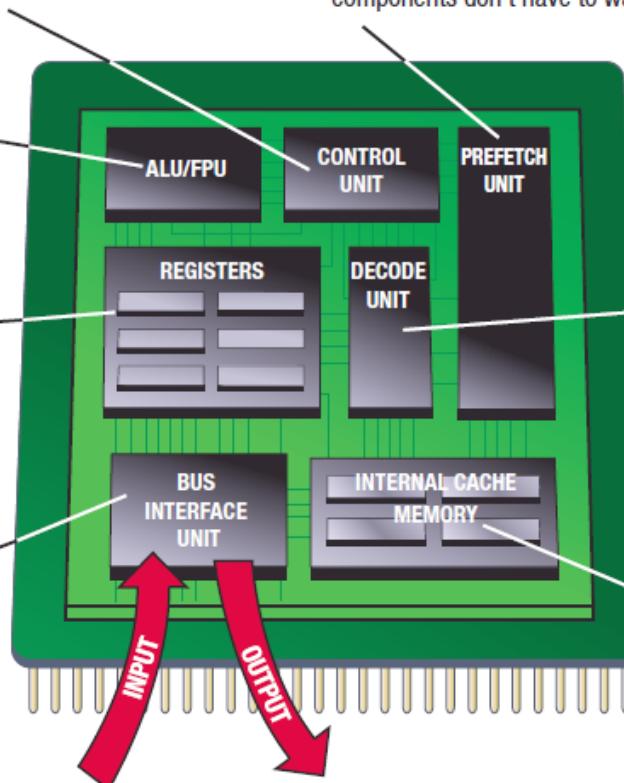
Performs the arithmetic and logical operations, as directed by the control unit.

REGISTERS

Hold the results of processing.

BUS INTERFACE UNIT

The place where data and instructions enter or leave the core.



DECODE UNIT

Takes instructions from the prefetch unit and translates them into a form that the control unit can understand.

INTERNAL CACHE MEMORY

Stores data and instructions before and during processing.

FIGURE 2-19

Inside a CPU core.



The System Clock and the Machine Cycle

- System Clock
 - Small quartz crystal on the motherboard
 - Timing mechanism within the computer system that synchronizes the computer's operations
 - Sends out a signal on a regular basis to all computer components
 - Each signal is a cycle
 - Number of cycles per second is measured in hertz (Hz)
 - One megahertz = one million ticks of the system clock



The System Clock and the Machine Cycle

- Many PC system clocks run at 200 MHz
- Computers can run at a multiple or fraction of the system clock speed
- A CPU clock speed of 2 GHz means the CPU clock “ticks” 10 times during each system clock tick
- During each CPU clock tick, one or more pieces of microcode are processed
- A CPU with a higher clock speed processes more instructions per second than the same CPU with a lower CPU clock speed



The System Clock and the Machine Cycle

- Machine Cycle
 - The series of operations involved in the execution of a single machine level instruction

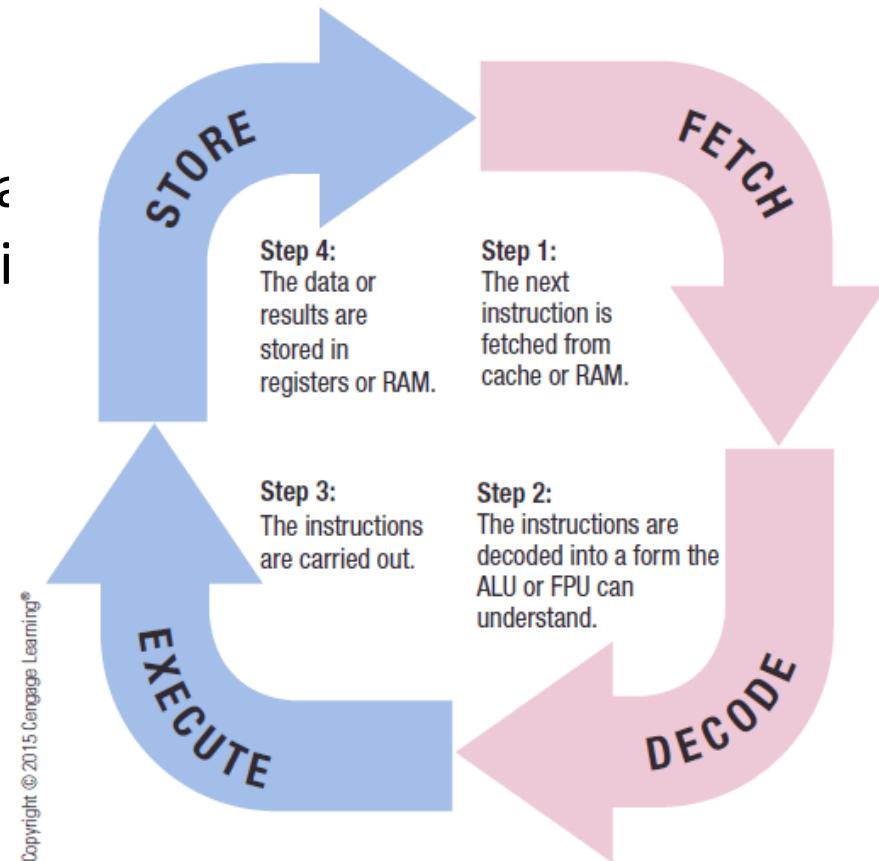


FIGURE 2-20

A machine cycle. A machine cycle is typically accomplished in four steps.

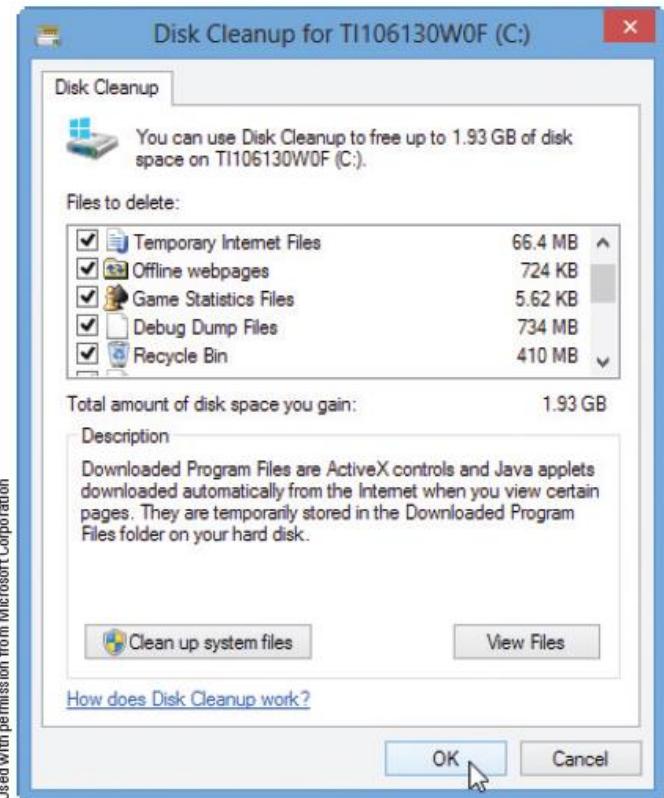
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Making Computers Faster and Better Now and in the Future

- Improving the Performance of Your System Today
 - Add more memory
 - Perform system maintenance
 - Uninstall programs properly
 - Remove unnecessary programs from the Startup list
 - Consider placing large files not needed on a regular basis on external storage
 - Delete temporary files

FIGURE 2-22
Windows Disk Cleanup. Running the Disk Cleanup program can help free up room on your hard drive.





Making Computers Faster and Better Now and in the Future

- Error check and defrag the hard drive periodically
- Scan for viruses and spyware continually
- Clean out dust once or twice a year
- Buy a larger or second hard drive
- Upgrade your Internet connection
- Upgrade your video graphics card



Making Computers Faster and Better Now and in the Future

- Strategies for Making Faster and Better Computers
 - Improved Architecture
 - Smaller components, faster bus speeds, multiple CPU cores, support for virtualization
 - Improved Materials
 - Flexible electronic components
 - Copper, high-k, graphene chip



 **FIGURE 2-23**
Flexible electronics.



Making Computers Faster and Better Now and in the Future

- Pipelining
 - Allows multiple instructions to be processed at one time
- Multiprocessing and Parallel Processing
 - Use multiple processors to speed up processing



Making Computers Faster and Better Now and in the Future

Stages

Fetch Instruction 1	Decode Instruction 1	Execute Instruction 1	Store Result Instruction 1	Fetch Instruction 2	Decode Instruction 2	Execute Instruction 2
---------------------	----------------------	-----------------------	----------------------------	---------------------	----------------------	-----------------------

WITHOUT PIPELINING

Without pipelining, an instruction finishes an entire machine cycle before another instruction is started.

Stages

Fetch Instruction 1	Fetch Instruction 2	Fetch Instruction 3	Fetch Instruction 4	Fetch Instruction 5	Fetch Instruction 6	Fetch Instruction 7
Decode Instruction 1	Decode Instruction 2	Decode Instruction 3	Decode Instruction 4	Decode Instruction 5	Decode Instruction 6	Decode Instruction 7
Execute Instruction 1	Execute Instruction 2	Execute Instruction 3	Execute Instruction 4	Execute Instruction 5	Execute Instruction 6	Execute Instruction 7
Store Result Instruction 1	Store Result Instruction 2	Store Result Instruction 3	Store Result Instruction 4			

WITH PIPELINING

With pipelining, a new instruction is started when the preceding instruction moves to the next stage of the pipeline.

FIGURE 2-24

Pipelining. Pipelining streamlines the machine cycle by executing different stages of multiple instructions at the same time so that the different parts of the CPU are idle less often.

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Future Trends

- Nanotechnology
 - The science of creating tiny computers and components less than 100 nanometers in size
 - Carbon nanotubes (CNTs) used in many products today
 - Nanofilters and nanosensors
 - Future applications may be built by working at the individual atomic and molecular levels

FIGURE 2-25

Carbon nanotubes.

This light bulb is powered and held in place by two carbon nanotube fibers.



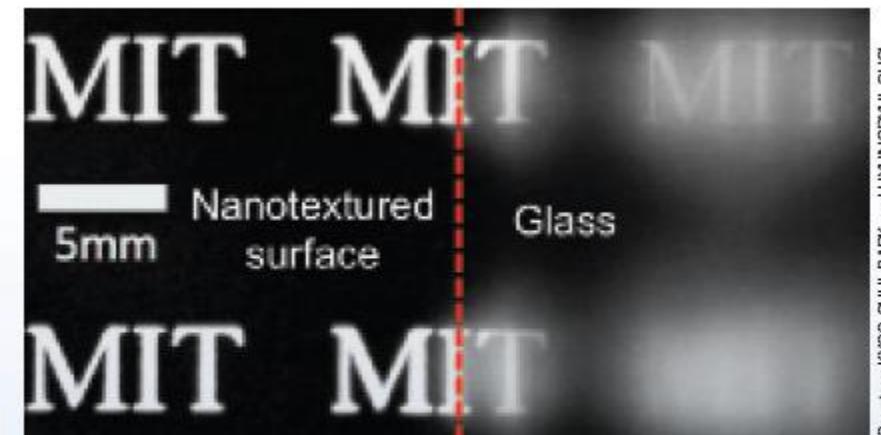
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Technology and You Box

“Magic” Glass

- MIT has developed nano-sized conical patterns on the surface of glass to eliminated its reflective properties
- Glass resists fogging and is self-cleaning
- Possible uses:
 - Smartphone screens
 - Eyeglasses
 - TVs
 - Car windshieds
 - Building windows



Courtesy KYOO-QHUL PARK and HYUNGRAU CHO

MIT “magic” glass vs. normal glass. The normal half of this piece of glass (right) can fog up and produce glare; the MIT glass half (left) remains clear.



Future Trends

- Quantum Computing
 - Applies the principles of quantum physics and quantum mechanics to computers
 - Utilizes atoms or nuclei working together as quantum bits (qubits)
 - Qubits function simultaneously as the computer's processor and memory and can represent more than two states
 - Expected to be used for specialized applications, such as encryption and code breaking



Future Trends

- Optical Computing
 - Uses light, from laser beams or infrared beams, to perform digital computations
 - Opto-electronic computers use both optical and electronic components
- Silicon Photonics
 - The process of making optical devices using silicon manufacturing techniques
 - Possible low-cost solution to future data-intensive computing applications—telemedicine, cloud data centers



Future Trends

- Tera-Scale Computing
 - The ability to process one trillion floating-point operations per second (teraflops)
 - Terascale research is focusing on creating multi-core processors with tens to hundreds of cores
 - Intel has created a Single-chip Cloud Computer which contains 48 cores on one silicon chip
 - Expected to be needed for future applications

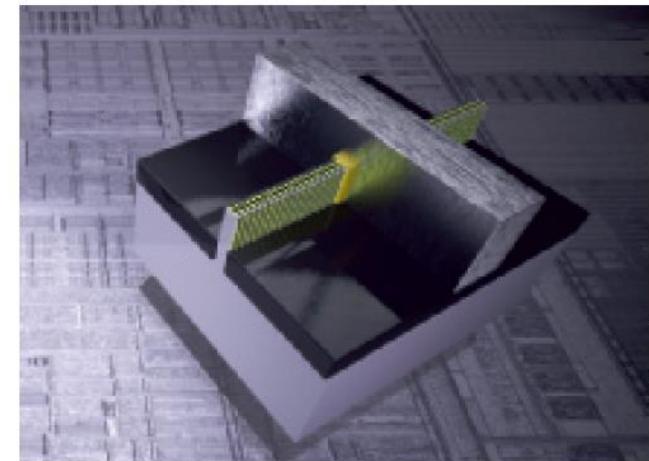


Future Trends

- 3D Chips
 - Contain transistors that are layered to cut down on the surface area required
 - Created by layering individual silicon wafers on top of one another
 - Being used with memory, flash memory, and CPUs

FIGURE 2-28

3D chips. In this 3D transistor, the electrical current (represented by the yellow dots) flows on three sides of a vertical fin.



Courtesy Intel Corporation



Quick Quiz

1. Optical computers use which of the following to transmit and process data?
 - a. Liquid
 - b. Light
 - c. Silicon
2. True or False: If your computer is running slowly, adding more memory might speed it up.
3. A quantum bit is known as a(n) _____.

Answers:

1) b; 2) True; 3) qubit



Summary

- Data and Program Representation
- Inside the System Unit
- How the CPU Works
- Making Computers Faster and Better Now and in the Future

15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 3

Storage



Deborah Morley
Charles S. Parker

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Learning Objectives

1. Name several general characteristics of storage systems.
2. Describe the two most common types of hard drives and what they are used for today.
3. Discuss the various types of optical discs available today and how they differ from each other.
4. Identify some flash memory storage devices and media and explain how they are used today.
5. List at least three other types of storage systems.
6. Summarize the storage alternatives for a typical personal computer.



Overview

- This chapter covers:
 - The characteristics common among all storage systems
 - The primary storage for most personal computers—the hard drive
 - How optical discs work and the various types that are available today
 - Flash memory storage systems
 - Network and cloud storage, smart cards, holographic storage, and storage systems used with large computer systems
 - Storage alternatives for a typical personal computer



Storage System Characteristics

- Storage Media and Storage Devices
 - Medium
 - Hardware where data is stored
 - DVD disc, flash memory card, etc.
 - Device
 - DVD drive, flash memory card reader, etc.
 - Medium is inserted into device to be used
 - Can be internal, external, or remote
 - Storage devices are typically identified by letter



Storage System Characteristics

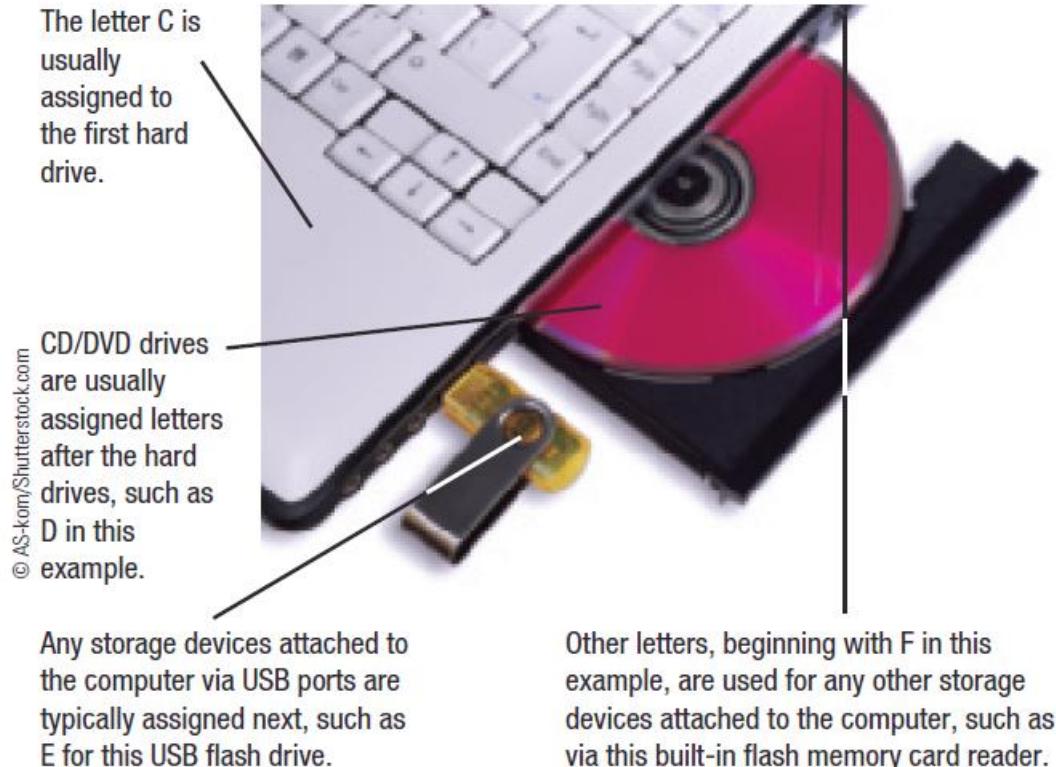


FIGURE 3-1

Storage device identifiers. To keep track of storage devices in an unambiguous way, the computer system assigns letters of the alphabet or names to each of them.



Storage System Characteristics

- Volatility
 - Storage media are nonvolatile
- Random vs. Sequential Access
 - Random access (direct access) allows data to be retrieved from any location on the storage medium
 - Virtually all storage devices use random access
 - Sequential access means retrieval of data can occur only in the order in which it was physically stored on the storage medium
 - Magnetic tape drive

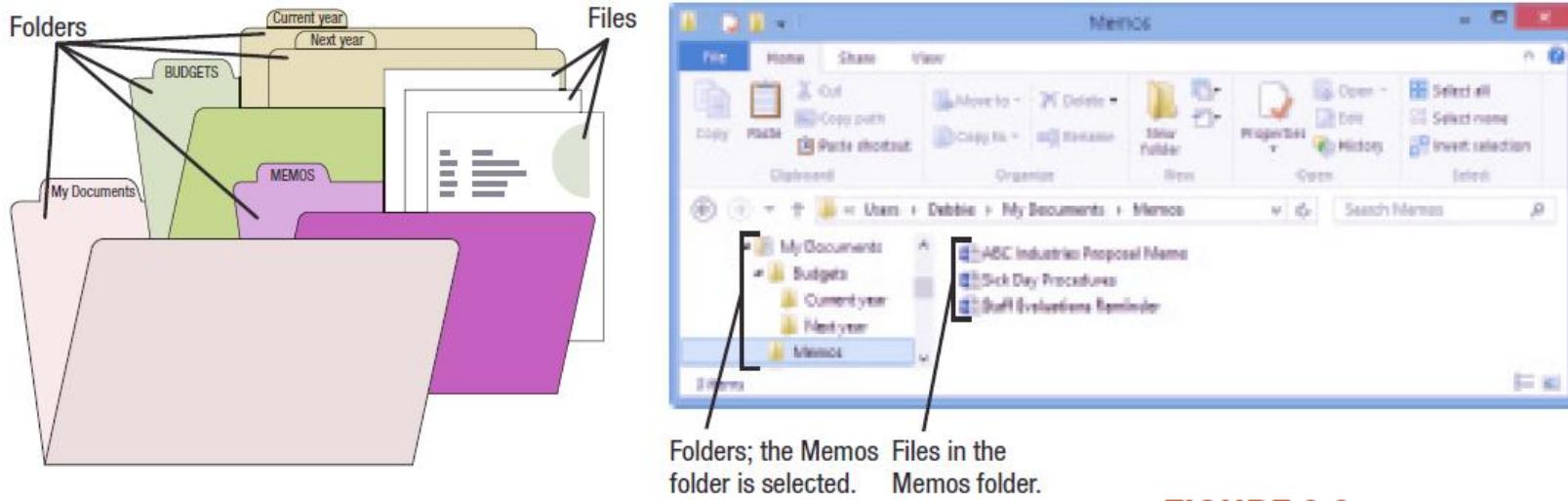


Storage System Characteristics

- Logical vs. Physical Representation
 - File
 - Anything stored on a storage medium, such as a program, document, digital image, or song
 - Filename
 - Name given to a file by the user
 - Folder
 - Named place on a storage medium into which files can be stored



Storage System Characteristics



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FIGURE 3-2

Organizing data.

Folders are used to organize related items on a storage medium.



Storage System Characteristics

- Logical file representation
 - Individuals view a document stored as one complete unit in a particular folder on a particular drive
- Physical file representation
 - Computers access a particular document stored on a storage medium using its physical location or locations
- Types of Storage Technology Used
 - Magnetic (conventional hard drives)
 - Optical (optical discs)
 - Electrons (flash memory media)



Hard Drives

- Hard Drive
 - Used to store most programs and data
 - Can be internal or external
 - Can be encrypted
- Magnetic Hard Drives
 - One or more permanently sealed metal magnetic disks with an access mechanism and read/write heads



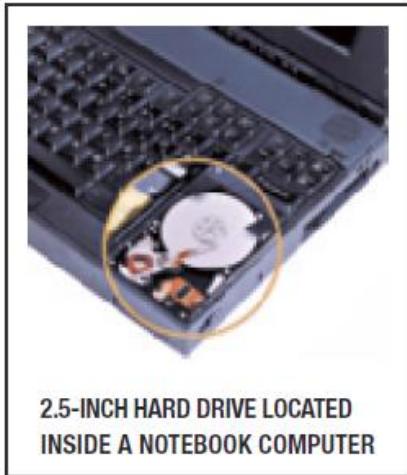
Courtesy Apricorn

FIGURE 3-3

Encrypted hard drives. The data stored on this external hard drive is accessed via a fingerprint scanner.



Hard Drives



MOUNTING SHAFT

The mounting shaft spins the hard disks at a speed of several thousand revolutions per minute while the computer is turned on.



READ/WRITE HEADS

There is a read/write head for each hard disk surface, and they move in and out over the disks together.

HARD DISKS

There are usually several hard disk surfaces on which to store data. Most hard drives store data on both sides of each disk.

SEALED DRIVE

The hard disks and the drive mechanism are hermetically sealed inside a case to keep them free from contamination.

ACCESS MECHANISM

The access mechanism moves the read/write heads in and out together between the hard disk surfaces to access required data.

Courtesy of Hitachi Global Storage Technologies; Courtesy Western Digital

FIGURE 3-5

Magnetic hard drives.

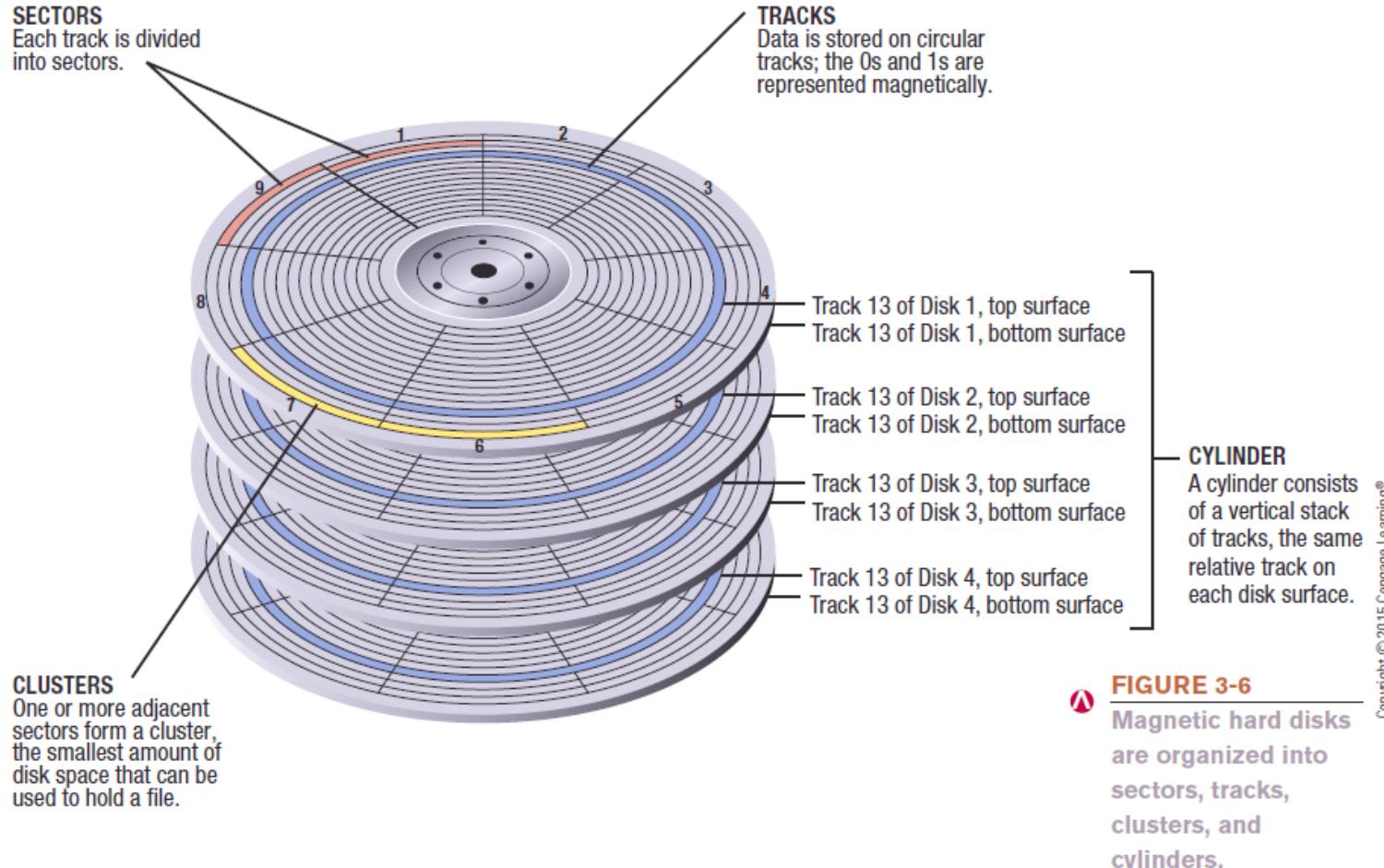


Hard Drives

- Hard disks are divided into:
 - Tracks
 - Concentric path on disk where data is recorded
 - Sectors
 - A small piece of the track
 - Clusters
 - One or more sectors; smallest addressable area of a disk
 - Cylinders
 - Collection of tracks located in the same location on a set of hard disk surfaces



Hard Drives





How It Works Box

More Storage for Your Tablet

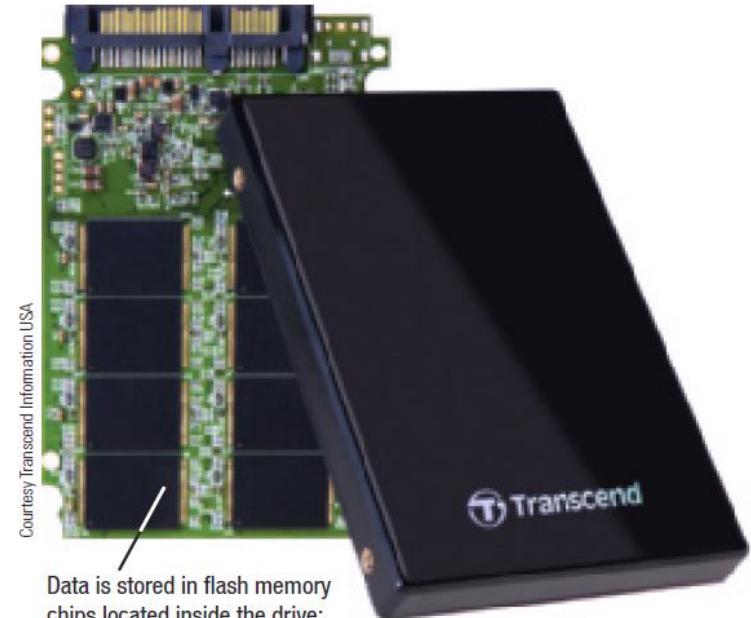
- Media tablets often have 64 GB of storage
- To extend storage, can transfer content to and from PCs
- Easier is to use a wireless hard drive
- Need the appropriate app





Hard Drives

- Solid State Drives (SSDs)
 - Use flash memory technology
 - Use less power and have no moving parts
 - Particularly appropriate for portable computers and mobile devices



Courtesy Transcend Information USA

Data is stored in flash memory chips located inside the drive; unlike magnetic drives, there are no moving parts.

FIGURE 3-7
Solid-state drives
(SSDs).



Inside the Industry Box

Data Recovery Experts

- Can recover data from damaged storage devices
- Can be used when devices are physically damaged or just stop working
- Back up to prevent data loss



Data recovery. The data on this destroyed computer (left) was recovered by data recovery experts in a clean room (right).



Internal and External Hard Drives

- Internal hard drives
 - Permanent storage devices located inside the system unit
 - Removed only if a problem develops
- External hard drives
 - Commonly used to transport large amounts of data from one computer to another
 - Portable external hard drives are smaller and easier to transport
 - Most connect with a USB connection although some may be wireless



Internal and External Hard Drives

Courtesy Western Digital



FULL-SIZED EXTERNAL HARD DRIVES

Are about the size of a 5 by 7-inch picture frame, but thicker; this drive contains two magnetic hard drives, which hold 6 TB total.

Courtesy Western Digital



PORTABLE HARD DRIVES (MAGNETIC)

Are about the size of a 3 by 5-inch index card, but thicker; this drive holds 2 TB.

Courtesy Transcend Information USA



PORTABLE HARD DRIVES (SSD)

Are about the size of a credit card, but thicker; this drive holds 256 GB.

FIGURE 3-8
External hard drives.



Hard Drive Speed, Disk Caching, and Hybrid Hard Drives

- Disk access time
 - Total time that it takes for a hard drive to read or write data
 - Consists of seek time, rotational delay, and data movement time
 - SSDs don't require seek time or rotational delays
- Disk cache
 - Memory used in conjunction with a magnetic hard drive to improve system performance
 - Typically consist of memory chips on a circuit board inside the hard drive case



Hard Drive Speed, Disk Caching, and Hybrid Hard Drives

- Hybrid Hard Drive
 - Combination of flash memory and magnetic hard drive
 - Uses flash memory for cache
 - Allows encryption to be built into the drive



MAGNETIC HARD DRIVE

This 2 TB drive contains 2 hard disks and 4 read/write heads that operate in a manner similar to a conventional hard drive.

FLASH MEMORY DISK CACHE

This drive contains 8 GB of flash memory to duplicate data as it is stored on the hard disks so the data can be accessed when the hard disks are not spinning.

FIGURE 3-9

Hybrid hard drives.

Hybrid hard drives contain both magnetic hard disks and a large quantity of flash memory for increased performance.

Courtesy of Seagate Technology LLC



Hard Drive Partitioning and File Systems

- Partitioning
 - Divides the physical capacity of a single drive logically into separate areas, called partitions
 - Partitions function as independent hard drives
 - Referred to as logical drives
 - Increases efficiency (smaller drives use smaller clusters)
- Partitions used to create:
 - A recovery partition
 - A new logical drive for data
 - A dual boot system



Hard Drive Partitioning and File Systems

- File system
 - Determines the partition size, cluster size, maximum drive size, and maximum file size
 - FAT, FAT32, and NTFS

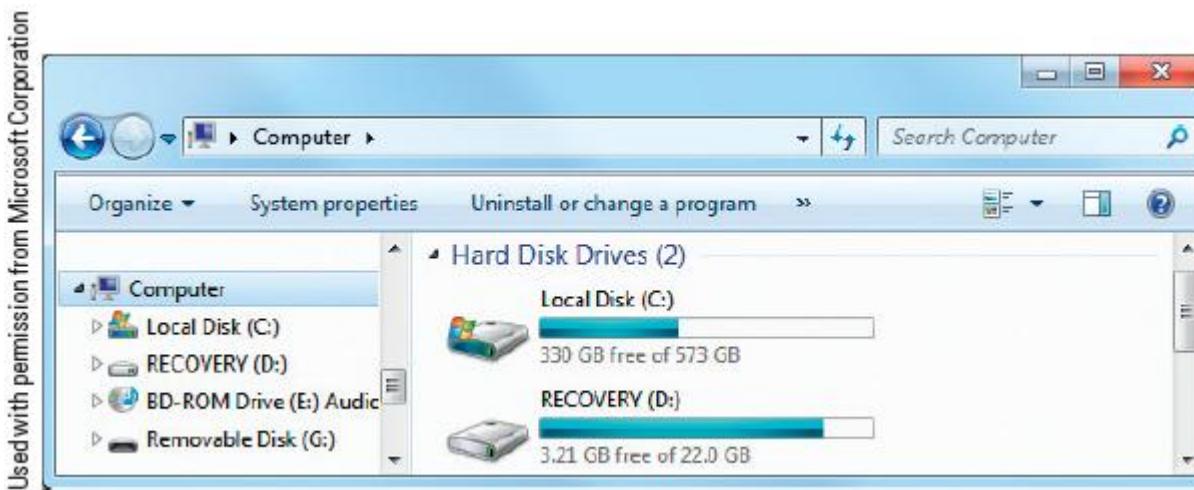


FIGURE 3-10
Hard drive partitions. New personal computers today often come with the primary hard drive divided into two partitions.



Hard Drive Interface Standards

- Determine how a drive connects to the computer
- Common standards
 - Parallel ATA (PATA) - older, slower standard
 - Serial ATA (SATA)
 - eSATA
 - SCSI and the newer serial attached SCSI (SAS)
 - Fibre Channel
 - Fibre Channel over Ethernet (FCoE)
 - Internet SCSI (iSCSI)



Quick Quiz

1. Of the following three options, the storage media that would likely hold the most data is a(n) _____.
 - a. internal hard drive
 - b. USB flash memory drive
 - c. portable hard drive
2. True or False: Hard drives typically contain more than one metal hard disk.
3. The circular rings on a magnetic disk on which data is stored are called _____.

Answers:

- 1) a; 2) True; 3) tracks



Optical Discs and Drives

- Optical Disc Characteristics
 - A type of storage read from and written to using laser beams
 - Today's standard for software delivery
 - Divided into sectors like magnetic discs but use a single spiral track (groove)
 - Have a relatively large capacity and are durable
 - Used for backup purposes and for storing and transporting music, photos, video, etc.



Optical Discs and Drives

- Representing Data on an Optical Disc
 - Read-only optical disc
 - Surface of disc is molded or stamped
 - Recordable or rewritable disc
 - Optical drive is used and the reflectivity of the disc is changed using a laser to represent the data
 - Pits and lands are used to represent 1s and 0s
 - The transition between a pit and a land represents a 1; no transition represents a 0



Optical Discs and Drives

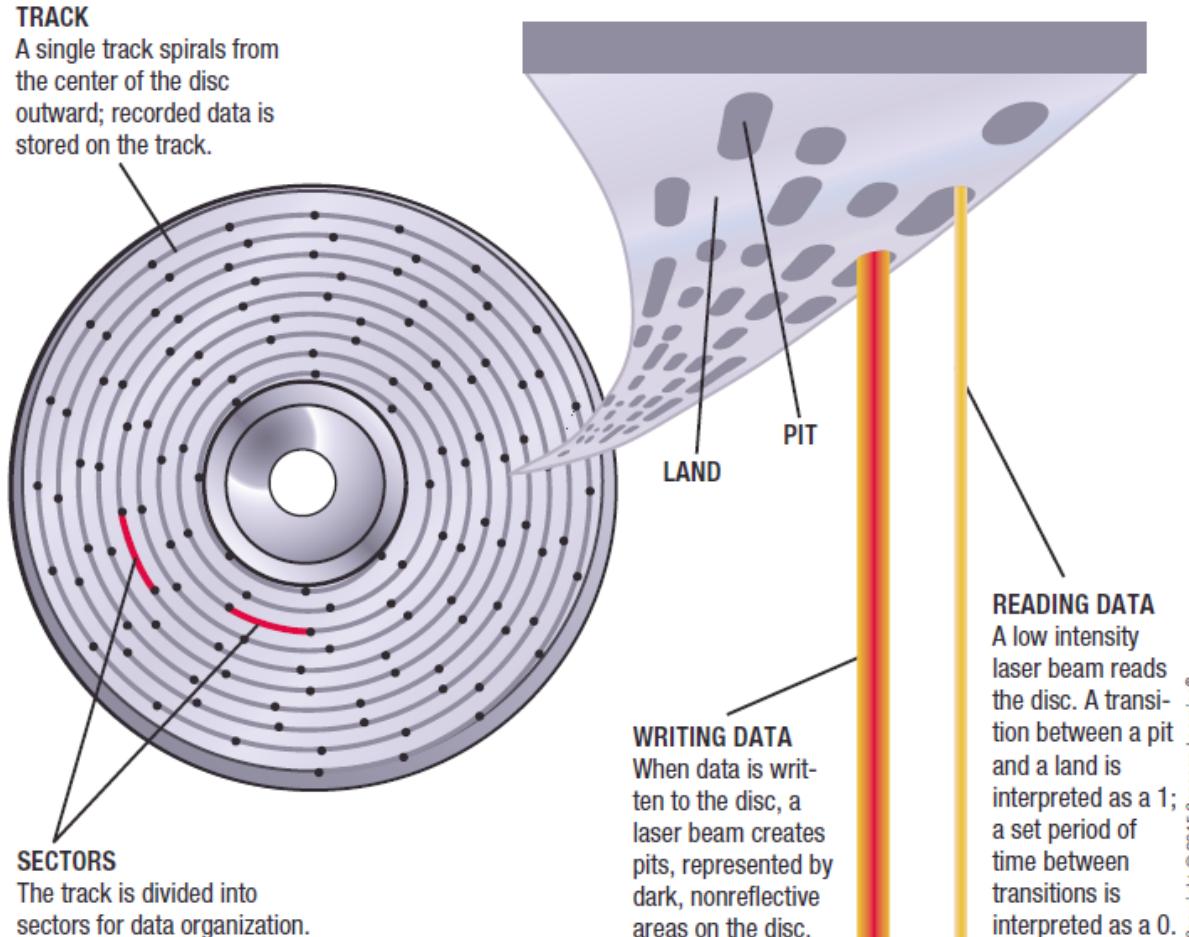


FIGURE 3-11
How recorded optical discs work.

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Optical Discs and Drives

- Optical Drives
 - Three categories of discs: CD, DVD, or Blu-Ray Disc (BD)
 - Can be read-only, recordable, or rewritable
 - Almost always downward compatible
 - Can support single or dual layer discs
 - Recording data onto disc is called burning
 - Can be internal or external drives
 - External drives typically connect via USB port

FIGURE 3-12
External optical drives. Can be connected as needed, typically via a USB port, such as to the netbook shown here.



Courtesy Apricorn



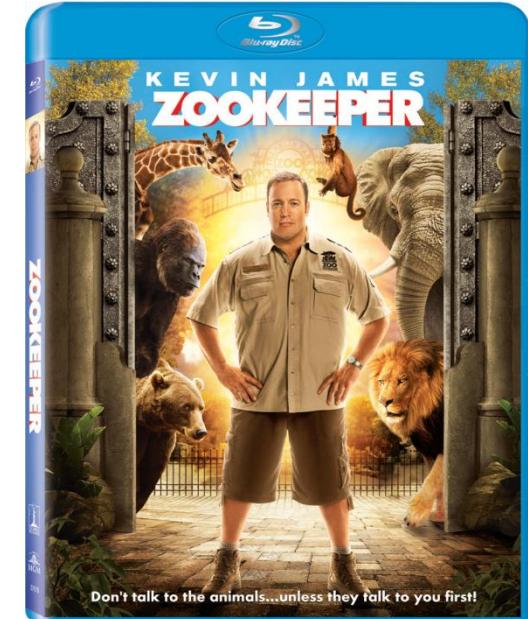
Optical Discs and Drives

- Optical Disc Shapes, Sizes, and Capacities
 - Standard size is 120-mm (about 4.7 inches)
 - Mini discs are smaller—80-mm
 - Theoretically can be made into various shapes—hearts, triangles, irregular shapes, or a hockey-rink shape
 - Patent battle exists about changing optical disc shapes
 - None of these different shapes are currently available



Optical Discs and Drives

- Major advantage: large capacity
 - CD discs are normally single layer and hold 650 or 700 MB
 - DVD discs hold 4.7 GB (single-layer) or 8.5 GB (dual-layer)
 - BD discs hold 25 GB (single-layer) or 50 GB (dual-layer)
 - Discs can also be double-sided
 - Researchers continually work to increase the capacity of optical discs
 - DL and XL discs
 - 4K (Ultra HD) Blu-ray Discs





Optical Discs and Drives

TYPE OF DISC	CAPACITY	USED FOR
CD	700 MB	Audio music delivery; custom CDs containing music, photos, etc.
DVD	4.7 GB	Movie and software delivery;
DVD-DL	8.5 GB	custom DVDs containing videos, music, photos, etc.
BD	25 GB	Primarily movie delivery
BD-DL	50 GB	
BDXL	100 GB (rewritable) or 128 GB (recordable)	

FIGURE 3-14

Summary of optical discs.



Read-Only Optical Discs

- CD ROM, DVD ROM, and BD-ROM
 - Can be read from, but not written to, by the user
 - CD-ROM (compact disc read-only memory)
 - DVD-ROM (digital versatile disc read-only memory)
 - BD-ROM (Blu-Ray Disc read-only memory)
 - Normally come pre-recorded
 - Software programs
 - Clip art and other graphics
 - Music
 - Movies
 - Games (PlayStation, Wii, Xbox, etc.)



Recordable Optical Discs

- CD-R, DVD-R, DVD+R, BD-R Discs
 - Can be written to, but cannot be erased and reused
 - No physically molded pits
 - Most have a recording layer containing organic light-sensitive dye between disc's plastic and reflective layers
 - Except the BD-R disc, which has inorganic material
 - Used for backing up files, sending large files to others, and creating custom music CDs



Rewritable Optical Discs

- CD-RW, DVD-RW, DVD+RW, and BD-RE Discs
 - Can be written to, but cannot be erased and reused
 - Uses phase change technology
 - Heating and cooling process is used to change the reflectivity of the disc
 - Capacities are identical to the read-only and recordable discs, except BDXL
 - Appropriate for transferring large files from one computer to another or temporarily storing TV shows



Quick Quiz

1. The capacity of the typical CD disc is _____.
 - a. 50 GB
 - b. 700 MB
 - c. 4.7 GB
2. True or False: A DVD-RW disc can be written to and rewritten to.
3. The tiny depressions, dark areas, or otherwise altered spots on an optical disc that are used to represent data are called _____.

Answers:

- 1) b; 2) True; 3) pits



Trend Box

DNA Data Storage

- Possible data storage medium
 - Long-term, high-density encoding
- Researchers have encoded data in DNA
 - Translated into binary 0s and 1s, then to a ternary code, and then as strings of DNA's chemical bases and stored in DNA
- Biggest obstacle is cost - \$12,400/MB
- Biggest possibility: archiving





Flash Memory Storage Systems

- Flash Memory
 - Chip-based storage medium that represents data using electrons
 - Used in SSDs and hybrid hard drives
- Embedded Flash Memory
 - Flash memory chips embedded into products, such as
 - Portable digital media players, digital cameras
 - Handheld gaming devices, GPS devices, mobile phones
 - Sunglasses and wristwatches



Flash Memory Storage Systems



FIGURE 3-16
Embedded flash
memory.

Courtesy Apple Inc.



MEDIA TABLET
Contains 64 GB of embedded flash



EMBEDDED FLASH MEMORY

Courtesy of SanDisk Corporation



Flash Memory Storage Systems

- Flash Memory Cards and Readers
 - Flash memory card
 - Small card containing one or more flash memory chips, a controller chip, and metal contacts to connect the card to the device or reader with which it is being used
 - Available in various formats that are not interchangeable:

CompactFlash	Secure Digital (SD)	xD Picture Card
Memory Stick	Secure Digital High Capacity (SDHC)	
MultiMedia Card (MMC)	Secure Digital Extended Capacity (SDXC)	



Flash Memory Storage Systems

Courtesy Kingston Technology Company, Inc.; © 2013 Micron Technology, Inc. All Rights Reserved. Used with permission.

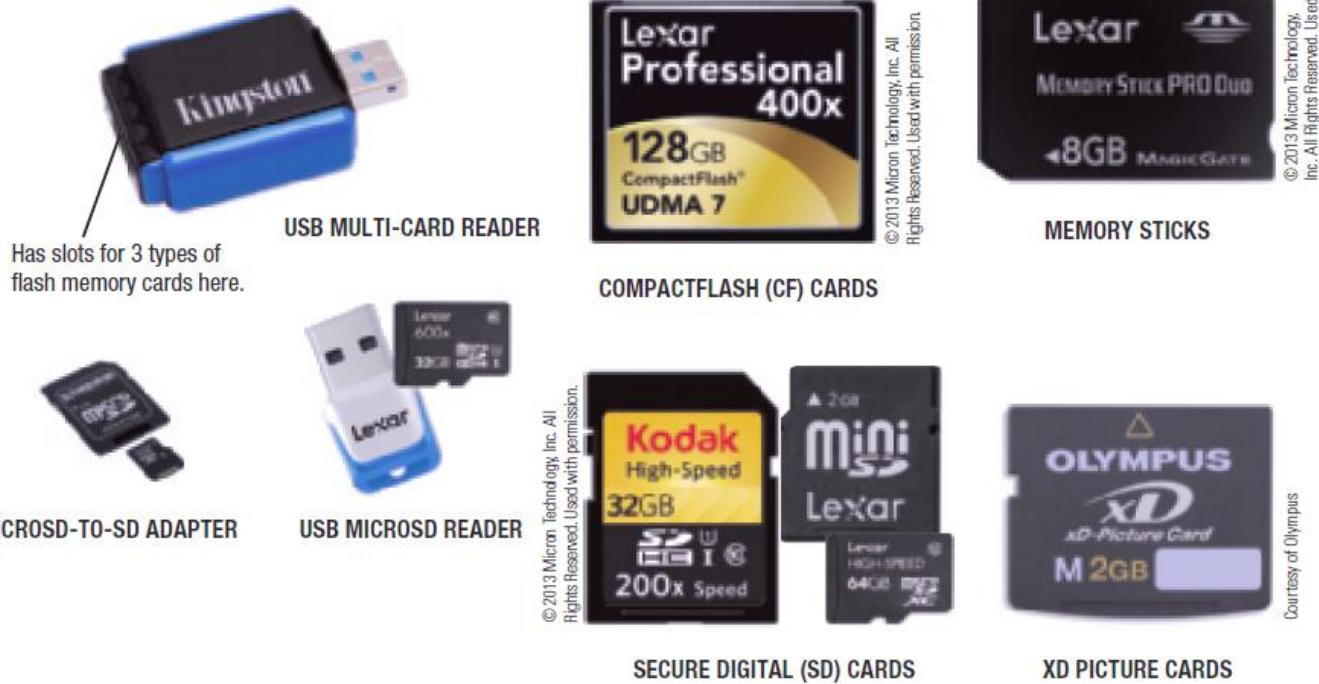


FIGURE 3-17
Some flash
memory cards,
readers, and
adapters.



Flash Memory Storage Systems

- General-purpose flash memory card
 - Appropriate for most applications
- Specialized flash memory cards
 - Professional flash memory cards
 - Designed for professional photographers
 - Gaming flash memory cards
 - Designed for gaming consoles
 - HD flash memory cards
 - Designed for capturing and transferring high-definition video



Flash Memory Storage Systems

- USB Flash Drives
 - Sometimes called flash memory drives, jump drives, or thumb drives
 - Flash memory media integrated into a self-contained unit that plug into and is powered by a USB port
 - Designed to be very small and very portable
 - Available in a host of formats including custom shapes
 - Can be built into a consumer product
 - Can be used to lock a computer and to issue Web site passwords
 - Can include biometric features, such as a built-in fingerprint reader



Flash Drive Storage Systems

Courtesy Kingston Technology Company, Inc.



CONVENTIONAL DRIVE

Courtesy CustomUSB.com



FIGURE 3-18
USB flash drives.

Courtesy CustomUSB.com



CUSTOM LANYARD DRIVE

Courtesy CustomUSB.com



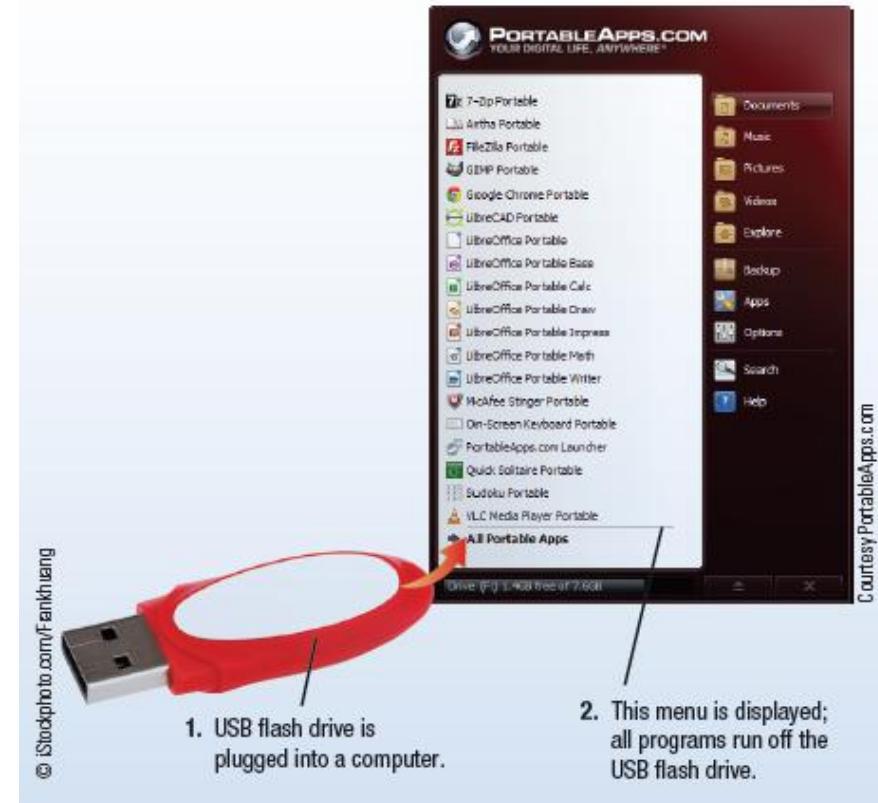
CUSTOM WALLET DRIVE



Technology and You Box

Thumb Drive PCs

- Portable apps turn USB flash drives and other small devices into personal computers
- Download app and desired software to the USB flash drive
- To use, plug into a computer





Other Types of Storage Systems

- Network Storage and Cloud Storage Systems
 - Remote storage
 - Using a storage device not directly connected to the computer being used
 - Accessed through the Internet or through a network
 - Network storage
 - Remote storage via local network

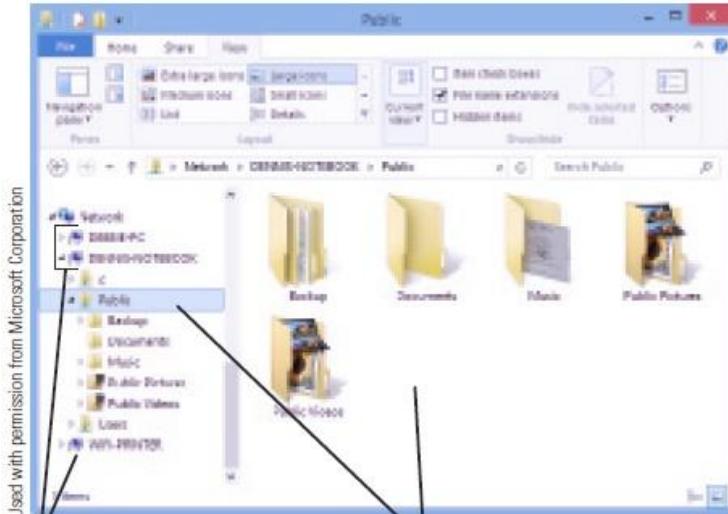


Network and Cloud Storage Systems

- Network attached storage (NAS)
 - High performance storage systems connected individually to a network
 - Designed for small business and home use
- Storage area network (SAN)
 - Separate network of hard drives or other storage devices which are attached to the main network



Network and Cloud Storage Systems



Used with permission from Microsoft Corporation

Devices on this network.

Items in the Public folder on the computer called DENNIS-NOTEBOOK.

SHARED FOLDERS

Shared folders on network computers appear and are accessed in a manner similar to local folders.



Courtesy Western Digital

NETWORK ATTACHED STORAGE (NAS) DEVICES

This NAS device holds up to 16 TB of data and provides storage for all computers on the network.

FIGURE 3-19
Network storage.



Network and Cloud Storage Systems

- Cloud storage (online storage)
 - Accessed via the Internet
 - Via Web sites (Flickr, Facebook, Google Docs, etc.)
 - Via online storage sites (Box, Dropbox, etc.)
 - Growing in importance because more and more applications are Web based
 - Increasing being used for backup purposes
 - Files can be synched between PC and cloud storage
 - Many Web sites providing online storage offer it free
 - Business cloud storage is available



Network and Cloud Storage Systems

Used with permission from Microsoft Corporation

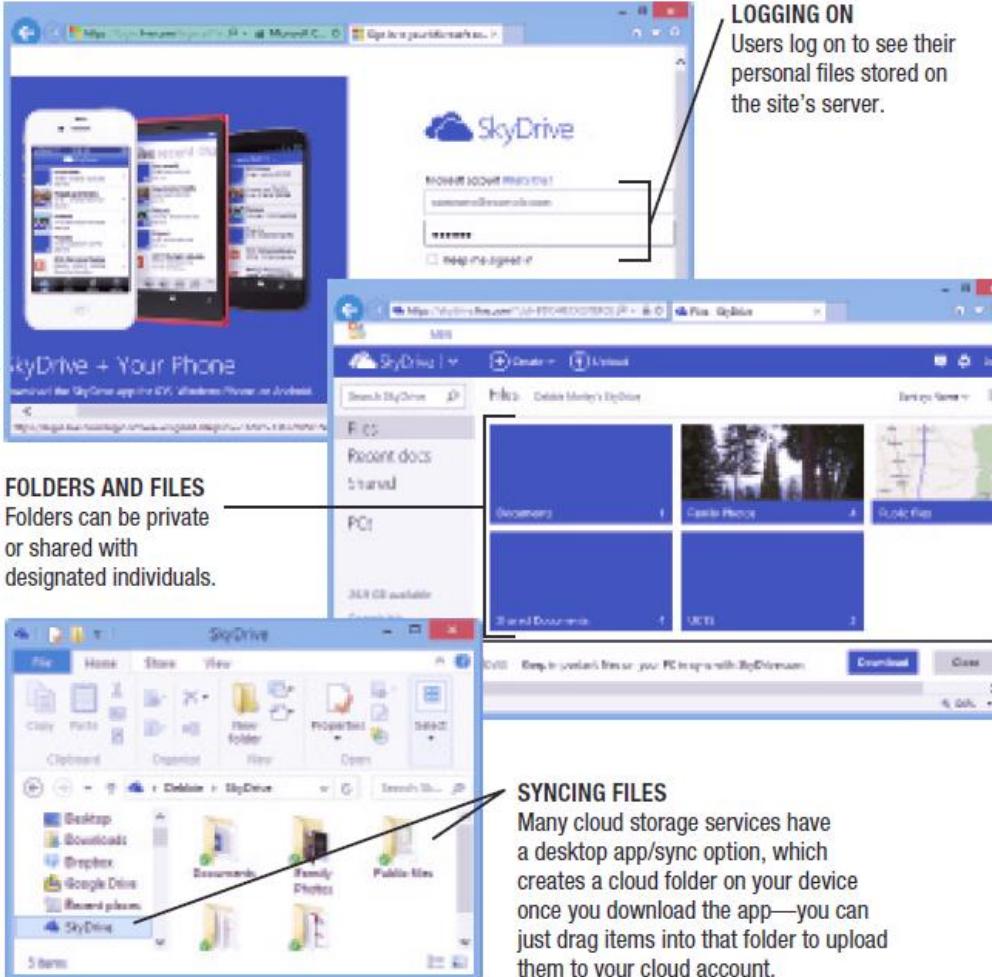


FIGURE 3-20

Cloud storage. This site provides 7 GB of free storage.



Smart Cards

- Smart Card
 - Credit card-sized piece of plastic that contains some computer circuitry (processor, memory, and storage)
 - Stores small amount of data (about 64 KB or less)
 - Commonly used to store prepaid amounts of digital cash or personal information
 - Smart card readers are built into or attached to a computer, door lock, vending machine, or other device
 - Some smart cards store biometric data
 - Use of mobile smart cards is an emerging trend



Smart Cards



LOGGING ONTO A COMPUTER VIA A CONTACT SMART CARD READER



MAKING A VENDING MACHINE PURCHASE VIA A CONTACT SMART CARD READER



ACCESSING A SECURE FACILITY VIA A CONTACTLESS SMART CARD READER



PURCHASING SUBWAY ACCESS VIA A CONTACTLESS SMART CARD READER

FIGURE 3-21
Common smart card applications.

Photos by HID Global Corporation



Holographic Storage

- Holographic storage
 - Holographic drives connect to a computer via a serial attached SCSI (SAS) or Fibre Channel interface
 - Uses multiple blue laser beams to store data in three dimensions
 - Reference beam and signal beam
 - Suited to applications in which large amounts of data need to be stored or retrieved quickly but rarely changed
 - Archiving business data, medical records, TV shows, sensor data , etc.



Holographic Storage

HOW HOLOGRAPHIC STORAGE WORKS

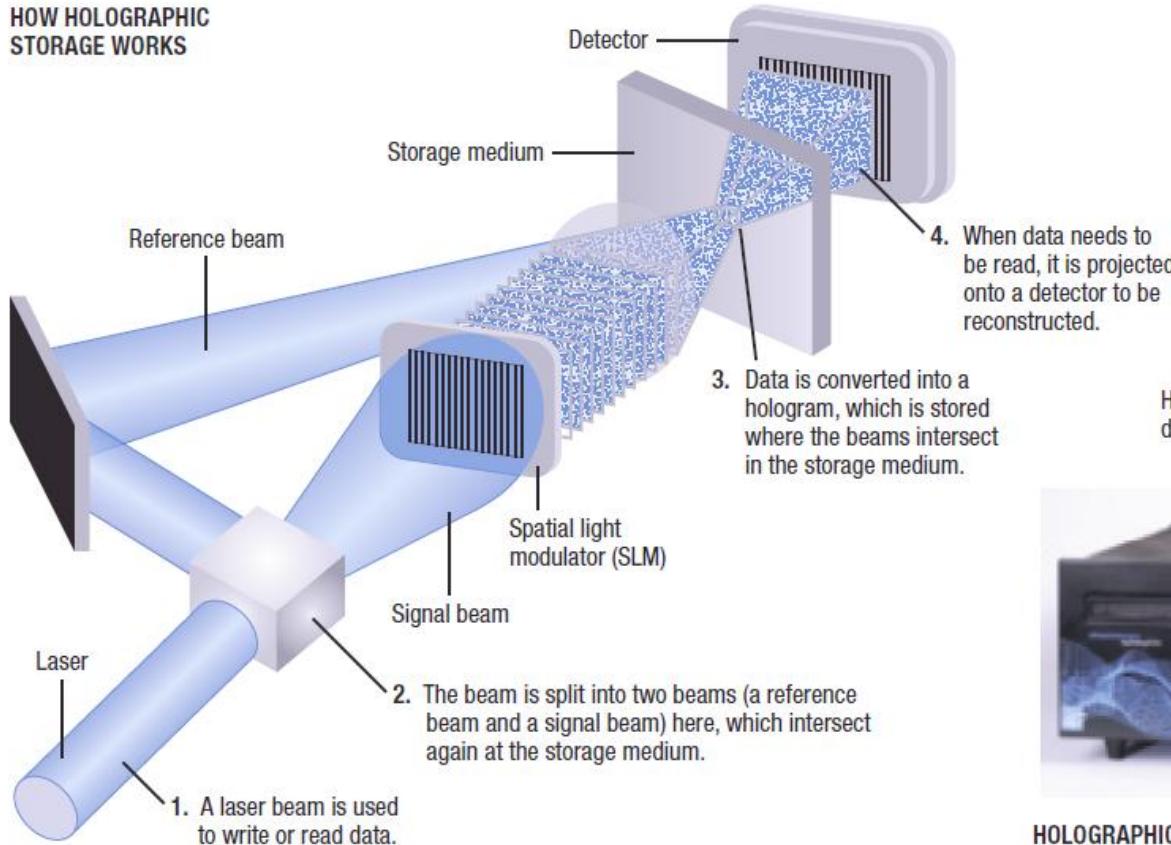


FIGURE 3-22

Holographic storage. Holographic drives store more than one million bits of data in a single flash of light.



Courtesy of Signal Lake

HOLOGRAPHIC DRIVES AND CARTRIDGES

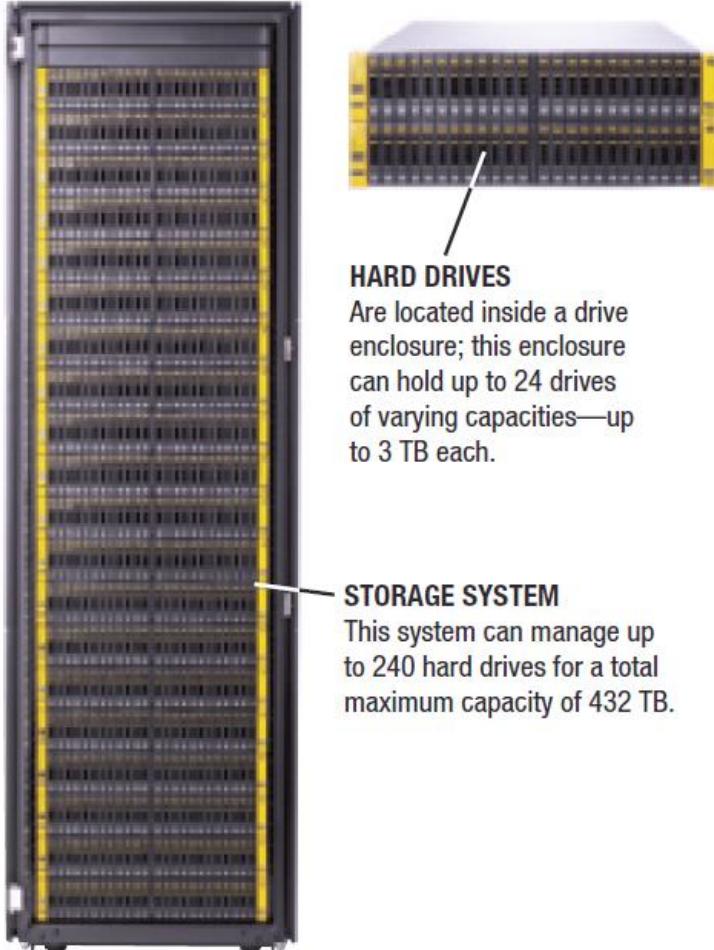


Storage Systems for Large Computer Systems

- Business storage needs are growing exponentially
 - Digital data produced is expected to double every two years through 2020
- Storage server
 - Hardware device containing multiple high-speed hard drives connected to the computer system or network
 - Most are based on magnetic hard discs



Storage Systems for Large Computer Systems



Courtesy Hewlett-Packard Development Company, L.P.

FIGURE 3-23

Large storage systems. Large storage systems are usually scalable so additional hard drives can be added as needed.



Storage Systems for Large Computer Systems

- RAID (redundant arrays of independent discs)
 - Method of storing data on two or more hard drives that work together to do the job of a larger drive
 - Mostly used to protect critical data on large storage systems
 - Usually involves recording redundant copies of stored data
 - Helps to increase fault tolerance



Storage Systems for Large Computer Systems

- Different levels of RAID:
 - RAID 0 = disk striping (spread files over two or more hard drives)
 - RAID 1 = disk mirroring (duplicate copy)
 - Other level use a combination of striping and mirroring
- Drobo system
 - New RAID storage system
 - Much easier to use than previous systems
 - Offers continuous data redundancy

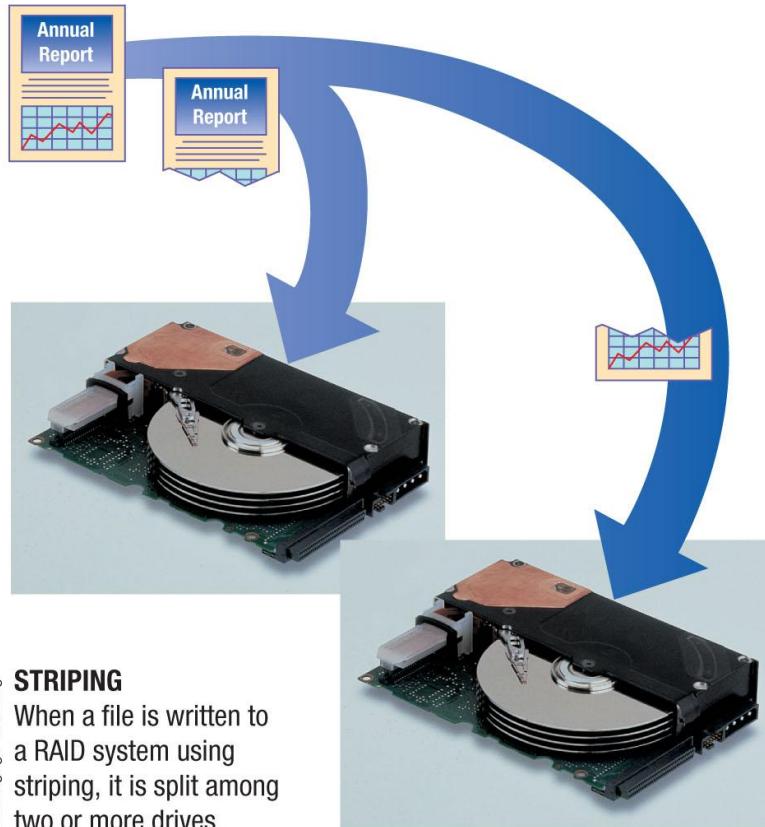


Courtesy Drobo, Inc.

FIGURE 3-25
A Drobo storage system.

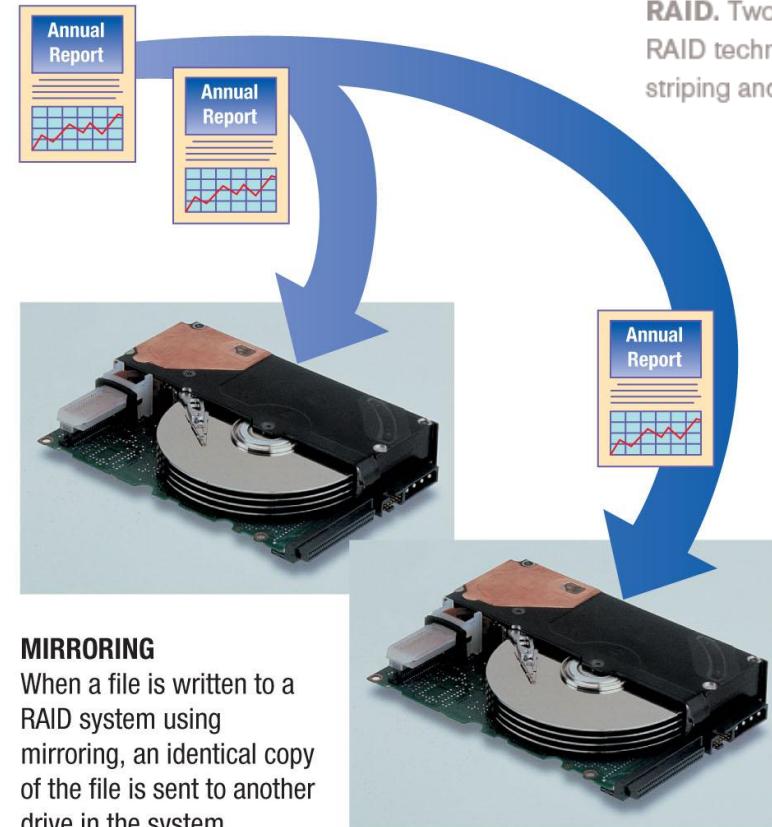


Storage Systems for Large Computer Systems



STRIPING

When a file is written to a RAID system using striping, it is split among two or more drives.



MIRRORING

When a file is written to a RAID system using mirroring, an identical copy of the file is sent to another drive in the system.

FIGURE 3-24

RAID. Two primary RAID techniques are striping and mirroring.



Magnetic Tape Systems

- Magnetic Tape
 - Plastic tape coated with a magnetizable substance that represents the bits and bytes of digital data
 - Primarily used for backup and archival purposes
 - Sequential access only
 - Low cost per terabyte
 - Most tapes today are in the form of cartridge tapes



Courtesy Imation

FIGURE 3-26

This magnetic tape cartridge holds 80 GB.



Evaluating Your Storage Alternatives

- Product Characteristics to Consider:
 - Speed
 - Compatibility
 - Storage capacity
 - Convenience
 - Portability
- Most Users Require:
 - Hard drive
 - Recordable or rewritable optical drive
 - Flash memory card reader
 - USB ports



Quick Quiz

1. An online photo sharing site is an example of _____.
 - a. RAID
 - b. cloud storage
 - c. holographic storage
2. True or False: Flash memory storage systems are called solid-state storage systems because they are nonvolatile.
3. A type of sequential storage that sometimes used today for backup purposes is _____.

Answers:

1) b; 2) False; 3) magnetic tape

15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 4

Input and Output



**Deborah Morley
Charles S. Parker**

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Learning Objectives

1. Explain the purpose of a computer keyboard and the types of keyboards widely used today.
2. List several different pointing devices and describe their functions.
3. Describe the purposes of scanners and readers and list some types of scanners and readers in use today.
4. Explain what digital cameras are and how they are used today.
5. Understand the devices that can be used for audio input.



Learning Objectives

6. Describe the characteristics of a display device and explain some of the technologies used to display images.
7. List several types of printers and explain their functions.
8. Identify the hardware devices typically used for audio output.



Overview

- This chapter covers:
 - The most common input devices
 - Hardware designed for capturing data in electronic form
 - Audio input
 - Types of display devices and how they work
 - Types of printers and how they work
 - Audio output devices



Keyboards

- An input device used to enter characters at the location marked by the insertion point or cursor
 - Can be wired or wireless
 - Typically contains:
 - Standard alphanumeric keys
 - Numeric keypad
 - Function keys
 - Delete and Backspace keys
 - Control and Alternate keys
 - Arrow directional keys and special keys



Keyboards

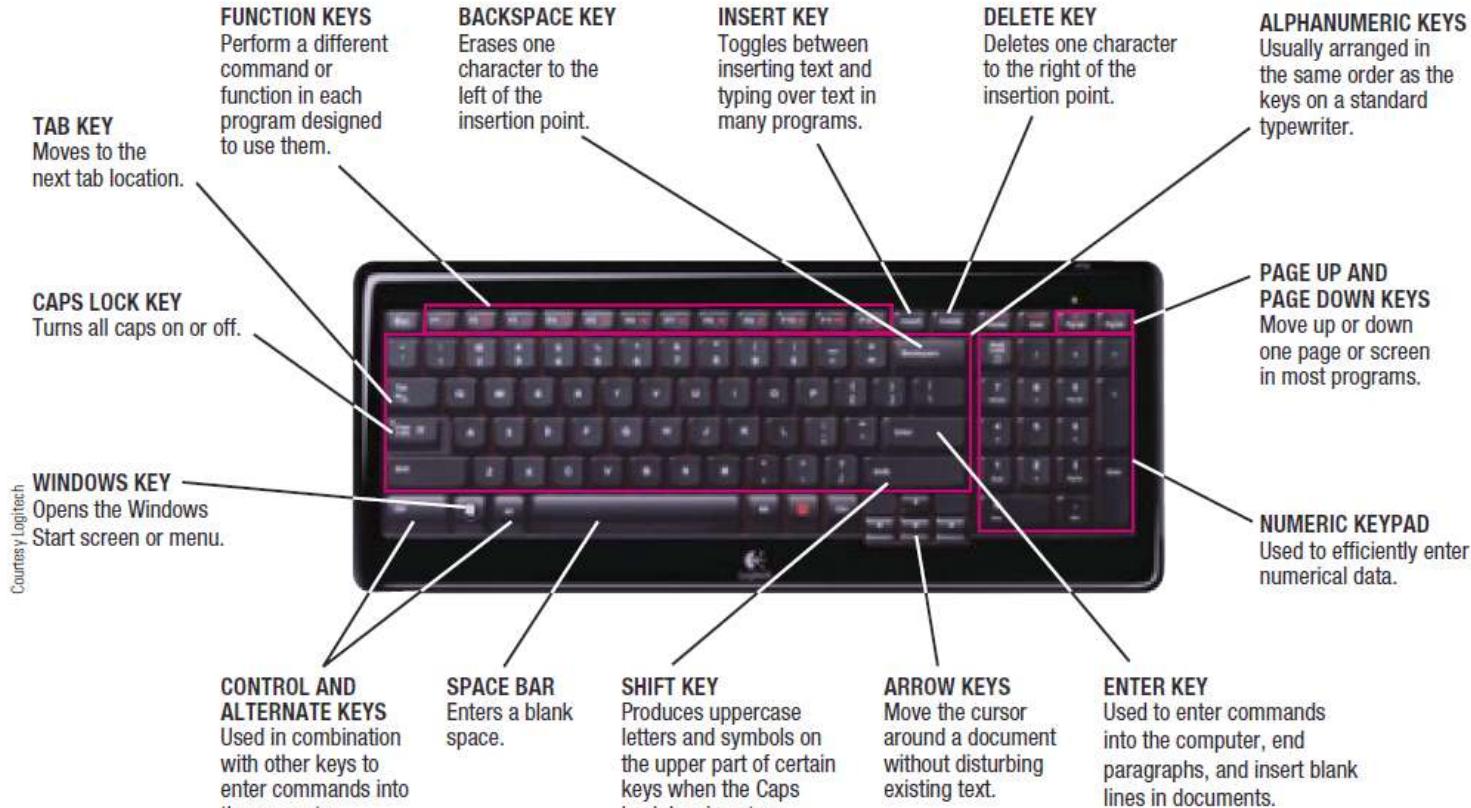


FIGURE 4-1
A typical desktop keyboard.

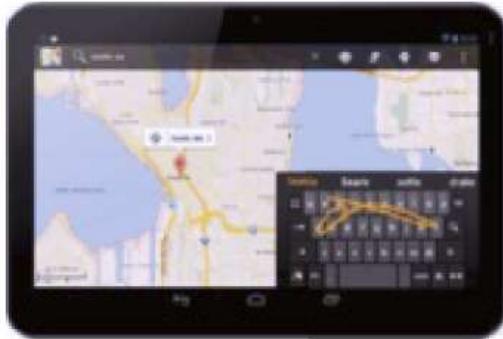


Keyboards

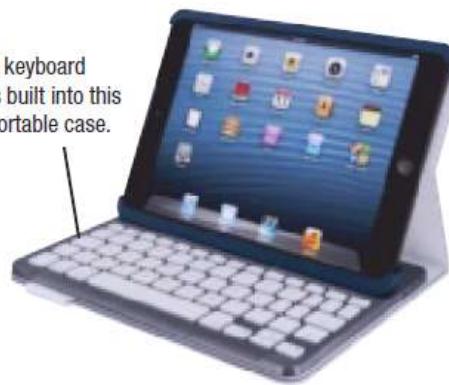
- Mobile devices often use:
 - Slide-out keyboard
 - Pen or touch input (on-screen keyboard)
 - Keyboard dock



SLIDE-OUT KEYBOARDS



ON-SCREEN KEYBOARDS



KEYBOARD FOLIO

FIGURE 4-2
Keyboards for
mobile devices.



Pointing and Touch Devices

- Pointing devices are used to:
 - Select and manipulate objects
 - Input data
 - Issue commands to the computer
- Common types of pointing devices:
 - Mouse
 - Pen/stylus
 - Devices that use touch input



Mice

- Mouse
 - Common pointing device that the user slides along a flat surface to move a pointer around the screen and clicks its buttons to make selections
 - Older mechanical mice use a ball
 - Optical or laser mice track with light
 - Touch mice support two-dimensional gestures



Mice



TRADITIONAL MICE

Support pointing, clicking, and scrolling.



Courtesy Logitech

TOUCH MICE

Support swiping, tapping, and other navigational movements.

FIGURE 4-3
Mice.

POINT

Move the mouse until the mouse pointer is at the desired location on the screen.



CLICK

Press and release the left mouse button.



RIGHT-CLICK

Press and release the right mouse button.



DOUBLE-CLICK

Press and release the left mouse button twice, in rapid succession.



DRAG-AND-DROP

When the mouse pointer is over the appropriate object, press and hold down the left mouse button, drag the object to the proper location on the screen by moving the mouse, and then drop the object by releasing the mouse button.



SCROLL WHEEL/BUTTON

If your mouse has a wheel or button on top, use it to scroll through the displayed document.



SWIPE

If your mouse supports gestures, swipe the surface in various directions with your fingers to scroll, flip, and zoom screen contents.



TAP

If your mouse supports gestures, tap on the mouse to perform clicks.



FIGURE 4-4
Common mouse operations.



Trend Box

Perceptual Computing

- Users control devices with 3D gestures, voice commands, and facial expressions
- Noncontact system
- Allows for full body input and input from a slight distance away





Pens/Styluses

- Stylus
 - Pen-like device used to draw or write electronically on the screen
 - Also called digital pen, electronic pen, tablet pen
 - Pen input is being used for:
 - Photography, graphic design, animation
 - Industrial design, document processing, and healthcare applications
 - Navigating through a document
 - Issuing commands



Pens/Styluses

- Pen-Based Computers and Mobile Devices
 - Pen input used with mobile devices and tablet computers
 - Used to input handwritten text and sketches and to manipulate objects
 - If handwriting recognition is used, written text can be converted to editable typed text

© iStockphoto.com/mkurtas



SMARTPHONES



TABLET COMPUTERS



DESKTOP COMPUTERS

FIGURE 4-5
Pen-based computers
and mobile devices.



Pens/Styluses

- Digital Writing Systems
 - Pen-based systems that capture handwritten input as it is being written
 - Requires special paper with a grid of dots
 - Handwritten input can be transferred to computer
- Graphics Tablets
 - Pen tablets or digitizing devices
 - Flat, touch sensitive tablet typically connected to computer using a USB port



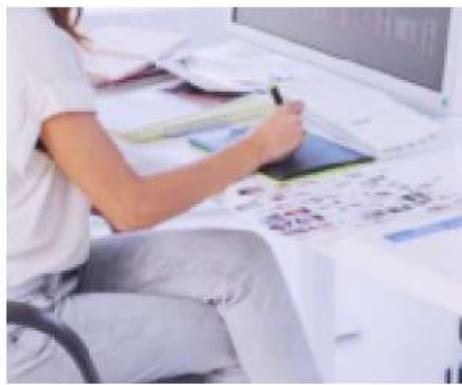
Pens/Styluses

- Signature Capture Devices
 - Found at check out counters to record customer signatures



DIGITAL WRITING SYSTEMS

Record all input written on the paper and transfer it to a device either in real time or when directed by the user.



GRAPHICS/PEN TABLETS

Transfer all input written or drawn on the tablet to the computer in real time and allow the use of pen navigation tools.



SIGNATURE CAPTURE DEVICES

Record signatures for purchases, deliveries, and other applications that require recorded authorization.

FIGURE 4-7
Other uses for
digital pens.



Touch Screens

- Touch Screens
 - Display devices that are touched with the finger to select commands or otherwise provide input to the computer
 - Common on portable computers, smartphones, and other mobile devices
 - Multi-touch
 - Can recognize input from more than one finger at a time
 - Table PC
 - Large screen computer either built into a table or designed to be used on a table



Touch Screens



Courtesy Dell Inc.

DESKTOP COMPUTERS



Courtesy Sony Electronics Inc.

NOTEBOOK COMPUTERS



Courtesy Dell Inc.

MOBILE DEVICES



Courtesy Lenovo

TABLE PCS

FIGURE 4-8

Touch screens.



Other Pointing Devices

- Gaming devices
- Trackballs
- Control buttons and wheels
- Touch pads



GAMING DEVICES
Most often used for gaming applications.



TRACKBALLS
An alternative to a mouse that some individuals find easier to use.



TOUCH PADS
Commonly found on notebook and netbook computers (left); also available as stand-alone devices (right).

FIGURE 4-9

Other common pointing devices.



Quick Quiz

1. An optical mouse is _____.
 - a. the same as a wireless mouse
 - b. a mouse that tracks movements with light instead of a ball
 - c. a mouse that contains a scroll wheel on the top
2. True or False: With handwriting recognition, text is input as a graphical image so the text cannot later be edited as text.
3. An input device that looks like an upside-down mouse with the ball on top is a(n) _____.

Answers:

- 1) b; 2) False; 3) trackball



How It Works Box

Augmented Reality

- Computer generated images are overlaid on top of real-time images
- Today, most often with smartphones using camera input, location info, and other data
- Displays appropriate information related to images captured by the smartphone



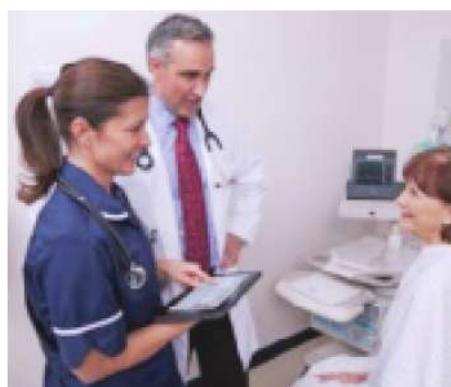


Scanners, Readers, and Digital Cameras

- Source documents
 - Already exists in physical form (photographs, checks, or product label)
- Source data automation
 - Captures data directly from a source document
 - Saves time
 - Increases accuracy
 - Utilizes scanning or reading devices

FIGURE 4-10

Source data automation.



RECORDING DATA DIRECTLY INTO A COMPUTER



CAPTURING DATA FROM ITS SOURCE DOCUMENT



Scanners

- Scanners (Optical Scanners)
 - Input devices that read printed text and graphics and transfers them to a computer in digital form
 - Data is typically input as a single image
 - Can scan photos, documents, images
 - Types of scanners
 - Flatbed
 - Portable
 - 3D
 - Receipt and business card scanners



Scanners

FIGURE 4-11

Scanners.



FLATBED SCANNERS

Used to input photos, sketches, slides, book pages, and other relatively flat documents into the computer.



PORTABLE SCANNERS

Used to capture documents or other data while on the go; the data is typically transferred to a computer at a later time.



INTEGRATED SCANNERS

Built into other devices, such as into the ATM machine shown here to capture images of deposited checks.



Scanners

- Scanning Quality and Resolution
 - Quality of scanned images indicated by optical resolution
 - Measured in number of dots per inch (dpi)
 - Can often be specified when image is scanned
 - Can be changed when scanned image is edited
 - Higher resolution means better quality but larger file size

FIGURE 4-12
Scanning resolution.



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RESOLUTION

Most scanners let you specify the resolution (in dpi) to use for the scan. High-resolution images look sharper but result in larger file sizes.



Readers

- Barcode Readers
 - Input devices that read barcodes
- Barcodes
 - Machine-readable codes that represent data as a set of bars
 - Common Types
 - Universal Product Code (UPC)
 - ISBN
 - DataBar
 - QR Codes



Readers



ISBN CODES



UPC (UNIVERSAL
PRODUCT CODE) CODES



DATABAR CODES



INTELLIGENT MAIL CODES



CODE 39 CODES



QR CODES

Courtesy Motorola Solutions; Copyright © 2015 Cengage Learning®

FIGURE 4-13

Common types of
barcodes.



Readers

FIGURE 4-14
Barcode readers.



FIXED BARCODE READERS

Used most often in retail point-of-sale applications.



PORTABLE BARCODE READERS

Used when portability is needed.



INTEGRATED BARCODE READERS

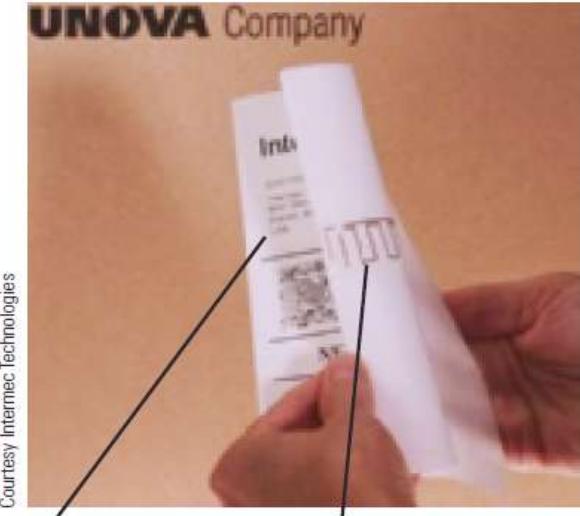
Used most often for consumer applications.



Readers

- Radio Frequency Identification (RFID) Readers
 - Technology used to store and transmit data located in RFID tags
 - RFID tags contain tiny chips and radio antennas
 - Can be attached to objects
 - Read by RFID readers
 - Tags only need to be within range of the reader, rather than in the line of sight

FIGURE 4-15
RFID tags.





Readers

- Applications
 - Tracking inventory and assets
 - Electronic toll collection
 - Tracking patients in hospitals
 - Ticketing applications
 - Speeding up ID process of travelers at border crossings
- Types of RFID Readers
 - Handheld, portal, and stationary
- Slow to catch on in retail industry due to privacy and security issues



Readers



Courtesy Intermec Technologies

INVENTORY TRACKING

This portal RFID reader reads all of the RFID tags attached to all of the items on the palette at one time.



Courtesy of TeamXcess.com

TICKETING APPLICATIONS

This stationary RFID reader is used to automatically open ski lift entry gates for valid lift ticket holders at a ski resort in Utah.



Courtesy MasterCard Worldwide

MOBILE PAYMENTS

This stationary RFID reader is used at checkout locations to process payments via RFID-enabled credit cards or NFC-enabled smartphones.



© AP Images/Denis Poroy

BORDER SECURITY

This stationary RFID reader is used at the U.S.-Mexico border crossing located in San Diego to reduce wait time.

FIGURE 4-16
RFID applications.



Readers

- Optical Mark Readers (OMRs)
 - Input data from special forms to score or tally exams, questionnaires, ballots
- Optical Character Recognition (OCR) Devices
 - OCR is the ability of a computer to recognize scanned text characters and convert them to electronic form as text, not images
 - OCR software is used to identify each character and convert it to editable text
 - Used to process turnaround documents like monthly bills



Readers

- Magnetic Ink Character Recognition (MICR) Readers
 - Also called check scanners
 - Used primarily for banking
 - Read the special magnetic characters printed at the bottom of checks
 - High volume readers process deposited checks
 - Used to facilitate remote deposits and electronic check processing



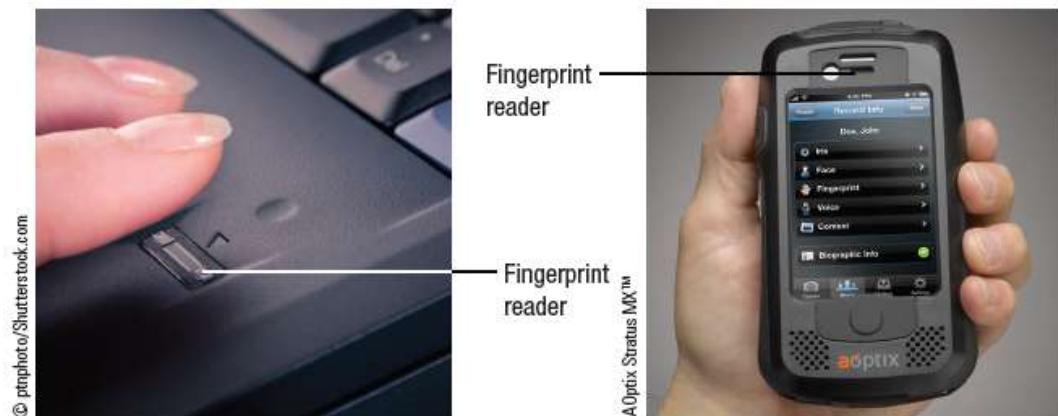
Courtesy, Epson America

FIGURE 4-19
Magnetic ink character recognition (MICR) readers are used primarily to process checks.



Readers

- Biometric Readers
 - Used to input biometric data such as an individual's fingerprint or voice
 - Can be stand-alone or built into another piece of hardware
 - Most often used for access control, to authorize electronic payments, log on to secure Web sites



PERSONAL COMPUTERS

Often used to control access to the device (such as the notebook computer shown here), as well as to log on to secure Web sites.

MOBILE DEVICES

Often used to record or verify an individual's identity (such as with the device shown here that has fully integrated iris, face, fingerprint, and voice biometric capabilities).

FIGURE 4-20

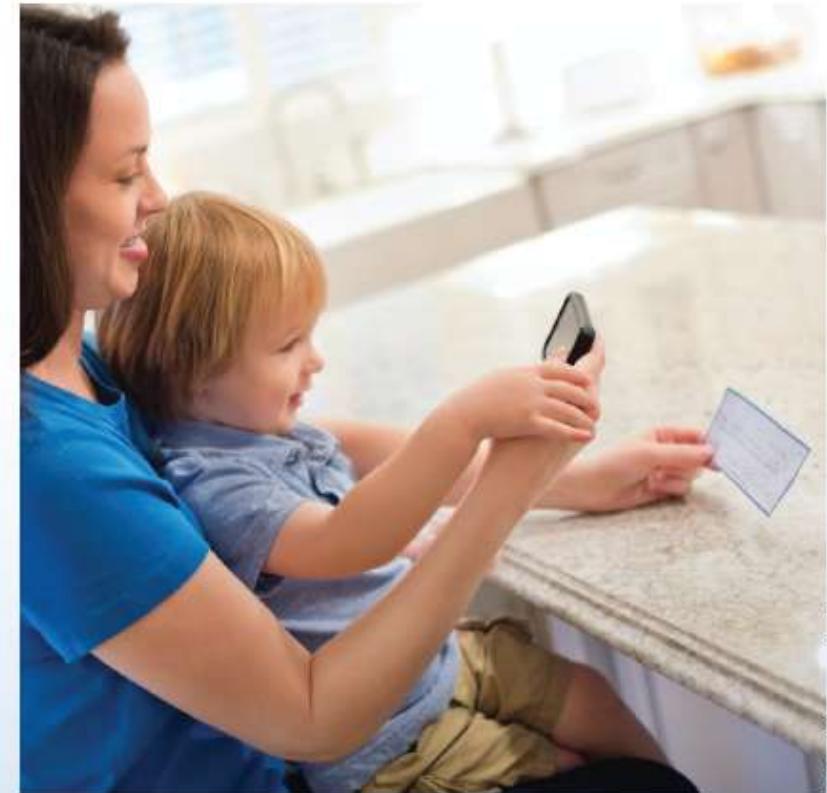
Biometric readers.



Technology and You Box

Mobile Deposits

- Mobile remote deposit capture
- Transmit check information via smartphone app and camera
- App optimizes the check front and back images and transmits images and deposit data to your bank



Smartphone cameras can be used to submit check images for remote deposit.



Digital Cameras

- Digital Cameras
 - Take pictures and records them as digital images
 - Can either be still cameras or video cameras
 - Integrated into many portable computers and mobile phones
- Digital Still Cameras
 - Primary appeal is that images are immediately available
 - Camera quality is measured in megapixels
 - Typically use flash memory for storage
 - Camera phones can be used to read barcodes, remotely deposit checks, etc.



Digital Cameras

Courtesy Sony Electronics Inc. ©MasashiShutterstock.com



PREVIEWS

Virtually all digital cameras let you display and erase images.

STORAGE MEDIA

Most cameras use removable storage media in addition to, or instead of, built-in storage.

TYPICAL CONSUMER DIGITAL CAMERAS

Courtesy Kingston Technology Company, Inc.



PROFESSIONAL DIGITAL CAMERAS

Courtesy Sony Electronics Inc.



© iStockphoto.com/Asiseeit

DIGITAL CAMERAS INTEGRATED INTO MOBILE PHONES

FIGURE 4-21

Digital still cameras.



Digital Cameras

- Digital Video Cameras
 - Digital camcorders, PC video cameras (PC cams, webcams)
 - Built-in or stand alone
 - Store images on digital media (flash memory, DVDs, hard drives, etc.)
- Applications
 - Surveillance video cameras
 - Video conferences and Webinars
 - Face recognition systems

Courtesy Sony Electronics Inc.



DIGITAL CAMCORDER

Typically store video on a built-in hard drive (as in this camera) or on DVD discs.



U.S. Air Force photo/Staff Sgt. Levi Riendeau

PC VIDEO CAMERAS

Commonly used to deliver video over the Internet, such as during a video phone call as shown here.

FIGURE 4-22
Digital video cameras.



Audio Input

- Voice Input and Speech Recognition Systems
 - Audio Input
 - The process of entering audio data into the computer
 - Voice Input
 - Inputting spoken words and converting them to digital form via microphone or headset
 - Can be used for podcasts and with VoIP (Voice over IP) systems
 - Provides spoken instructions to computer when used with speech recognition systems



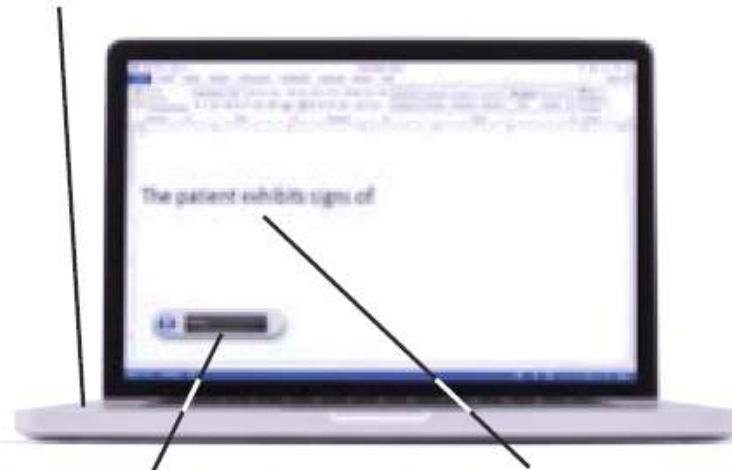
Audio Input

1. The user speaks into a microphone that cancels out background noise and inputs the speech into the computer.



© Ronen Bojdak/Shutterstock.com

2. An analog-to-digital converter on the sound card located inside the system unit converts the spoken words to phonemes, the fundamental sounds in the language being used, and digitizes them.



3. Voice recognition software determines the words that were spoken.

4. The spoken words appear on the screen in the application program (such as a word processor or an e-mail program) being used.

© Bombaert Patrick/Shutterstock.com; Used with permission from Microsoft Corporation

FIGURE 4-23

Speech recognition systems.



Audio Input

- Music Input Systems
 - Used to input music
 - Existing music can be input using CDs or a Web download
 - For original compositions, microphones, keyboard controllers, and guitar controllers can be used to input music



© Cameron Whitman/Shutterstock.com

FIGURE 4-24

Music input systems. Musicians can input original compositions into a computer via microphones, MIDI keyboards and guitars, and other devices.



Quick Quiz

1. Which of the following is used in conjunction with Scantron test forms, voting ballots, and other documents in which the selection is bubbled in?
 - a. OCR
 - b. MICR
 - c. OMR
2. True or False: Flatbed scanners can be used to scan photos, as well as documents on conventional paper.
3. A voice input system requires software and a(n) _____ in order to input voice data or commands into a computer.

Answers:

1) c; 2) True; 3) microphone



Display Devices

- Display Device
 - Presents output visually on some type of screen
 - Monitor
 - Display device for a desktop computer
 - Display Screen
 - Screen built into a variety of devices
 - Notebook and other portable computers
 - Mobile phones and mobile devices
 - Handheld gaming devices, home entertainment devices, kitchen appliances
 - Digital photo frames, e-book readers, smart watches
 - Digital signage systems, digital billboards



Display Devices

- Display Device Characteristics
 - Color vs. Monochrome Displays
 - Images are formed using pixels
 - Most displays today are color displays
 - CRT vs. Flat-Panel Displays
 - Cathode ray tube (CRT) displays: large, bulky, and heavy
 - Flat-panel displays: take up less desk space; use less power



Courtesy ASUSTeK Computer Inc.

ADDITIONAL DISPLAYS FOR MOBILE DEVICES
Typically duplicate the content displayed on the mobile device.



MULTIPLE MONITORS
Can be used with a single computer to extend a desktop, which can increase productivity.

FIGURE 4-26
Flat-panel displays.



Display Devices

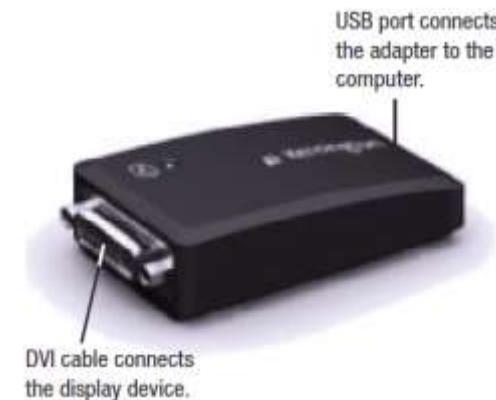
- Size and Aspect Ratio
 - Device size measured diagonally from corner to corner
- Screen Resolution
 - Number of pixels used on a display determines resolution
 - Affects the amount of information that can be displayed on the screen at one time
 - Can be changed to match users' preference



Display Devices

- Video Adapters, Interfaces, and Ports
 - Video cards determine the graphic capabilities of a computer
 - VGA, DVI, and HDMI are the three most common interfaces to connect monitors to a computer
 - Ports exposed in the system unit cases are to connect monitors to computers
 - New option is to use USB ports

FIGURE 4-28
A USB display adapter.





Display Devices

- Wired vs. Wireless Displays
 - Wired displays are physically connected to the system via a cable
 - Wireless displays connect using a wireless network connection (Wi-Fi, Bluetooth)
- 2D vs. 3D Displays
 - Most displays are 2D
 - 3D displays use filters, prisms, and multiple lenses to create the 3D effects



Display Devices

- Wearable Displays
 - Project images from a mobile device to a display screen built into glasses
- Touch and Gesture Capabilities
 - Kiosks and portable gaming devices
 - Mobile phones and media tablets

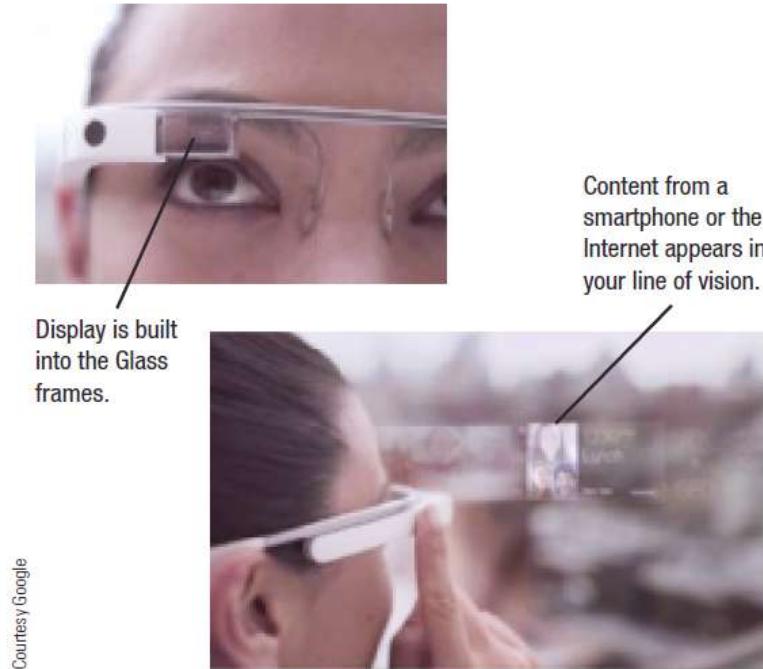


FIGURE 4-30
Google Glass.



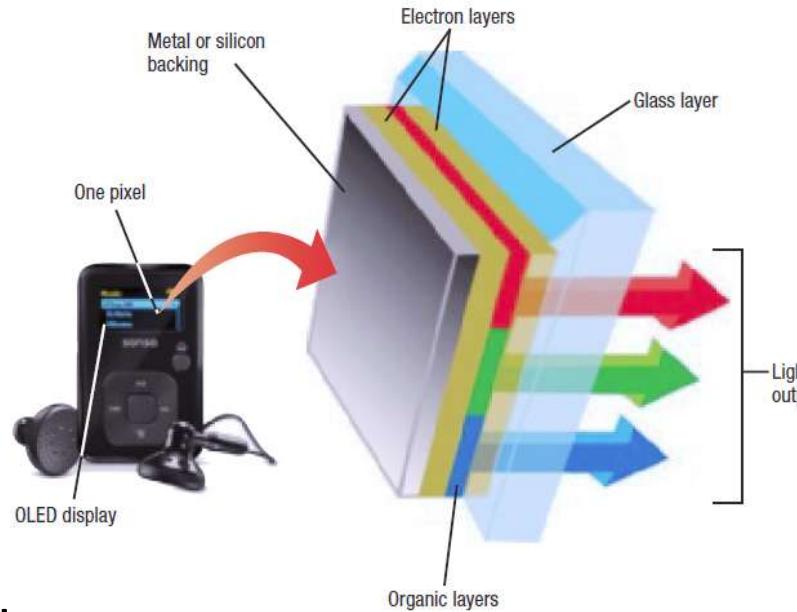
Flat Panel Display Technologies

- Liquid Crystal Displays (LCDs)
 - Use charged liquid crystals between sheets of glass or plastic
 - Requires backlighting
- Light Emitting Diode (LED) Displays
 - Used in alarm clocks and Christmas lights
 - Currently used to backlight LCD panels



Flat Panel Display Technologies

- Organic Light Emitting Diode (OLED) Displays
 - Use layers of organic material
 - Emit visible light when current is applied
 - Are thinner than LCDs
 - Have a wider viewing angle
 - Incorporated into many digital cameras, mobile phones, and portable digital media players



Courtesy: SanDisk Corporation. Copyright © 2015 Cengage Learning®

FIGURE 4-31
How OLED displays work. Each pixel on an OLED display emits light in the necessary color.



Flat Panel Display Technologies

- Special Types of OLEDs
 - FOLED (Flexible OLED)
 - OLED displays built on flexible surfaces such as plastic or metallic foil
 - TOLED (Transparent OLED)
 - Displays are transparent
 - Emit light toward top and bottom of display surface
 - PHOLED (Phosphorescent OLED)
 - Process that results in much more conversion of electrical energy into light instead of heat



Flat Panel Display Technologies



FOLEDs

Used to create flexible displays on plastic or another type of flexible material.



TOLEDs

Used to create transparent displays.

Courtesy of Universal Display Corporation

FIGURE 4-32

Special types
of OLEDs.



Flat Panel Display Technologies

- Interferometric Modulator (IMOD) Displays
 - Essentially a complex mirror that uses external light to display images
 - Designed initially for mobile phones and portable devices
 - Images are bright and clear, even in sunlight
- Plasma Displays
 - Use layers of gas between two plates of glass
 - Being replaced by LCDs



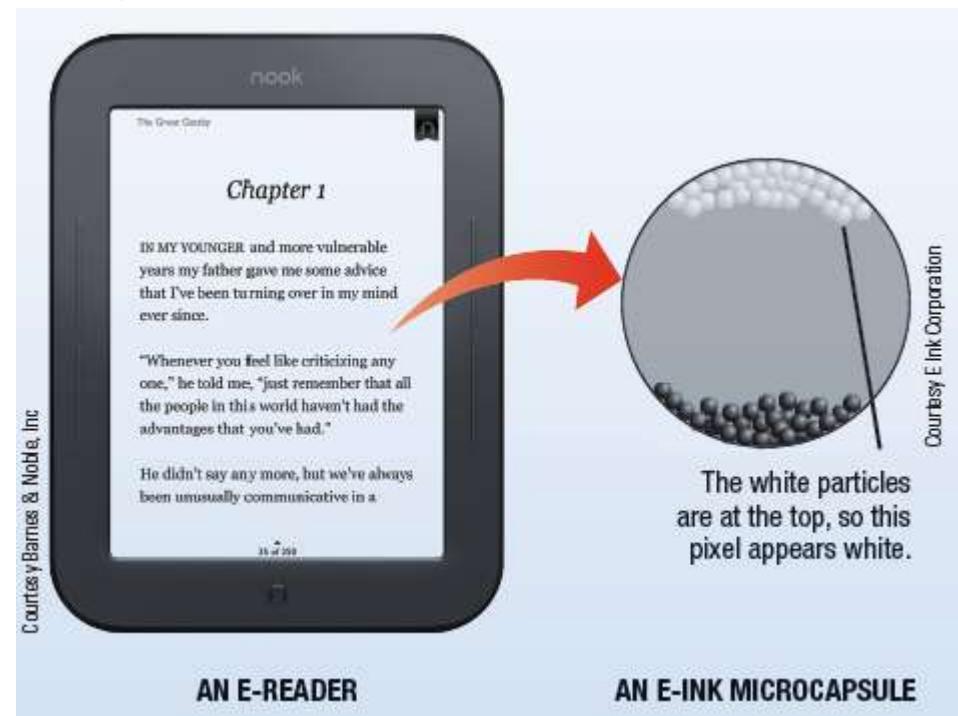
FIGURE 4-33
An IMOD display is
bright and readable,
even in direct
sunlight.



Inside the Industry Box

E-Paper

- Used for e-readers and other devices
- Easier to read in direct sunlight
- Content can change wireless
- Only uses power to change images, not maintain an image
- Use electronic ink
- Monochrome or color





Data and Multimedia Projectors

- Display output from a computer to a wall or projection screen
- Found in classrooms and conference rooms
- Can be wireless or integrated into devices
- Some contain an iPod dock
- Pico projectors are pocket-size and connect mobile and portable devices
- Hologram projectors used to display 3D images
- 3D projectors are designed to project 3D images that are viewed with 3D glasses



Data and Multimedia Projectors



FIGURE 4-34

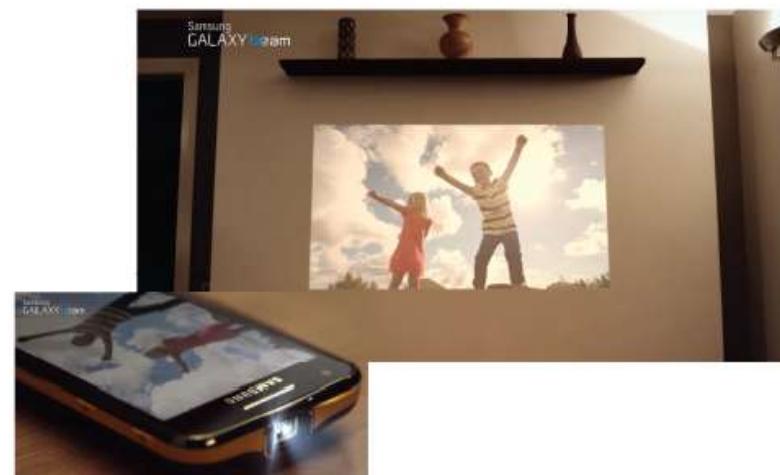
Data projectors.

Courtesy Epson America



CONVENTIONAL DATA PROJECTORS

Frequently used for both business and classroom presentations; the projector shown here is ceiling mounted and Wi-Fi-enabled.



PICO PROJECTORS

Can be stand-alone or built into a mobile device; images from the mobile device (such as the smartphone shown here) are projected onto any surface.



Printers

- Printing Technology
 - Impact Printers (Dot Matrix)
 - Print mechanism strikes an inked ribbon to transfer ink to the paper
 - Used to produce multipart forms
 - Non-Impact Printers (Ink-Jet/Laser)
 - Use liquid ink or toner
 - Produce higher quality images
 - Much quieter than impact printers



Courtesy InfoPrint Solutions Company

FIGURE 4-35

Dot-matrix printers.

Dot-matrix printers are impact printers; today they are typically high-speed printers used in manufacturing, shipping, or similar applications.



Printers

- Color vs. Black and White
 - Colors printers use magenta, cyan, yellow, and black ink
- Print Resolution
 - Measured in dpi (dots per inch)
 - More dots per inch results in higher quality output
 - 300 dpi for general purpose printing; 1,200 dpi for photographs; 2,400 dpi for professional applications
- Print Speed
 - Measured in pages per minute (PPM)
 - Range from about 15 to 65 ppm



Printers

- Personal vs. Network Printers
 - Personal printers connect directly to a single computer
 - Network printers connect directly to a home or an office network; some can perform cloud printing
 - Connection Options
 - USB connection most comm
- Multifunction Capabilities
 - Copy, fax, scan, print
 - All-in-ones

FIGURE 4-37

Cloud printing.

Allows you to send documents to a printer via the Internet.

Courtesy Epson America





Laser Printers

- Use toner powder and technology similar to that of a photocopier to produce images on paper
- The standard for business documents
- Print one entire page at a time
- Generally faster and have better quality output than ink-jet printers
- Can be black and white or color
- Common print resolution for laser printers is between 600 and 2,400 dpi
- Use toner cartridges



Ink-Jet Printers

- Sprays droplets of ink to produce images on paper
- Use ink cartridges
- Usually print in color
- Often the choice for home use
- Relatively inexpensive with good-quality output
- Print more slowly than laser printers
- Potential applications for the future
 - Dispensing liquid metal, aromas, computer chips and other circuitry, “printing” human tissue



Ink-Jet Printers

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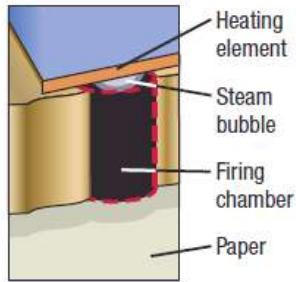


Each ink cartridge is made up of multiple tiny ink-filled firing chambers; to print images, the appropriate color ink is ejected through the appropriate firing chamber.

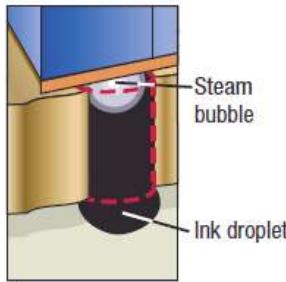


INK-JET PRINTER

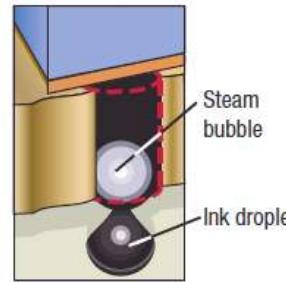
Courtesy, Hewlett-Packard Company



1. A heating element makes the ink boil, which causes a steam bubble to form.



2. As the steam bubble expands, it pushes ink through the firing chamber.



3. The ink droplet is ejected onto the paper and the steam bubble collapses, pulling more ink into the firing chamber.

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FIGURE 4-40

How ink-jet printers work.

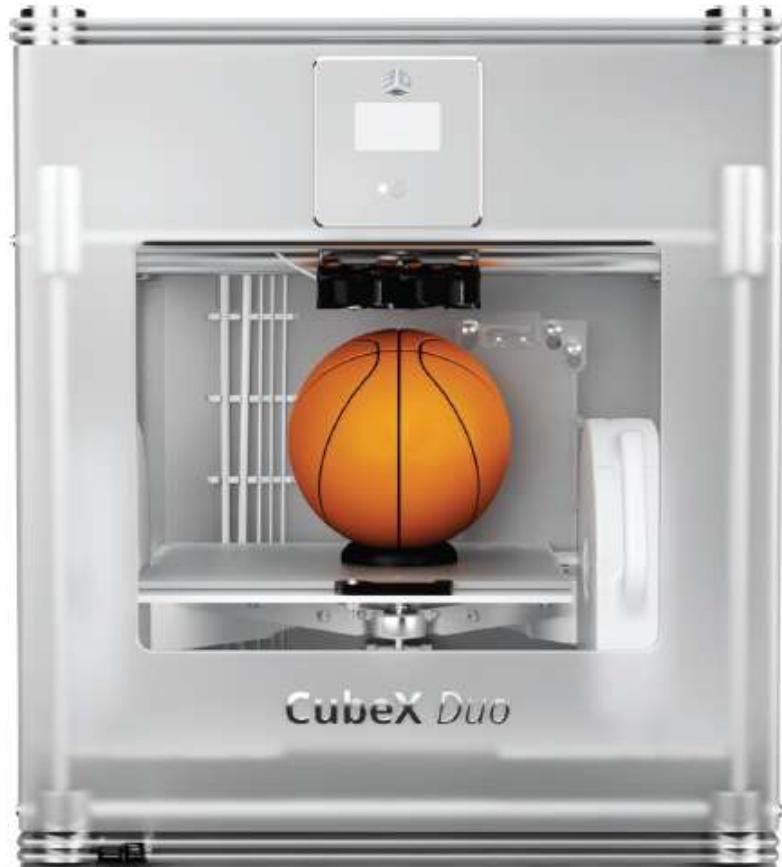


Special Purpose Printers

- Barcode, label, and postage printers
- Photo printers
- Portable and integrated printers
- Wide-format ink-jet printers
- 3D printers

FIGURE 4-44

3D printers. This printer can print objects up to the size of a standard basketball.



Courtesy 3D Systems, Inc.



Audio Output

- Audio Output
 - Voice, music, and other audible sounds
 - Common audio output devices
 - Computer speakers
 - Headphones and headsets
 - Earphones and earbuds



COMPUTER SPEAKERS
Used to output sound from a computer.



TABLET DOCK
Used to output sound from a media tablet.



HEADSETS
Used when both voice input and audio output are required.

FIGURE 4-45
Audio output devices.



Quick Quiz

1. Which of the following types of display devices should have the largest footprint (the amount of room taken up on a desk)?
 - a. CRT monitor
 - b. OLED display
 - c. LCD display
2. True or False: Laser printers can only print in black and white.
3. _____ printers form images with drops of liquid ink.

Answers:

- 1) a; 2) False; 3) Ink-jet printers



Summary

- Keyboards
- Pointing and Touch Devices
- Scanners, Readers, and Digital Cameras
- Audio Input
- Display Devices
- Printers
- Audio Output

15th Edition

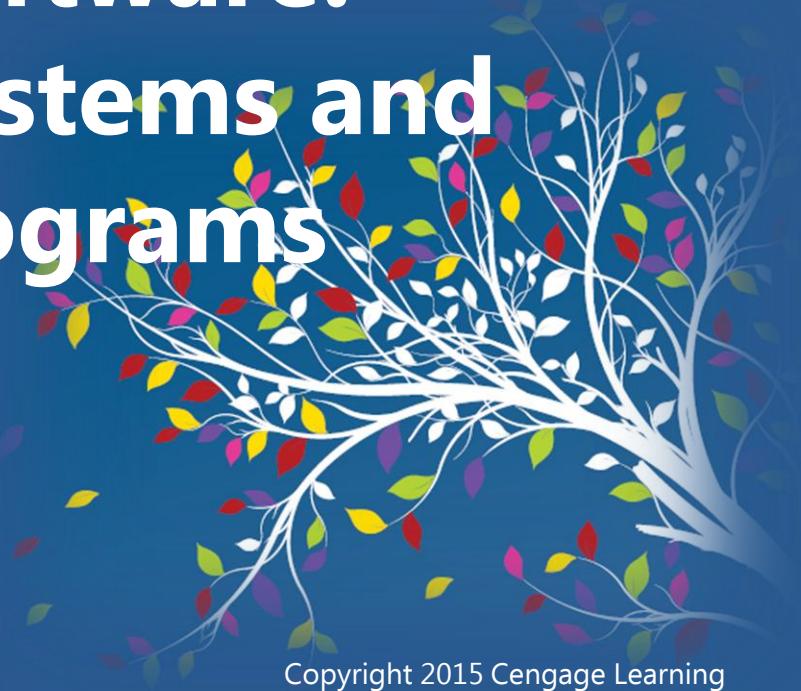
Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 5

System Software: Operating Systems and Utility Programs

Deborah Morley
Charles S. Parker



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Learning Objectives

1. Understand the difference between system software and application software.
2. Explain the different functions of an operating system and discuss some ways that operating systems enhance processing efficiency.
3. List several ways in which operating systems differ from one another.
4. Name today's most widely used operating systems for personal computers and servers.



Learning Objectives

5. State several devices other than personal computers and servers that require an operating system and list one possible operating system for each type of device.
6. Discuss the role of utility programs and outline several tasks that these programs perform.
7. Describe what the operating systems of the future might be like.



Overview

- This chapter covers:
 - Differences between system software and application software
 - Functions of and general differences between operating systems
 - Specific operating systems most widely used today
 - Functions of and various types of utility programs
 - A look at future of operating systems



System Software vs. Application Software

- System Software
 - The operating system and utility programs that control a computer system and allow you to use your computer
 - Enables the boot process, launches applications, transfers files, controls hardware configuration, manages files on the hard drive, and protects from unauthorized use
- Application Software
 - Programs that allow a user to perform specific tasks on a computer
 - Word processing, playing games, browsing the Web, listening to music, etc.



The Operating System

- Operating System
 - A collection of programs that manage and coordinate the activities taking place within a computer
 - Acts as an intermediary between the user and the computer and between the application programs and system hardware

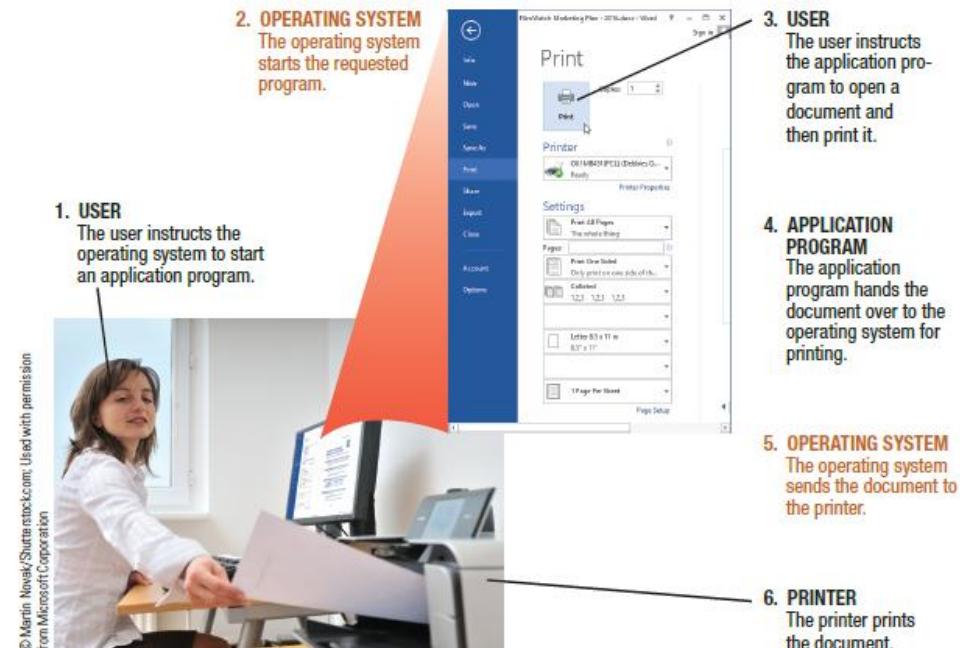


FIGURE 5-1
The intermediary role of the operating system.



Functions of an Operating System

- Interfacing with Users (typically via a GUI)
- Booting the Computer
 - Loads essential part of operating system (kernel) into memory
 - Reads opening batch of instructions
 - Determines hardware connected to computer
- Configuring Devices
 - Device drivers are often needed; can be reinstalled if needed
 - Plug and Play devices are recognized automatically



Functions of an Operating System

- Managing Network Connections
 - Manages wired connections to home or office network
 - Manages wireless connections at home, school, work, or on the go
- Managing and Monitoring Resources and Jobs
 - Makes resources available to devices and programs
 - Monitors for problems and attempts to correct those that arise
 - Schedules jobs
 - Jobs to be printed
 - Files to be retrieved from hard drive



Functions of an Operating System

- File Management
 - Keeps track of stored files on computer so they can be retrieved when needed
 - Files usually viewed in a hierarchical format
- Security
 - Passwords
 - Biometric characteristics
 - Firewalls



Functions of an Operating System

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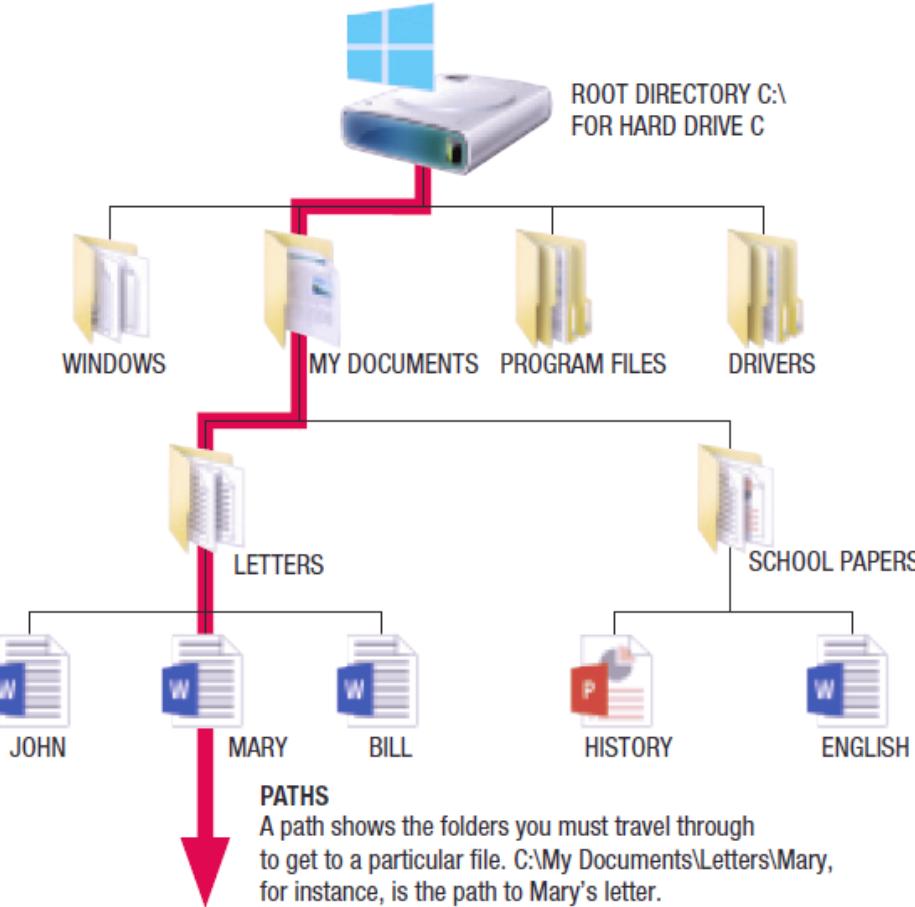


FIGURE 5-5
A sample hard drive organization.



Processing Techniques for Increased Efficiency

- Multitasking
 - The ability of an operating system to have more than one program (task) open at one time
 - CPU rotates between tasks
 - Switching is done quickly
 - Appears as though all programs executing at the same time



Processing Techniques for Increased Efficiency

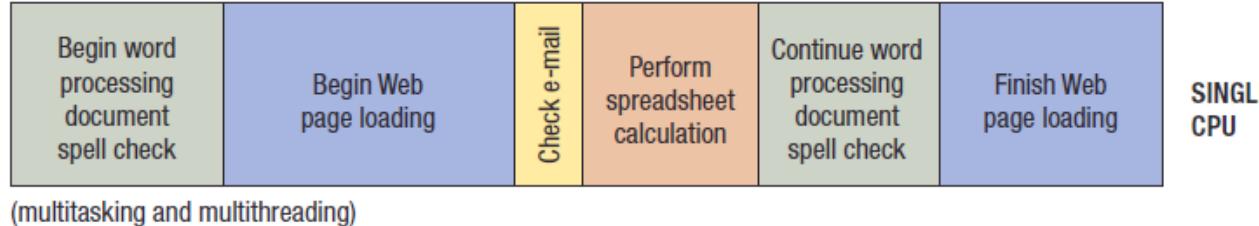
- Multithreading
 - The ability to rotate between multiple threads so that processing is completed faster and more efficiently
 - Thread
 - Sequence of instructions within a program that is independent of other thread
- Multiprocessing and Parallel Processing
 - Multiple processors (or multiple cores) are used in one computer system to perform work more efficiently
 - Tasks are performed sequentially



Processing Techniques for Increased Efficiency

SEQUENTIAL PROCESSING

Tasks are performed one right after the other.



SIMULTANEOUS PROCESSING

Multiple tasks are performed at the exact same time.

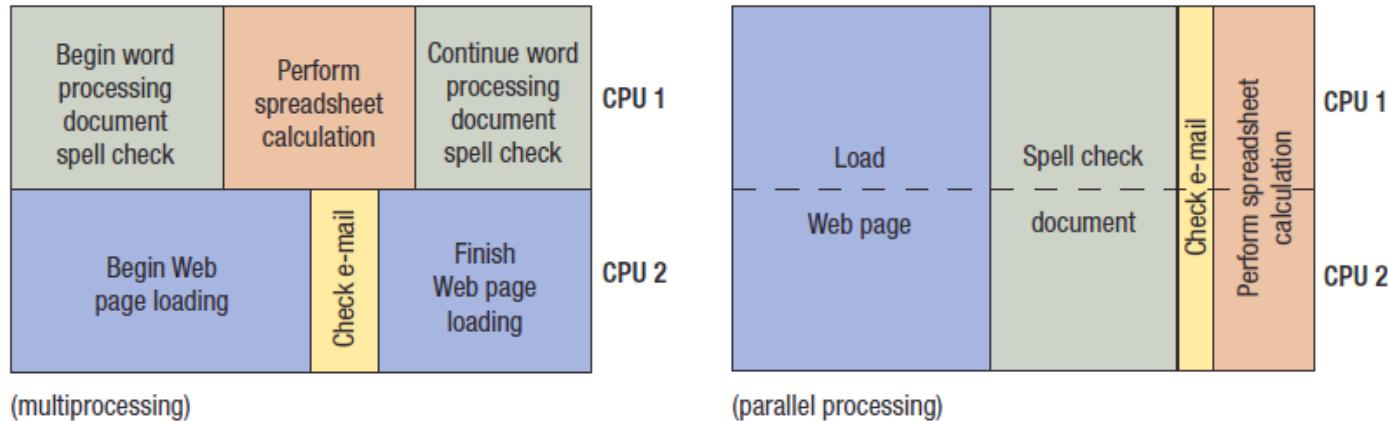


FIGURE 5-7
Sequential vs.
simultaneous
processing.



Processing Techniques for Increased Efficiency

- Memory Management
 - Optimizing the use of main memory (RAM)
 - Virtual memory
 - Memory-management technique that uses hard drive space as additional RAM

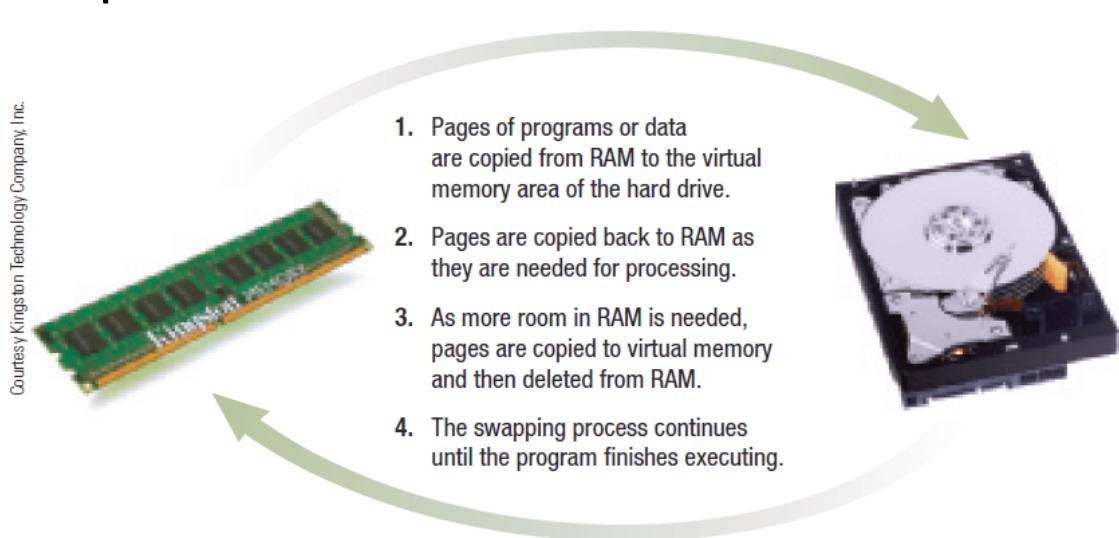


FIGURE 5-8
How virtual memory works.



Processing Techniques for Increased Efficiency

- Buffering and Spooling
 - Buffer
 - Area in RAM or on the hard drive designated to hold data that is used by different hardware devices or programs
 - Buffering or Spooling
 - Placing items in a buffer so they can be retrieved by the appropriate device when needed

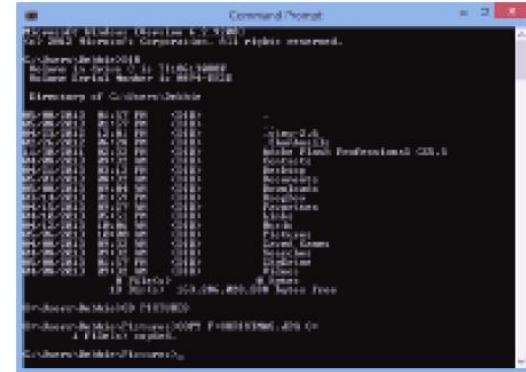


Differences Among Operating Systems

- Command Line Interface
 - Require users to input commands using the keyboard
 - Graphical User Interface
 - Graphics based interface
 - Used by most operating systems

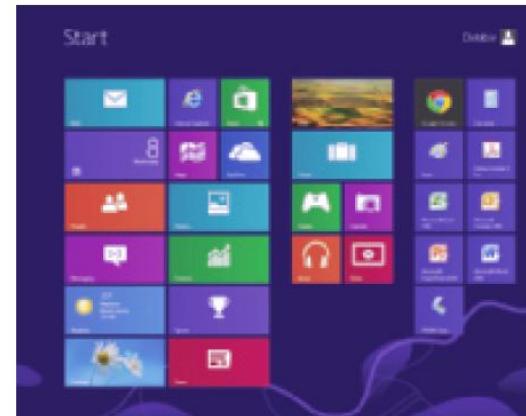
FIGURE 5-10

Command line vs. graphical user interfaces.



COMMAND LINE INTERFACE

Commands are entered using the keyboard



GRAPHICAL USER INTERFACE
Objects (such as icons, buttons, menus, and tiles) are selected with the mouse, pen, or finger to issue commands to the computer.



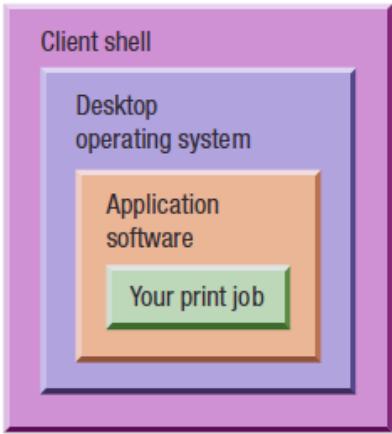
Differences Among Operating Systems

- Categories of Operating Systems
 - Personal (Desktop) Operating Systems
 - Designed to be installed on a single computer
 - Server (Network) Operating Systems
 - Designed to be installed on a network server
 - Client computers still use a personal operating system
 - Server operating system controls access to network resources
 - Mobile and embedded operating systems are also common



Differences Among Operating Systems

1. The client software provides a shell around your desktop operating system. The shell program enables your computer to communicate with the server operating system, which is located on the network server.



2. When you request a network activity, such as printing a document using a network printer, your application program passes the job to your desktop operating system, which sends it to the client shell, which sends it on to the server operating system, which is located on the network server.

Desktop computer running Windows and client software for the server operating system being used.



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3. The server operating system then lines up your job in its print queue and prints the job when its turn comes.



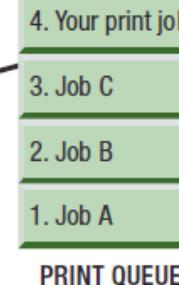
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Your print job

Network server running a server operating system.



Network printer



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 **FIGURE 5-11**
How network operating systems work.



Differences Among Operating Systems

- The Types of Processors Supported
 - Desktop, mobile, server processors
 - 32-bit or 64-bit CPUs
- Support for Virtualization and Other Technologies
 - New types of buses
 - Virtualization
 - Mobility
 - Security concerns
 - Power-consumption concerns
 - Touch and gesture input
 - The move to cloud



Quick Quiz

1. Which of the following processing techniques allows a computer to work with more than one program at a time?
 - a. Parallel processing
 - b. Virtual memory
 - c. Multitasking
2. True or False: Most operating systems today use a command line interface.
3. _____ is the task included with operating systems that allows you to keep track of the files stored on a PC.

Answers:

1) c; 2) False; 3) File management



Trend Box

Internet Monitors

- Locked-down system with restricted functionality
- Essentially just a monitor that provides Internet access
- Users can run apps but can't change settings so easier for businesses to provide Internet access without much maintenance





Operating Systems for Personal Computers and Servers

- DOS (Disk Operating System)
 - DOS traditionally used a command-line interface
 - Dominant operating system in the 1980s and early 1990s
 - PC-DOS
 - Created originally for IBM microcomputers
 - MS-DOS
 - Created for use with IBM-compatible computers
 - Can enter DOS commands in Windows



DOS

Used with permission from Microsoft Corporation

Microsoft Windows [Version 6.2.9200]
(c) 2012 Microsoft Corporation. All rights reserved.
C:\Users\Debbie>CD PICTURES
C:\Users\Debbie\Pictures>F:
F:\>COPY CHRISMAS.JPG C:
1 file(s) copied.
F:\>C:
C:\Users\Debbie\Pictures>DIR
Volume in drive C is 11106130NDF
Volume Serial Number is 0894-EE2E
Directory of C:\Users\Debbie\Pictures
05/09/2013 02:50 PM <DIR> .
05/09/2013 02:50 PM <DIR> ..
01/02/2013 10:28 AM <DIR> 2013-01-02 log cab
01/28/2013 08:34 AM <DIR> 2013-01-28 anne
05/06/2013 09:59 AM 29,160 Christmas.jpg

CHANGE DIRECTORY (CD) COMMAND

Changes to a new location on the current drive.

DRIVE COMMAND

Changes to a new drive.

COPY COMMAND

Copies files from one location to another.

DIRECTORY (DIR) COMMAND

Displays the files and folders in the current location.

FIGURE 5-12

DOS. Even though DOS has become technologically obsolete, Windows users can still issue DOS commands via the Command Prompt.



Windows

- Windows
 - The predominant personal operating system developed by Microsoft Corporation
 - Windows 1.0 through Windows Vista
 - Windows 1.0 released in 1985
 - Windows 1.0 through Windows 3.x were operating environments for DOS
 - Windows 95, Windows 98, and Windows ME
 - Designed for personal computers



Windows

- Windows NT (New Technology)
 - First 32-bit version of Windows designed for high-end workstations and servers
 - Replaced by Windows 2000
- Windows XP
 - Replaced both Windows 2000 and Windows Me
- Windows Vista
 - Replaced Windows XP
 - Introduced the Aero interface and Sidebar feature



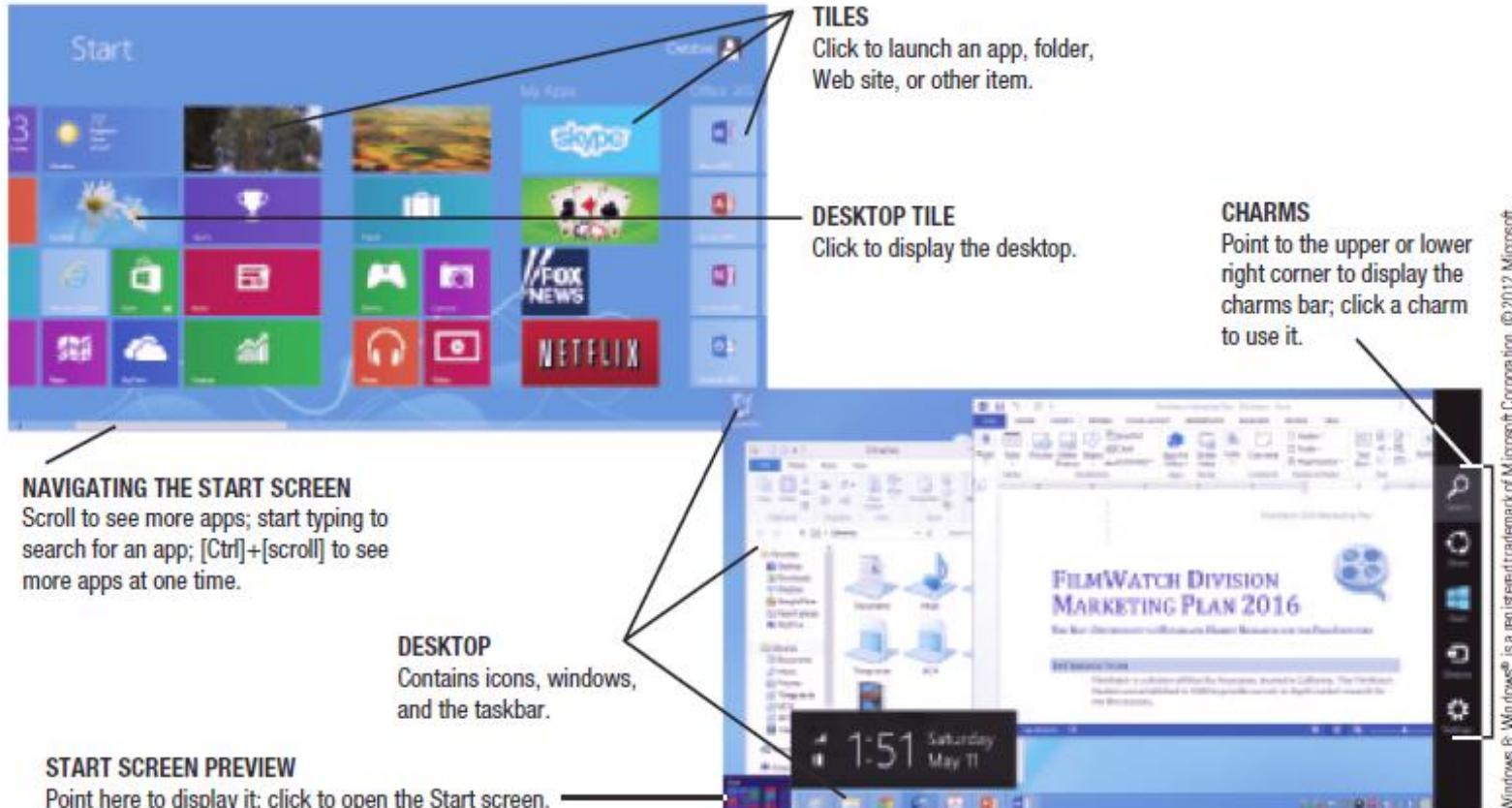
Windows

- Windows 7
 - Released in late 2009
 - Home Premium (primary version for home users)
 - Professional (primary version for businesses)
 - Libraries feature gives you virtual folders
- Windows 8
 - Current version of Windows
 - Designed to be used with smartphones, desktop computers, with or without a keyboard or mouse
 - Supports multi-touch input
 - Includes Start screen, tiles, and charms bar



Windows

WINDOWS 8 START SCREEN



WINDOWS 8 DESKTOP

FIGURE 5-14
Windows 8.



Windows

- Windows Server
 - The version of Windows designed for server use
 - Windows Server 2012 is the latest version
 - Supports both virtualization and cloud computing
- Windows Home Server
 - Preinstalled on home server devices
 - Designed to provide services for a home network
 - Can be set up to back up all devices in the home on a regular basis



Mac OS

- Mac OS
 - Proprietary operating system for computers made by Apple Corporation
 - Based on the UNIX operating system
 - Originally set the standard for graphical user interfaces
 - Mac OS X Family
 - Mac OS X Mountain Lion and Mac OS X Mavericks
 - Mac OS X Server
 - Server version of Mac OS X



Mac OS

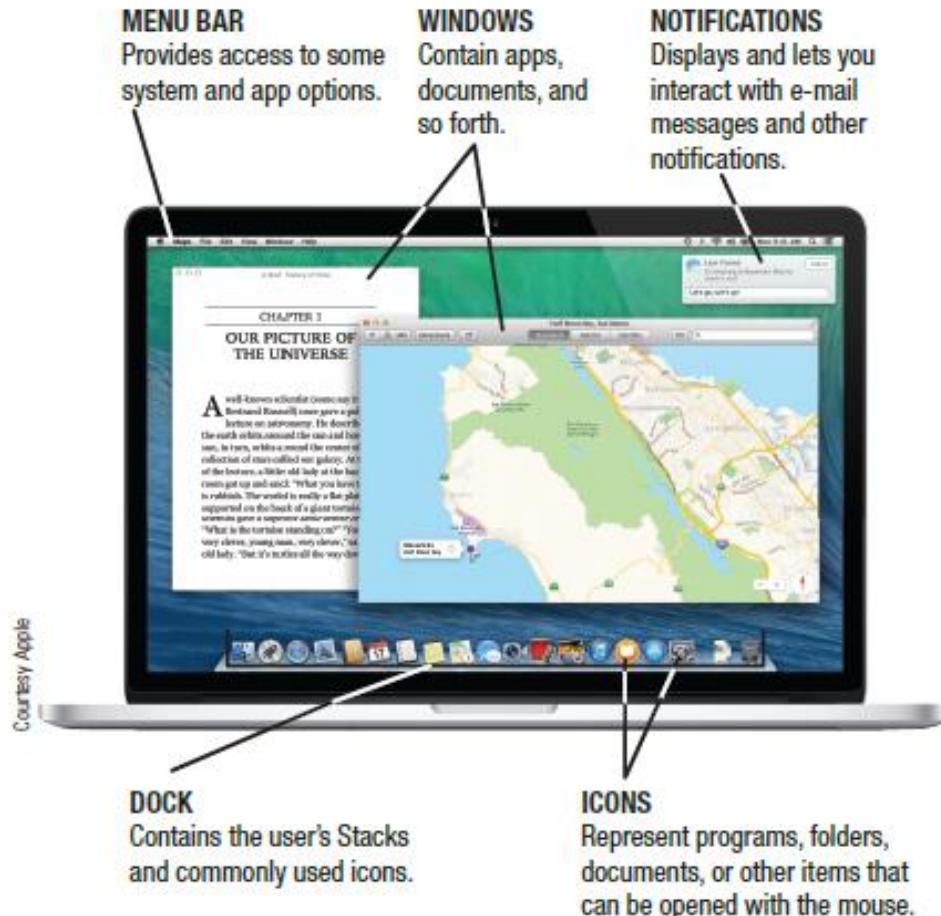


FIGURE 5-15

Mac OS X
Mavericks.



UNIX

- UNIX
 - Operating system developed in the late 1960s for midrange servers
 - Multiuser, multitasking operating system
 - More expensive, requires high level of technical knowledge; harder to install, maintain, and upgrade
 - “UNIX” initially referred to the original UNIX operating system, now refers to a group of similar operating systems based on UNIX
 - Single UNIX Specification
 - A standardized UNIX environment



Linux

- Linux
 - Developed by Linus Torvalds in 1991—resembles UNIX but was developed independently
 - Is open-source software; has been collaboratively modified by volunteer programmers all over the world
 - Originally used a command line interface, most recent versions use a GUI
 - Strong support from mainstream companies, such as IBM, NVIDIA, HP, Dell, and Novell
 - Individuals and organizations are switching to Linux and other open source software because of cost

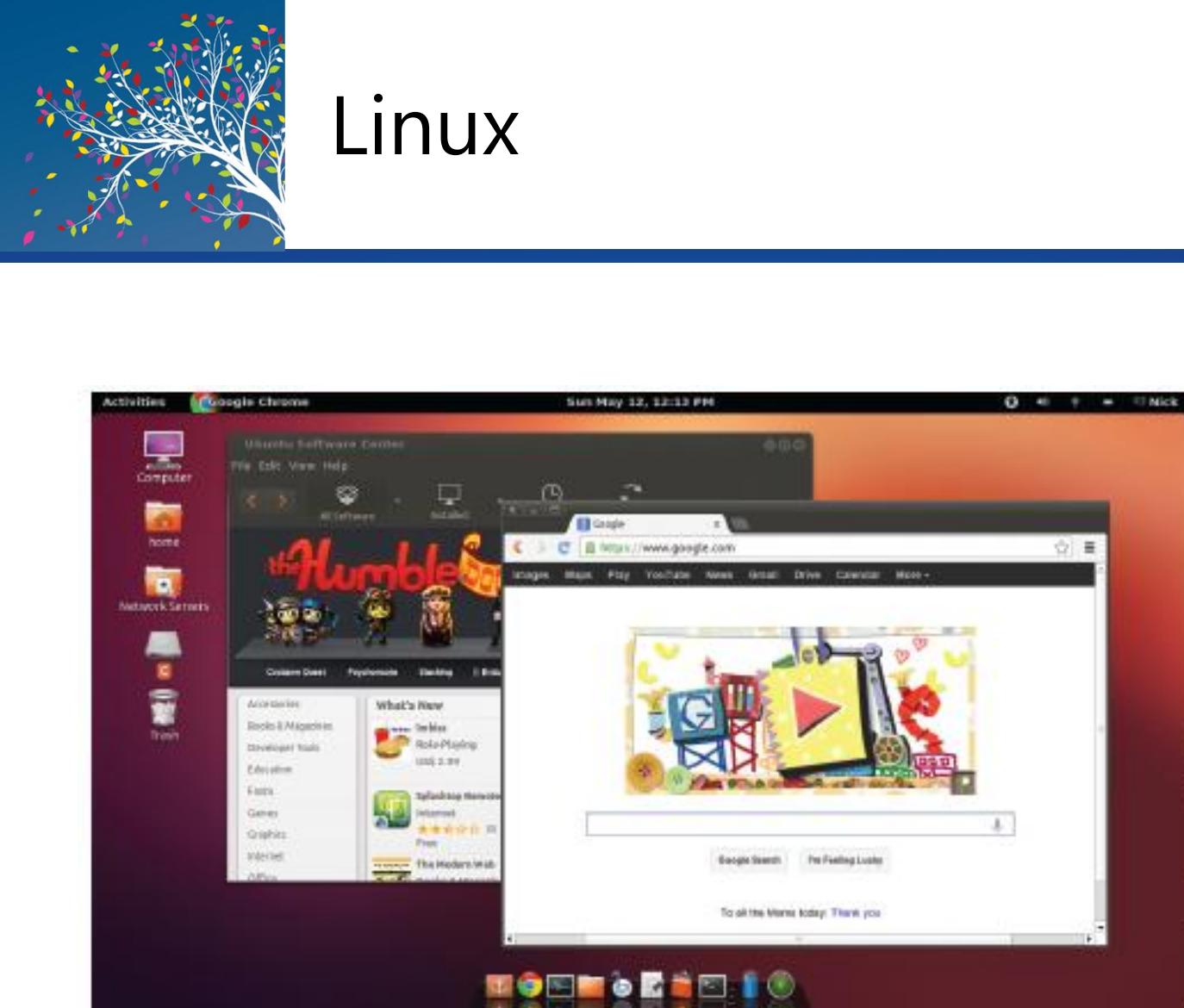


FIGURE 5-16

Linux. This version is Ubuntu, one of the most widely-used Linux operating systems.

Courtesy Ubuntu; Courtesy Nick Morley



Chrome OS

- Chrome OS
 - The first cloud operating system
 - Essentially is the Chrome Web browser redesigned to run a computer, in addition to accessing Web resources
 - Replaces traditional desktop operating systems
 - Is currently only available preinstalled on Chrome devices



Quick Quiz

1. Which of the following is the most recent personal version of Windows?
 - a. Windows 8
 - b. Windows Leopard
 - c. Windows XP
2. True or False: Linux is an open source operating system available for free via the Internet.
3. The operating system most commonly used on Apple personal computers is _____.

Answers:

- 1) a; 2) True; 3) Mac OS



Technology and You Box

Smart Cars

- Use of computers in cars has skyrocketed
- Self-driving systems and self-parking systems
- Lane departure and blind spot detection systems
- Windshield displays
- Collision warnings and auto brake systems
- Keyless entry and ignition systems
- Distraction-prevention systems
- Safety of gadgets is a concern



Courtesy Audi



Operating Systems for Mobile Devices

- Windows Phone 8, Windows RT, and Windows Embedded
 - Windows Phone
 - Latest version of Windows designed for smartphones
 - Windows Phone 8 is based on the Windows 8 operating system
 - Windows RT
 - Designed for tablet use
 - Windows Embedded
 - Designed primarily for consumer and industrial devices that are not personal computers



Operating Systems for Mobile Phones and Other Devices

- Android
 - Linux-based operating system created with current mobile device capabilities in mind
 - Can create applications that take full advantage of all the features a mobile device has to offer
 - Open platform
 - Current version is Android 4.3, also known as Jelly Bean
 - Devices support multitasking, multiple cores, NFC mobile payment transactions, Internet phone calls



Operating Systems for Mobile Phones and Other Devices



FIGURE 5-18

Android is used with both phones (left) and media tablets (right).



Operating Systems for Mobile Phones and Other Devices

- iOS
 - Designed for Apple Mobile phones and mobile devices
 - Current version is iOS 7
 - Supports multitasking
 - Includes Safari Web browser, the Siri intelligent assistant, *Facetime* video calling, *AirDrop* to send items to others, and apps for email, messaging, music, and search



Operating Systems for Mobile Phones and Other Devices



FIGURE 5-19

iOS.

Courtesy Apple



Operating Systems for Mobile Phones and Other Devices

- Blackberry OS and Blackberry PlayBook OS
 - Designed for Blackberry devices
- Mobile Linux
 - Other mobile operating systems based on Linux besides Android and iOs
 - Ubuntu, webOS, Firefox OS, and Tizen



Operating Systems for Larger Computers

- Larger computers sometimes use operating systems designed solely for that type of system
- IBM's z/OS is designed for IBM mainframes
- Windows, UNIX, and Linux are also used with servers, mainframes, and supercomputers
- Larger computers may also use a customized operating system based on a conventional operating system



Inside the Industry Box

Weather Forecasting in the Alps

- Weather forecasting is difficult in the Alps due to complex topography and intense precipitation
- Supercomputer Piz Daint is Linux based, uses CPUs and GPUS, and runs at 750 teraflops
- Can run 30 weather forecasting models simultaneously
- Cooled with water from a nearby lake



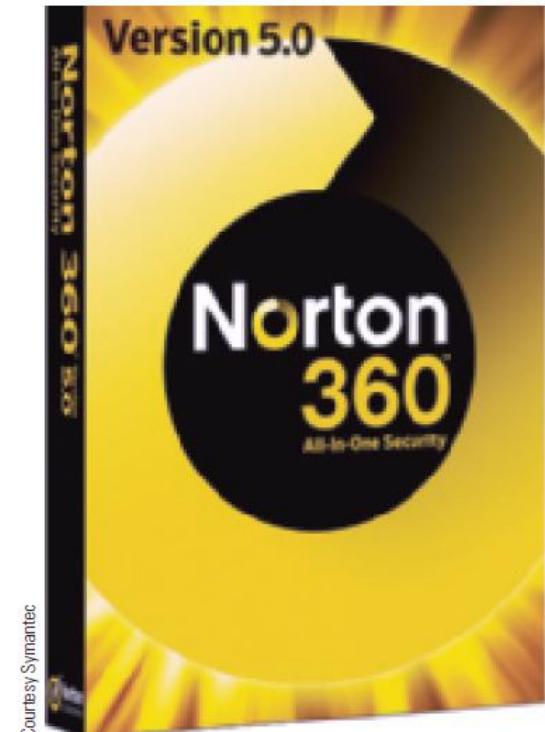


Utility Programs

- Utility Program
 - Software that performs a specific task, usually related to managing or maintaining the computer system
 - Many utilities are built into operating systems (for finding files, viewing images, backing up files, etc.)
 - Utilities are also available as stand-alone products and as suites

FIGURE 5-20

Utility suites. Utility suites contain a number of related utility programs.



Courtesy Symantec

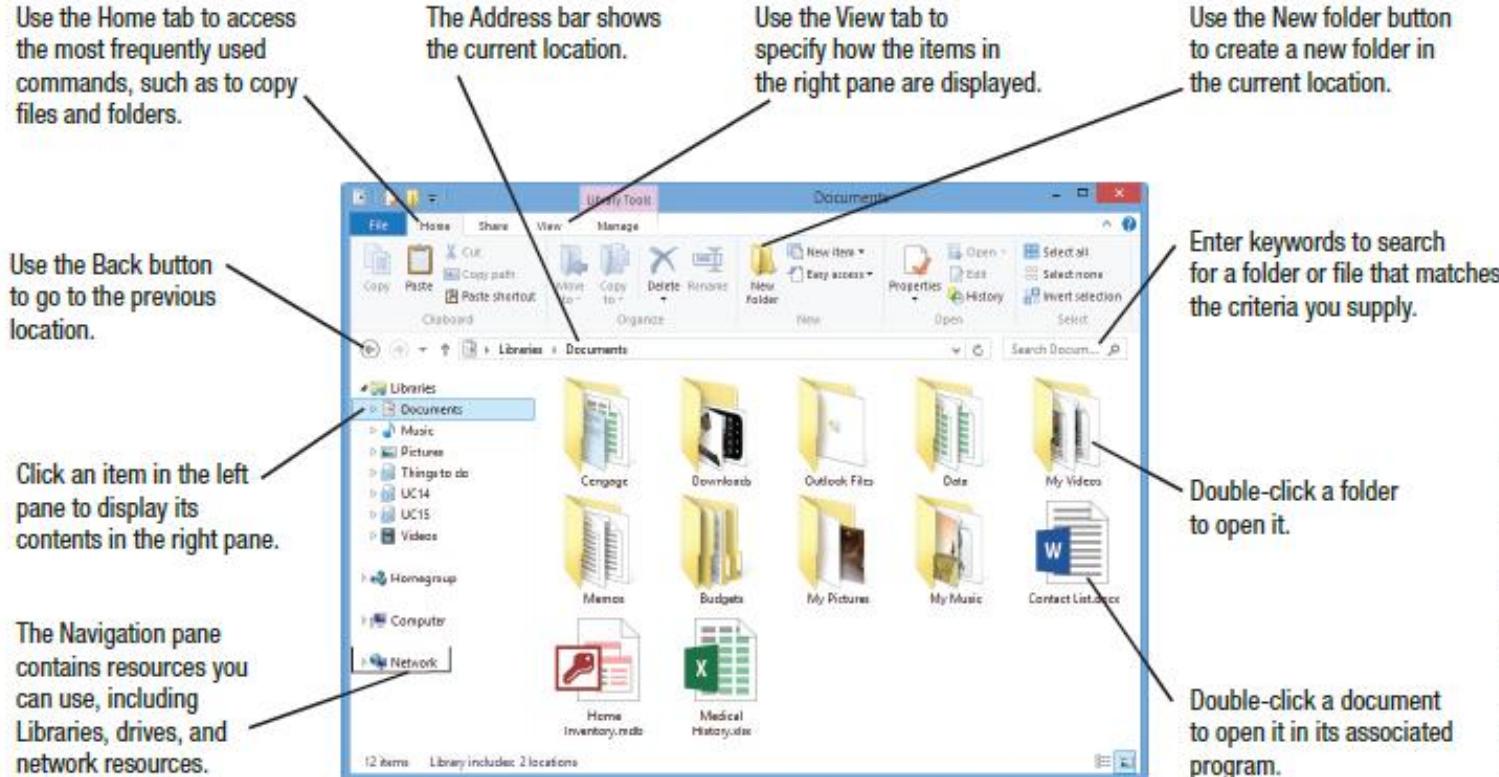


File Management Programs

- Enable the user to perform file management tasks, such as:
 - Looking at the contents of a storage medium
 - Copying, moving, and renaming files and folders
 - Deleting files and folders
 - File management program in Windows 8 is File Explorer
 - To copy or move files, use the Home tab to copy (or cut) and then paste
 - To delete files, use the Delete key on the keyboard or the Home tab



File Management Programs



Used with permission from Microsoft Corporation

FIGURE 5-21
Using File Explorer to look at the files stored on a computer.

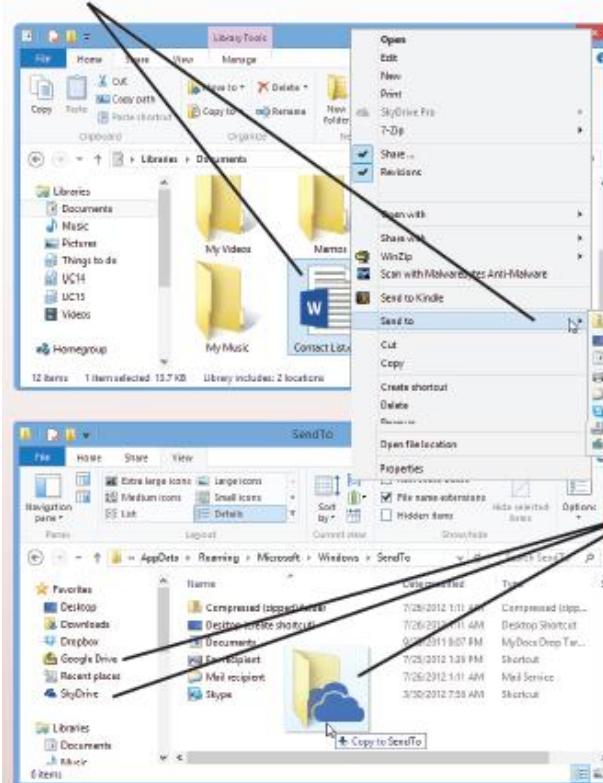


How It Works Box

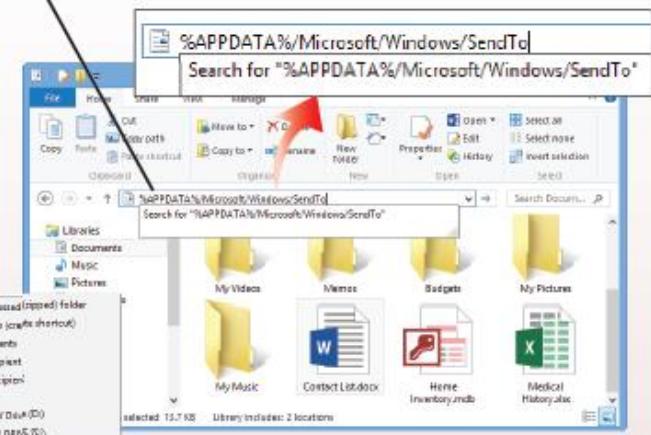
Sending to the Cloud

- Add cloud locations to the Send To menu
- Google Drive, SkyDrive, etc.

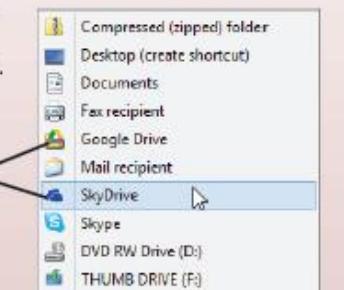
Step 1: Right-click an item to display the *Send to* menu.



Step 2: To open the SendTo folder, type this command in the Address bar.



Step 3: Copy your desired locations (such as your SkyDrive or Google Drive favorites) to the SendTo folder.



Step 4: The new locations will now appear on the *Send to* menu.



Utility Programs

- Search Tools
 - Designed to search for documents and other files on the user's hard drive
 - Windows 8 has Search charm to search for files, apps, and Store items
 - Are often integrated into file management programs
 - Third-party search tools are also available
- Diagnostic and Disk Management Programs
 - Diagnostic programs evaluate your system and make recommendations for fixing any errors found
 - Disk management programs diagnose and repair problems related to your hard drive



Utility Programs

- Uninstall and Cleanup Utilities
 - Uninstall utilities remove programs from your hard drive without leaving bits and pieces behind
 - Important to properly uninstall programs, not just delete them
 - Cleanup utilities delete temporary files
 - Files still in Recycle Bin
 - Temporary Internet files
 - Temporary installation files



Utility Programs

- File Compression Programs
 - Reduce the size of files to optimize storage space and transmission time
 - Both zip and unzip files
 - WinZip (Windows users) and Stuffit (Mac users)
- Backup and Recovery Utilities
 - Make the backup and restoration process easier
 - Creating a backup means making a duplicate copy of important files
 - Can use a recordable or rewritable CD or DVD disc, a USB flash drive, or an external hard drive



Utility Programs

- Good backup procedures are critical for everyone
 - Individuals should back up important documents, e-mail, photos, home video, etc.
 - Performing a backup can include backing up an entire computer (so it can be restored at a later date)
 - Can do the backup manually or use backup utility programs (stand alone or those built into operating systems)
 - Can also backup individual files as they are modified

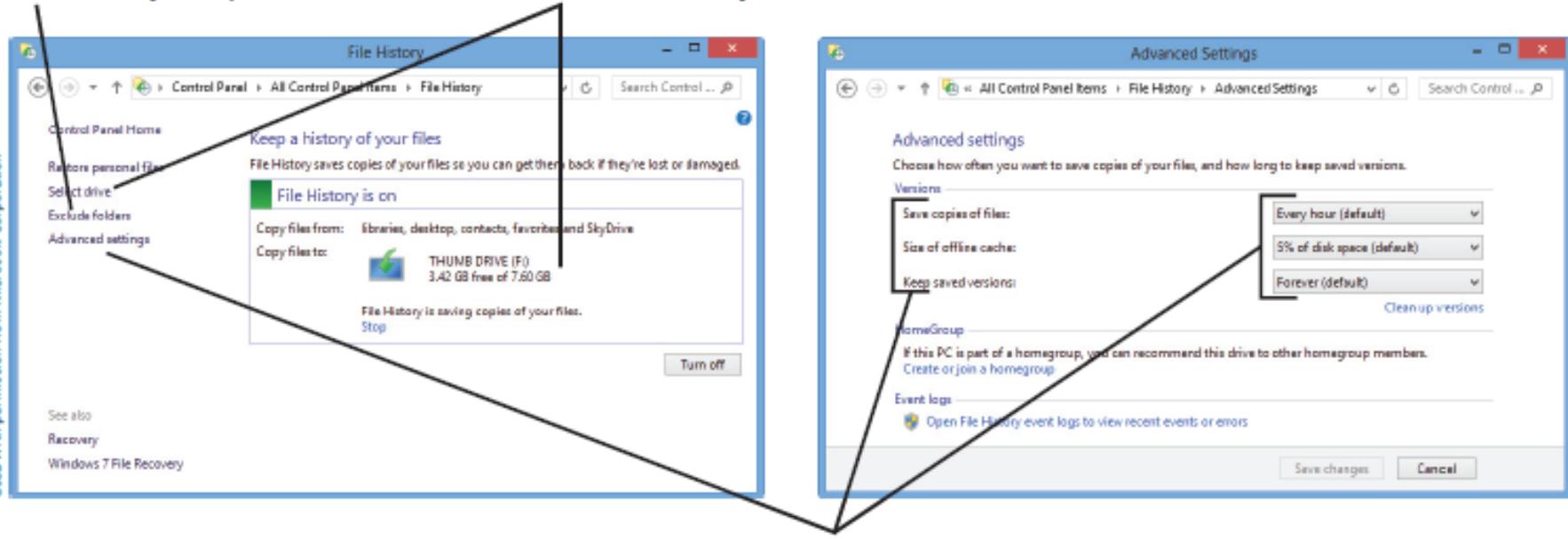


Utility Programs

Click to exclude any folders from the File History backup.

Click to select the drive to be used with File History.

Used with permission from Microsoft Corporation



Use the Advanced settings to specify how often files are saved and how long they are kept.

FIGURE 5-26
The Windows File History program.



Utility Programs

- Antivirus, Antispyware, Firewalls, and Other Security Programs
 - Security Concerns
 - Viruses, spyware, identity theft, phishing schemes
 - Security programs protect computers and users and it is essential that all computer users protect themselves and their computers
 - Antivirus programs
 - Antispyware programs
 - Firewalls
 - Many are included in Windows and other operating systems



The Future of Operating Systems

- Will continue to become more user-friendly
- Will eventually be driven primarily by a voice interface, touch, and/or gesture interface
- Likely to continue to become more stable and self-healing
- Will likely continue to include security and other technological improvements as they become available
- Will almost certainly include improvements in the areas of synchronizing and coordinating data and activities among a person's various computing and communicating devices
- May be used primarily to access software available through the Internet or other networks



Quick Quiz

1. Which of the following is the type of utility program used to make a file smaller for transfer over the Internet?
 - a. Uninstall program
 - b. Antivirus program
 - c. File compression program
2. True or False: A file management program can be used to see the files located on a storage medium.
3. A(n) _____ is a duplicate copy of one or more files that can be used if there is a problem with the original files.

Answers:

- 1) c; 2) True; 3) backup



Summary

- System Software vs. Application Software
- The Operating System
- Operating Systems for Personal Computers and Servers
- Operating Systems for Mobile Phones and Other Devices
- Operating Systems for Larger Computers
- Utility Programs
- The Future of Operating Systems

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Chapter 6:

Application Software



**Deborah Morley
Charles S. Parker**

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Learning Objectives

1. Describe what application software is, the different types of ownership rights, and the difference between installed and cloud software.
2. Detail some concepts and commands that many software programs have in common.
3. Discuss word processing and explain what kinds of documents are created using this type of program.
4. Explain the purpose of spreadsheet software and the kinds of documents created using this type of program.



Learning Objectives

5. Identify some of the vocabulary used with database software and discuss the benefits of using this type of program.
6. Describe what presentation graphics and electronic slide shows are and when they might be used.
7. List some types of graphics and multimedia software that consumers use frequently.
8. Name several other types of application software programs and discuss what functions they perform.



Overview

- This chapter covers:
 - General characteristics of application software
 - The most widely used types of application software, including:
 - Word processing
 - Spreadsheet
 - Database
 - Presentation graphics
 - Graphics and multimedia software
 - Overview of other types of application software



The Basics of Application Software

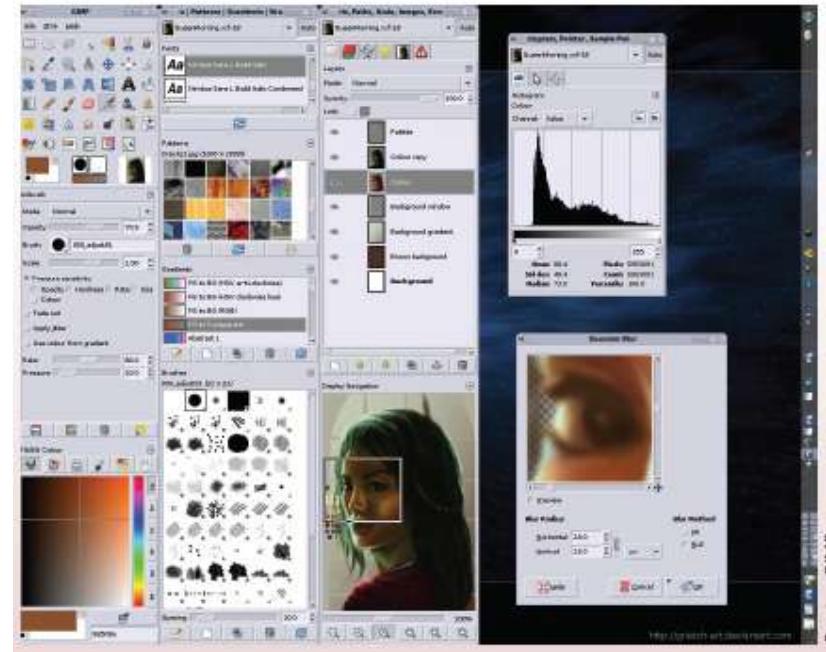
- Software Ownership Rights
 - Specify the allowable use of the program
 - Software license
 - Gives you the right to use a software program
 - Specifies the conditions under which the buyer can use the software
 - Open source software
 - Programs with source code made available to the general public



Inside the Industry Box

Open Source Software

- Use is growing
- In addition to Linux and other open source operating systems, there are many open source apps
- Open source is typically cheaper
- Can also be more stable and
- secure



The GNU Image Manipulation Program (GIMP).

Courtesy GIMP



The Basics of Application Software

- Commercial Software
 - Copyrighted software developed and sold for profit
 - Typically comes with a single-user license
- Shareware
 - Copyrighted software distributed on the honor system
 - Consumers should either pay for it or uninstall it after the trial period
- Freeware
 - Copyrighted software programs that are given away by the author for others to use free of charge
- Public Domain Software
 - Software that is not copyrighted and ownership rights have been donated to the public domain



The Basics of Application Software

TYPE OF SOFTWARE	EXAMPLES
Commercial software	Microsoft Office (office suite) Norton AntiVirus (antivirus program) Adobe Photoshop (image editing program) Minecraft - Pocket Edition (game)
Shareware	WinZip (file compression program) Video Edit Magic (video editing program) Image Shrinker (image optimizer) Deluxe Ski Jump 3 (game)
Freeware	Chrome (Web browser) LibreOffice (office suite) QuickTime Player (media player) Evernote (notetaking/archiving software)
Public domain software	Lynx (text-based Web browser) Quake 3 (game)

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FIGURE 6-2

Software ownership rights.



Desktop vs. Mobile Software

- Personal computers use desktop software
- Smartphones and other mobile devices typically require mobile software called apps
 - Specifically designed for a specific type of device
 - Wide range of software available via app stores (Google Play, Apple App Store, etc.)



Courtesy Instagram; Courtesy Dunduck Media, Inc.; Google screenshots © Google Inc. and used with permission; Courtesy RunMyJava; Theta images; iStock Images © 2011 eBay Inc. All Rights Reserved.

FIGURE 6-5

Mobile apps.



Technology and You Box

Mobile Ticketing

- Download ticket to mobile device to use for admittance
- Tickets for movies, sporting events, concerts, etc.
- Boarding passes
- Custom tickets





Installed vs. Cloud Software

- Installed Software
 - Must be installed on the computer before it can be run
 - Can be purchased in physical form
 - Can be downloaded from the Internet

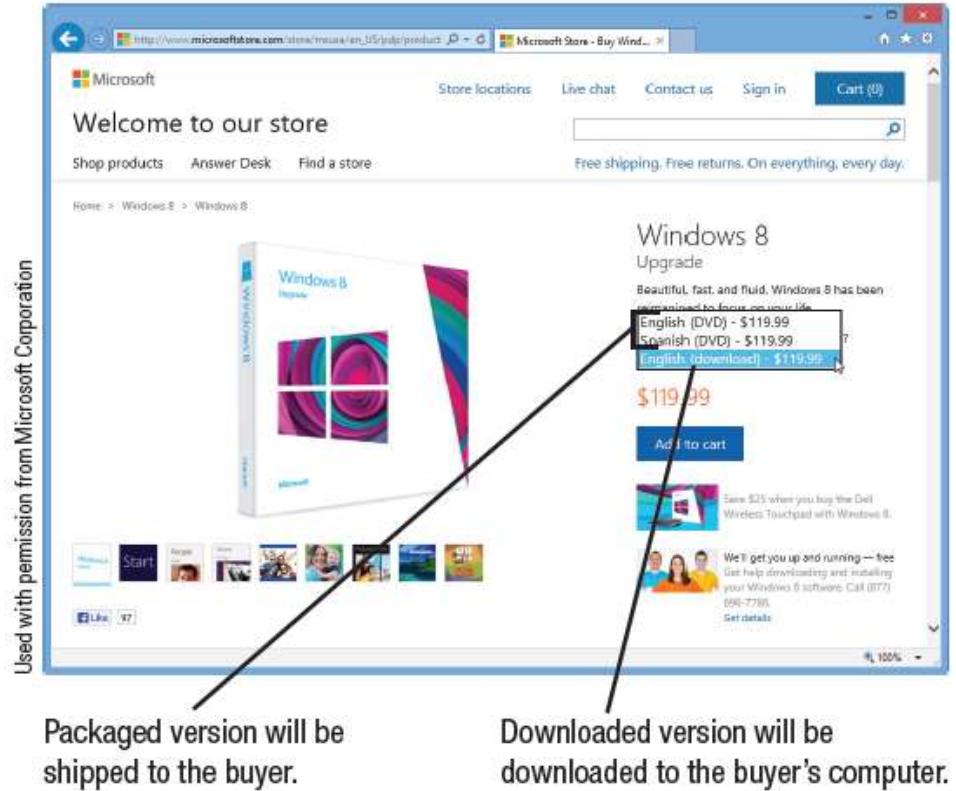


FIGURE 6-6

Installed software.

Is often purchased via the Internet.



Installed vs. Cloud Software

- Cloud Software
 - Is delivered on-demand via the Web
 - Also called Software as a Service (SaaS) and cloudware
 - Includes free software and fee-based software
 - Advantages of cloud software
 - Files can be accessed from any computer with an Internet connection
 - Ease of implementation
 - Improved collaboration capabilities
 - Always working with the most current version of software



Installed vs. Cloud Software

- Potential disadvantages of cloud software
 - Online applications tend to run more slowly
 - Have file size limits
 - Cost may eventually exceed the cost of purchasing a similar installed version of the software



Installed vs. Cloud Software



BUSINESS SaaS APPLICATIONS

This program allows you to share documents and collaborate on projects online.

Google Docs

Office on Demand



WEB DATABASE APPLICATIONS

This application allows you to retrieve property information, such as home values and homes for sale.

Courtesy of Zillow. Google is a trademark of Google Inc. © 2012 Zillow.com, Inc. Used with permission. Used with permission from Microsoft Corporation.

CLOUD PRODUCTIVITY APPLICATIONS

These programs allow you to create documents online.

FIGURE 6-7

Cloud software is commonly used with both computers and mobile devices.



Trend Box

Airline Apps

- American Airlines is issuing media tablets to all cabin personnel and iPads to all pilots
- Replaces paper manuals and maps
- Expected to be able to provide passengers with additional services such as connection and weather info and food purchases and other in-flight transactions





Software Suites

- Software Suites
 - Collection of software programs bundled together and sold as a single software package
 - Office suites are used by most businesses/individuals to produce documents and typically include:
 - Word processing software
 - Spreadsheet software
 - Database software
 - Presentation graphics-software
 - Provide a common interface among programs in the suite

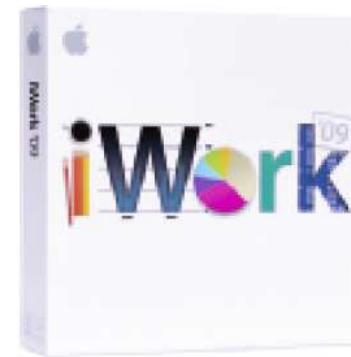
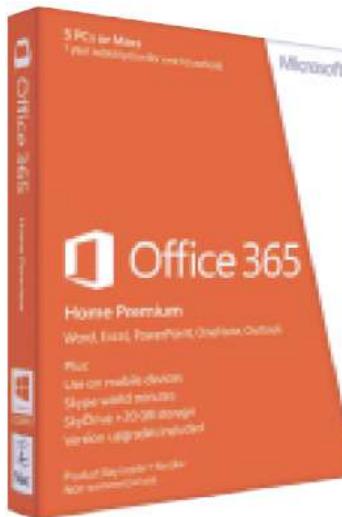


Software Suites

- Latest version of Office is 2013 (traditional installed)/365 (subscription)
 - Office on Demand
 - Read mode

FIGURE 6-8

Office suites. Three of the most common commercial office suites are Microsoft Office, Corel WordPerfect Office, and Apple iWork.



Courtesy Apple



Common Software Commands

- Toolbars, Menus, Keyboard Shortcuts, and the Ribbon
 - Provide access to most commands in application programs
 - Keyboard shortcuts can be used

FIGURE 6-9

Common application software commands.

COMMAND	COMMAND BUTTON	KEYBOARD SHORTCUT	DESCRIPTION
Open		Ctrl+O	Opens a dialog box so you can choose a saved document to open from a storage medium so it can be edited or printed.
Save		Ctrl+S	Saves the current version of the document to a storage medium.
Print		Ctrl+P	Prints the current version of the document onto paper.
Cut		Ctrl+X	Moves the selected item to the Clipboard.
Copy		Ctrl+C	Copies the selected item to the Clipboard.
Paste		Ctrl+V	Pastes the last item copied or cut to the Clipboard to the current location.
Undo		Ctrl+Z	Undoes the last change to the document.
Close		Alt+F4	Closes the document. Any changes made to the document are lost if the document wasn't saved first.

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Common Software Commands

- Ribbon used in Microsoft Office 2007 and later
 - Commands are organized into groups located on tabs
 - Contextual tabs appear on the Ribbon as needed and contain special commands

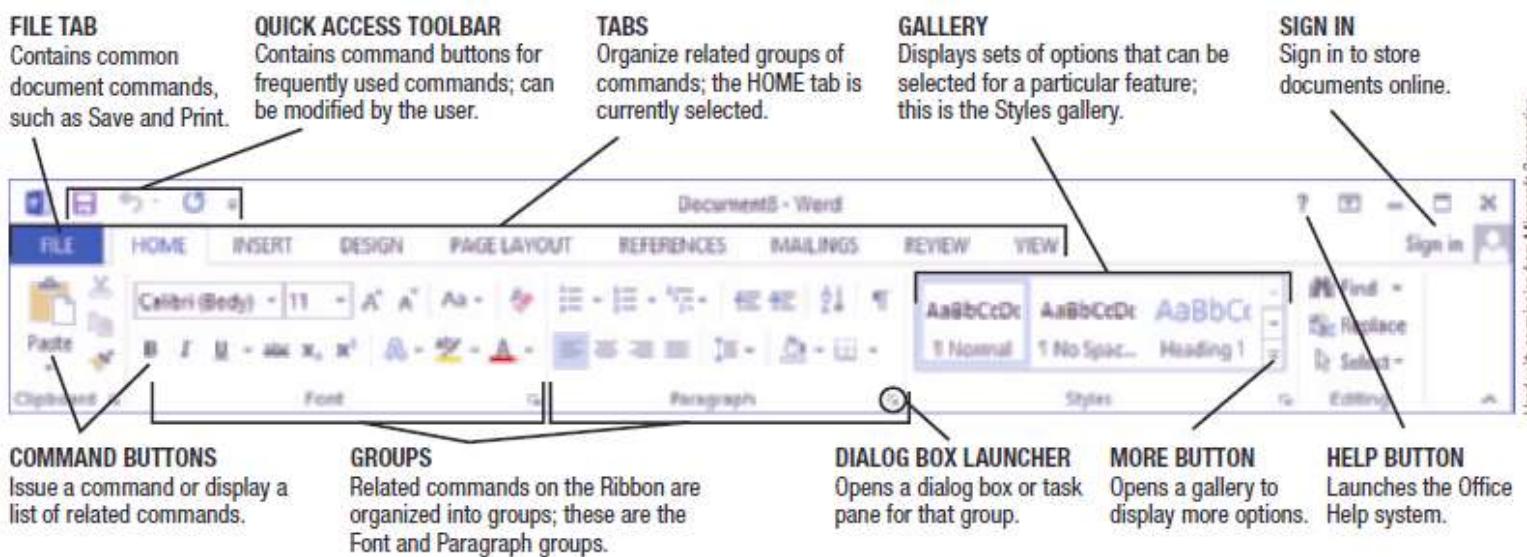


FIGURE 6-10

The Microsoft Office Ribbon.



Common Software Commands

- Editing a Document
 - Changing the content of the document, such as inserting or deleting words
 - Insertion point
 - Indicates the current location in a document, which is where the changes will be made
 - Typing text inserts the text at the insertion point location
 - Delete and Backspace keys delete text
 - Text and objects can typically be selected and moved, copied, deleted, or formatted



Common Software Commands

- Formatting a Document
 - Changes the appearance of the document
 - Changes font face, font size, and/or font color
 - Changes line spacing or margins
 - Adds page numbers and/or borders

This is 10-point Arial.

This is 12-point Times New Roman.

This is 16-point Lucida Handwriting.

This is 20-point Calibri.

This 16-point Calibri text is bold and italic.

This 16-point Calibri text is red and underlined.

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FIGURE 6-11

Fonts. The font face, size, style, and color used with text can be specified in many application programs.



Common Software Commands

- Getting Help
 - Often built into the program and typically contains:
 - Table of Contents
 - Browsing
 - Search
 - Online help (via manufacturer's Web site and independent sites)
 - Offline help (periodicals, books, tutorial videos, classes)



Quick Quiz

1. Software programs that are distributed on the honor system and can be legally and ethically shared with others to try out the software are referred to as _____.
 - a. shareware programs
 - b. commercial software
 - c. public domain software
2. True or False: Software purchased via the Internet is always in downloaded, not packaged, form.
3. A group of related software programs sold together as one unit is called a(n) _____.

Answers:

1) a; 2) False; 3) software suite



Word Processing Concepts

- What Is Word Processing?
 - Using a computer and word processing software to create, edit, save, and print written documents such as letters, contracts, and manuscripts
 - Common Word Processing Software Programs
 - Microsoft Word
 - Corel WordPerfect
 - Apple Pages



How It Works Box

Gesture Input with Microsoft Office

- Microsoft Office and Windows 8 support gestures to replace mouse commands
- Tap, Press and hold, Slide, Swipe, Pinch, and Stretch





Word Processing Concepts

- Creating a Word Processing Document
 - Word wrap
 - Automatically returns the insertion point to the next line when the end of the screen line is reached
 - Character formatting (font face, size, style, or color)
 - Paragraph formatting (line spacing, indentation, alignment, and styles)
 - Page formatting (margins, paper size, orientation, headers, footers, etc.)
 - Document formatting (footnotes, end notes, table of contents, index, background, theme)



Word Processing Concepts

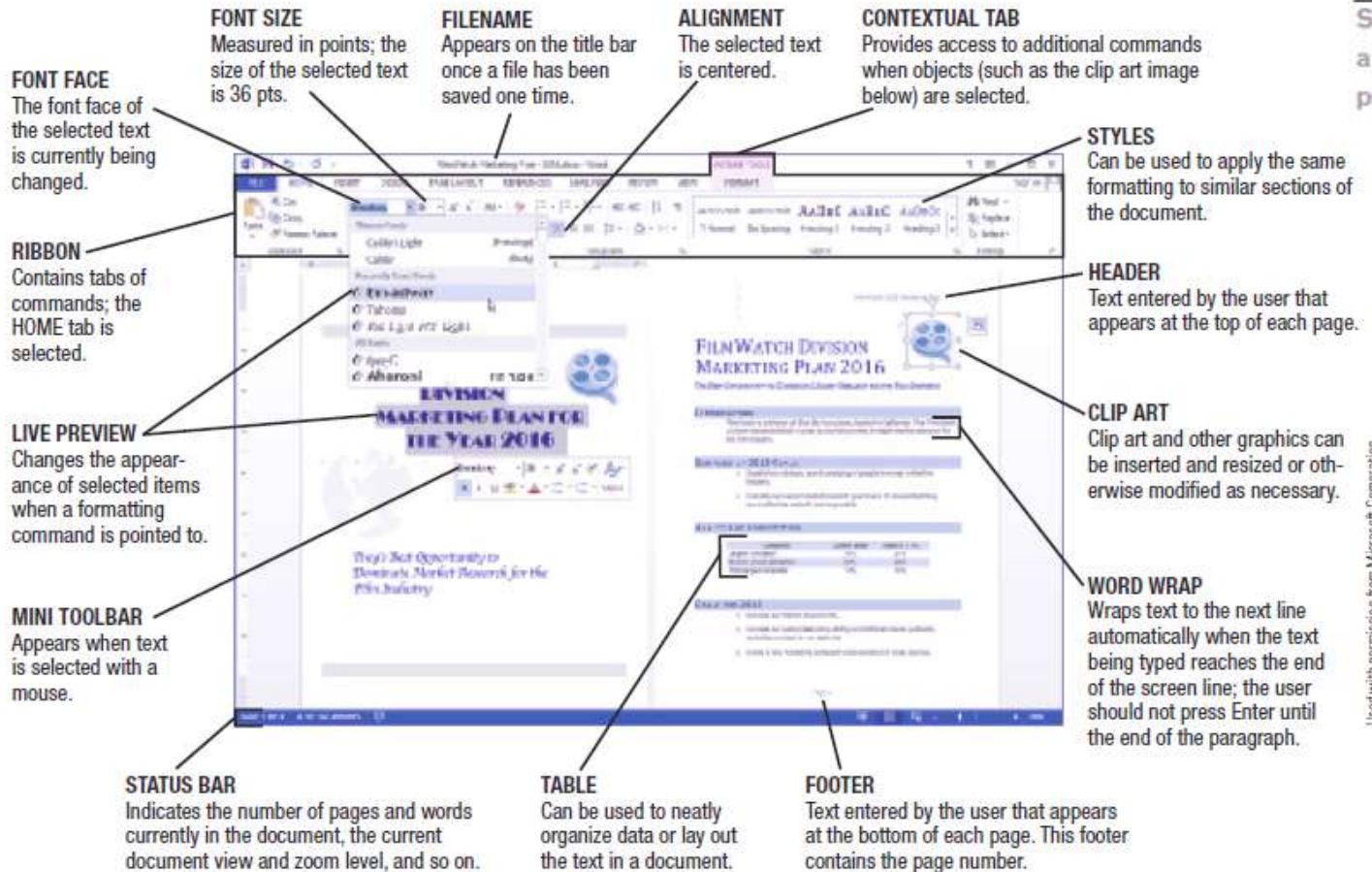


FIGURE 6-13

Some features in a typical word processing program.

Used with permission from Microsoft Corporation



Word Processing Concepts

- Tables, Graphics, and Templates
 - Tables
 - Allow content to be organized in a table consisting of rows and columns
 - Graphics or Drawing Features
 - Allow images to be inserted into a document (clip art, photographs, drawn images, etc.) and then modified
 - Templates
 - Help users create new documents quickly



Word Processing Concepts

- Word Processing and the Web
 - Most word processing programs today include Web-related features allowing you to:
 - Send a document as an e-mail message
 - Include Web page hyperlinks in documents
 - Create or modify Web pages
 - Create and publish blogs
 - Collaborate with others online



Spreadsheet Concepts

- What Is a Spreadsheet?
 - Documents containing a group of numbers and other data organized into rows and columns
 - Spreadsheet software includes the following tools
 - Formulas, data analysis tools, charts, and graphs
 - Most widely used spreadsheet programs:
 - Microsoft Excel
 - Corel Quattro Pro
 - Apple Numbers



Spreadsheet Concepts

- Creating a Spreadsheet
 - Worksheet: a single spreadsheet
 - Workbook: a collection of worksheets saved in a single file
 - Worksheets are divided into rows and columns
 - Cell
 - The intersection of a row and a column
 - Each cell is identified by a cell address, such as A1
 - Cell pointer is used to select a cell
 - Cell pointer can be used to select more than one cell (range or block)



Spreadsheet Concepts

FIGURE 6-15
Some features in a typical spreadsheet program.

NAME BOX

Identifies the active cell, which is the location of the cell pointer.

COLUMNS

Run vertically and are identified by letters.

FORMULA BAR

Lists the contents of the active cell, in this case the formula entered into cell E8.

RIBBON

- Contains tabs of commands grouped by function; the HOME tab is selected.

CELL HEIGHT AND WIDTH

Can be changed to a specific value or to automatically fit the content.

ROWS Run horizontally and are identified by numbers.

WORKSHEET TABS

Identify the different worksheets saved in a single spreadsheet (workbook) file.

CELL FORMATTING

Can be applied to cells (this cell is shaded blue with a double bottom border) and to cell content (such as currency with two decimal places).

QUICK ANALYSIS TOOL

Allows you to quickly and easily analyze data using tools such as color-coding and graphs.

- NUMBER FORMATS

Used to specify the appearance of the numbers on a worksheet.

- ACTIVE CELL/RANGE

Identifies the active cell or range; in this case the active cell is E8, and the range D8:E9 is selected.

WORKSHEET AREA

Contains the worksheet itself.

– GRAPHS

Are typically based on worksheet data and can be inserted into the worksheet area.



Spreadsheet Concepts

- Entering Data into a Spreadsheet Cell
 - Labels
 - Text-based entry in a worksheet cell that identifies data on the worksheet
 - Constant Values
 - Numerical entry in a worksheet cell
 - Formulas
 - Perform mathematical operations on the content of other cells
 - Usually reference the cell address, not the current data in a cell
 - Use mathematical operators; begin with an = sign



Spreadsheet Concepts

- Function
 - A named, pre-programmed formula
 - Hundreds of functions that can be used in spreadsheets

EXAMPLES OF FUNCTIONS

=SUM(range)	Calculates the sum of all values in a range.
=MAX(range)	Finds the highest value in a range.
=MIN(range)	Finds the lowest value in a range.
=AVERAGE(range)	Calculates the average of values in a range.
=PMT(rate, number of payments, loan amount)	Calculates the periodic payment for a loan.
=IF(conditional expression, value if true, value if false)	Supplies the values to be displayed if the conditional expression is true or if it is false.
=NOW()	Inserts the current date and time.

FIGURE 6-17
Common
spreadsheet
functions.



Spreadsheet Concepts

- Absolute vs. Relative Cell Referencing
 - Relative cell references
 - Cell addresses are adjusted as the formula is copied
 - Absolute cell references
 - Formulas are copied exactly as they are written
 - Appropriate when you want to use a specific cell address in all copies of the formula
 - Use \$ to make cell references absolute: \$B\$6



Spreadsheet Concepts

COPYING WITH RELATIVE CELL REFERENCES

In most formulas, cell addresses are relative and will be adjusted as the formula is copied.

Used with permission from Microsoft Corporation.

	A	B	C	D	E
1		Cones	Sundaes	Total	
2	April	600	200	800	
3	May	800	500	1300	
4	June	1500	600	2100	
5	Total			4200	
6					

Results when the formula in cell D2 is copied to cells D3 and D4.

Formula in cell D2 is $=B2+C2$.

Formula in cell D4 is $=B4+C4$.

COPYING WITH ABSOLUTE CELL REFERENCES

A dollar sign (\$) marks a cell reference as absolute; it will be copied exactly as it appears in the source cell.

	A	B	C	D	E
1		Cones	Sundaes	Total	
2	April	600	200	800	
3	May	800	500	800	
4	June	1500	600	800	
5	Total			2400	
6					

Formula in cell D2 is $=\$B\$2+\$C\2 .

Results when the formula in cell D2 is copied to cells D3 and D4.

Formula in cell D4 is $=\$B\$2+\$C\2 .

IMPROPER USE

	A	B	C	D	E
1		Cones	Sundaes	Total	Percent
2	April	600	200	800	19.65%
3	May	800	500	1300	30.95%
4	June	1500	600	2100	50.80%
5	Total			4200	100.00%
6					

Formula in cell E2 is $=D2/\$D\5 .

Results when the formula in cell E2 is copied to cells E3 and E4.

Formula in cell E4 is $=D4/\$D\5 .

FIGURE 6-18

Relative vs. absolute cell referencing.



Spreadsheet Concepts

- Charts and What-If Analysis
 - Most spreadsheet programs include some type of charting or graphing capability
 - Can create charts from the data in the spreadsheet (do not have to reenter it)
 - Charts change accordingly if the data in the spreadsheet changes
 - When cell contents are changed, formulas are automatically recalculated
 - What-if-analysis
 - Tool frequently used to help make business decisions



Spreadsheet Concepts

- Spreadsheets and the Web
 - Most spreadsheet programs have built-in Web capabilities enabling the user to:
 - Save the current worksheet as a Web page
 - Insert hyperlinks inserted into worksheet cells
 - Select and copy ranges of cells to a Web publishing or word processing program to insert spreadsheet data into a Web page as a table
 - Send a workbook as an e-mail message
 - Collaborate online



Quick Quiz

1. Changing the line spacing of a document is an example of which word processing feature?
 - a. word wrap
 - b. editing
 - c. formatting
2. True or False: A label is a special type of named formula, such as SUM to add up a group of cell values.
3. A spreadsheet document created in a spreadsheet program is often called a(n) _____.

Answers:

1) c; 2) False; 3) worksheet



Database Concepts

- What Is a Database?
 - A collection of related data that is stored in a manner enabling information to be retrieved as needed
 - Database Management System (DBMS)
 - Software that allows the creation and manipulation of an electronic database
 - Most widely used relational database programs
 - Microsoft Access
 - Oracle Database
 - IBM's DB2

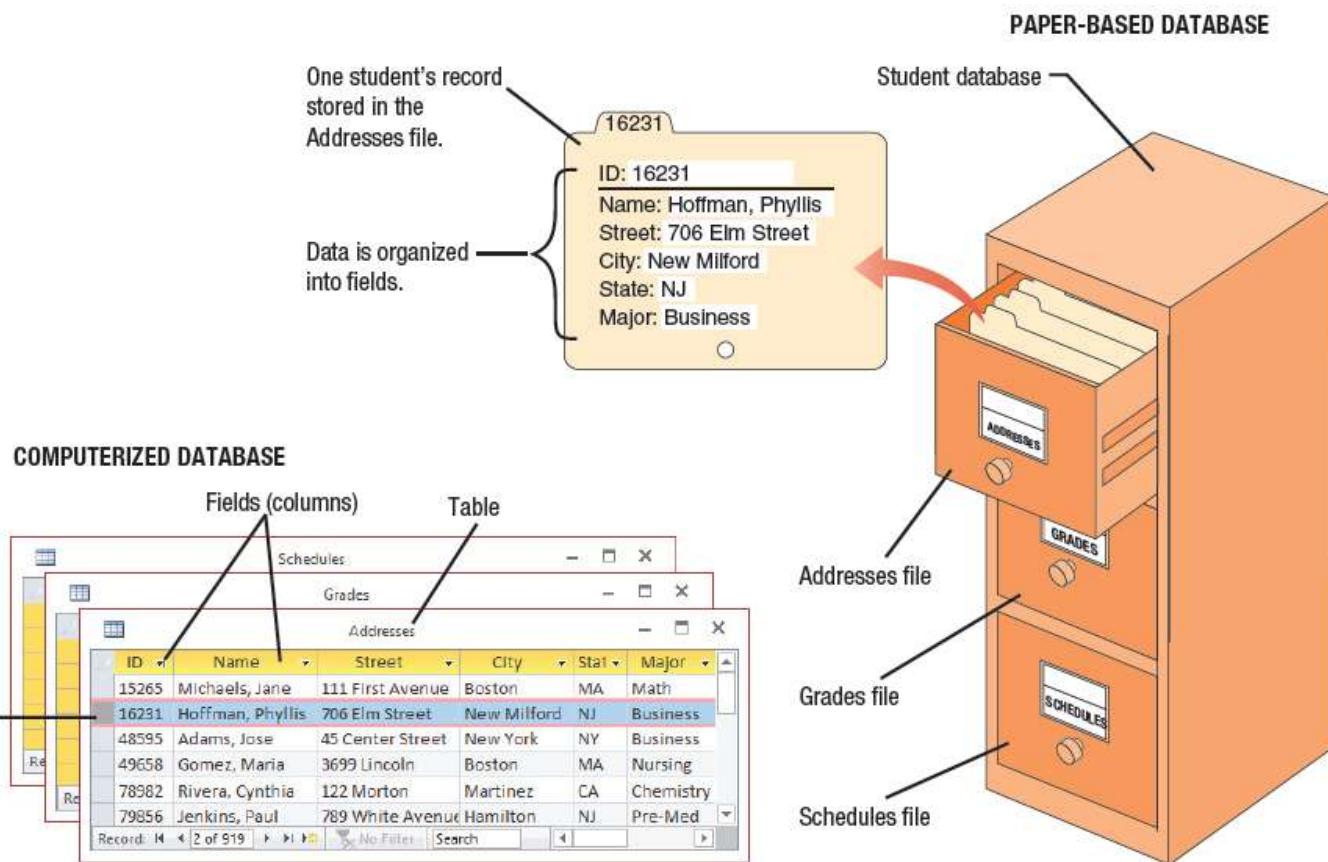


Database Concepts

FIGURE 6-19

Paper-based vs. computerized databases. Data is organized into fields (columns), records (rows), and tables.

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Database Concepts

- Data in a database is organized into fields (columns), records (rows), and tables
 - Field (column)
 - A single type of data to be stored in a database
 - Record (row)
 - A collection of related fields
 - Table
 - A collection of related records
 - Database file
 - Collection of related tables



Database Concepts

- Creating a Database
 - Database file is created first
 - Contains objects, such as tables, forms, and queries
 - Tables can then be created
 - Typically, the table structure is specified first
 - Table structure includes:
 - Field name (unique identifying name)
 - Data type (text, number, date, object)
 - Field size (maximum number of characters)
 - Default value (initial content of the field)
 - The table is named and saved
 - Tables can be created in either Datasheet or Design view



Database Concepts

DATABASE FILE

Contains the Inventory database objects.

RIBBON

Contains tabs of commands grouped by function; the CREATE tab, which is used to create new database objects, is selected.

DATABASE OBJECTS

Include Tables (for storing data), Forms (for viewing and editing table data), and Queries and Reports (for retrieving information from tables).

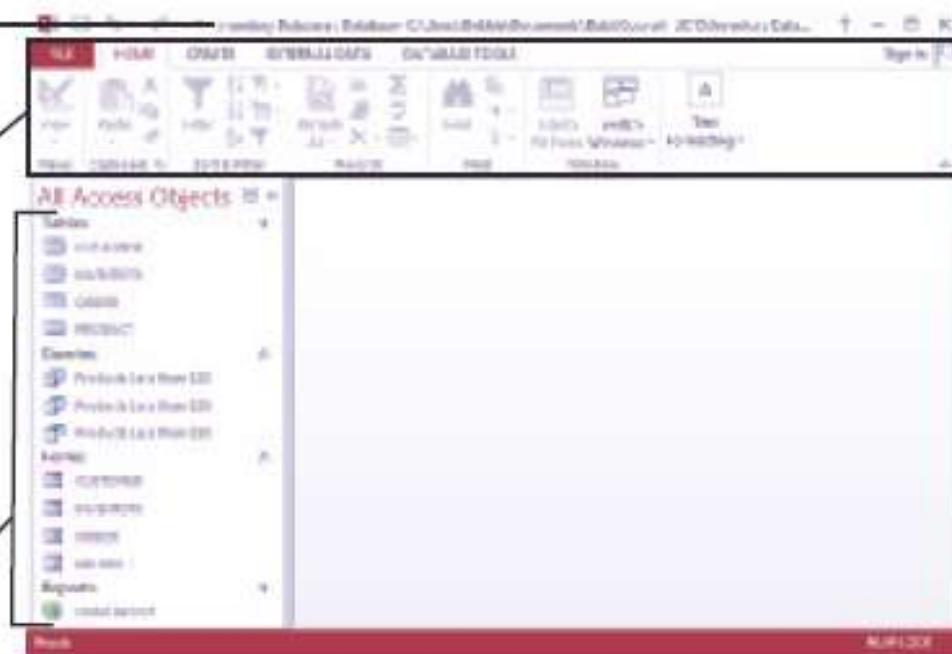


FIGURE 6-20

Typical database objects. Common database objects include tables, forms, queries, and reports. The first object to be created is the table.

Used with permission from Microsoft Corporation



Database Concepts

- Data can be displayed using a form or Datasheet view
- Data can be edited

FIGURE 6-22

Table data can be modified using a form or the Datasheet view.

Used with permission from Microsoft Corporation

The screenshot shows two views of the 'Product' table in Microsoft Access:

- Form View:** A window titled 'Product' displays five fields: Product Name (Wax), Product Number (A351), Supplier (Candle Industries), Price (\$3.00), and Number In Stock (7). A red box highlights the entire form area.
- Datasheet View:** A window titled 'Product' displays multiple records in a grid format. The columns are Product Name, Product Number, Supplier, Price, and In Stock. A red box highlights the entire grid area.

Annotations explain the interface:

- Click to the left of a form or table record to select that record.** Points to the left edge of the form window.
- Click the Record buttons to display other records.** Points to the navigation buttons at the bottom of the datasheet window.
- Click in a field to edit it.** Points to a data cell in the datasheet.

FORM
Displays one record at a time.

DATASHEET VIEW
Displays multiple records at a time.

Product Name	Product Number	Supplier	Price	In Stock
Skis	A202	Ellis	\$90.00	25
Boots	A211	Ajax Bros.	\$60.00	11
Poles	A220	Bent Corp.	\$25.00	99
Bindings	A240	Acme Corp.	\$15.00	55
Wax	A351	Candle Industries	\$3.00	7



Database Concepts

- Queries and Reports
 - Query
 - A question; a request for specific information from the database
 - Contains criteria to specify the records and fields to be included in the query results
 - Is named and saved so it can be run again at a later time



Database Concept

QUERY DESIGN SCREEN

This query will display only the records that meet the specified criteria each time the query is retrieved.

Only these three fields will be displayed in the query results.

The screenshot shows the Microsoft Access Query Design View. The title bar says 'Inventory Database : Database- C:\Users\Debbie\Documents\Dat...'. The query name is 'Products Less than \$25'. The design grid has three columns: 'Field' (Product Name), 'Table' (Product), and 'Sort' (Product). The 'Criteria' row contains '<25'. The 'Show' column has checkboxes for 'Product Name' (checked), 'Product Number' (checked), and 'Price' (checked). The status bar at the bottom shows 'Form View', 'NUM LOCK', and 'SQL' buttons.

Only the records in which the price is less than \$25 will be displayed in the query results.

Used with permission from Microsoft Corporation

The screenshot shows the Microsoft Access Query Results View for the same query. The results grid displays two rows: 'Bindings' with Product Number A240 and Price \$15.00, and 'Wax' with Product Number A351 and Price \$3.00. The status bar at the bottom shows 'Name of the product', 'NUM LOCK', and 'SQL' buttons.

QUERY RESULTS
The two records meeting the specified criteria are displayed.

FIGURE 6-23
Creating and using a database query.



Database Concepts

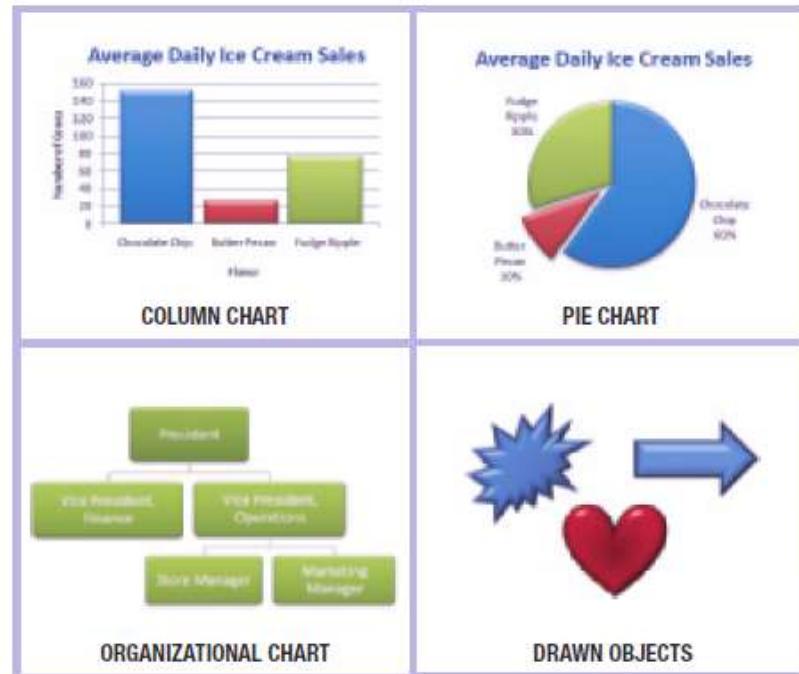
- Reports
 - Created when a more formal output is desired
 - Associated with either a table or a query
 - Data is displayed in the specified location
- Databases and the Web
 - Many Web sites use one or more databases to:
 - Keep track of inventory
 - Allow searching for people, documents, products, or other information
 - Searching for products on a retail store's Web site
 - Place real-time orders



Presentation Graphics Concepts

- What Is a Presentation Graphic?
 - An image designed to visually enhance a presentation
 - Can be used in electronic slide shows, as well as in printed reports

FIGURE 6-24
Examples of presentation graphics.



Used with permission from Microsoft Corporation



Presentation Graphics Concepts

- Slide
 - A one-page presentation graphic that can be displayed in a group with others to form an electronic slide show
- Electronic Slide Show
 - A group of electronic slides that are displayed one after the other on a computer monitor or other display device
- Presentation Graphics Software
 - Used to create presentation graphics
- Most common presentation graphics programs
 - Microsoft PowerPoint
 - Corel Presentations
 - Apple Keynote



Presentation Graphics Concepts

- Creating a Presentation
 - Preformatted slide layouts can often be used
 - New slides can be added to a new or existing presentation as needed
 - Slides can contain a variety of elements
 - Text
 - Images
 - Charts
 - Audio clips
 - Video clips



Presentation Graphics Concepts

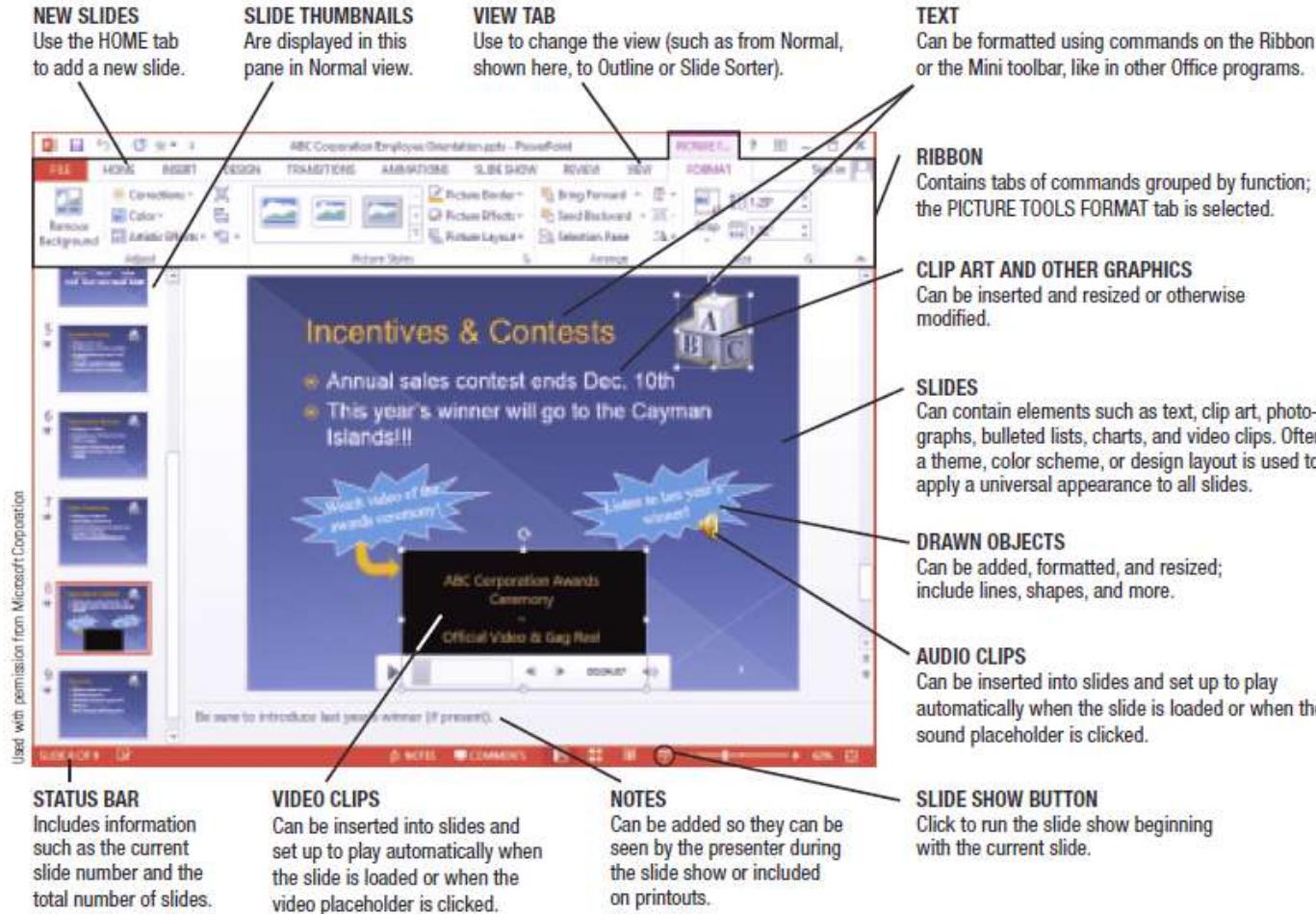


FIGURE 6-25
Some features in a typical presentation graphics program.



Presentation Graphics Concepts

- Finishing a Presentation
 - Slide Sorter View
 - Shows thumbnails of all slides in presentation
 - Used to rearrange the slide order
 - Show can be set up to run automatically or manually
 - Speaker Tools
 - Speaker notes and pens
 - Presenter view
 - Recorded narration
 - Can print the slides to create overhead transparencies or an audience handout



Presentation Graphics Concepts



Used with permission from Microsoft Corporation



SLIDE SHOW VIEW

Displays the slide show for the audience in full screen with the software interface hidden. Slides can be advanced at predetermined intervals or by clicking the mouse or pressing the spacebar.

PRESENTER VIEW

Seen only by the presenter on a different display device; includes a preview of the next slide, a timer, speaker notes, annotation tools, and so forth.

FIGURE 6-26

Running an electronic slide show.



Presentation Graphics Concepts

- Presentation Graphics and the Web
 - Presentation graphics programs can be used to generate Web pages or Web page content
 - Slides can include hyperlinks
 - Users can usually control Web-based presentations accessed via a Web browser



Graphics and Multimedia Concepts

- Graphics
 - Graphical images, such as digital photographs, clip art, scanned drawings, and original images created using a software program
- Multimedia
 - Technically refers to any application that contains more than one type of media
 - Often used to refer to audio or video content
- Large variety of graphics and multimedia software used to:
 - Create or modify graphics
 - Edit digital audio or video
 - Play multimedia files
 - Burn CDs and DVDs



Graphics and Multimedia Concepts

- Graphics Software (Digital Imaging Software)
 - Used to create or modify images
 - Painting Programs
 - Typically used to create bitmap images (Microsoft Paint)
 - Drawing Programs (Illustration programs)
 - Typically create images using mathematical formulas
 - Popular programs include Adobe Illustrator, CorelDRAW, and Corel Painter



Graphics and Multimedia Concepts

- Image Editing or Photo Editing Programs
 - Designed for touching up or modifying images
 - Correcting brightness/contrast
 - Cropping/eliminating red eye
 - Optimize file size for the Web
 - Adobe Photoshop, Apple iPhoto, etc.



Graphics and Multimedia Concepts

- Audio Capture and Editing Software
 - Used to create and edit audio files
 - Sound recorder software captures sound from a microphone
 - Ripping software captures sound from a CD
 - Edits and applies special effects
 - Common consumer products
 - Windows Sound Recorder, Apple GarageBand, Audacity



FIGURE 6-28
Audio editing software.



Graphics and Multimedia Concepts

- Video Editing and DVD Authoring Software
 - Video Editing Software
 - Modifies existing videos
 - Prepares video clips for presentations or Web sites
 - DVD Authoring Software
 - Organizes content to be transferred to DVD
 - DVD Burning Software
 - Records data on recordable or rewritable DVDs
 - Common consumer video editing programs include Roxio Creator, Apple iMovie, etc.



Graphics and Multimedia Concepts

 **FIGURE 6-29**

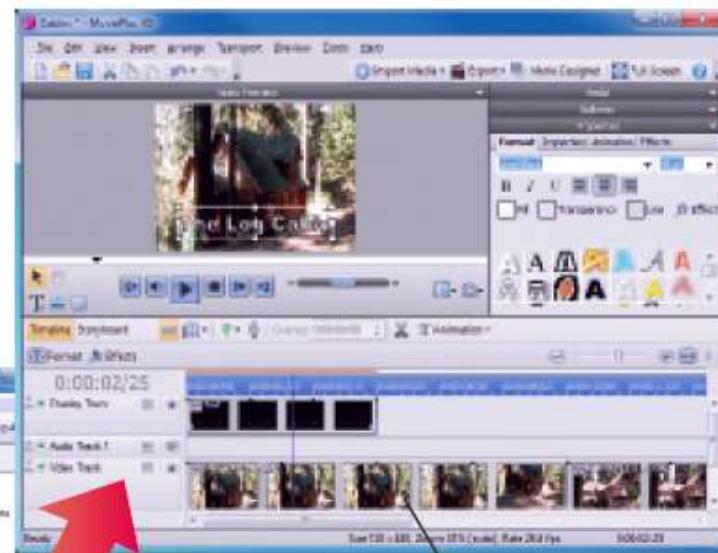
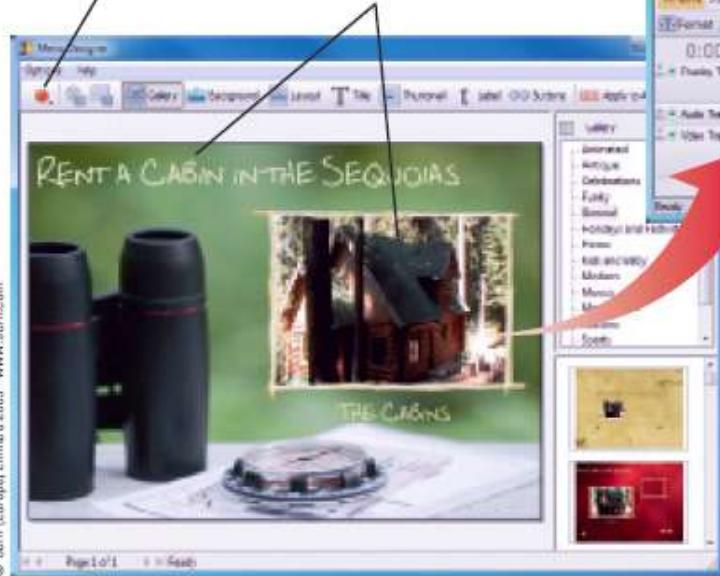
Video editing software. Often includes both video editing and DVD authoring capabilities.

VIDEO EDITING

Allows users to import and edit video; the finished video can be stored in a file or included in a DVD presentation.

Click to burn the finished presentation to a DVD.

The DVD includes the video clips and uses the titles and appearance designated by the user.



Video clips can be edited as needed; the timeline is used to crop out sections of the current video clip.

DVD AUTHORING

Allows users to import and organize photos, video, and music into a finished DVD presentation.



Graphics and Multimedia Concepts

- Media Players
 - Programs designed to play audio and video files
 - Music CDs, downloaded music, online audio
 - Downloaded and online video
 - Important to adhere to copyright laws when using digital music
 - Media players include:
 - RealPlayer, Apple QuickTime, Windows Media Player, etc.



Graphics and Multimedia Concepts

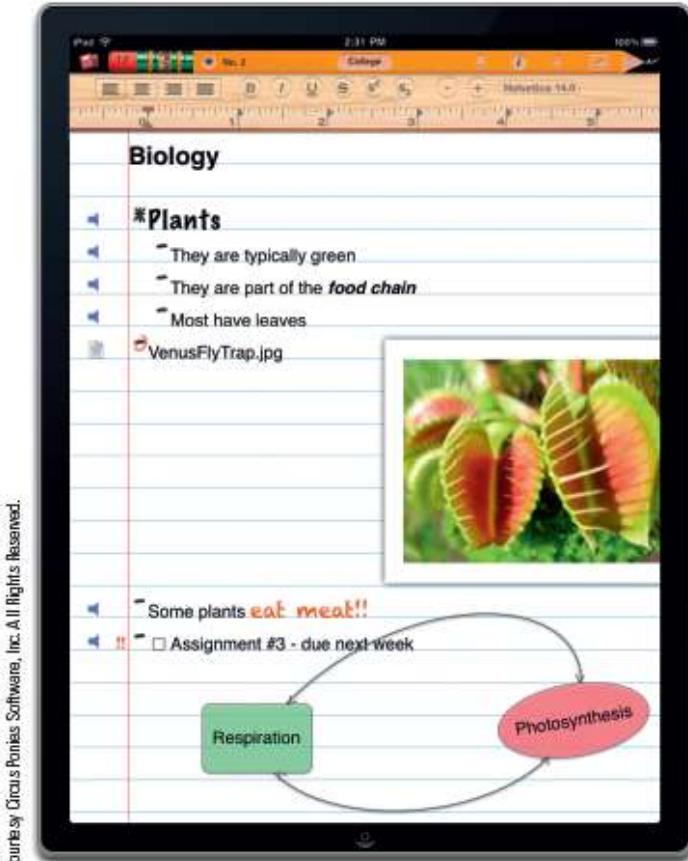
- Graphics, Multimedia, and the Web
 - Often used by individuals and businesses to create Web sites or content to be shared via the Web
 - Company logos
 - Web site banners
 - Games
 - Tutorials
 - Videos
 - Demonstrations
 - Other multimedia content



Other Types of Application Software

- Desktop and Personal Publishing Software
- Educational, Entertainment, and Reference Software
- Note Taking Software and Web Notebooks

FIGURE 6-32
Note taking software.
Allows individuals to record and organize important data.



Courtesy of Cirrus Ronies Software, Inc. All rights reserved.



Other Types of Application Software

- CAD and Other Types of Design Software
- Accounting and Personal Finance Software
- Project Management, Collaboration, and Remote Access Software



Courtesy TeamViewer; © Chardhamin/Shutterstock.com
© Bombaert Patrick/Shutterstock.com

FIGURE 6-34

Remote access software. Allows you to use a computer from a remote Internet-enabled device.



Quick Quiz

1. A single type of data to be included in a database (viewed as a column in a table) is called a _____.
 - a. record
 - b. field
 - c. table
2. True or False: Each slide in a slide presentation can contain only one type of element, such as text, an image, or a video clip.
3. Recording content on a CD or DVD disc is referred to as _____ the disc.

Answers:

1) b; 2) False; 3) burning



Summary

- The Basics of Application Software
- Word Processing Concepts
- Spreadsheet Concepts
- Database Concepts
- Presentation Graphics Content
- Graphics and Multimedia Concepts
- Other Types of Application Software

15th Edition

Understanding Computers

Today and Tomorrow

Comprehensive

Chapter 7

Computer Networks



Deborah Morley

Charles S. Parker

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Learning Objectives

1. Define a computer network and its purpose.
2. Describe several uses for networks.
3. Understand the various characteristics of a network, such as topology, architecture, and size.
4. Understand characteristics about data and how it travels over a network.



Learning Objectives

5. Name specific types of wired and wireless networking media and explain how they transmit data.
6. Identify the most common communications protocols and networking standards used with networks today.
7. List several types of networking hardware and explain the purpose of each.



Overview

- This chapter covers:
 - Computer network is defined
 - Common networking and communications applications
 - Networking concepts and terminology
 - Technical issues related to networks, including general characteristics of data transmission, and types of transmission media in use today
 - Explanation of the various communications protocols and networking standards
 - Various types of hardware used with a computer network



What Is a Network?

- Network
 - A connected system of objects or people
- Computer network
 - A collection of computers and other hardware devices connected together so users can share hardware, software, and data, and electronically communicate
- Computer networks are converging with telephone and other communications networks
- Networks range from small private networks to the Internet
- In most businesses, computer networks are essential



Inside the Industry Box

Wireless Power

- Powers/recharges devices via wireless signals and magnetic induction
- Wireless Power Consortium supports the Qi standard
- Can use built-in or external charging receiver
- May be built into walls, homes, cars, garage floors, etc. in the future



Qi wireless charging stations are available in some recent cars, such as the Toyota Avalon shown here.



Networking Applications

- The Internet
 - Largest computer network in the world
- Telephone Service
 - POTS Network
 - One of the first networks
 - Still used today to provide telephone service to landline phones
 - Mobile Phones (wireless phones)
 - Use a wireless network for communications



Networking Applications

- Cellular (cell) Phones
 - Must be within range of cell tower to function
- Dual-mode Phones
 - Allow users to make telephone calls using more than one communications network
 - Cellular/Wi-Fi dual-mode phones can switch seamlessly between the Wi-Fi network and a cellular network
- Satellite Phones
 - Communicate via satellite technology
 - Most often used by individuals such as soldiers, journalists, wilderness guides, and researchers



Networking Applications



CELLULAR PHONES

Can be used wherever cellular phone coverage is available.



SATELLITE PHONES

Can be used virtually anywhere.

FIGURE 7-2
Types of mobile phones.



Networking Applications

- Television and Radio Broadcasting
 - Still used to deliver TV and radio content to the public
 - Other networks involved with television content delivery are cable TV networks, satellite TV networks, and private closed-circuit television systems
- Global Positioning System (GPS) Applications
 - Uses satellites and a receiver to determine the exact geographic location of the receiver
 - GPS receivers
 - Commonly used by individuals to determine their geographic location



Networking Applications

- GPS receivers
 - Used on the job by surveyors, farmers, and fishermen
 - Used to guide vehicles and equipment
 - Used by the military to guide munitions and trucks, and to track military aircraft, ships, and submarines

Courtesy of MTAC Digital Corporation; © iStockphoto.com/Confer



HANDHELD GPS RECEIVERS



CAR-MOUNTED GPS RECEIVERS



GPS RECEIVERS INTEGRATED INTO SMARTPHONES

FIGURE 7-3

GPS receivers.
Allow people to determine their exact geographical location, usually for safety or navigational purposes.



Networking Applications

- Monitoring Systems
 - Use networking technology to determine the current location or status of an object
 - RFID-based Systems
 - Monitor the status of objects
 - GPS-based Monitoring Systems
 - Monitor the physical location of objects
 - Vehicle and child monitoring systems
 - Electronic Medical Monitors
 - Home healthcare



Networking Applications

- Sensors are used in some monitoring systems
 - Sensor networks
 - Home automation (smart thermostats, etc.)

FIGURE 7-5
Smart thermostats.
This thermostat (left) contains a variety of sensors and can be controlled remotely via a mobile app (right).

Courtesy NestLabs





Networking Applications

- Multimedia Networking
 - Distributing digital multimedia content, typically via a home network
 - Necessary networking capabilities are often built into devices being used
 - Might need to use multimedia networking device such as a digital media receiver or digital media streamer
 - Placesshifting Content
 - Allows individuals to view multimedia content at a more convenient location, i.e., Slingbox



Networking Applications

- Videoconferencing, Collaborative Computing, and Telecommuting
 - Videoconferencing
 - Use of computers, video cameras, microphones, and networking technologies to conduct face-to-face meetings over a network
 - Telepresence Videoconferencing
 - A setup that more closely mimics a real-time meeting environment



Networking Applications

- Collaborative Computing (workgroup computing)
 - Enables individuals to work together on documents and projects
- Telecommuting
 - Individuals work from a remote location (usually home) and communicate with their places of business and clients using networking technologies
 - Allows for employee flexibility



Networking Applications

- Telemedicine
 - Use of networking technology to provide medical information and services
 - Remote monitoring and consultations
 - Remote diagnosis
 - Telesurgery
 - Robot assisted surgery where doctor's physical location is different from the patient's and robot's
 - Will be needed for long-term space exploration



Networking Applications



FIGURE 7-8

Examples of telemedicine applications.

REMOTE CONSULTATIONS

Using remote-controlled teleconferencing robots, physicians can “virtually” consult with patients or other physicians in a different physical location; the robot (left photo) transmits video images and audio to and from the doctor (via his or her computer or mobile device, right photo) in real time.



TELESURGERY

Using voice or computer commands, surgeons can perform operations (such as inserting a catheter during the heart surgery shown here) remotely via the Internet or a private network; a robotic system uses the surgeon’s commands to physically operate on the patient.



Network Characteristics

- Wired vs. Wireless Networks
 - Wired
 - A network in which computers and other devices are physically connected to the network with cables
 - Found in schools, businesses, and government facilities
 - Wireless
 - A network in which computers and other devices are connected to the network without physical cables
 - Data is typically sent via radio waves
 - Found in homes, schools, and businesses



Trend Box

Stadium Wireless Networks

- Professional sports venues are increasingly including wireless access and other technology
- Free Wi-Fi
- Seat tablet holders
- In-game apps
- HD video boards



© AP Photo/San Francisco 49ers

An artist rendering of the new San Francisco 49er Levi's Stadium.



Network Characteristics

- Network Topologies: Indicate how the devices in the network are arranged
 - Star Networks
 - All networked devices connect to a central device/server
 - If the central device fails, the network cannot work
 - Bus Network
 - Uses a central cable to which all network devices connect
 - Mesh network
 - Multiple connections among the devices on the network so that messages can take any of several possible paths



Network Characteristics

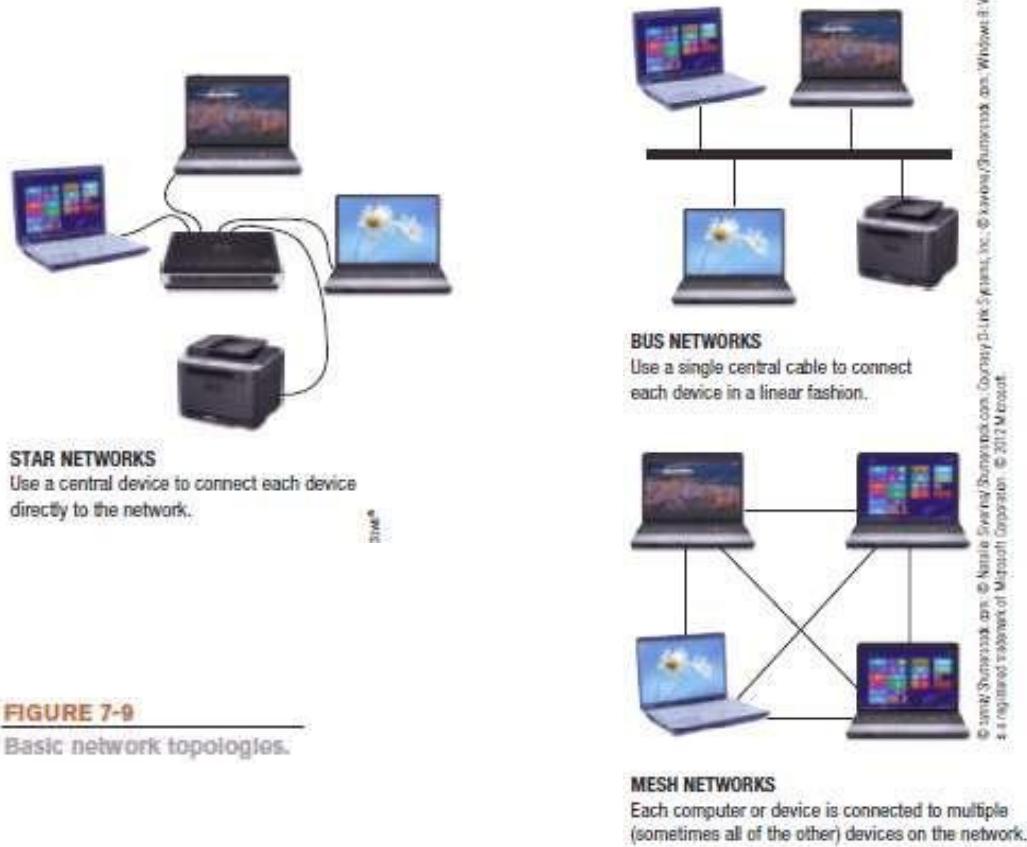


FIGURE 7-9
Basic network topologies.



Network Characteristics

- Network Architectures
 - Client-Server Networks
 - Client
 - Computer or other device on the network that requests and utilizes network resources
 - Server
 - Computer dedicated to processing client requests



Network Characteristics

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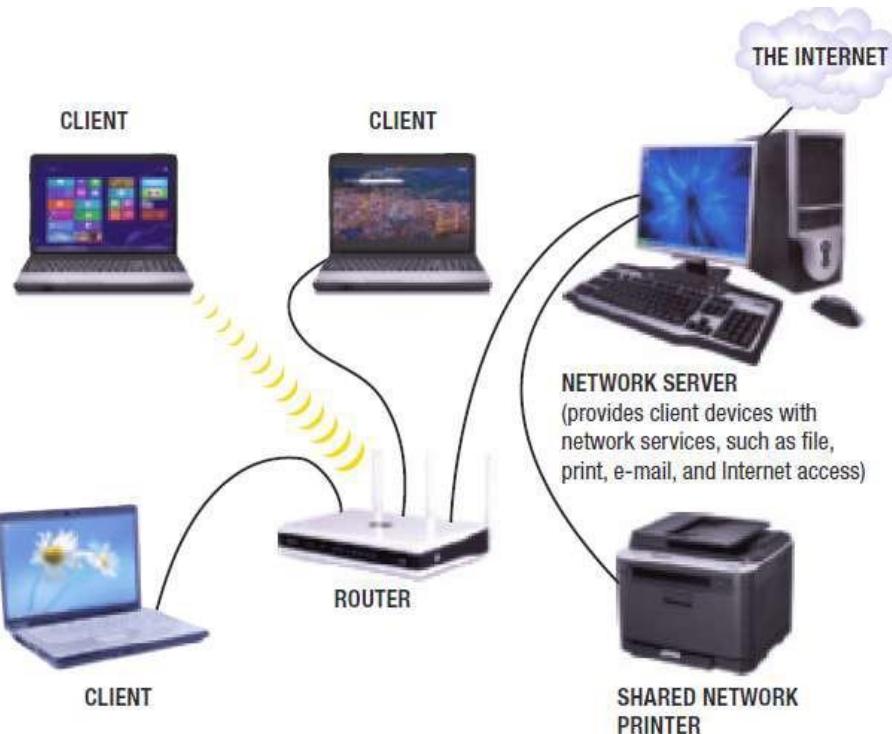


FIGURE 7-10
Client-server networks.
Client computers
communicate through one
or more servers.



Network Characteristics

- Peer-to-Peer (P2P) Networks
 - Central server is not used
 - All computers on the network work at the same functional level
 - Users have direct access to the computers and devices attached to the network
 - Less complicated and less expensive to implement than client-server networks
 - Internet P2P Computing
 - Content is exchanged over the Internet directly between users



Network Characteristics

- Network Size and Coverage Area
 - Personal Area Networks (PANs)
 - Connect an individual's personal devices
 - Devices must be physically located close together
 - Local Area Networks (LANs)
 - Connect devices located in a small geographic area
 - Metropolitan Area Networks (MANs)
 - Cover a metropolitan area such as a city or county
 - Wide Area Networks (WANs)
 - Cover a large geographic area
 - Two or more LANs connected together



Network Characteristics

- Intranets and Extranets
 - Intranet
 - Private network designed to be used by an organizations' employees; set up like the Internet
 - Extranet
 - Company network accessible by authorized outsiders
- Virtual Private Networks (VPNs)
 - Private, secure path over the Internet that provides authorized users a secure means of accessing a private network via the Internet
 - Uses tunneling and special encryption technology



Quick Quiz

1. Which of the following describes a group of private secure paths set up using the Internet?
 - a. VPN
 - b. WAN
 - c. WSN
2. True or False: With a bus network, all devices are connected directly to each other without the use of a central hub or cable.
3. A private network that is set up similar to the World Wide Web for use by employees of a specific organization is called a(n)
_____.

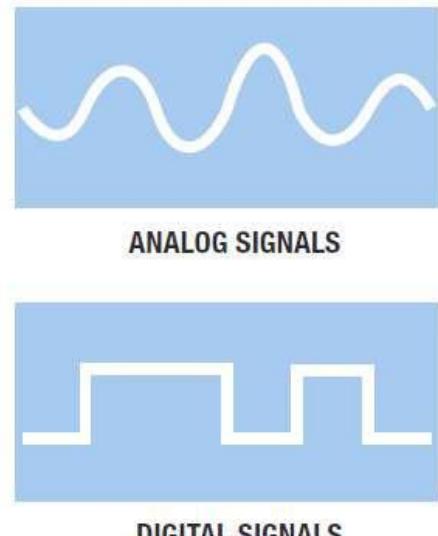
Answers:

1) a; 2) False; 3) intranet



Data Transmission Characteristics

- Bandwidth
 - The amount of data that can be transferred in a given period of time
 - Measured in bits per second (bps), Kbps (thousands), Mbps (millions), or GFbps (billions)
- Analog vs. Digital Signals
 - Data represented by two discrete states: 0s and 1s
 - Conventional telephone systems use analog signals
 - Represent data with continuous waves



 **FIGURE 7-14**
Analog vs. digital signals.



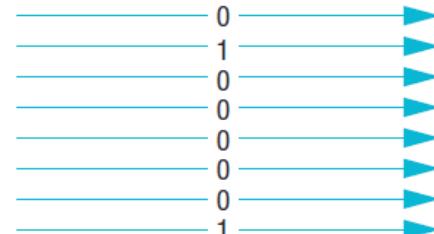
Data Transmission Characteristics

- Transmission Type and Timing
 - Serial
 - Data sent one bit at a time, one after another, along a single path
 - Parallel
 - Data sent at least one byte at time with each bit in the byte taking a different path



SERIAL TRANSMISSIONS

All the bits in one byte follow one another over a single path.



PARALLEL TRANSMISSIONS

The eight bits in each byte are transmitted over separate paths at the same time.

FIGURE 7-15

Serial vs. parallel transmissions.



Data Transmission Characteristics

- Synchronous Transmission
 - Blocks of data are transferred at regular, specified intervals
 - Most data transmissions within a computer and over a network are synchronous
- Asynchronous Transmission
 - Data is sent when ready without being synchronized
 - Start bits and stop bits used to identify the bits that belong in each byte
- Isochronous Transmission
 - Data sent at the same time as other, related, data

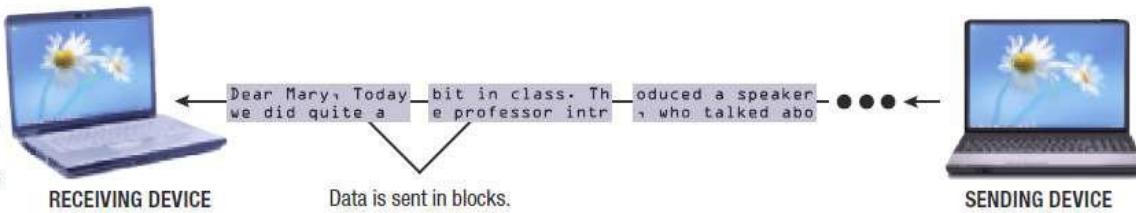


Data Transmission Characteristics

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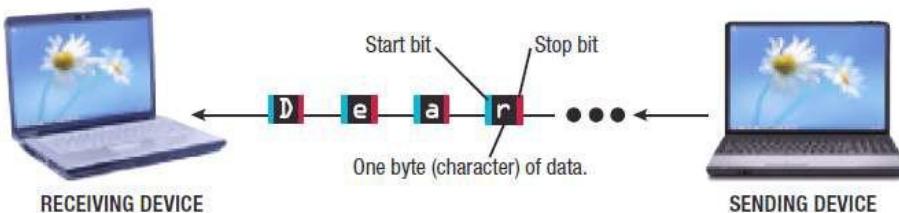
SYNCHRONOUS TRANSMISSIONS

Data is sent in blocks and the blocks are timed so that the receiving device knows when they will arrive.



ASYNCHRONOUS TRANSMISSIONS

Data is sent one byte at a time, along with a start bit and a stop bit.



ISOCHRONOUS TRANSMISSIONS

The entire transmission is sent together after requesting and being assigned the bandwidth necessary for all the data to arrive at the correct time.

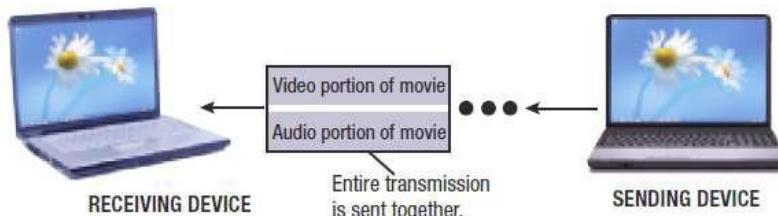


FIGURE 7-16
Transmission timing. Most network transmissions use synchronous transmission.



Data Transmission Characteristics

- Simplex Transmission
 - Data travels in a single direction only
- Half-Duplex Transmission
 - Data travels in either direction but only one way at a time
- Full-Duplex Transmission
 - Data travels in both directions at the same time

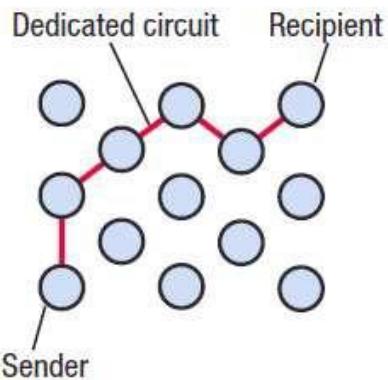


Data Transmission Characteristics

- Delivery Method
 - Circuit-Switching
 - Dedicated path over a network is established between sender and receiver; all data follows that path
 - Packet-Switching
 - Messages are separated into small units called packets and travel along the network separately; packets are reassembled once destination is reached
 - Broadcasting
 - Data is sent out to all other nodes on the network and retrieved only by the intended recipient; primarily used with LANs

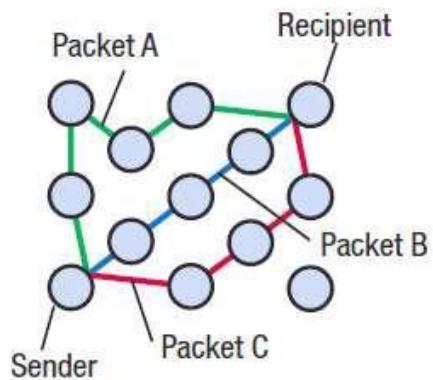


Data Transmission Characteristics



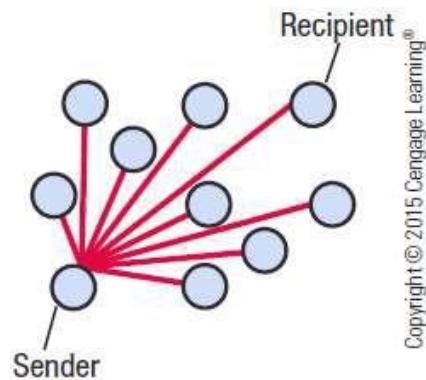
CIRCUIT-SWITCHED NETWORKS

Data uses a dedicated path from the sender to the recipient.



PACKET-SWITCHED NETWORKS

Data is sent as individual packets, which are assembled at the recipient's destination.



BROADCAST NETWORKS

Data is broadcast to all nodes within range; the designated recipient retrieves the data.

FIGURE 7-17

Circuit-switched, packet-switched, and broadcast networks.



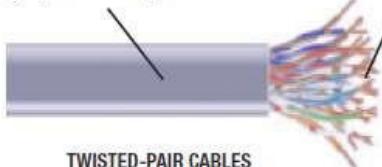
Networking Media

- Wired Networking Media
 - Twisted-Pair Cable
 - Pairs of insulated wires twisted together
 - Used for telephone and network connections (LANs)
 - Coaxial Cable
 - Thick center wire surrounded by insulation
 - Used for computer networks and cable television delivery
 - Fiber-Optic Cable
 - Utilizes hundreds of thin transparent clear glass or plastic fibers over which lasers transmit data as light
 - Used for high-speed communications



Networking Media

The entire cable is covered by a plastic covering.



TWISTED-PAIR CABLES

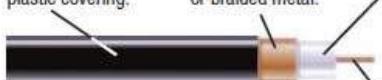
Pairs of copper wires are insulated with a plastic coating and twisted together; most cables contain at least two pairs.



FIGURE 7-18

Wired network transmission media.

The entire cable is covered by a plastic covering.



COAXIAL CABLES

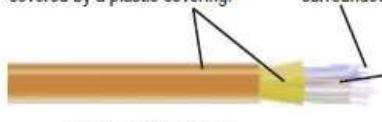
Outer conductor is made out of woven or braided metal.

White insulating material surrounds the copper wire.

The innermost part of the cable is a single copper wire.



The entire cable is surrounded by strengthening material and covered by a plastic covering.



FIBER-OPTIC CABLES

The core of each fiber is a single glass or plastic tube, which is surrounded by a reflective cladding.

A protective plastic coating protects each fiber; a cable contains multiple fibers.



Courtesy of Black Box Corporation; Courtesy Belkin International, Inc.



Networking Media

- Wireless Networking Media
 - Data is sent through the airwaves using radio signals
 - The Electromagnetic and Wireless Spectrum
 - Radio frequencies are assigned by the FCC and are measured in hertz (Hz)
 - The electromagnetic spectrum is the range of common electromagnetic radiation (energy)
 - Different parts of the spectrum have different properties, which make certain frequencies more appropriate for certain applications



Networking Media

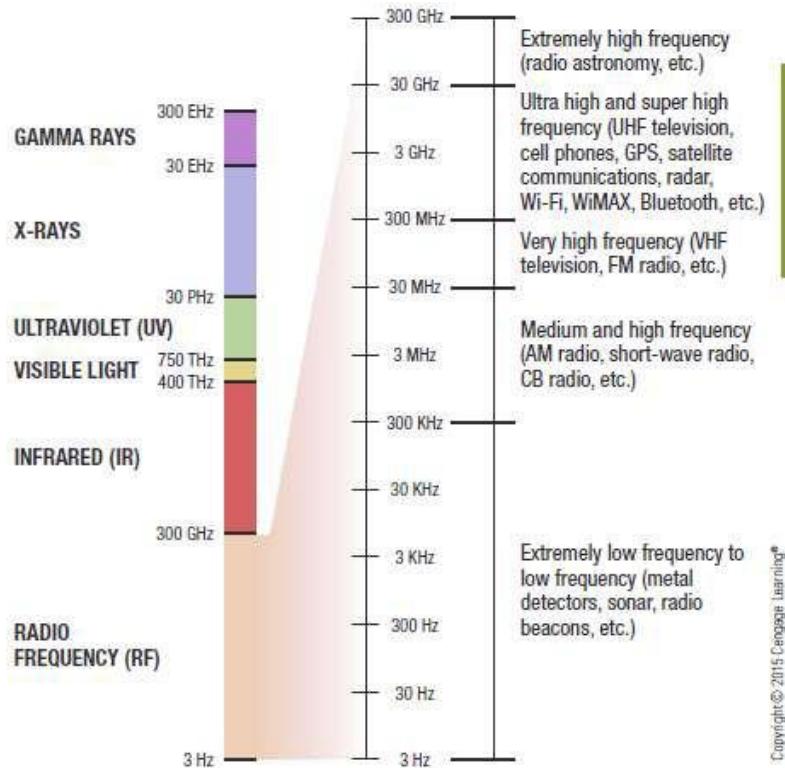


FIGURE 7-19

The electromagnetic spectrum. Each type of communication is assigned specific frequencies within which to operate.

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Networking Media

- Frequencies assigned to an application usually consist of a range of frequencies to be used as needed
- Most wireless networking applications use frequencies in the RF band at the low end of the spectrum—up to 300 GHz
 - Often called the *wireless spectrum*
- The 900 MHz, 2.4GHz, 5 GHz, and 5.8 GHz frequencies are within an unlicensed part of the spectrum and can be used by any product or individual
 - Cordless landline phones, garage door openers, Wi-Fi, WiMAX, and Bluetooth



Networking Media

- Cellular Radio Transmissions
 - Use cellular towers within honeycomb-shaped zones called cells
 - Calls are transferred from cell tower to cell tower as the individual moves
 - Cell tower forwards call to the MTSO
 - MTSO routes call to the recipient's phone
 - Data sent via cell phones works in similar manner
 - The speed of cellular radio transmissions depends on the type of cellular standard being used



Networking Media

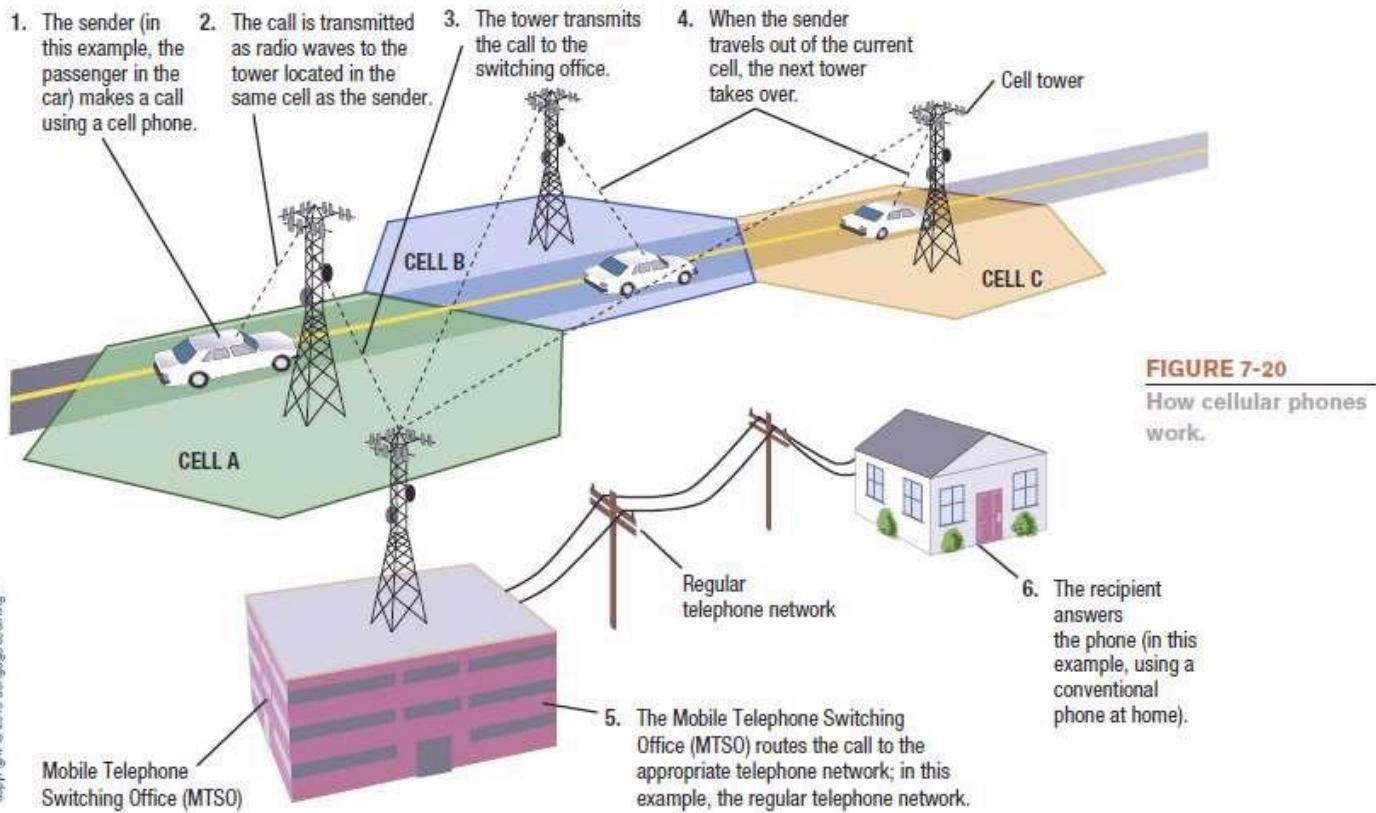


FIGURE 7-20
How cellular phones work.



Networking Media

- Microwave and Satellite Transmissions
 - Microwaves
 - High-frequency radio signals that are sent and received using microwave stations or satellites
 - Signals are line of sight, so microwave stations are usually built on tall buildings, towers, mountaintops
 - Microwave stations
 - Earth-based stations that transmit signals directly to each other within a range of 30 miles
 - Stations designed to communicate with satellites (television and internet services) are called satellite dishes



Networking Media

- Communication satellites are launched into orbit to send and receive microwave signals from earth
 - Traditional satellites use geosynchronous orbit 22,300 miles above the earth
 - A delay of less than one half-second is common when signals travel from earth to satellite and back
 - Low earth orbit (LEO) satellites were developed to combat delay
 - Medium earth orbit (MEO) satellites are most often used for GPS systems



Networking Media

3. An orbiting satellite receives the request and beams it down to the satellite dish at the ISP's operations center.

2. The request is sent up to a satellite from the individual's satellite dish.



1. Data, such as a Web page request, is sent from the individual's computer to the satellite dish via a satellite modem.



4. The ISP's operations center receives the request (via its satellite dish) and transfers it to the Internet.



5. The request travels over the Internet as usual. The requested information takes a reverse route back to the individual.

FIGURE 7-21

How satellite Internet works.



Networking Media

- Infrared (IR) Transmissions
 - Sends data as infrared light rays
 - Like an infrared television remote, IR requires line of sight
 - Because of this limitation, many formerly IR devices (wireless mice, keyboards) now use RF technology
 - IR is sometimes used to beam data between some mobile devices, game consoles, and handheld gaming devices



Quick Quiz

1. Which of the following transmission media transmits data as light pulses?
 - a. coaxial cable
 - b. fiber-optic cable
 - c. twisted-pair cable
2. True or False: Cellular radio is a form of wireless network transmission.
3. A device located in space that orbits the earth to provide communications services is called a(n) _____.

Answers:

1) b; 2) True; 3) satellite



Communications Protocols and Networking Standards

- Protocol
 - A set of rules for a particular situation
 - Communications Protocol
 - A set of rules that determine how devices on a network communicate
- Standard
 - A set of criteria or requirements approved by a recognized standards organization
 - Address how networked computers connect/communicate
 - Needed to ensure products can work with other products



TCP/IP and Other Communications Protocols

- TCP/IP
 - Most widely used communications protocol
 - Consists of two protocols
 - Transmission Control Protocols (TCP)
 - Responsible for delivery of data
 - Internet Protocols (IP)
 - Provides addresses and routing information
 - Uses packet switching to transmit data
 - TCP/IP support is built into almost all operating systems and IP addresses are used to identify computers and devices on networks



TCP/IP and Other Communications Protocols

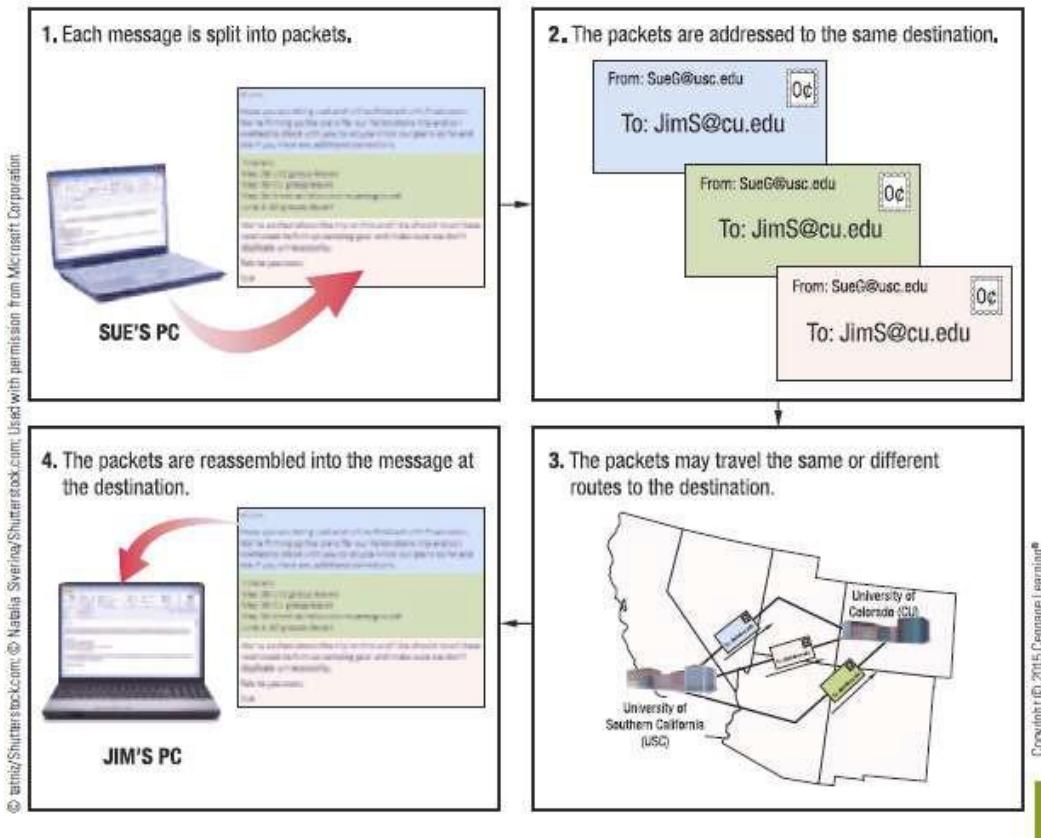


FIGURE 7-22
How TCP/IP works.
TCP/IP networks
(like the Internet) use
packet switching.

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TCP/IP and Other Communications Protocols

- Other Protocols
 - HTTP (Hypertext Transfer Protocol) and HTTPS (Secure Hypertext Transfer Protocol)
 - Used to display Web pages
 - FTP (File Transfer Protocol)
 - Used to transfer files over the Internet
 - SMTP (Simple Mail Transfer Protocol) and POP3 (Post Office Protocol)
 - Used to deliver e-mail over the Internet



Ethernet (802.3)

- Ethernet (802.3)
 - Most widely used standard for wired networks
 - Typically used with LANs that have a star topology
 - Works with twisted-pair, coaxial, and fiber-optic cabling
 - Continually evolving
 - Most common today are Fast Ethernet, Gigabit Ethernet, and 10 Gigabit Ethernet
 - 40 Gigabit Ethernet and 100 Gigabit Ethernet standards ratified in 2010
 - Terabit Ethernet standard is currently under development



Ethernet (802.3)

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STANDARD	MAXIMUM SPEED
10BASE-T	10 Mbps
Fast Ethernet (100BASE-T or 100BASE-TX)	100 Mbps
Gigabit Ethernet (1000BASE-T)	1,000 Mbps (1 Gbps)
10 Gigabit Ethernet (10GBASE-T)	10 Gbps
40 Gigabit Ethernet	40 Gbps
100 Gigabit Ethernet	100 Gbps
400 Gigabit Ethernet*	400 Gbps
Terabit Ethernet*	1,000 Gbps (1 Tbps)

*Under consideration for development

FIGURE 7-23

Ethernet standards.



Ethernet (802.3)

- Power over Ethernet (PoE)
 - Allows electrical power to be sent along the cables on an Ethernet network along with data
 - Devices are not plugged into an electrical outlet
 - Most often used in business networks with remote wired devices
 - Can also be used to place networked devices near ceilings or other locations where a nearby power outlet may not be available



Ethernet (802.3)

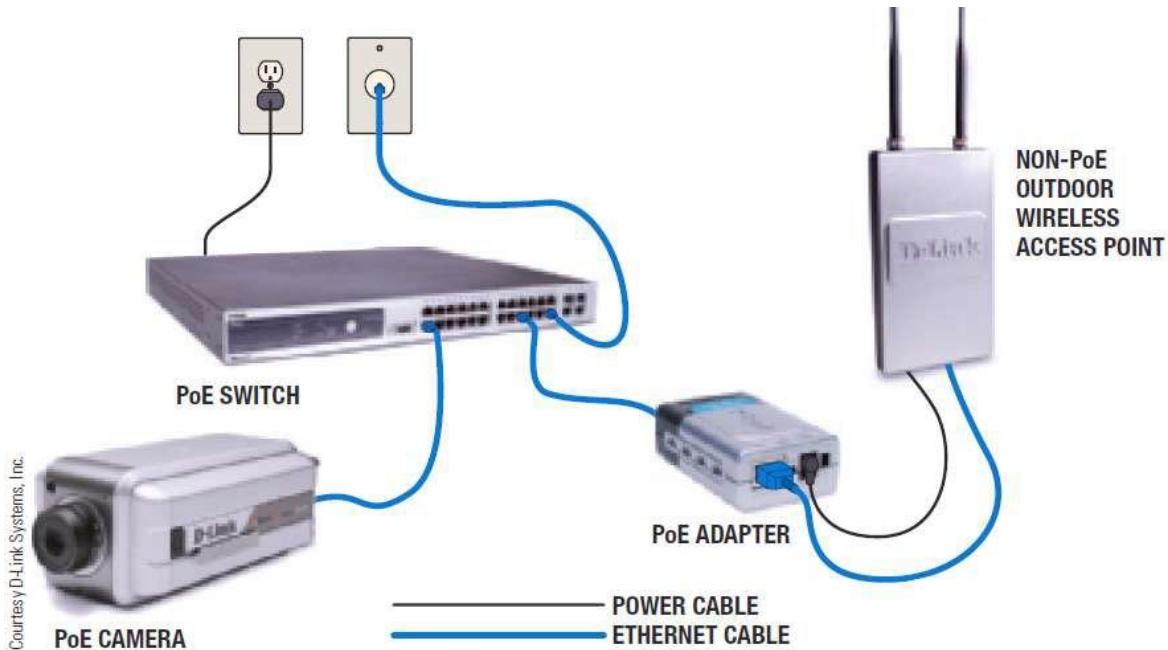


FIGURE 7-23

Ethernet standards.



Phoneline, Powerline, G.hn, and Broadband over Powerline (BPL)

- Phoneline
 - Allows networking via ordinary telephone wiring
- Powerline
 - Allows networking via ordinary electrical outlets
 - For wired home networks, Phoneline and Powerline are alternatives to Ethernet



Courtesy Belkin International, Inc.

FIGURE 7-25
WeMo. Allows you to remotely control your lights with your smartphone; works over existing power lines.



Phoneline, Powerline, G.hn, and Broadband over Powerline (BPL)

- G.hn
 - A unified world-wide standard for creating home networks over any existing home wiring—phone lines, power lines, and coaxial cable
- Broadband over Powerline (BPL)
 - Designed to deliver broadband Internet to homes via the existing outdoor power lines
 - Great potential for delivering broadband access to homes or businesses with access to electricity, but not widely available



Wi-Fi (802.11)

- Wi-Fi (802.11)
 - A family of wireless networking standards using IEEE standard 802.11
 - Current standard for wireless networks in homes and offices (wireless Ethernet)
 - Built into many everyday objects today
 - Designed for medium-range transmission; speed and distance depends on Wi-Fi standard being used, solid objects in the way, interference, etc.

FIGURE 7-26
Smart scales.
This scale transmits readings to a smartphone via Wi-Fi .





Technology and You Box

Wi-Fi SD Cards

- Upload photos wirelessly and automatically from camera to computer, mobile device, or cloud photo service
- Some include location information
- Some sync photos and videos to cloud account
- Can share photos quickly with others as well as have backups





Wi-Fi (802.11)

- Most widely used standards today are 802.11g, 802.11n, and 802.11ac
- Wi-Fi Alliance
 - Certifies that hardware from various vendors will work together
 - Developing WiGig (802.11ad) standard for very fast short-range networking
- Wi-Fi has a limited range
 - Many businesses may be physically too large for Wi-Fi to cover the entire organization



Wi-Fi (802.11)

FIGURE 7-27

Common Wi-Fi standards.

WI-FI STANDARD	DESCRIPTION
802.11b	An early Wi-Fi standard; supports data transfer rates of 11 Mbps.
802.11a	Supports data transfer rates of 54 Mbps, but uses a different radio frequency (5 GHz) than 802.11b/g (2.4 GHz), making the standards incompatible.
802.11g	A current Wi-Fi standard; supports data transfer rates of 54 Mbps and uses the same 2.4 GHz frequency as 802.11b, so their products are compatible.
802.11n	A current Wi-Fi standard; supports speeds up to about 300 Mbps and has twice the range of 802.11g. It can use either the 2.4 GHz or 5 GHz frequency.
802.11ac	The newest Wi-Fi standard expected to be ratified in 2014; supports speed up to about three times faster than 802.11n and uses the 5 GHz frequency (though virtually all 802.11ac routers also support 2.4 GHz devices for backward compatibility).



WiMAX (802.16)

- WiMAX (802.16)
 - Standards for longer range wireless networking connections, typically MANs
 - Fixed WiMAX
 - Designed to provide Internet access fixed locations (hotzones)
 - Typical hotzone radius is between 2 and 6 miles
 - Possible to provide coverage to an entire city by using multiple WiMAX towers
 - Mobile WiMAX
 - Mobile version of the standard



WiMAX (802.16)

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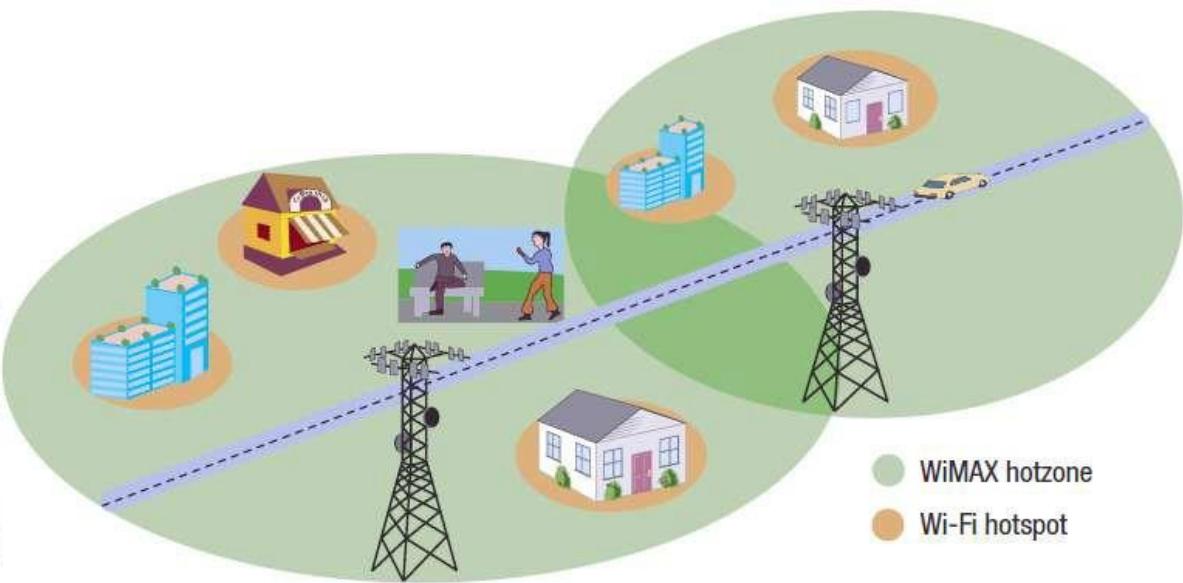


FIGURE 7-29
WIMAX vs. WI-FI.
A WiMAX hotzone is larger than a Wi-Fi hotspot and so has a greater range; it can provide service to anyone in the hotzone, including mobile users.



Cellular Standards

- Cellular Standards
 - First Generation
 - Analog and voice only
 - 2G (Second Generation)
 - Digital, both voice and data, faster
 - 3G and 4G networks
 - Current standards
 - Use packet switching
 - 3G speeds are between 1 and 4 Mbps
 - 4G speeds currently range from about 3 to 15 Mbps



Bluetooth, Ultra Wideband (UWB), and Other Short-Range Wireless Standards

- Bluetooth
 - Networking standard for very short-range wireless connections
 - Bluetooth 4.0 (Bluetooth Smart) is low energy so can run for years on small battery
- Wireless USB
 - Wireless version of USB designed to connect peripheral devices
- Wi-Fi Direct
 - Standard for connecting Wi-Fi devices directly, without using a router or an access point



Bluetooth, Ultra Wideband (UWB), and Other Short-Range Wireless Standards

- Ultra Wideband (UWB)
 - Networking standard for very short-range wireless connections among multimedia devices
- WirelessHD (WiHD): designed for very fast transfers between home electronic devices
- TransferJet
 - Standard for very short-range wireless connections between devices
 - Devices need to touch in order to communicate



Bluetooth, Ultra Wideband (UWB), and Other Short-Range Wireless Standards

- ZigBee
 - Designed for inexpensive and simple short-range networking, particularly sensor networks
 - Can be used for home and commercial automation systems
- Z-Wave
 - Devices can communicate with each other and be controlled via home control modules and remotely using a computer or mobile phone



Bluetooth, Ultra Wideband (UWB), and Other Short-Range Wireless Standards

CATEGORY	EXAMPLES	INTENDED PURPOSE	APPROXIMATE RANGE
Short range	Bluetooth Wireless USB	To connect peripheral devices to a mobile phone or computer.	33 feet–200 feet
	Ultra Wideband (UWB) WirelessHD (WiHD) TransferJet WiGig	To connect and transfer multimedia content between home consumer electronic devices (computers, TVs, DVD players, etc.).	1 inch–33 feet
	ZigBee Z-Wave	To connect a variety of home, personal, and commercial automation devices.	33 feet–328 feet
Medium range	Wi-Fi (802.11)	To connect computers and other devices to a local area network.	100–300 feet indoors; 300–900 feet outdoors
	Wi-Fi Direct	To connect computers and other devices directly together.	600 feet
Long range	WiMAX Mobile WiMAX	To provide Internet access to a large geographic area for fixed and/or mobile users.	6 miles non-line of sight; 30 miles line of sight
	Cellular standards	To connect mobile phones and mobile devices to a cellular network for telephone and Internet service.	10 miles

FIGURE 7-33
Summary of common wireless networking standards.



How It Works Box

Smart Homes

- Home automation
 - Use Z-Wave, Bluetooth, Wi-Fi or other wireless standards to control lights, door locks, thermostats, etc.
- Smart door locks can be unlocked via proximity sensors and Bluetooth 4.0
 - Can send temporary keys to others
 - Can check on status of locks and keys online





Networking Hardware

- Network Adapter
 - Used to connect a computer to a network
 - Also called network interface card (NIC) when in the form of an expansion card
- Modem
 - Device that enables a computer to communicate over analog networking media
 - Term is often used interchangeably with network adapter
 - Most computers and mobile devices today come with a built-in network adapter and/or modem



Networking Hardware



FIGURE 7-34

Network adapters
and modems.



Networking Hardware

- Switch
 - Central device that connects devices in a wired network but only sends data to the intended recipient
 - Hub – similar but sends data to all recipients
- Router
 - Connects multiple networks: two LANs, two WANS, LAN and the Internet
 - Passes data to intended recipient only
 - Routes traffic over the Internet
- Wireless Access Point
 - Device used to grant network access to wireless client devices



Networking Hardware

- Wireless Router
 - Typically connects both wired and wireless devices to a network and to connect the network to the Internet
 - Often integrates a switch, router, and wireless access point
- Bridge
 - Used to connect two LANs together
 - In a home network, wirelessly connects a wired device to the network



Networking Hardware



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FIGURE 7-35

Wireless routers.
Provide wireless users access to each other and an Internet connection.



Networking Hardware

- Repeaters
 - Amplify signals along a network
- Range Extenders
 - Repeaters for a wireless network
- Antennas
 - Devices used for receiving or sending radio signals
 - Some network adapters can use an external antenna
 - Can be directional or omnidirectional
 - Strength measured in decibels (dB)



Networking Hardware

- Multiplexer
 - Combines transmissions from several different devices to send them as one message
- Concentrator
 - Combines messages and sends them via a single transmission medium in such a way that all of the messages are simultaneously active

Networking Hardware

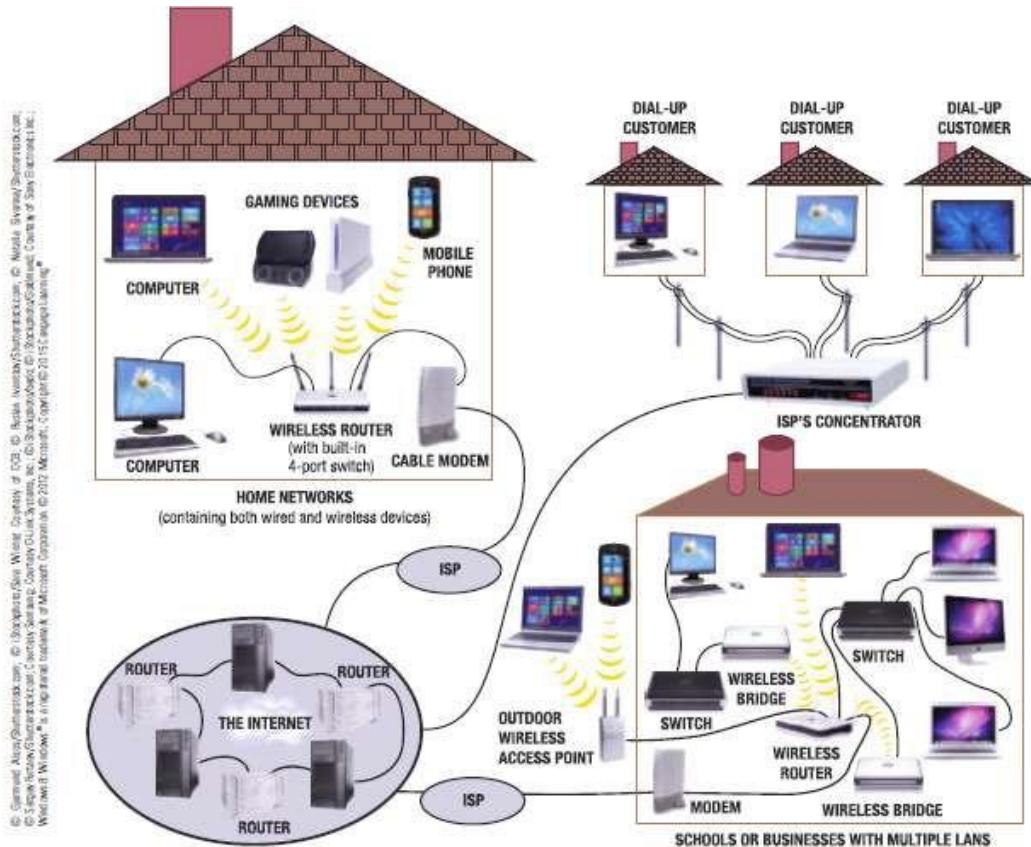


FIGURE 7-36
Networking hardware.
As shown in this example, many different types of hardware are used to connect networking devices.



Quick Quiz

1. Which of the following is the protocol used to transfer data over the Internet?
 - a. Wi-Fi
 - b. Bluetooth
 - c. TCP/IP
2. True or False: An ExpressCard network adapter is most commonly used with desktop computers.
3. A device used to connect a computer to the Internet is typically referred to as a(n) _____.

Answers:

1) c; 2) False; 3) modem



Summary

- Networking Applications
- Network Characteristics
- Data Transmission Characteristics
- Networking Media
- Communications Protocols and Networking Standards
- Networking Hardware

15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 8:

The Internet and the World Wide Web



**Deborah Morley
Charles S. Parker**

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Learning Objectives

1. Discuss how the Internet evolved and what it is like today.
2. Identify the various types of individuals, companies, and organizations involved in the Internet community and explain their purposes.
3. Describe device and connection options for connecting to the Internet, as well as some considerations to keep in mind when selecting an ISP.
4. Understand how to search effectively for information on the Internet and how to cite Internet resources properly.



Learning Objectives

5. List several ways to communicate over the Internet, in addition to e-mail.
6. List several useful activities that can be performed via the Web.
7. Discuss censorship and privacy and how they are related to Internet use.



Overview

- This chapter covers:
 - The evolution of the Internet
 - The Internet community
 - Different options for connecting to the Internet
 - Internet searching
 - Common applications available via the Internet
 - Societal issues that apply to Internet use



Evolution of the Internet

- Internet
 - Largest and most well-known computer network, linking millions of computers all over the world
 - The Internet has actually operated in one form or another for several decades
- ARPANET
 - The predecessor of the Internet
 - Created in 1969 and named after the Advanced Research Projects Agency (ARPA), which sponsored its development
 - Initially connected four supercomputers; eventually evolved into today's Internet



Evolution of the Internet

- The World Wide Web
 - The collection of Web pages available through the Internet
 - Proposed by Tim Berners-Lee in 1989
 - Originally only text-based content; release of the Mosaic browser in 1993 led to graphical content
 - Web 2.0
 - Wide variety of content available via Web pages today such as social networking, RSS, podcasts, blogs and wikis
 - The World Wide Web and the Internet are not owned by any person, business, or organization



Evolution of the Internet

- Primary infrastructure that makes up the Internet backbone is typically owned by communications companies
- Internet2
 - Consortium of researchers, educators, and technology leaders from industry, government, and the international community
 - Dedicated to the development of revolutionary Internet technologies
 - Research and development tool, much of which is focused on speed



Evolution of the Internet

- The Internet Community Today
 - Users
 - People who use the Internet
 - Internet Service Providers (ISPs)
 - Provide access to the Internet, typically for a fee
 - Include most communication and media companies



FIGURE 8-2
Companies that provide Internet access today include telephone, cable, and satellite companies.



Evolution of the Internet

- Internet Content Providers
 - Persons or organizations that provide Internet content
 - Businesses, non-profit organizations, educational institutions, individuals
- Application Service Providers (ASPs) and Web Services
 - Companies that manage and distribute Web-based software services over the Internet
 - Cloud software, Software as a Service (SaaS), cloudware
 - Often fee-based business software
 - Web service: self-contained business application that operates over the Internet



Evolution of the Internet

Clicking this button logs a Zappos.com customer in via an Amazon Web service.

The screenshot shows the Zappos.com login page. At the top right, there is a button labeled "Login with Amazon" with a small "a" icon. A large red arrow points from the text above to this button. The page itself has fields for "Email Address" and "Password", a "LOG IN" button, and a link for "Forgot your password?". To the right, there's a section titled "Or..." with options to "CREATE AN ACCOUNT" or "Login with Amazon". The "Login with Amazon" option includes links to track orders, view history, and manage favorites. The URL in the browser bar is https://secure-www.zappos.com/login.

FIGURE 8-3

Web services. This Web service enables Web developers to use Amazon's authentication system for users.

Courtesy Zappos.com



Evolution of the Internet

- Infrastructure Companies
 - Enterprises that own or operate the physical structure of the Internet
 - Conventional and mobile phone companies, cable companies, and satellite Internet providers
- Hardware and Software Companies
 - Provide the hardware and software used in conjunction with the Internet and Web



Evolution of the Internet

- The Government and Other Organizations
 - Some countries limit information and access
 - FCC influences communications
 - Internet Society (ISOC)
 - Addresses issues impacting the future of the internet
 - Internet Corporation for Assigned Names and Numbers (ICANN)
 - Domain and IP management
 - World Wide Web Consortium (W3C)
 - Protocols and standards, ensures interoperability



Myths About the Internet

- Myth 1: The Internet is Free
 - Most people and businesses pay for Internet access
 - Businesses, schools, and libraries lease communications lines from phone companies
 - Mobile phone users pay hotspot providers or mobile phone providers for access
 - Fee-based content is growing at a rapid pace
 - Music/movie downloads
 - Donation-based sites



FIGURE 8-4

Fee-based Web content. The use of fee-based Web content, such as streaming movies via Netflix as shown here, is growing.



Courtesy Netflix, Inc.



Myths About the Internet

- Myth 2: Someone Controls the Internet
 - No single group or organization controls the Internet
 - Governments can regulate Internet use within its country, but difficult to enforce
- Myth 3: The Internet and World Wide Web are identical
 - Internet is the physical network
 - WWW is the collection of Web pages available over the Internet
 - Other resources are available via the Internet, for example, FTP



Getting Set Up to Use the Internet

- Type of Device
 - Combination of factors to consider
 - Devices available to you
 - Whether you need access just at home or while on the go
 - What types of Internet content you want to access
 - Personal Computers
 - Smartphones, Media Tablets, and Other Mobile Devices
 - Gaming Devices and Televisions



Getting Set Up to Use the Internet

Courtesy Viewsonic Corporation



PERSONAL COMPUTERS



SMARTPHONES



Courtesy Groupon

SMART TVs



FIGURE 8-5

A variety of devices can be used to access the Internet.

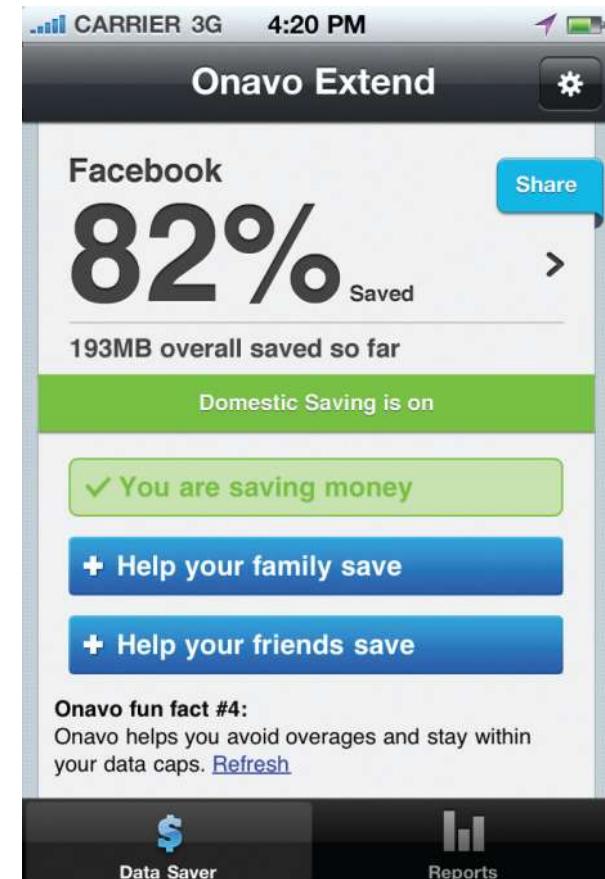
Courtesy Yahoo!® ConnectedTV



Inside the Industry Box

Mobile Data Caps

- Mobile data use is increasing rapidly
- Many wireless carriers now have data caps for mobile devices
- Either lose high-speed access or are charged a fee when data cap is exceeded
- Best to monitor your data use to stay below your data cap
- Onavo also compresses data





Types of Connection and Internet Access

- Computer must be connected to the Internet to obtain access
- Most connections today are broadband
- Dial-up vs. Direct Connections
 - Dial-up connections use standard phone lines
 - Uses modem to dial-up ISP
 - Inconvenient
 - Slower, but cheaper
 - Ties up phone lines
 - Relatively secure from hackers



Types of Connection and Internet Access

- Direct connections
 - Device is continually connected to the Internet
 - Access Internet using a browser—Internet Explorer, Chrome, or Firefox
 - Direct connections are typically broadband
 - Because you are always connected, it is important to protect your computer from hackers



Types of Connection and Internet Access

- Conventional Dial-Up
 - Uses dial-up modem connected to standard telephone jack
 - Most often used with home computers for users who do not need or do not want to pay for broadband
 - Inexpensive hardware
 - Easy to set up and use
 - Widespread availability
 - Slow connection speed



Types of Connection and Internet Access

- Cable
 - Most widely used home broadband connection
 - Fast, between 15 and 50 Mbps
 - Requires a cable modem
- DSL
 - Broadband delivered over telephone lines
 - Must be less than 3 miles from a switching station
 - Transmits over telephone lines but does not tie up the line
 - Typically 1-15 Mbps



Types of Connection and Internet Access

- Satellite
 - Broadband option for rural areas
 - Slower and more expensive than cable or DSL
 - Requires satellite modem and transceiver dish
 - Performance might degrade or stop altogether during bad weather
- Fixed Wireless
 - Uses radio transmission towers rather than satellites
 - Requires a modem and, sometimes, an outside-mounted transceiver
 - Uses WiMAX technology to broadcast



Types of Connection and Internet Access

- Broadband over Fiber (BoF)
 - Delivers over fiber-optic cabling all the way to the building
 - Also called fiber-to-the-premises (FTTP)
 - Most often installed by telephone companies
 - Download speeds between 15 Mbps and 150 Mbps
 - Requires special networking equipment
- Mobile Wireless
 - Access via a smartphone or media tablet
 - Typically requires a data plan



Types of Connection and Internet Access

Type of Internet Connection	Availability	Approximate Maximum Speed*	Approximate Monthly Price
Conventional dial-up	Anywhere there is telephone service	56 Kbps	Free-\$20
Cable	Virtually anywhere cable TV service is available	3-100 Mbps	\$30-110
DSL	Within 3 miles of a switching station that supports DSL	1-25 Mbps	\$20-65
Satellite	Anywhere there is a clear view of the southern sky and where a satellite dish can be mounted and receive a signal	5-15 Mbps	\$40-100
Fixed wireless	Selected areas where service is available	1-12 Mbps	\$35-75
Broadband over fiber (BoF)	Anywhere fiber has been installed to the building	15-150 Mbps	\$45-130
Mobile wireless (3G/4G)	Virtually anywhere cellular phone service is available	1-30 Mbps	Varies greatly; often bundled with mobile phone service

* Download speed; most connections have slower upload speeds.

FIGURE 8-7
Typical home Internet connection options.



Types of Connection and Internet Access

- Wi-Fi Hotspots
 - Public wireless networks (Wi-Fi)
 - Both free and fee-based are available

FIGURE 8-9

Wi-Fi hotspots.
Hotspots are used to wirelessly connect to the Internet via the Internet connection belonging to a business, city, school, or other organization.



COFFEEHOMES AND OTHER PUBLIC LOCATIONS
Often fee-based, though some are available for free.



HOTELS AND CONFERENCE CENTERS
Often free for guests.



HOSPITALS, BUSINESSES, AND OTHER ORGANIZATIONS
Usually designed for employees but are sometimes also available free to visitors.



COLLEGE CAMPUSES
Usually designed for students and faculty; sometimes used directly in class, as shown here.



Selecting an ISP and Setting Up Your Computer

- Selecting an ISP
 - Type of device used, type of Internet connection, and service desired, geographic location will likely determine your ISP options
 - Questions to ask include speed, outages, support, limits, pricing options, etc.
 - Pricing options between different ISP companies will vary
 - Many ISPs offer tiers or different levels (speeds) of service for different prices



Selecting an ISP and Setting Up Your Computer

- Setting Up Your Computer
 - Install necessary hardware
 - Some may require professional installation, i.e., satellites and broadband over fiber
 - Select user name and a payment method
 - Perform any necessary set-up to share the connection with other computers or devices



Quick Quiz

1. The Internet began as an experimental network known by which name?
 - a. ARPANET
 - b. Internet2
 - c. World Wide Web
2. True or False: Cable is a common type of direct Internet connection.
3. A type of always-on broadband Internet access available through conventional phone lines that does not tie up your phone line is _____.

Answers:

- 1) a; 2) True; 3) DSL



Searching the Internet

- Search Sites
 - Web sites designed to help users search for Web pages that match specified keywords or selected categories
 - Typically use a search engine in conjunction with a database containing information about Web pages to locate appropriate Web pages
 - Many search sites available (Google, Bing, Yahoo, Ask.com, etc.)
 - Real-time search engines are emerging
 - Search the Web live rather than relying on a database, i.e., MyLiveSearch



Searching the Internet

- Keyword Search
 - Keywords are typed in a search box to locate information on the Internet
 - Matching Web pages are called hits
 - Clicking on a Web page name displays that page
- Directory Search
 - Categories are selected to locate information on the Internet
- Search Site Tools
 - Search for music files, image files, news articles, maps, people, videos
 - Google is one of the most versatile search sites



Searching the Internet

FUNCTION	EXPLANATION
Calculator	Enter a mathematical expression or a conversion to see the result.
Currency converter	Enter an amount and currency types (such as <i>10 Euro in USD</i>) to see the corresponding value.
Dictionary	Enter the term <i>define</i> followed by a term to view definitions for that term from online sources.
Earthquakes	Enter the term <i>earthquake</i> to see recent earthquake activity around the world.
Flight information	Enter an airline and a flight number to see status information.
Movie showtimes	Enter the term <i>movie</i> followed by a ZIP Code to view movies showing in that area.
Number search	Enter a UPS, FedEx, or USPS tracking number; an area code; or a UPC code to view the associated information.
Sports scores	Enter a team name or league name to see scores, schedules, and other information.
Sunrise/sunset	Enter the term <i>sunrise</i> or <i>sunset</i> followed by a city name to see the time of the sunrise or sunset in that city.
Street maps	Enter an address to find a map to that location.
Time	Enter the term <i>time</i> followed by a city name to see the current time in that city.
Weather	Enter the term <i>weather</i> followed by a city name or ZIP Code to view the weather for that location.
Yellow pages	Enter a type of business and city name or ZIP Code to view businesses in that local area.

FIGURE 8-13
Google search tools.

EXAMPLES:

10 miles in feet

AA 144

American Airlines Flight 144
Orlando - Dallas 4 hours 20 mins

LAX IAD

Length: 10 Miles = 52800 Feet

Departure: 2:47 PM Arrival: 3:42 PM Duration: 1 hour 55 mins



Search Strategies

- Using Phrases
 - Phrase searching is typing more than one keyword in a keyword search

SEARCH PHRASE USED	SEARCH SITE	NUMBER OF PAGES FOUND	TITLE OF FIRST TWO NONSPONSORED PAGES FOUND*
dogs	Google	1,420,000,000	Dogs – Wikipedia, the free encyclopedia Dog: Dog Breeds, Adoption, Bringing a Dog Home and Care
	Bing	53,200,000	Dog – Wikipedia, the free encyclopedia Dog Supplies Dog Accessories & Dog Products – Dog.com
hand signals	Google	26,300,000	Hand Signals – Wikipedia, the free encyclopedia California Driver Handbook – Safe Driving Practices
	Bing	17,400,000	Hand Signals – Wikipedia, the free encyclopedia Hand Signs Part 1
dog hand signals	Google	1,830,000	DDEAF Training Hand Signs – Deaf Dog Education Action Fund Dog Training Hand Signals – Dog Training Excellence
	Bing	6,500,000	How to Teach a Dog Hand Signals eHow.com Dog Training Hand Signals, A Different Type of Communication
"dog hand signals"	Google	51,500	DDEAF Training Hand Signs – Deaf Dog Education Action Fund Utilize Dog Hand Signals in Your Training: Dog Obedience Training
	Bing	6,490	How to Teach a Dog Hand Signals eHow.com Dog Training Hand Signals, A Different Type of Communication

* Highlighted entries indicate Web pages about dog hand signals.

FIGURE 8-14

Examples of phrase searching. Using different search phrases and different search sites can significantly change the search results.



Search Strategies

- Using Boolean Operators
 - Use AND, OR, and NOT to further refine a search
 - Check to see what operators can be used on the site
- Using Multiple Search Sites
 - Different search sites can return different results
- Using Appropriate Keywords, Synonyms, Variant Word Forms, and Wildcards
 - Synonyms are different words that mean the same thing
 - Variations of your keywords, alternate spellings, etc.
 - Wildcards, such as *, can be used to search for keyword patterns



Search Strategies

- Using Field Searches
 - Field searches are searches limited to a particular characteristic, such as page title, page text, URL, top level domain or Web site

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FIELD TYPE	EXAMPLE	EXPLANATION
Title	title: "tax tips"	Searches for Web pages containing the words "tax tips" in the page title.
Text	text: "tax tips"	Searches for Web pages containing "tax tips" in the text of the page.
Site	forms site:irs.gov	Searches for Web pages associated with the keyword "forms" that are located only on the irs.gov Web site.
Domain	tax tips site:*.gov	Searches for Web pages associated with the keywords "tax tips" that are located on government Web sites (they can have anything for the first part of the domain name, but must have a .gov TLD).

FIGURE 8-15
Field searching.
Field searches limit search results to just those pages that match specific field criteria, in addition to any specified search criteria.



Evaluating Search Results

- Does the title and listed description sound appropriate for the information you are seeking?
- Is the URL from an appropriate company or organization?
- You should also evaluate:
 - The author
 - The source
 - Determine if reliable or biased
 - The date
 - Many online articles are years old
- Verify online information with a second source



Citing Internet Resources

- To avoid plagiarism, proper citation procedures should be used for all Internet content used in a paper, book, or on a Web site
- Citation should include:
 - Author
 - Date of publication
 - Article or Web page title
 - “Retrieved” statement listing the date the article was retrieved from the Internet and the URL used



Citing Internet Resources

TYPE OF RESOURCE	CITATION EXAMPLE
Web page article (magazine)	Dvorak, J. (2013, June 3). The Google assumption engine. <i>PC Magazine</i> . Retrieved from http://www.pc当地.com/article2/0,2817,2419867,00.asp
Web page article (journal)	Dickens, C. (2013, June). Health literacy and nursing: An update. <i>American Journal of Nursing</i> , 113(6), 52–57. Retrieved from http://journals.lww.com/ajnonline/Fulltext/2013/06000/Health_Literacy_and_Nursing__An_Update.29.aspx
Web page article (not appearing in a periodical)	Elias, P. (2013, June 01). Judge orders Google to turn over data to FBI. Retrieved from http://www.nbcnews.com/technology/judge-orders-google-turn-over-data-fbi-6C10157219
Web page content (not an article)	<i>Security 101 - Internet Security Glossary / Norton</i> . (n.d.) Retrieved from http://us.norton.com/security-101
E-mail (cited in text, not reference list)	M. Rodriguez (personal communication, March 28, 2014)

FIGURE 8-16
Citing Web sources.
These examples follow the American Psychological Association (APA) citation guidelines.



Quick Quiz

1. With which of the following does the user select a category matching the topic for which he or she is searching?
 - a. keyword search
 - b. directory search
 - c. field search
2. True or False: The search phrase “trailer NOT horse” would locate Web pages about horse trailers
3. The program used by many search sites to retrieve matching Web pages from their database is called a(n) _____.

Answers:

1) b; 2) False; 3) search engine



Beyond Browsing and E-Mail

- Many types of other online communications methods exist
- Instant Messaging (IM) and Text Messaging
 - Instant Messaging
 - Exchanging real-time messages
 - Example of presence technology
 - Text Messaging
 - Used by mobile phone users
 - Also called Short Message Service (SMS)
 - Beginning to replace e-mail for personal communication
 - Can be group messages



FIGURE 8-18

Group messaging.

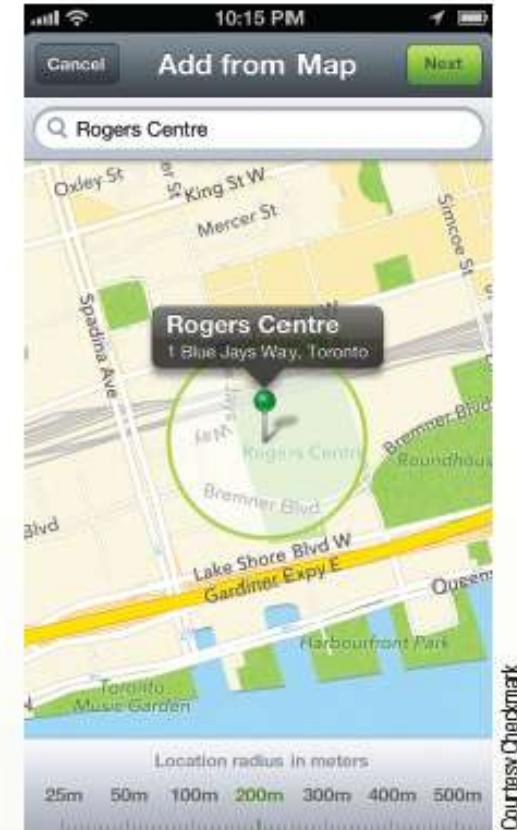
Works the same as traditional IM, just with more people.



How It Works Box

Geofencing

- Form of geobrowsing
- Businesses or individuals can set up geofences
 - Business can be notified when a customer enters or exits a geofence (location-based marketing)
 - Individual can be reminded of tasks to perform when they enter or exit a geofence



Creating up a geofence from a map location.



Beyond Browsing and E-Mail

- Twittering and Social Networking Updates
 - Users post short updates called tweets
 - Used in both business and personal lives
 - Other types of status updates are available via some social networking sites



FIGURE 8-19

Twitter. Allows individuals to post and view tweets.



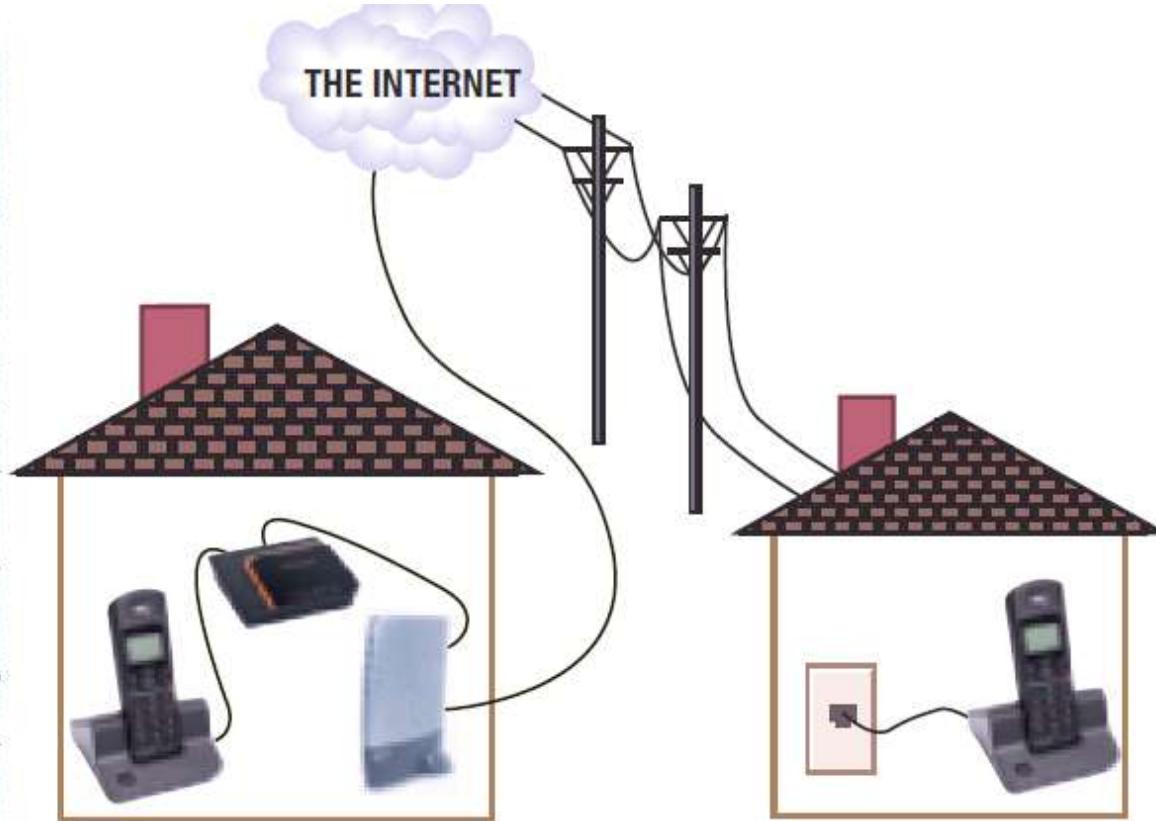
Beyond Browsing and E-Mail

- Forums
 - Web page that enables individuals to post messages on a particular topic for others to read and respond to
- Voice over Internet Protocol (VoIP)
 - Making telephone calls over the Internet
 - Computer to computer
 - Skype, IM, etc.
 - More permanent VoIP setups replace landline phones
 - Relatively inexpensive—as little as \$25 per month
 - Does not work when Internet connection or power is out



Beyond Browsing and E-Mail

Courtesy Vonage; Courtesy D-Link Systems, Inc.; © S. Bonnaire/Shutterstock.com



1. A conventional phone is plugged into a VoIP adapter, which is connected to a broadband modem.
2. Calls coming from the VoIP phone travel over the Internet to the recipient's phone.

FIGURE 8-20

Voice over IP (VoIP). Permanent VoIP setups allow telephone calls to be placed via a broadband Internet connection using a conventional telephone.



Beyond Browsing and E-Mail

- Web Conferences and Webinars
 - Web Conference
 - Face-to-face meeting (videoconferencing) taking place via the Internet
 - Typically takes place using a personal computer or mobile phone
 - Used by individuals and businesses
 - Business Web conferencing is often used for meetings between individuals located in different geographical locations



Beyond Browsing and E-Mail

- Webinar
 - A seminar presented via the Web
- Webcast
 - A completely one-way presentation
- Social Networking/Social Media
 - Social Networking Site
 - A site that enables a community of individuals to communicate and share information
 - Social Media
 - The collection of social networking sites and other communications channels used to share information



Beyond Browsing and E-Mail

Social Media Uses:

- Share information about yourself (Facebook, etc.)
- Connect people in specific geographic areas
- Check in to locations
- Sign in to Web sites
- Business marketing tool
- For security and safety reasons, users should be careful not to reveal too much about themselves
- Sites are increasingly monitored by colleges and employers
 - Carefully check what is posted and remove anything that might be potentially embarrassing



Beyond Browsing and E-Mail

Courtesy ABC.com; Courtesy YouTube

SHARE
Share Web content via online communications or social networks.

LOGIN
Log in to a Web site using social network credentials.

Share this video Embed Email Video call ▾

<http://youtu.be/n3wqorGX3xU>

Start at: 0:00

▾



FIGURE 8-22
Social networks are integrated into many Web sites.



Online Shopping and Investing

- Online Shopping
 - Buying products or services over the Internet
- Online Auction
 - Bids are placed for items and the highest bidder purchases the item
- Online Banking
 - Performing banking activities via the Web
- Online investing
 - Buying and selling stocks or other types of investments via the Web

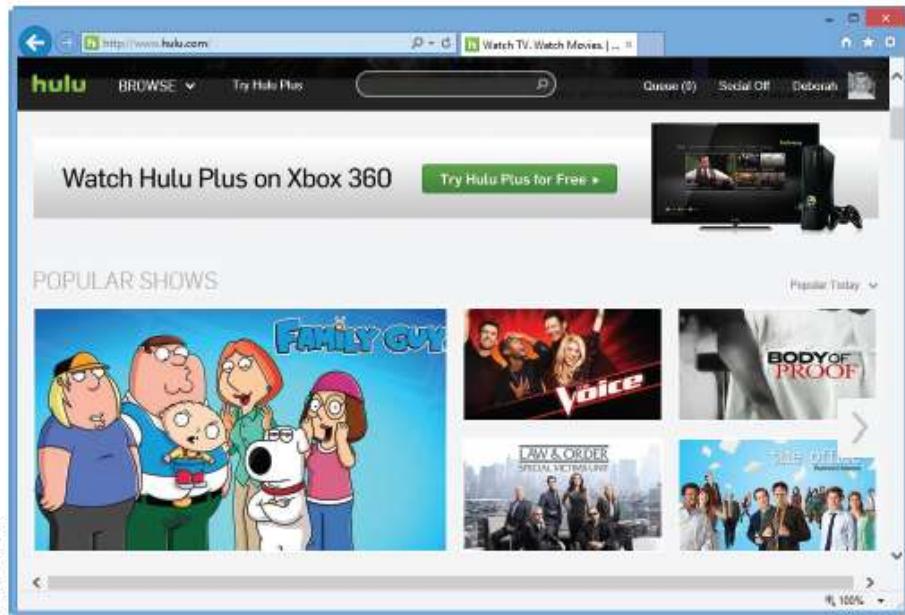


Online Entertainment

- Online Music
 - Music played or obtained via the Web
- Online TV, Videos, and Movies
 - Videos watched or downloaded via the Web
 - Live or recorded TV shows available via the Web
 - Feature films available via the Web
 - Video-on-demand (VoD)
 - Downloading movies and television shows, on demand, via the Web
 - Internet Protocol Television (IPTV) – content delivered directly to your TV



Online Entertainment



ONLINE TV AND MOVIES

TV shows and movies can be watched online for free via a variety of Web sites.



 **FIGURE 8-26**

Online TV and movies.

Courtesy Barnes & Noble, Inc.; © Disney/Pixar. All Rights Reserved.

VIDEO-ON-DEMAND

Rented or purchased TV shows and movies can be delivered to your computer, TV, or mobile device.



Technology and You Box

High Tech Workouts

- Video workouts available for smartphones and media tablets
- Typically streamed via the Internet
- Some are free; others are purchased individually or via a subscription
- Other high-tech workout devices include watches that record workout data and smart scales



A PumpOne iPad video workout.



Online Entertainment

- Online Gaming
 - Playing games via the Web
 - Web-based games, online multiplayer games, etc.
 - Quite often associated with Internet addiction
 - The inability to stop using the Internet or to prevent extensive use of the Internet from interfering with other aspect's of one's life
 - Gamification trend involves using gaming elements (earning points or rewards) in a non-entertainment context, such as for customer and employee engagement



Online News, Reference, and Information

- Online News
 - Available through Web sites belonging to news organizations, television networks, newspapers, magazines, etc.
 - Usually updated on a continual basis
 - Growing trend is to abandon print subscriptions and provide Web-only service--mainly due to cost
 - News archives are often available (sometimes requires a fee)



Online News, Reference, and Information

- Reference Sites
 - Provide access to specific types of useful information
 - Phone and address directories, weather, maps, home values, encyclopedias, dictionaries, etc.
- Portal Web page
 - Designed to be selected as a browser's home page; typically can be customized



Online News, Reference, and Information

Search capabilities.

Customized weather.

Access to Web mail and Skype.

News stories are organized into story tiles.

Click a story tile banner to view all stories in that category.

Click a story headline to view that story.

Access to social networks.

Used with permission from Microsoft Corporation

FIGURE 8-28

Portal pages. Portal pages can contain a wide variety of customized news and information.



Online News, Reference, and Information

- RSS (Really Simple Syndication) Feeds
 - News tool that delivers selected Web content to subscribers as the content is published to a Web site
- Podcasts
 - Recorded audio or video file that can be played or downloaded via the Web
 - Prepared by individuals and businesses
 - Used to share knowledge, express opinions, share original poems, songs, or short stories
 - Typically uploaded to the Web on a regular basis



Online News, Reference, and Information

- Product, Corporate, Government, and Other Information
 - Vast amount of product and government information available online
 - Product specifications
 - Instruction manuals
 - Tax forms
 - Government publications
 - Legislative bills
 - Wide variety of information from non-profit organizations, conservation groups, political parties, etc., also available



Trend Box

Internet of Things (IoT)

- Everyday objects are connected to and uniquely identified on the Internet
- Also called Machine-to-Machine (M2M)
- Will include sensors in shoes and other objects, smart fitness devices, home automation systems, smart farm equipment, smart freeways and traffic lights, etc.
- Devices will communicate with each other and provide feedback to users as needed
- Initial applications include home automation and wearable technology



Trend Box

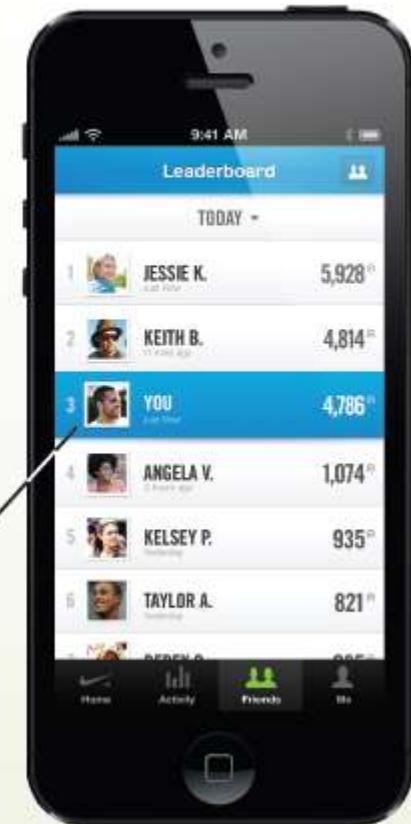
1. Wear the FuelBand on your wrist during the day (you can recharge it when needed via a USB port).



2. The FuelBand tracks your activity—look at the lights on the band or press a button to display your NikeFuel total to view your progress.



3. The FuelBand syncs your data with your PC or smartphone so you can review your activity history and monitor your achievement streaks for motivation, as well as share and compare your progress with others.



Courtesy Nike Inc.



Online Education and Writing

- Online Education
 - Using the Internet to facilitate learning
 - Web-based learning management systems
 - Used to deliver course content, manage assignments and grades, and more
 - Student response systems
 - Students use a special device or their mobile phone to respond to surveys or review questions during lectures



Online Education and Writing

- Web-based training (WBT)
 - Any instruction delivered via the Web
 - Commonly used for employee training
- Distance Learning
 - Students take classes from a different location from the one where the delivery of instruction takes place
- Online Testing
 - Taking tests via the Internet
 - Available for both objective and performance-based exams
 - Typically graded automatically
 - Cheating is an issue



Online Education and Writing

- Online Writing
 - Blogs
 - A Web page that contains short, frequently updated entries in chronological order, typically by just one individual
 - Wikis
 - A collaborative Web page that is designed to be edited and republished by a variety of individuals
 - Wikipedia is one of the largest
 - Carefully evaluate content, as irresponsible individuals can enter erroneous information
 - E-portfolios
 - A collection of an individual's work accessible via the Web



Censorship and Privacy Issues

- Censorship
 - Some countries block some Internet content
 - To hinder spread of information from political opposition
 - To filter out material determined to be offensive
 - To protect national security
 - Some countries have attempted to regulate Internet content
 - Difficulty defining “patently offensive” and “indecent”
 - Difficult finding a fair balance between protection and censorship



Censorship and Privacy Issues

– Internet Filtering

- Using software or browser options to block access to particular Web pages or types of Web pages
- Used by individuals, schools, employers, public computers, etc.
- Can use browser settings or special filtering software
- For computers and mobile devices

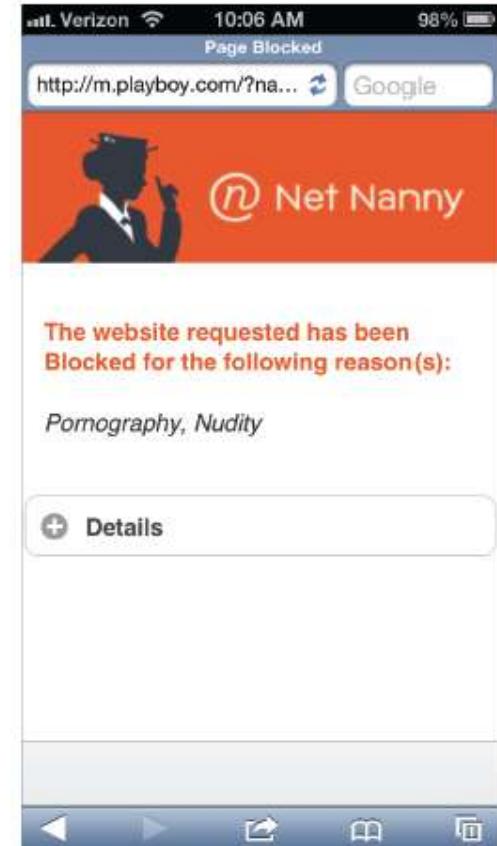


FIGURE 8-35
Internet filtering.



Censorship and Privacy Issues

- Web Browsing Privacy
 - Encompasses what information about individuals is available, how it is used, and by whom
 - Cookies
 - Small files stored on a hard drive by a Web server
 - Used to identify return visitors and their preferences
 - Can be used to track Web activity
 - Can be personally or non-personally identifiable
 - Data can be viewed or deleted
 - Settings can be changed; can be managed with software



Censorship and Privacy Issues

Used with permission from Microsoft Corporation

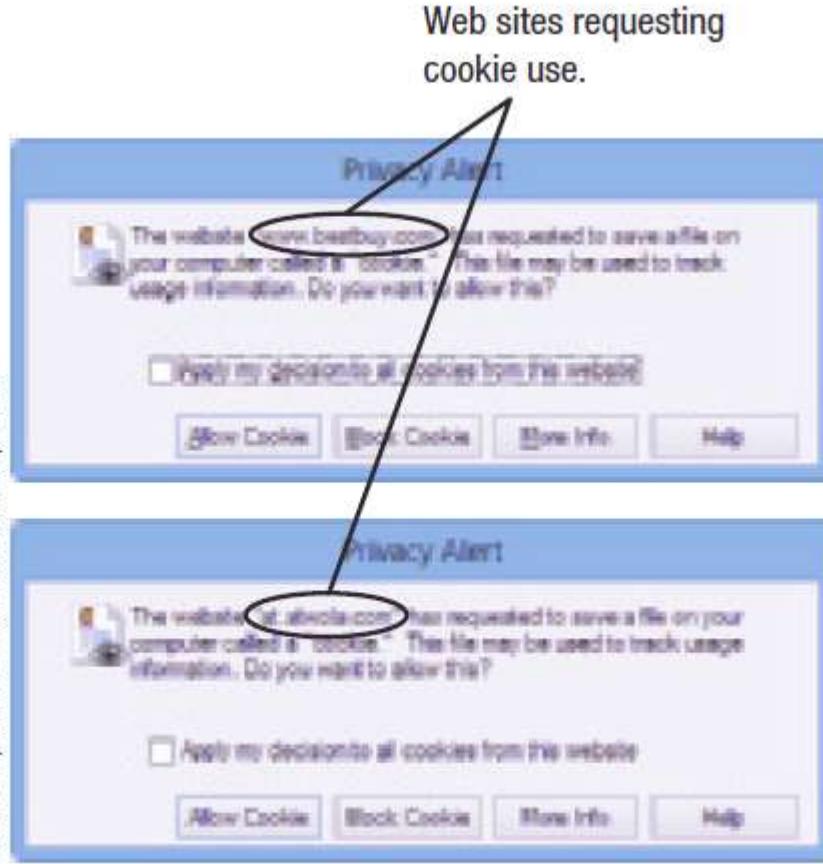


FIGURE 8-37

Cookie prompts.

After selecting the "Prompt" option in the cookie settings, you will have to accept or reject each cookie request.



Censorship and Privacy Issues

- Spyware and Adware
 - Spyware
 - Software installed without users knowledge that transmits data secretly through the user's Internet connection
 - Sometimes used by advertisers to gather marketing information
 - Used by criminals to gather personal data stored on your computer

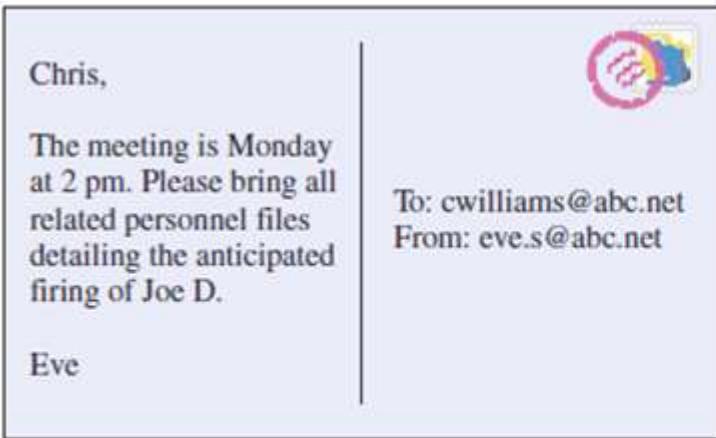


Censorship and Privacy Issues

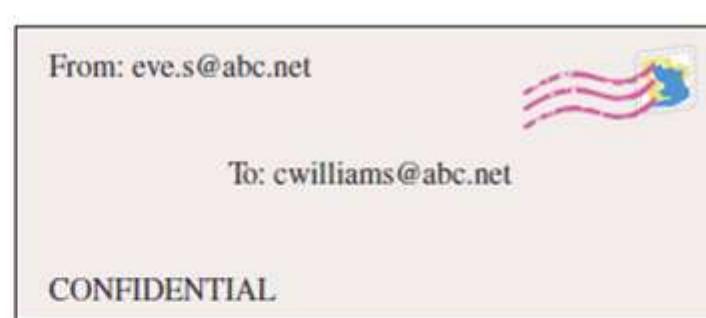
- Adware
 - Software supported by onscreen advertising
 - Often included in free programs
 - Does not gather information
 - Is not installed without user's consent
- E-Mail Privacy
 - Only encrypted e-mail can be transmitted privately
 - Employers and ISPs have access to e-mails sent through those organizations
 - Businesses and ISPs typically archive e-mail messages



Censorship and Privacy Issues



REGULAR (NONENCRYPTED E-MAIL) = POSTCARD



ENCRYPTED E-MAIL = SEALED LETTER

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FIGURE 8-38

You cannot assume e-mail messages are private, unless they are encrypted.



Quick Quiz

1. Ordering a movie or television show to be downloaded from the Internet is referred to as?
 - a. Interactive TV
 - b. Online radio
 - c. Video-on-demand (VOD)
2. True or False: A URL that begins with *https://* indicates the page being viewed is secure.
3. Blocking access to particular Web pages or types of Web pages using browser settings or special software is called Internet _____.

Answers:

- 1) c; 2) *True*; 3) *filtering*



Summary

- Evolution of the Internet
- Getting Set Up to Use the Internet
- Searching the Internet
- Beyond Browsing and E-Mail
- Censorship and Privacy Issues

15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 9:

Network and Internet Security

**Deborah Morley
Charles S. Parker**



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Learning Objectives

1. Explain why computer users should be concerned about network and Internet security.
2. List several examples of unauthorized access and unauthorized use.
3. Explain several ways to protect against unauthorized access and unauthorized use, including access control systems, firewalls, and encryption.
4. Provide several examples of computer sabotage.
5. List how individuals and businesses can protect against computer sabotage.



Learning Objectives

6. Discuss online theft, identity theft, spoofing, phishing, and other types of dot cons.
7. Detail steps an individual can take to protect against online theft, identity theft, spoofing, phishing, and other types of dot cons.
8. Identify personal safety risks associated with Internet use.
9. List steps individuals can take to safeguard their personal safety when using the Internet.
10. Discuss the current state of network and Internet security legislation.



Overview

- This chapter covers:
 - Security concerns stemming from the use of computer networks and the Internet in our society
 - Safeguards and precautions that can be taken to reduce the risk of problems related to these security concerns
 - Personal safety issues related to the Internet
 - Legislation related to network and Internet security



Why Be Concerned About Network and Internet Security?

- Computer Crime (cybercrime)
 - Any illegal act involving a computer, including:
 - Theft of financial assets
 - Manipulating data for personal advantage
 - Act of sabotage (releasing a computer virus, shutting down a Web server)
 - Phishing and Internet scams
- All computer users should be aware of security concerns and the precautions that can be taken



Unauthorized Access and Unauthorized Use

- Unauthorized Access
 - Gaining access to a computer, network, file, or other resource without permission
- Unauthorized Use
 - Using a computer resource for unapproved activities
- Both can be committed by insiders and outsiders
- Codes of Conduct
 - Used to specify rules for behavior, typically by a business or school



Unauthorized Access and Unauthorized Use

- Hacking
 - Using a computer to break into another computer system
 - A serious threat for individuals, businesses, and the country (national security), i.e., cyberterrorism
 - Often performed via wireless networks today
 - Many wireless networks are left unsecured
- War Driving
 - Driving around an area to find a Wi-Fi network to access and use without authorization

FIGURE 9-2

Wi-Fi finders. Online mapping services and smartphone apps can show you the available Wi-Fi hotspots for a particular geographic area.



Courtesy of iWi-Fi



Unauthorized Access and Unauthorized Use

- Wi-Fi Piggybacking
 - Accessing an unsecured Wi-Fi network from the hacker's current location without authorization
- Interception of Communications
 - Unsecured messages, files, logon information, etc., can be intercepted using software designed for that purpose
 - New trend: intercept credit and debit card information during the card verification process
 - Packetsniffing software



Protecting Against Unauthorized Access and Unauthorized Use

- Access Control Systems
 - Used to control access to facilities, computer networks, company databases, and Web site accounts
 - Identification Systems
 - Verify that the person trying to access the facility or system is an authorized user
 - Authentication Systems
 - Determine if the person is who he or she claims to be



Protecting Against Unauthorized Access and Unauthorized Use

- Possessed Knowledge Access Systems
 - Use information that only the authorized user should know
 - Typically passwords
 - Passwords should be strong and changed frequently
 - Typically used in conjunction with usernames
 - Disadvantages
 - Passwords can be forgotten
 - If known, password can be used by someone who is not an authorized user



Protecting Against Unauthorized Access and Unauthorized Use

PASSWORD STRATEGIES

Make the password at least eight characters and include both uppercase and lowercase letters, as well as numbers and special symbols.

Choose passwords that are not in a dictionary—for instance, mix numbers and special characters with abbreviations or unusual words you will remember but that do not conform to a pattern a computer can readily figure out.

Do not use your name, your kids' or pets' names, your address, your birthdate, or any other public information as your password.

Determine a *passphrase* that you can remember and use corresponding letters and symbols (such as the first letter of each word) for your password. For instance, the passphrase "My son John is five years older than my daughter Abby" could be used to remember the corresponding strong password "Msji5yotMd@".

Develop a system using a basic password for all Web sites plus site-specific information (such as the first two letters of the site and a number you will remember) to create a different password for each site, but still ones you can easily remember. For instance, you can combine your dog's name with the site initials followed by a number that is significant to you to form a password such as "RoverAM27" for Amazon.com.

Do not keep a written copy of the password in your desk or taped to your monitor. If you need to write down your password, create a password-protected file on your computer that contains all your passwords or use a password manager program.

Use a different password for your highly sensitive activities (such as online banking or stock trading) than for other Web sites. If a hacker determines your password on a low-security site (which is easier to break into), he or she can use it on an account containing sensitive data if you use the same password on both accounts.

Change your passwords frequently—at least every 6 months.

FIGURE 9-4
Strategies for creating strong passwords.



Protecting Against Unauthorized Access and Unauthorized Use

- Cognitive Authentication Systems
 - Use information the individual knows or can easily remember (birthplace, pet names, etc.)
 - Used in many password recovery systems
- Two-Factor Authentication
 - Using two different methods to authenticate users
 - Typically possessed knowledge (password) with either
 - Biometric Feature – something you are
 - Possessed Object – something you have
 - Hard token – physical object used
 - Soft token – supplies a one-time password (OTP)



Protecting Against Unauthorized Access and Unauthorized Use



FIGURE 9-5

Facebook two-factor authentication. The first time you log on with a new device, you must supply the OTP sent to your mobile phone in addition to your conventional username/password combination.



Protecting Against Unauthorized Access and Unauthorized Use

- Possessed Object Access Systems
 - Use a physical object an individual has in his/her possession to identify that individual
 - Smart cards, magnetic cards
 - RFID-encoded badges, USB security keys or tokens



PHYSICAL ACCESS

The object (in this case a mobile phone containing an appropriate microSD card) is read by a reader to provide access to a facility.



LOGICAL ACCESS

The object (in this case a smart card employee badge) is read by a reader (this reader is integrated into the computer) to provide access to that computer system.

FIGURE 9-6
Possessed objects. Can grant access to both facilities and computer resources (including computers, networks, and Web sites).



Protecting Against Unauthorized Access and Unauthorized Use

- Disadvantages
 - Can be lost or used by an unauthorized individual
- Biometric Access Systems
 - Identifies users by a particular unique biological characteristic
 - Fingerprint, hand, face, iris, voice, etc.
 - Data read by biometric reader must match what is stored in a database



Protecting Against Unauthorized Access and Unauthorized Use

- Often used to:
 - Control access to secure facilities
 - Log on to computers, punch in/out at work, law enforcement, etc.
- Advantages
 - Biometric access systems are very accurate
 - Cannot be lost or forgotten
- Disadvantages
 - Cannot be reset if compromised
 - Hardware and software are expensive



Protecting Against Unauthorized Access and Unauthorized Use



FINGERPRINT READERS

Typically used to protect access to work facilities or computers, to log on to secure Web sites, for law enforcement identification, and to pay for products or services.

VEIN READERS

Beginning to replace hand geometry readers to control access to facilities (such as government offices, prisons, and military facilities) and to punch in and out of work.



FACE RECOGNITION SYSTEMS

Typically used to control access to highly secure areas, to identify individuals for law enforcement purposes, and to log on to devices or apps, as shown here.

IRIS RECOGNITION SYSTEMS

Typically used to control access to highly secure areas and by the military, such as to identify Afghan patients as shown here.

FIGURE 9-7

Types of biometric access and identification systems.



Protecting Against Unauthorized Access and Unauthorized Use

- Controlling Access to Wireless Networks
 - In general, Wi-Fi is less secure than wired networks
 - Security is usually off by default; wireless networks should be secured
 - Wireless network owners should:
 - Change the router's default password
 - Enable encryption (WPA2 is more secure than WPA)
 - Enable other security features as needed
 - Can hide network name (SSID)



Protecting Against Unauthorized Access and Unauthorized Use

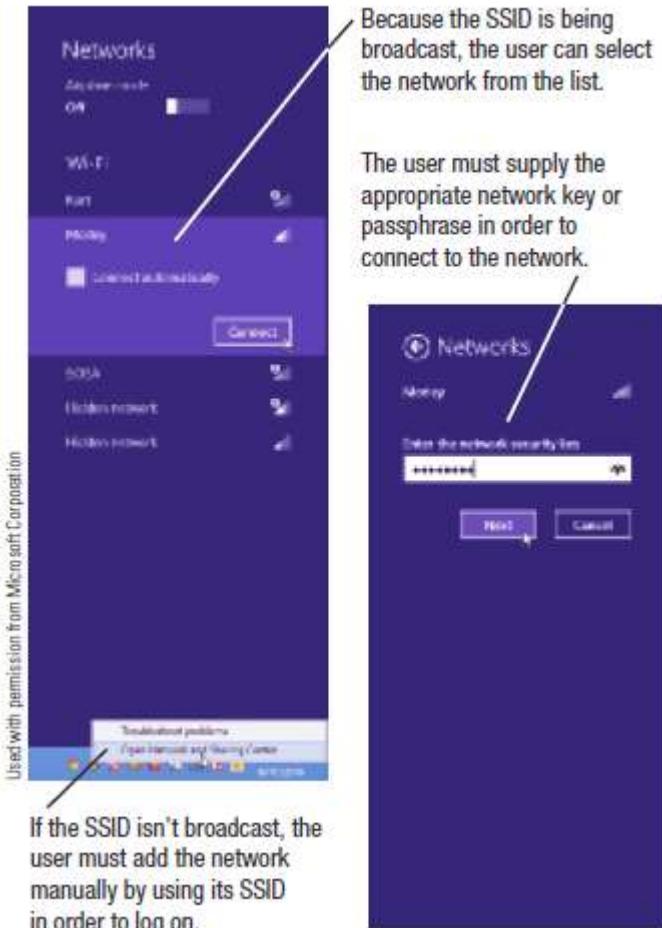


FIGURE 9-8

Accessing a Wi-Fi network. To access a secure network, the appropriate passphrase must be supplied.



How It Works Box

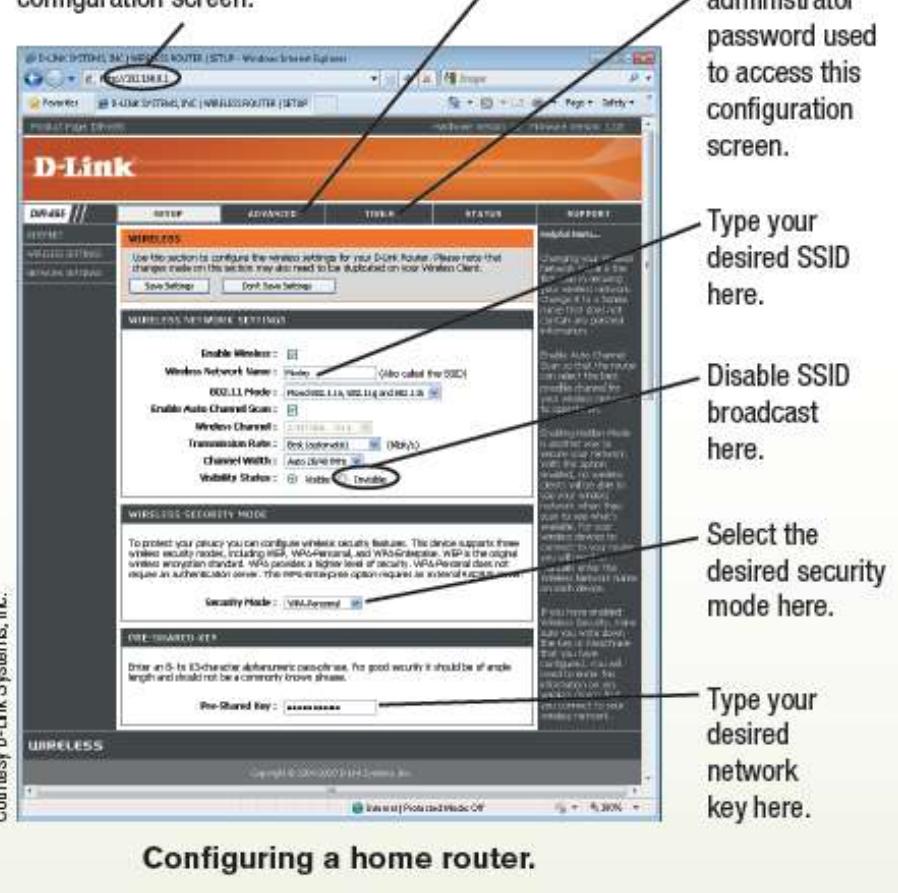
Securing a Wireless Home Router

- Use router's configuration screen
- Be sure to change the access password
- Enter the SSID name, select the security mode, and type a secure passphrase
- Can use MAC filtering

Use the router's IP address to display the router's configuration screen.

Use this tab to enable MAC address filtering.

Use this tab to change the administrator password used to access this configuration screen.



Configuring a home router.



Protecting Against Unauthorized Access and Unauthorized Use

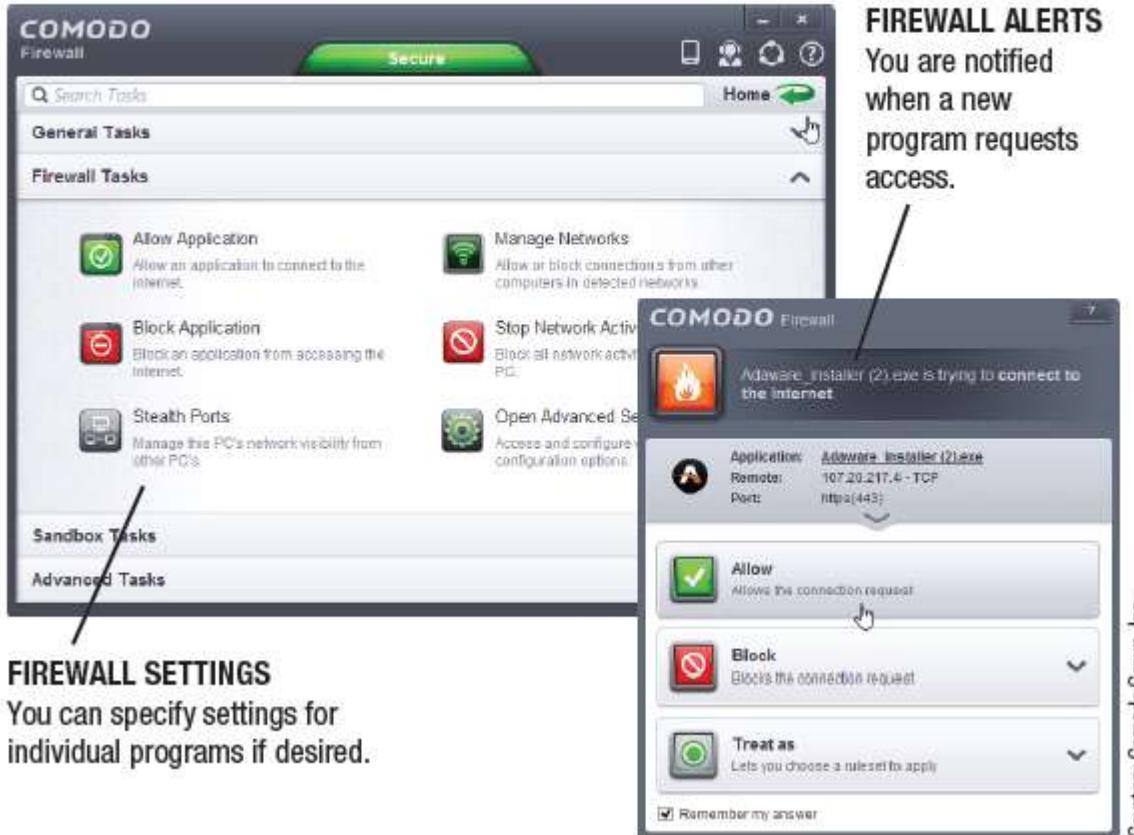
- Firewalls
 - A collection of hardware and/or software intended to protect a computer or computer network from unauthorized access
 - Typically two-way, so they check all incoming (from the Internet) and outgoing (to the Internet) traffic
 - Important for home computers that have a direct Internet connection, as well as for businesses
 - Work by closing down external communications ports



Protecting Against Unauthorized Access and Unauthorized Use

FIGURE 9-9

A personal firewall.





Protecting Against Unauthorized Access and Unauthorized Use

- Intrusion Prevention System (IPS) Software
 - Monitors traffic to try and detect possible attacks
 - If an attack is discovered, IPS software can immediately block it
- Encryption
 - Method of scrambling contents of e-mail or files to make them unreadable if intercepted
 - Secure Web pages use encryption
 - SSL and EV SSL



Protecting Against Unauthorized Access and Unauthorized Use

- Private Key Encryption (symmetric key encryption)
 - Uses a single key
 - Most often used to encrypt files on a computer
 - If used to send files to others, the recipient and sender must agree on the private key to be used
- Public Key Encryption (asymmetric key encryption)
 - Uses two keys (a private key and a public key) to encrypt and decrypt documents
 - Public key can be given to anyone
 - Key pairs are obtained through a Certificate Authority



Protecting Against Unauthorized Access and Unauthorized Use

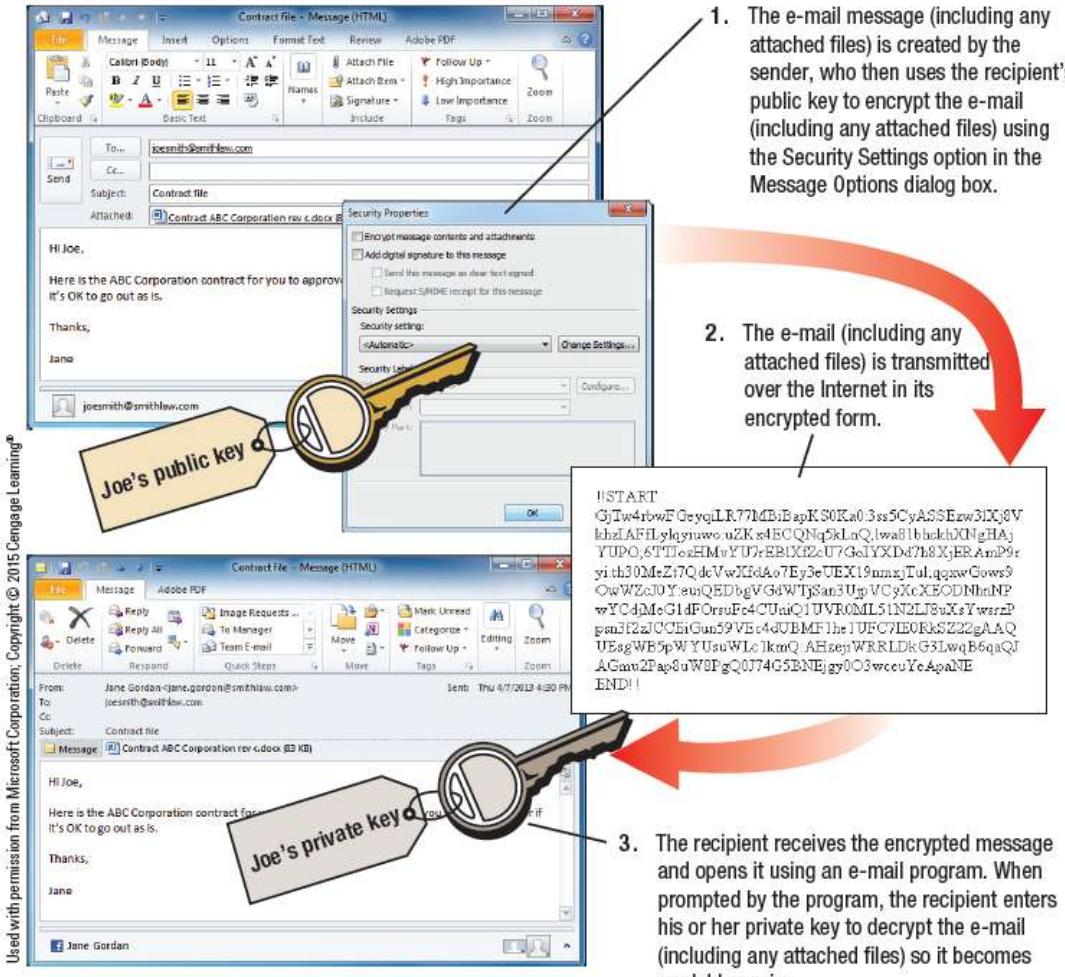


FIGURE 9-11
Using public key
encryption to secure
an e-mail message.



Protecting Against Unauthorized Access and Unauthorized Use

- Web-based encrypted e-mail (HushMail) is available
- Various strengths of encryption available
 - Stronger is more difficult to crack
 - Strong = 128-bit (16-character keys)
 - Military = 2,048-bit (256-character keys)



Protecting Against Unauthorized Access and Unauthorized Use

- Virtual Private Networks (VPNs)
 - A private secure path over the Internet
 - Allows authorized users to securely access a private network via the Internet
 - Much less expensive than a private secure network
 - Can provide a secure environment over a large geographical area
 - Typically used by businesses to remotely access corporate networks via the Internet
 - Personal VPNs can be used by individuals to surf safely at a wireless hotspot



Protecting Against Unauthorized Access and Unauthorized Use

- Additional Public Hotspot Precautions
 - Individuals should take additional precautions when using public hotspots in addition to using security software, secure Web pages, VPNs, and file encryption

PUBLIC HOTSPOT PRECAUTIONS

Turn off automatic connections and pay attention to the list of available hotspots to make sure you connect to a legitimate access point (not an evil twin).

Use a personal firewall to control the traffic going to and coming from your device and temporarily use it to block all incoming connections.

Use a virtual private network (VPN) to secure all activity between your device and the Internet.

Only enter passwords, credit card numbers, and other data on secure Web pages using a VPN.

If you're not using a VPN, encrypt all sensitive files before transferring or e-mailing them.

If you're not using a VPN, avoid online shopping, banking, and other sensitive transactions.

Turn off file sharing so others can't access the files on your hard drive.

Turn off Bluetooth and Wi-Fi when you are not using them.

Disable *ad hoc* capabilities to prevent another device from connecting to your device directly without using an access point.

Use antivirus software and make sure your operating system and browser are up to date.

FIGURE 9-12

Sensible precautions for public Wi-Fi hotspot users.



Protecting Against Unauthorized Access and Unauthorized Use

- Sensible Employee Precautions
 - Screen potential new hires carefully
 - Watch for disgruntled employees and ex-employees
 - Ask business partners to review their security
 - Develop policies and controls
 - Use software to manage devices and prevent data leaks
 - Data leakage prevention systems
 - Outbound-content monitoring systems
 - Mobile device management (MDM) - BYOD



Protecting Against Unauthorized Access and Unauthorized Use

The screenshot shows the Airwatch mobile device management (MDM) software interface. At the top, it says "Gita's iPad". Below that is a toolbar with icons for Device Query, Gear Potables, Send Message, Lock Device, Enterprise View, and Device Wise. A navigation bar below the toolbar includes tabs for Security (which is selected), Profiles, Apps, Content, Certificates, User, GPS, and Event Log.

The main content area is divided into several sections:

- Hardware:**
 - Device is not compromised (green)
 - OS version is compliant (green)
- Encryption:**
 - Data protection is enabled (green)
 - Block-level encryption is enabled (green)
 - File level encryption is enabled (green)
- Network:**
 - SIM card status normal (green)
 - Device is roaming (red warning)
 - Data roaming is enabled (red warning)
- Certificates:**
 - 2 Certificates installed (green)
 - 1 Certificate expiring in 5 days (red warning)
- MDM:**
 - Device security enabled (green)
 - MDM not broken in the past 30 days (green)
- Passcode:**
 - Passcode is present (green)
 - Passcode is compliant (green)
 - Passcode is compliant with profiles (green)
- Corporate:**
 - vPPoE is configured (green)
 - Corporate email is configured (green)
 - Wi-Fi is configured (green)
- Profiles:**
 - 2 Assigned profiles are installed (green)

A large red arrow points from the bottom left towards the "Network" section of the interface.

Courtesy Airwatch

FIGURE 9-13

Mobile device management (MDM) software. Secures and manages the mobile devices used in an organization.



Inside the Industry Box

Securing BYOD

- BYOD = Bring Your Own Device
- Some businesses use BYOD as a cost-saving measure
- Individuals want to carry their devices with them and use for both work and personal use
- Security is a disadvantage
 - Businesses need to ensure company networks and data are not adversely affected
 - MDM software can help
 - Containerization can separate work and personal data and apps





Quick Quiz

1. Which of the following is an example of possessed knowledge?
 - a. Password
 - b. Smart card
 - c. Fingerprint
2. True or False: With public key encryption, a single key is used to both encrypt and decrypt the file.
3. A(n) _____ controls access to a computer from the Internet and protects programs installed on a computer from accessing the Internet without authorization from the user.

Answers:

- 1) a; 2) False; 3) firewall



Computer Sabotage

- Computer Sabotage
 - Acts of malicious destruction to a computer or computer resource
 - Launching a computer virus
 - Denial of Service (DoS) attack
- Botnet
 - A group of bots (computers controlled by a hacker) that are controlled by one individual and work together in a coordinated fashion
 - Used by botherders (criminals) to send spam, launch Internet attacks, and spread malware



Computer Sabotage

- Malware
 - Any type of malicious software
 - Written to perform destructive acts (damaging programs, deleting files, erasing drives, etc.)
 - Logic bomb
 - Time bomb
 - Writing malware is considered unethical; distributing is illegal



Computer Sabotage

- Computer Viruses
 - A software program installed without the user's knowledge and designed to alter the way a computer operates or to cause harm to the computer system
 - Often embedded in downloaded programs and e-mail messages (games, videos, music files)
- Computer Worm
 - Malicious program designed to spread rapidly by sending copies of itself to other computers via a network
 - Typically sent as an e-mail attachment



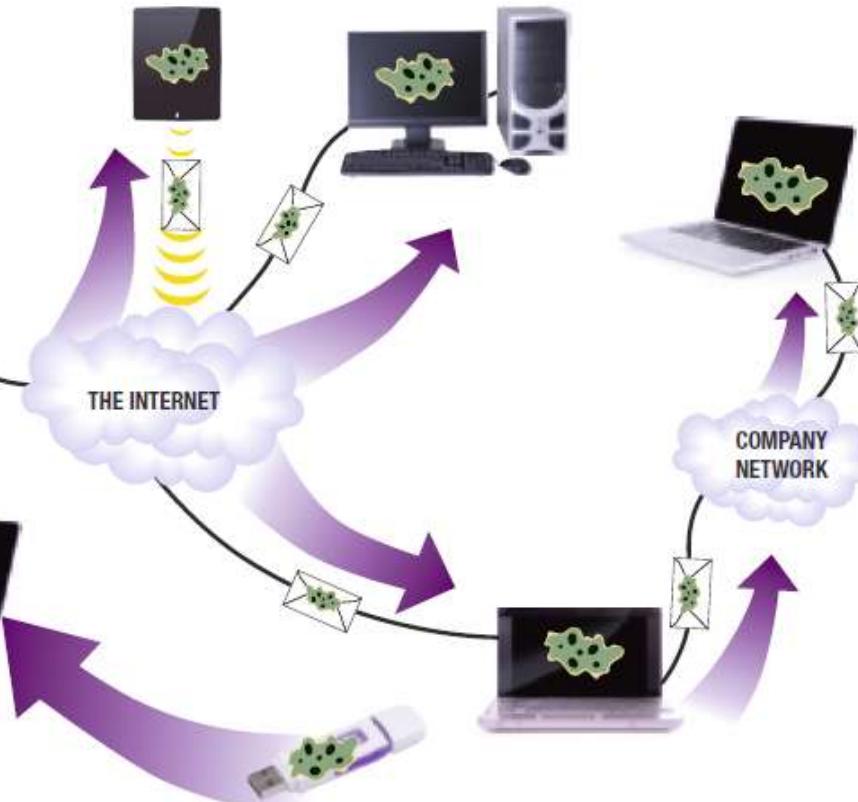
Computer Sabotage

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1. A computer virus originates when an unscrupulous programmer intentionally creates it and embeds it in a file. The infected file is then posted to a Web page where it will be downloaded via the Internet or is sent as an e-mail attachment to a large group of people.



3. A virus can spread very quickly because every computer that comes in contact with the virus—whether through an infected removable storage medium, infected downloaded file, or infected e-mail attachment—becomes infected, unless virus-protection software is used to prevent it.



2. When the infected file is opened on a computer, the virus copies itself to that computer's hard drive and the computer becomes infected. The virus may then e-mail itself to people in the newly infected computer's e-mail address book or copy itself to any removable storage medium inserted into that computer.

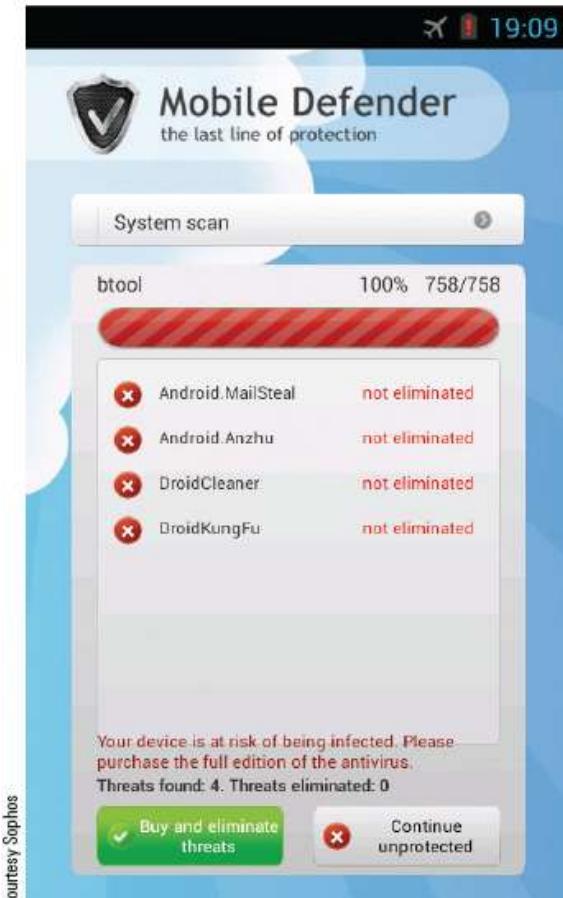
FIGURE 9-14
How a computer virus or other type of malicious software might spread.



Computer Sabotage

- Trojan Horse
 - Malicious program that masquerades as something else
 - Usually appears to be a game or utility program
 - Cannot replicate themselves; must be downloaded and installed
 - Rogue antivirus programs (scareware) are common today
 - Ransomware

FIGURE 9-15
Rogue anti-malware apps. These programs try to trick victims into purchasing subscriptions to remove nonexistent malware supposedly installed on their devices.





Computer Sabotage

- Mobile Malware
 - Can infect smartphones, media tablets, printers, etc.
 - Smartphones with Bluetooth are particularly vulnerable to attack
 - Mobile threats are expected to continue to increase
- Denial of Service (DoS) Attacks
 - Act of sabotage that attempts to flood a network server or Web server with so much activity that it is unable to function
 - Distributed DoS Attacks target popular Web sites and use multiple computers



Computer Sabotage

1. Hacker's computer sends several simultaneous requests; each request asks to establish a connection to the server but supplies false return information. In a distributed DoS attack, multiple computers send multiple requests at one time.



HACKER'S COMPUTER

Hello? I'd like some info...

2. The server tries to respond to each request but can't locate the computer because false return information was provided. The server waits for a short period of time before closing the connection, which ties up the server and keeps others from connecting.

I can't find you, I'll wait and try again...

3. The hacker's computer continues to send new requests so, as a connection is closed by the server, a new request is waiting. This cycle continues, which ties up the server indefinitely.

Hello? I'd like some info...



WEB SERVER

Hello? I'd like some info...

I'm busy, I can't help you right now.



LEGITIMATE COMPUTER

4. The server becomes so overwhelmed that legitimate requests cannot get through and, eventually, the server usually crashes.

FIGURE 9-16

How a denial of service (DoS) attack might work.



Computer Sabotage

- Data, Program, or Web Site Alteration
 - Sabotage occurs when a hacker breaches a computer system in order to delete/change data or modify programs
 - Student changing grades
 - Employee performing vengeful acts, such as deleting or changing corporate data
 - Data on Web sites can also be altered
 - Hacking into and changing social networking account contents (Facebook pages, Twitter tweets, etc.)
 - Altering legitimate site to perform malware attacks



Protecting Against Computer Sabotage

- Security Software
 - Typically a suite of programs used to protect your computer against a variety of threats
 - Antivirus Software
 - Used to detect and eliminate computer viruses and other types of malware
 - Should be set up to run continuously to check incoming e-mail messages, instant messages, Web page content, and downloaded files
 - Quarantines any suspicious content as it arrives
 - Should be set to perform regular system scans



Protecting Against Computer Sabotage

- Keep your security software up to date as new malware is introduced all the time
- ISPs and Web mail providers today also offer some malware protection to their subscribers
- Other Security Precautions
 - Control access to computers and networks
 - Intrusion protection systems can help businesses detect and protect against denial of service (DoS) attacks



Protecting Against Computer Sabotage

SECURITY SOFTWARE



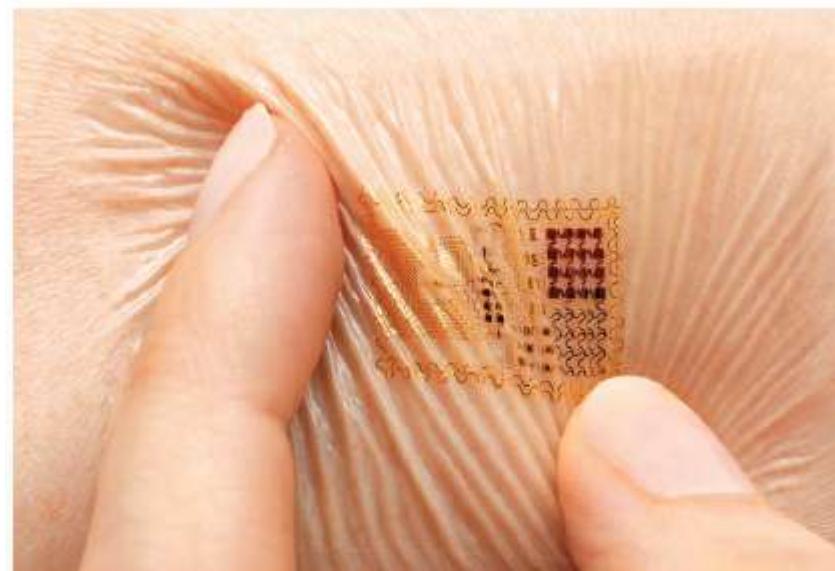
Courtesy: Malwarebytes; Courtesy: Lookout; Courtesy: SUPERAntiSpyware



Trend Box

Beyond Fingerprint Readers—Digital Tattoos and More

- Facial gestures can be used to unlock a phone by smiling or winking at it
 - Some include Liveness Check
- Future alternatives for logging individuals on to devices or secure Web sites
 - Digital tattoos are stamped onto skin
 - Authentication pills are swallowed



Courtesy MCID Inc.



Quick Quiz

1. Which of the following is used to control your computer by someone else?
 - a. Worm
 - b. Trojan horse
 - c. Botnet
2. True or False: Computer viruses can only be spread via the Internet.
3. A(n) _____ is a type of malware that masquerades as something else.

Answers:

1) c; 2) False; 3) Trojan horse



Online Theft, Online Fraud, and Other Dot Cons

- Dot Con
 - A fraud or scam carried out through the Internet
 - The Internet Crime Complaint Center received and processed more than 24,000 complaints per month in 2012
- Data or Information Theft
 - Theft of data or information located on or being sent from a computer
 - Can occur in several ways
 - Stealing an actual computer or mobile device
 - A hacker gaining unauthorized access



Online Theft, Online Fraud, and Other Dot Cons

- Identify Theft
 - Using someone else's identity to purchase goods or services, obtain new credit cards or bank loans, or illegally masquerade as that individual
 - Information obtained via documents, stolen information, spyware, etc.
 - Expensive and time consuming to recover from
 - Millions of Americans have their identity stolen each year

Online Theft, Online Fraud, and Other Dot Cons



1. The thief obtains information about an individual from discarded mail, employee records, credit card transactions, Web server files, or some other method.
2. The thief makes purchases, opens new credit card accounts, and more in the victim's name. Often, the thief changes the address on the account to delay discovery.
3. The victim usually finds out by being denied credit or by being contacted about overdue bills generated by the thief. Clearing one's name after identity theft is time consuming and can be very difficult and frustrating for the victim.

FIGURE 9-19
How identity theft
works.



Online Theft, Online Fraud, and Other Dot Cons

- Phishing
 - Use of spoofed e-mail messages to gain credit card numbers and other personal data
- Spear Phishing
 - A personalized phishing scheme targeted to specific individuals
- Social Media Hacks
 - The act of accessing someone else's social media account to make changes to the content or to perform an activity as that individual



Online Theft, Online Fraud, and Other Dot Cons

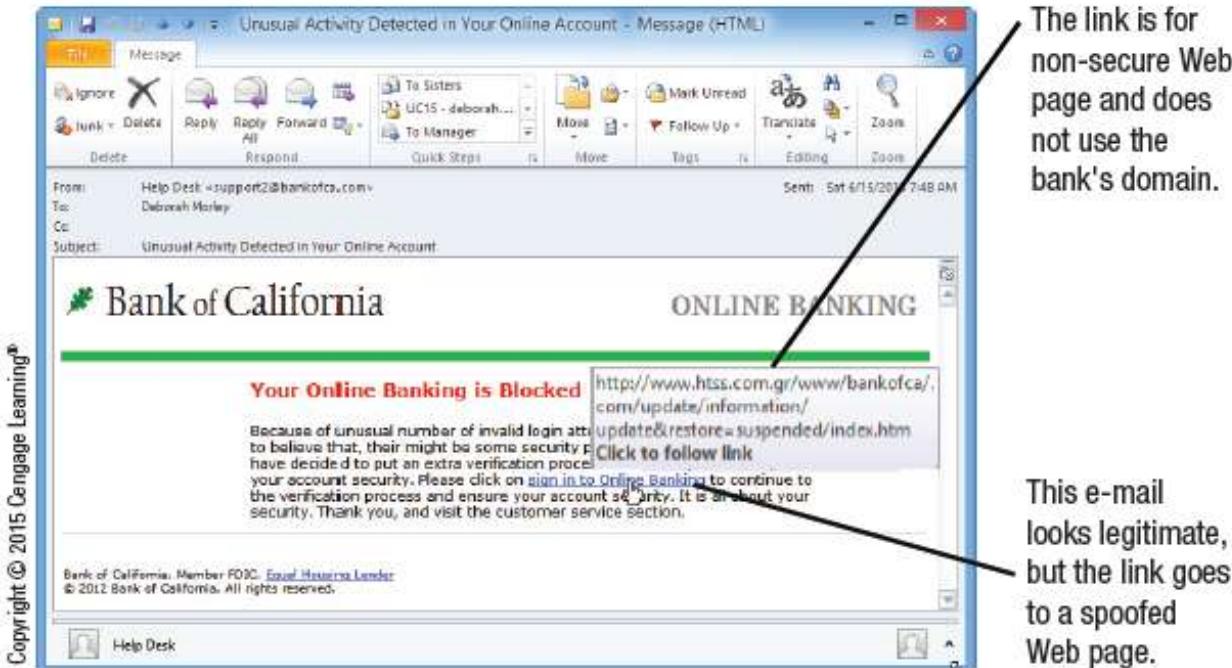


FIGURE 9-20
Phishing. Phishing schemes typically use legitimate-looking e-mails to trick users into providing private information.



Online Theft, Online Fraud, and Other Dot Cons

- Pharming
 - The use of spoofed domain names to obtain personal information
 - DNS servers are hacked to route requests for legitimate Web pages to spoofed Web pages (DNS poisoning)
- Drive-by Pharming
 - Hacker changes the victim's designated DNS server to the pharmer's DNS server



Online Theft, Online Fraud, and Other Dot Cons

- Online Auction Fraud
 - Occurs when an item purchased through an online auction is never delivered or the item is not as specified
 - Illegal, but as with other types of online fraud, prosecution is difficult
- Other Internet Scams
 - Loan and pyramid scams
 - Work-at-home cons
 - Nigerian letter fraud scheme
 - Pornographic sites
 - Fake job site postings



Protecting Against Online Theft, Online Fraud, and Other Dot Cons

- Protecting Against Data and Information Theft
 - Businesses should use good security measures
 - Individuals should not give out personal information (Social Security number, mother's maiden name, etc.) unless absolutely necessary
- Protecting Against Identity Theft, Phishing, and Pharming
 - Shred documents containing sensitive data, credit card offers, etc.
 - Order a full credit history on yourself a few times a year to check for accounts listed in your name
 - Don't place sensitive outgoing mail in your mailbox



Protecting Against Online Theft, Online Fraud, and Other Dot Cons

- Watch bills and credit report to detect identity theft early
- Never click a link in an e-mail message to go to a secure Web site—always type the URL in the browser instead
- Antiphishing Tools
 - Antiphishing tools built into Web browsers can help warn you of potential phishing sites
 - Some secure sites use additional layers of security to protect against identity thieves
 - Some banks and other financial institutions add an additional step in their logon process



Protecting Against Online Theft, Online Fraud, and Other Dot Cons

A PHISHING E-MAIL OFTEN . . .

Tries to scare you into responding by sounding urgent, including a warning that your account will be cancelled if you do not respond, or telling you that you have been a victim of fraud.

Asks you to provide personal information, such as your bank account number, an account password, credit card number, PIN number, mother's maiden name, or Social Security number.

Contains links that do not go where the link text says it will go (point to a hyperlink in the e-mail message to view the URL for that link to see the actual domain being used—a phisher would have to use a URL like microsoft.phisher.com, not microsoft.com).

Uses legitimate logos from the company the phisher is posing as.

Appears to come from a known organization, but one you may not have an association with.

Appears to be text or text and images but is actually a single image; it has been created that way to avoid being caught in a spam filter (a program that sorts e-mail based on legitimate e-mail and suspected spam) because spam filters cannot read text that is part of an image in an e-mail message.

Contains spelling or grammatical errors.

FIGURE 9-22

Tips for identifying phishing e-mail messages.



Protecting Against Online Theft, Online Fraud, and Other Dot Cons

TIPS FOR AVOIDING IDENTITY THEFT

Protect your Social Security number—give it out only when necessary.

Be careful with your physical mail and trash—shred all documents containing sensitive data.

Secure your computer—update your operating system and use up-to-date security (antivirus, antispyware, firewall, etc.) software.

Be cautious—never click on a link in an e-mail message or respond to a too-good-to-be-true offer.

Use strong passwords for your computer and online accounts.

Verify sources before sharing sensitive information—never respond to e-mail or phone requests for sensitive information.

Be vigilant while on the go—safeguard your wallet, smartphone, and portable computer.

Watch your bills and monitor your credit reports—react immediately if you suspect fraudulent activity.

Use security software or browser features that warn you if you try to view a known phishing site.

FIGURE 9-23

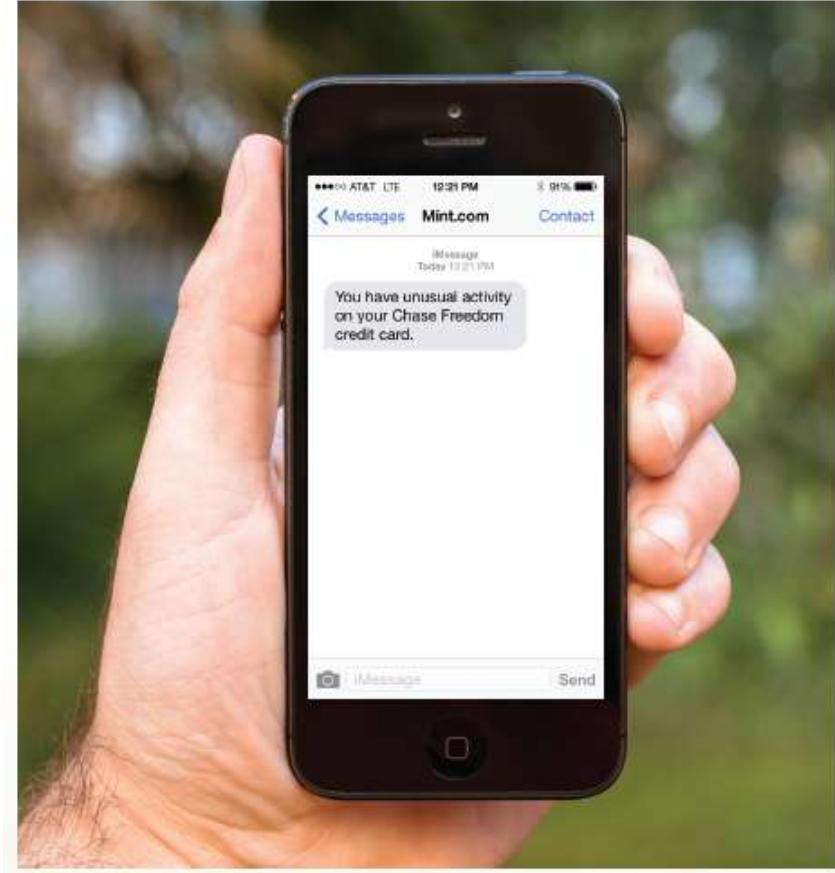
Tips to reduce your risk of identity theft.



Technology and You Box

Online Financial Alerts

- Can get e-mail or text alerts for account activity
- Can help identify unauthorized activity quickly
- Online money management aggregator services can be used to view the status of multiple accounts (credit cards, bank accounts, etc.)
 - Can set up alerts



© frankreporter/Stockphoto. Courtesy Mint.com



Protecting Against Online Theft, Online Fraud, and Other Dot Cons

- Digital Certificate
 - Group of electronic data that can be used to verify the identity of a person or organization
 - Obtained from Certificate Authorities
 - Typically contains identity information about the person or organization, an expiration date, and a pair of keys to be used with encryption and digital signatures
 - Are also used with secure Web sites to guarantee that the site is secure and actually belongs to the stated individual or organization
 - Can be SSL or EV SSL



Protecting Against Online Theft, Online Fraud, and Other Dot Cons

- Digital signatures
 - Unique digital codes that can be attached to an e-mail message or document
 - Can be used to verify the identity of the sender
 - Can be used to guarantee the message or file has not been changed since it was signed
 - Uses public key encryption
 - Document is signed with the sender's private key
 - The key and the document create a unique digital signature
 - Signature is verified using the sender's public key



Protecting Against Online Theft, Online Fraud, and Other Dot Cons

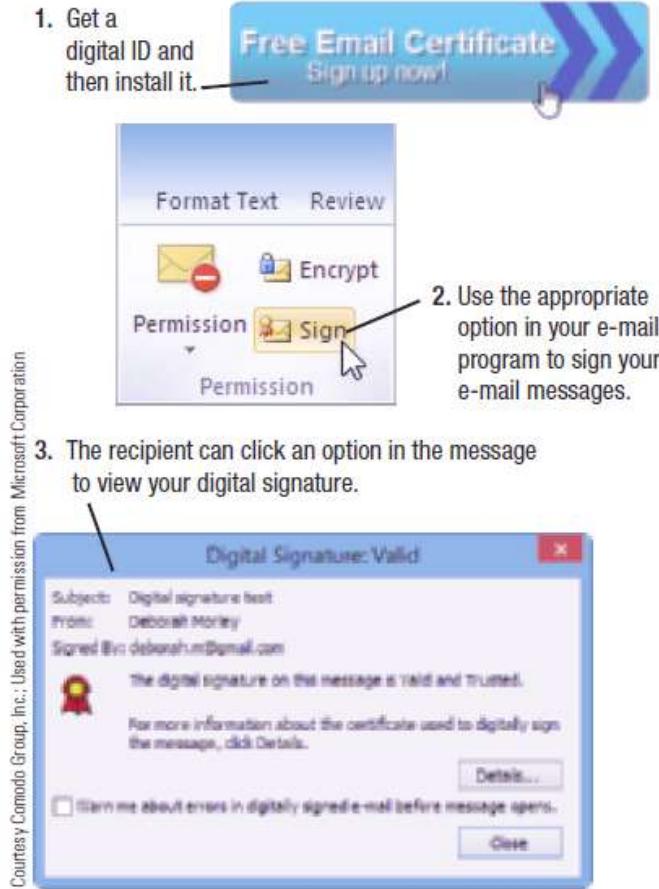


FIGURE 9-26

Digitally signing an e-mail message in Microsoft Outlook.



Protecting Against Online Theft, Online Fraud, and Other Dot Cons

- Protecting Against Online Auction Fraud and Other Internet Scams
 - Use common sense
 - Check online auction seller's feedback before bidding
 - Pay for online purchases via a credit card so transactions can be disputed if needed
 - Use an online payment system
 - Take advantage of buyer protection
 - Use an escrow service for high-priced items



Personal Safety Issues

- Cyberbullying
 - Children or teenagers bullying other children or teenagers via the Internet
 - E-mails
 - Social networking sites
 - Blogs
 - Common today--estimated to affect 50% of all US teenagers



Courtesy National Crime Prevention Council

 **FIGURE 9-27**
An anti-cyberbullying
Web banner.



Personal Safety Issues

- Cyberstalking
 - Repeated threats or harassing behavior between adults carried out via e-mail or another Internet communication method
 - Although there are no specific federal laws against cyberstalking, all states have made it illegal
- Online Pornography
 - Attempts to ban this type of material from the Internet have not been successful
 - Online pornography involving minors is illegal



Protecting Against Cyberbullying, Cyberstalking, and Other Personal Safety Concerns

- Safety Tips for Adults
 - Be cautious and discreet online
 - Use gender-neutral, nonprovocative identifying names
 - Do not reveal personal information
 - Can request your personal information be removed from online dire
- Safety Tips for Children and Teens
 - Monitor children's computer and smart phone activities
 - Caution older children about sending compromising photos; sexting can result in child pornography charges being filed against teens



Network and Internet Security Legislation

DATE	LAW AND DESCRIPTION
2004	Identity Theft Penalty Enhancement Act Adds extra years to prison sentences for criminals who use identity theft (including the use of stolen credit card numbers) to commit other crimes.
2003	CAN-SPAM Act Implements regulations for unsolicited e-mail messages.
2003	Fair and Accurate Credit Transactions Act (FACTA) Amends the Fair Credit Reporting Act (FCRA) to require that the three nationwide consumer reporting agencies (Equifax, Experian, and TransUnion) provide consumers, upon request, a free copy of their credit report once every 12 months.
2003	PROTECT Act Includes provisions to prohibit virtual child pornography.
2003	Health Insurance Portability and Accountability Act (HIPAA) Includes a Security Rule that sets minimum security standards to protect health information stored electronically.
2002	Homeland Security Act Includes provisions to combat cyberterrorism, including protecting ISPs against lawsuits from customers for revealing private information to law enforcement agencies.
2002	Sarbanes-Oxley Act Requires archiving a variety of electronic records and protecting the integrity of corporate financial data.
2001	USA PATRIOT Act Grants federal authorities expanded surveillance and intelligence-gathering powers, such as broadening the ability of federal agents to obtain the real identity of Internet users, intercept e-mail and other types of Internet communications, follow online activity of suspects, expand their wiretapping authority, and more.
1998	Identity Theft and Assumption Deterrence Act of 1998 Makes it a federal crime to knowingly use someone else's means of identification, such as name, Social Security number, or credit card, to commit any unlawful activity.
1997	No Electronic Theft (NET) Act Expands computer piracy laws to include online distribution of copyrighted materials.
1996	National Information Infrastructure Protection Act Amends the Computer Fraud and Abuse Act of 1984 to punish information theft crossing state lines and to crack down on network trespassing.
1984	Computer Fraud and Abuse Act of 1984 Makes it a crime to break into computers owned by the federal government. This act has been regularly amended over the years as technology has changed.

FIGURE 9-28

Computer network
and Internet security
legislation.



Quick Quiz

1. Sending an e-mail that looks like it came from someone else in order to obtain information for fraudulent purposes is called _____.
 - a. hacking
 - b. online auction fraud
 - c. phishing
2. True or False: Cyberstalkers often find their victims online.
3. Using someone else's identity to purchase goods or services or perform other transactions is called _____.

Answers:

1) c; 2) True; 3) identity theft



Summary

- Why Be Concerned About Network and Internet Security?
- Unauthorized Access and Unauthorized Use
- Protecting Against Unauthorized Access and Unauthorized Use
- Computer Sabotage
- Protecting Against Computer Sabotage
- Online Theft, Online Fraud, and Other Dot Cons
- Protecting Against Online Theft, Online Fraud, and Other Dot Cons
- Personal Safety Issues



Summary

- Protecting Against Cyberbullying, Cyberstalking, and Other Personal Safety Concerns
- Network and Internet Security Legislation

15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 10

Multimedia and the Web



**Deborah Morley
Charles S. Parker**

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Learning Objectives

1. Define Web-based multimedia and list some advantages and disadvantages of using multimedia.
2. Describe each of the following multimedia elements—text, images, animation, audio, and video—and tell how they differ.
3. Briefly describe the basic steps and principles involved with designing a multimedia Web site.
4. List the various tasks involved with developing a multimedia Web site.



Learning Objectives

5. Explain how markup languages, scripting languages, and other tools are used today to create multimedia Web pages.
6. Discuss the possible use of Web-based multimedia in the future.



Overview

- This chapter covers:
 - What Web-based multimedia is and how it is used today
 - The advantages and disadvantages of using multimedia
 - Basic multimedia elements commonly found on Web pages
 - Steps and principles in designing a multimedia site
 - How a multimedia Web site is developed and the software used during this process
 - The future of Web-based multimedia



What Is Web-Based Multimedia?

- Multimedia
 - The integration of a variety of media, such as text, images, video, animation, and sound
- Web-Based Multimedia (also called rich media)
 - Multimedia (sound, video, animation) located on Web pages
- Multimedia Sites
 - Are interactive
 - Often contain elements that users interact with directly
 - Display information as requested by the Web page visitor



What Is Web-Based Multimedia?

- Fast computers and broadband Internet connections make Web-based multimedia much more feasible than in the past
- Vast majority of Web sites today include multimedia (advertisements, TV shows, podcasts, user generated content)
- Why Learn About Web-Based Multimedia?
 - Multimedia is an integral component of the Web
 - Businesses and individuals need to understand the characteristics of the various types of multimedia elements and the impact of adding them to a Web site



Web-Based Multimedia Applications

- Information Delivery
 - Photos of products, video clips and podcasts, and users' manuals are used to convey information
 - Important component in Web-based training (WBT)
- E-Commerce
 - Online catalogs, samples of movies and music, etc.
 - Virtual Reality (VR)
 - The use of a computer to create three-dimensional environments that look like they do in the real world (i.e., homes for sale)
 - Augmented Virtual Reality - overlaying computer generated images on top of real time images



Web-Based Multimedia Applications

- Entertainment
 - Online TV/movies and games are available through TV network sites
- Social Media and Virtual Worlds
 - Photos and videos on many social networking sites
 - 3D Virtual Worlds (Second Life)



Web-Based Multimedia Applications

FIGURE 10-1

Web-based multi-media applications.



Courtesy Centers for Disease Control and Prevention

INFORMATION DELIVERY

Images, video, audio, and animation are often used to convey information, such as via this Web-based training course offered by the CDC.



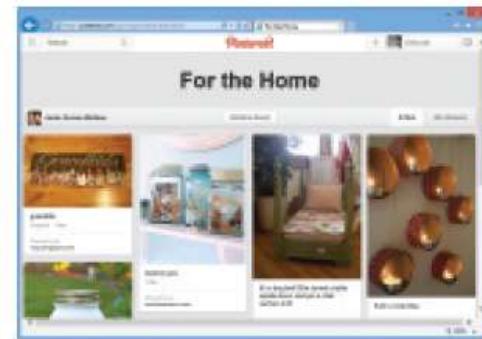
© 2013 Hulu

ENTERTAINMENT

Video and audio are often used in entertainment applications, such as Web sites like Hulu that offer TV shows for online viewing.

E-COMMERCE

Images and video are often used for e-commerce purposes, such as this virtual reality tour of a home for sale.



Courtesy Pinterest

SOCIAL MEDIA

Many social media sites such as Pinterest, shown here, include photos and video.



Advantages and Disadvantages of Web-Based Multimedia

- Advantages
 - Can deliver some content that could not be delivered otherwise
 - Can address a variety of learning styles
 - Visual learners
 - Auditory learners
 - Kinesthetic learners
 - Material more interesting and enjoyable
 - Many ideas are easier to convey in multimedia format



Advantages and Disadvantages of Web-Based Multimedia

- Disadvantages
 - Time and cost of development
 - The cost of hosting and delivering the multimedia needs to be considered
 - The impact on visitors that have slow Internet connections or low bandwidth caps



Inside the Industry Box

Military Virtual Worlds

- U.S. military simulations traditionally take months to develop
- Virtual world simulations can be developed much more quickly and requires less personnel and skills
- MOSES is a simulation created using an OpenSim grid
- Can be secured behind firewall



Courtesy of Douglas Maxwell, US Army Research Lab Simulation and Training Technology Center, 2013



Multimedia Elements

- Text
 - Used to supply basic content, and to add text-based menus and hyperlinks
 - Serif Typeface
 - Small lines on edges of letters
 - More readable, used for large bodies of text
 - Sans Serif Typeface
 - No lines on edges of letters
 - Used for titles, headings, Web page banners

Serif
ABC
DEFGHIJKLM
NOPQRSTUVWXYZ
WXYZ
0123456789

Times New Roman

ABC
DEFGHIJKLM
NOPQRSTUVWXYZ
WXYZ
0123456789

Cooper Black

SERIF TYPEFACES

No serif
ABC
DEFGHIJKLM
NOPQRSTUVWXYZ
WXYZ
0123456789

Copyright © 2015 Cengage Learning®

ABC
DEFGHIJKLM
NOPQRSTUVWXYZ
WXYZ
0123456789

Arial

Dom Casual

SANS SERIF TYPEFACES

FIGURE 10-3
Typefaces. Typefaces are collections of text characters that share a common design and can be either serif or sans serif.



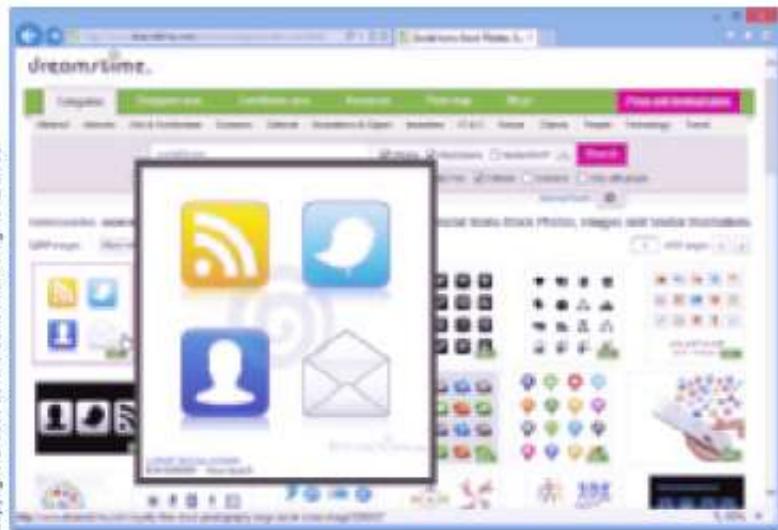
Multimedia Elements

- Different typefaces can convey widely different feelings
- Important to select a typeface that matches the style of the Web site
- When a consistent text appearance is required (such as for a logo) an image containing the text is used instead
- Images (Graphics)
 - Digital representations of photographs, drawings, charts, and other visual images
 - Images are static and are available in many formats—TIF, BMP, GIF, JPEG, and PNG
 - Clip art consists of pre-drawn images
 - Stock photos are also available online



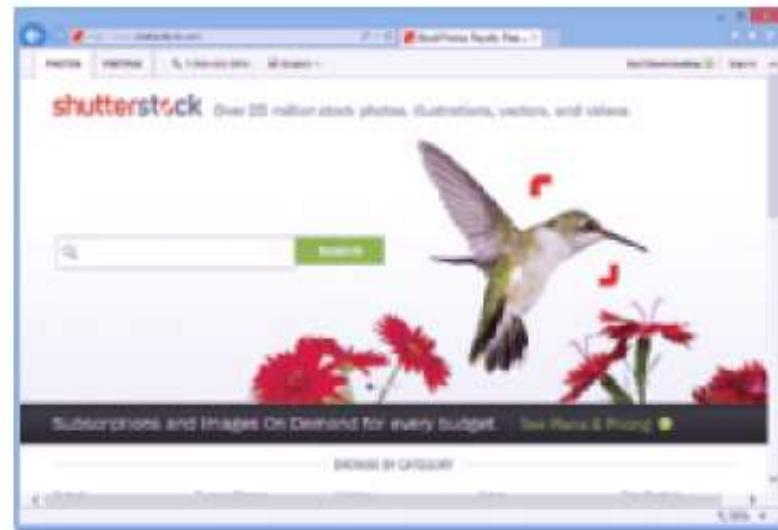
Multimedia Elements

Copyright © 2010-2013 Dreamstime. All rights reserved.



CLIP ART IMAGES

Typically use the PNG or JPEG format and can be downloaded from a variety of Web sites. Some of the images on this site are free for both personal and commercial use.



STOCK PHOTOGRAPHS

Typically use the JPEG format and can be downloaded from stock photograph agencies. The agency shown here has a variety of images organized by topics; all images require a fee for use, but all are royalty free.

FIGURE 10-4

Both clip art and stock photographs are plentiful on the Web.



Multimedia Elements

- GIF
 - Graphic Interchange Format
 - Commonly used for Web page images
 - Used with logos, banners, other nonphotographic images
 - 256 colors max
 - Uses lossless file compression
 - Can be transparent
 - Can be interlaced



Multimedia Elements

NONTRANSPARENT VS. TRANSPARENT GIFS

Nontransparent GIF
(the image's white background is visible on top of the page's yellow background).

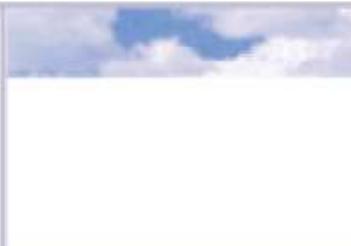


Transparent GIF with white specified as the transparent color (the yellow background is visible through the transparent areas of the image so the image appears to be nonrectangular).



NONINTERLACED VS. INTERLACED GIFS

Noninterlaced GIF
(the image is displayed top to bottom).



Interlaced GIF
(the complete image is displayed initially, but the quality is progressively increased).



FIGURE 10-5
Transparent and interlaced GIFs.



Multimedia Elements

- PNG
 - Portable Network Graphics
 - Format designed specifically for use with Web page images in 1996
 - Uses lossless compression
 - Can compress more efficiently than GIF
 - Can use specific color palette of 256 colors or true color palette of 16 million colors
 - Can also be transparent and interlaced



Multimedia Elements

- JPEG
 - Joint Photographic Experts Group
 - Standard format for Web page photos
 - Uses lossy file compression
 - Image quality is lost during compression
 - Can use true color
 - Can be progressive
 - The amount of compression is specified when the file is saved



Multimedia Elements



No compression
(37 KB)



40% compression
(13 KB)



80% compression
(7 KB)



100% compression
(3 KB)

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FIGURE 10-6

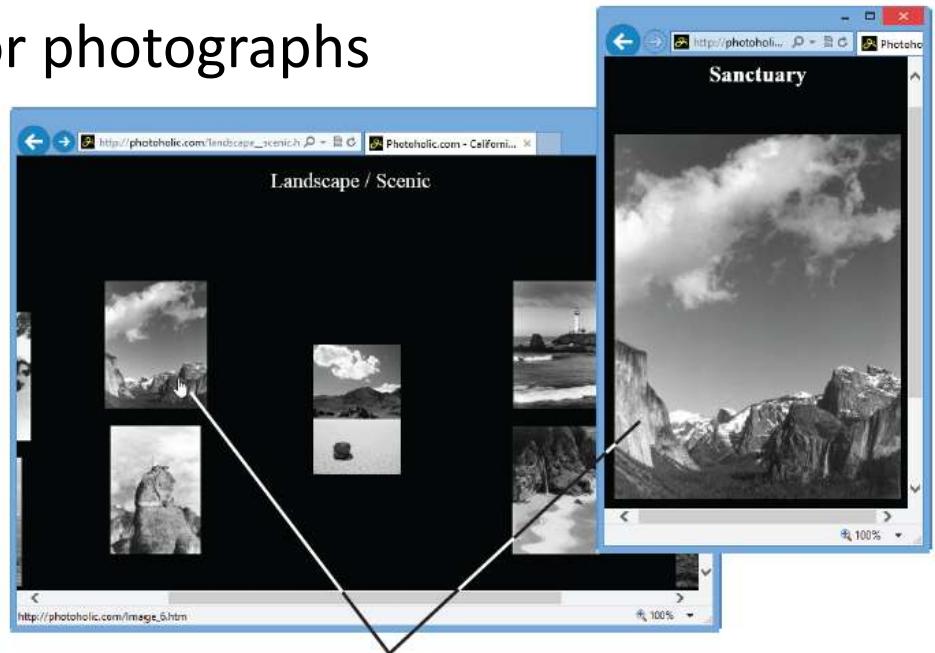
The amount of compression in a JPEG file affects both the file size and the display quality.



Multimedia Elements

- Choosing a Graphic Format
 - GIF or PNG—typically used for line art (clip art, logos, navigation buttons, etc.)
 - JPEG—typically used for photographs
 - Use thumbnail images when very large images are required

FIGURE 10-7
Thumbnail images.



Clicking a thumbnail image displays the full-sized image.



Multimedia Elements

- Animation
 - A series of graphical images are displayed in succession to simulate movement
 - Java Applet
 - A small program inserted into a Web page that performs a specific task
 - Animated GIF
 - A group of GIF images saved as an animated GIF file that is inserted in a Web page
 - Displayed one after another to simulate movement



Multimedia Elements

- For more complex animations, developers can use JavaScript or another scripting language
 - Flash, Silverlight
- Many Web-based animations require a plug-in
- Animation and interactivity can also be achieved using programming languages
- Audio
 - All types of sound including music, spoken voice, sound effects
 - Can be recorded using a microphone or MIDI instrument, captured from CDs, or downloaded from the Internet



Multimedia Elements

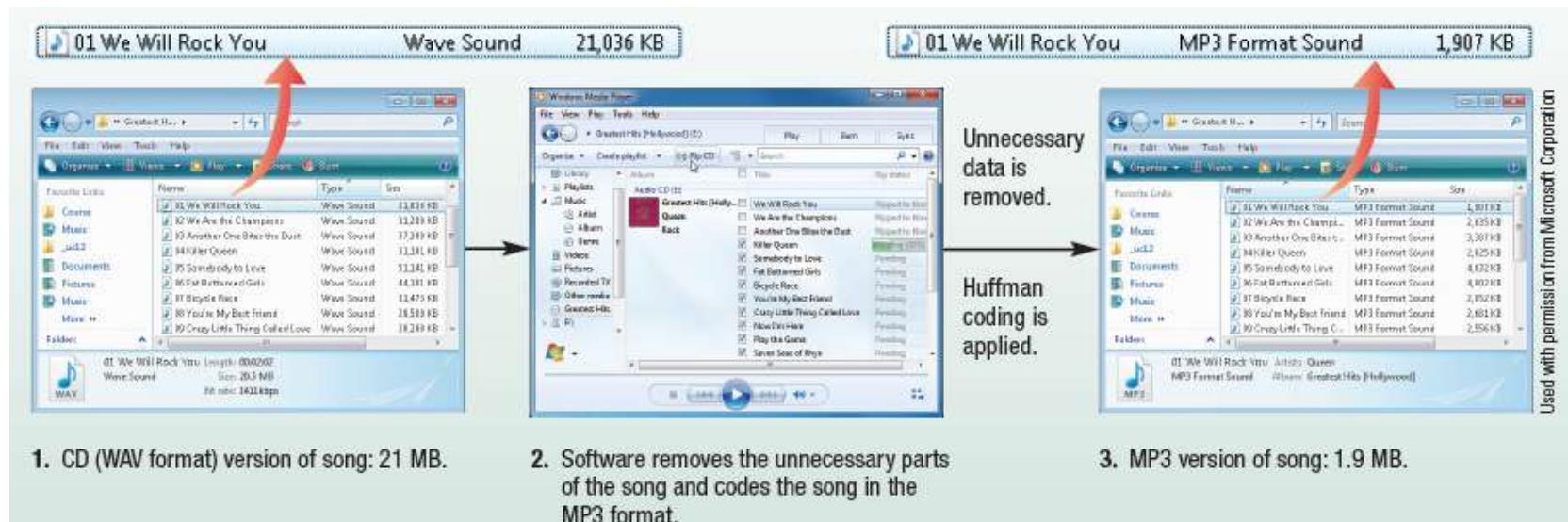
- Often played when an event occurs on a Web page or when the visitor clicks a link
- Streaming audio is used to speed up delivery
- Common audio file formats include:
 - Waveform (.wav)
 - Moving Picture Experts Group Audio Layer 3 (.mp3)
 - Audio Interchange Format File (.aiff)
 - Advanced Audio Coding (.aac or .m4a)



How It Works Box

MP3 Compression

- Patented compression method; MPEG Audio Layer 3
- Typically compresses a CD-quality song to 1/10th of its size
- Used with Internet music downloads
- Uses perceptual coding and Huffman coding





Multimedia Elements

- Video
 - Begins as a continuous stream of visual information, which is then broken into separate images (frames) when the video is recorded
 - Video data, like audio data, is usually compressed
 - Streaming video is recommended to speed up delivery
 - Common video file formats include:

.avi	.mp2	.mov
.flv	.mp4	.wmv



Quick Quiz

1. The most common file format for Web page photographs is _____.
 - a. GIF
 - b. JPEG
 - c. PNG
2. True or False: Delivery speed is one potential disadvantage of using Web-based multimedia.
3. A small image that is linked to a larger version of the same image is called a(n) _____.

Answers:

- 1) b; 2) True; 3) thumbnail image



Multimedia Web Site Design

- Web Site Design
 - The process of planning what a Web site will look like and how it will function
 - Good planning is very important
- Basic Design Principles
 - Web pages should be interesting and exciting applications
 - Provide information of value or interest
 - Provide a stimulating experience
 - Pages should load quickly and be easy to use



Multimedia Web Site Design

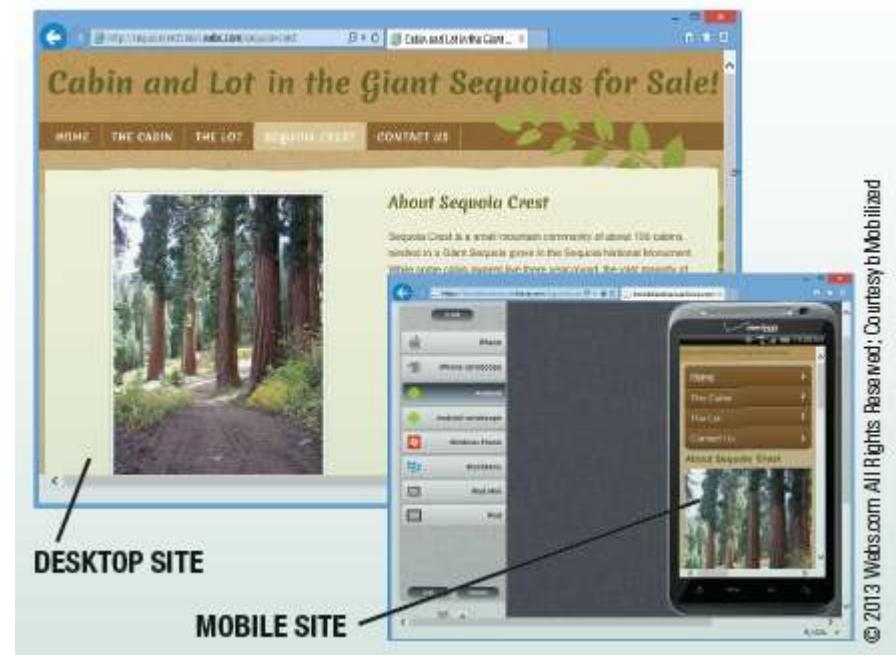
- Plan for all needed delivery methods and devices
 - Features that require a specific browser
 - Features that require little used plug-ins
 - The size of the page content
 - Different devices, browsers, and screen resolutions affect how Web pages display
 - High-bandwidth items
 - Watch image file size (use thumbnails)
 - Use links to audio, video, and other high-bandwidth items
 - Use streaming audio and video



Technology and You Box

Responsive Web Design (RWD)

- Focuses on building sites that are compatible with a variety of devices
- Can create multiple versions of your site yourself or use a flexible site that adjusts to each visitor's device
- Can create a desktop site and use a service to generate mobile versions



© 2013 Webs.com All Rights Reserved; Courtesy of hMobilized



Determining the Objectives and Intended Audience of the Site

- One of the first steps in designing a multimedia application or Web site
- Objectives of the site affect its content
 - Main purpose
 - Supplemental activities and social media tie-ins
- Intended audience affects the appearance (such as the style, graphics, fonts, and colors) of the site
- Once the objectives and audience have been identified, you should have a good idea of the main topics to be included in the site



Using Flowcharts, Page Layouts, and Storyboards

- Flowchart
 - Used during the Web design process to illustrate how the pages in a Web site relate to one another
- Page Layout
 - Illustrates the basic layout and navigational structure of a Web site
 - Typically two are created: one for the home page and one for the rest of the pages in the site
- Storyboard
 - Ordered series of sketches showing each page or screen in an animation sequence



Using Flowcharts, Page Layouts, and Storyboards



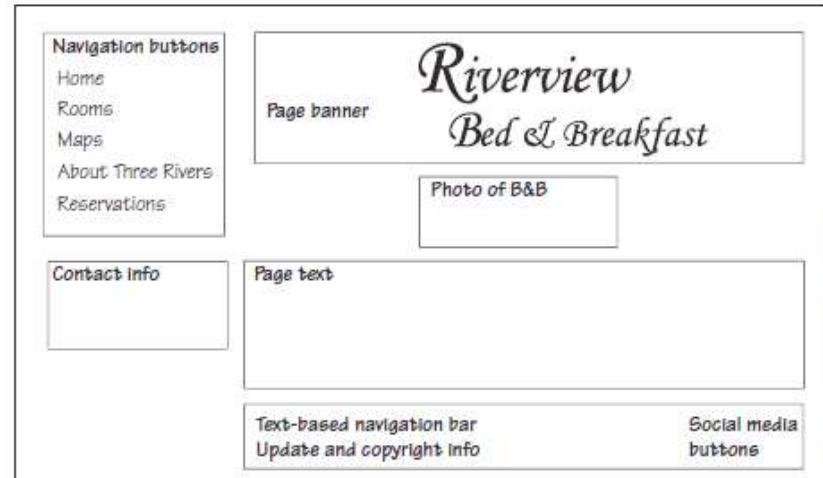
FLOWCHARTS

Describe the logical organization of the site. Each box represents a separate Web page.

FIGURE 10-12

Web site flowcharts
and page layouts.

A sample flowchart and
page layout for a bed-
and-breakfast Web site
are shown here.



PAGE LAYOUTS

Illustrate the basic design and navigational structure of a Web site. There are typically two layouts—one for the home page (shown here) and one for all other pages on the site.



Navigational Design Considerations

- Users should be able to get to most pages on the site within three mouse clicks
 - Using site maps and drop-down menus with larger Web sites will help
- Navigational items should be placed in the same location on every page
- Break long pages into multiple pages
- Add a text name to images
- A link to the home page should appear on every page
- Include identifying information on each page to indicate which page is currently displayed



Navigational Design Considerations

SOCIAL MEDIA BUTTONS
Gives visitors quick and easy access to the Web site's social media pages.

SEARCH BOX
Allows users to find pages on the site containing specific information.

HOME PAGE LINK
Gives users a quick link to the site's home page from any page on the site; link is often a company logo.

SITE MAP
A Web page that contains links to all of the main pages on a site.

MENU TABS
Provide access to the main pages of a site, as well as indicate the currently displayed page.

NAVIGATION BAR
A group of text- or image-based links; should be in the same location on every page of the site.

ICONS
Help users identify navigational links.

Courtesy Smithsonian

LL Bean® is a registered trademark of LL Bean Inc. Copyright 2013

FIGURE 10-13
Navigational tools.
A wide variety of navigational tools exists to help make Web sites easy to use.

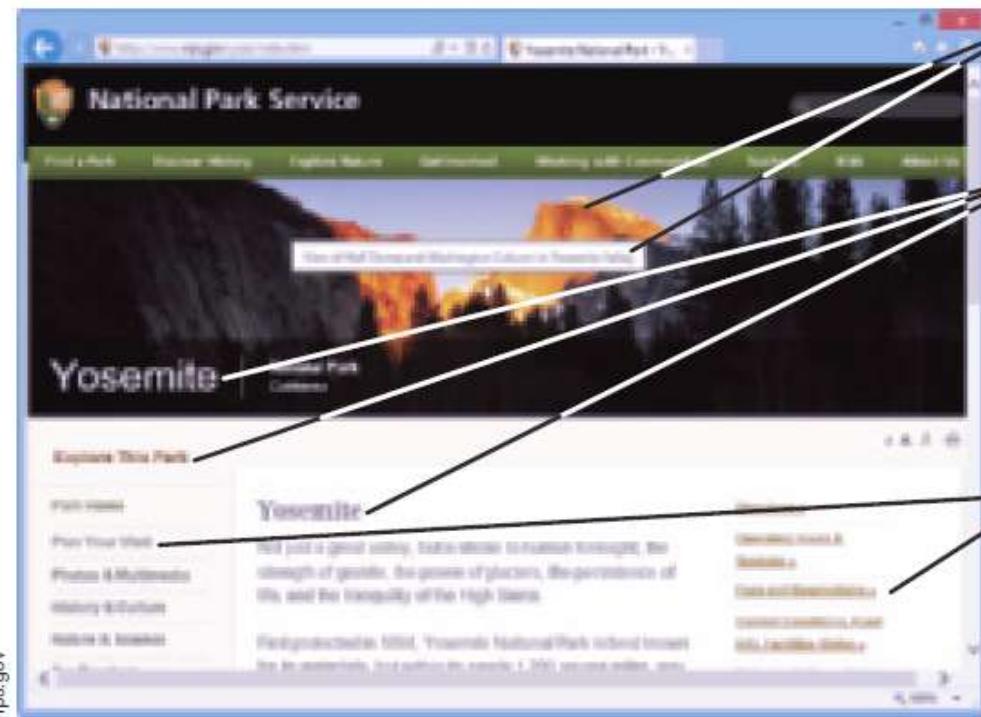


Access Considerations

- Device Compatibility
 - The device being used to access a Web site affects how the site will appear and how functional it will be
 - Develop a plan for mobile access of your site
- Assistive Technology
 - Hardware and software specially designed for individuals with physical disabilities
 - Screen readers and Braille displays
 - Alternative text (alt tags)
 - Also watch reading level of site



Access Considerations



ALTERNATIVE TEXT

Images have alternative text descriptions.

COLORS AND CONTRAST

There is a high degree of contrast between the text and the background colors to make the text as readable as possible.

DESCRIPTIVE AND UNDERLINED HYPERLINKS

Hyperlinks make sense when read aloud; hyperlinks that are not part of a navigation bar are underlined.

FIGURE 10-15
Some Web page characteristics that are compatible with assistive technology.



Quick Quiz

1. Which of the following is most often used to illustrate what a Web page will look like?
 - a. Flowchart
 - b. Storyboard
 - c. Page layout
2. True or False: In order for a screen reading program to identify an image-based hyperlink, alternative text must be assigned to that image.
3. A Web page that contains links to all the main pages on a Web site is called a(n) _____.

Answers:

- 1) c; 2) True; 3) site map



Multimedia Web Site Development

- Web Site Development
 - The process of creating, testing, publishing, and maintaining a Web site
 - Occurs after the site is designed
 - Can be performed in-house or outsourced
- Creating the Multimedia Elements
 - Usually several different software programs are used
 - Image editing and animation software
 - Audio and video editing software
 - Each element should be saved in the appropriate size, resolution, and file format



Multimedia Web Site Development

- Creating the Web Site
 - Markup Language
 - Uses symbols or tags to describe what a document should look like when it is displayed in a Web browser
 - JavaScript or other scripting languages can be used to add dynamic content
 - Web site authoring software is often used to create an entire site



Multimedia Web Site Development

- Hypertext Markup Language (HTML)
 - The original markup language
 - Uses HTML tags to indicate where effects and elements belong in the Web page
 - Some tags are paired
 - The computer and browser being used still determines exactly how the Web page will display

TAG	PURPOSE
<html></html>	Marks the beginning and end of an HTML document.
<head></head>	Marks the head section, which contains the page title and meta tags.
<title></title>	Marks the title of the Web page.
<body></body>	Contains all the content of the Web page, including text, hyperlinks, and images.
<h1></h1> to <h6></h6>	Formats headings larger or smaller than the regular (non-heading) text in the document; H1 is the largest text.
	Indicates an image file to be inserted; attributes included within this tag specify the image filename, display size, alternative text, title, border, etc.
<a>	Defines a hyperlink using the specified URL; can include an image filename, hyperlink text, and other attributes.
	Bolds text.
<i></i>	Italicizes text.
<!-- -->	Indicates a comment that won't display when the Web page is viewed.
<hr>	Inserts a horizontal rule.
 	Inserts a line break (new line within the same paragraph).
<p>	Inserts a paragraph break (starts a new paragraph).

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FIGURE 10-17

Sample HTML tags.



Multimedia Web Site Development

Web page as displayed
in browser.

Right-click page and then click this option to view the Web page's source code.

HTML source code for
the Web page.

This is an XHTML page.

Specifies the title displayed on the browser's title bar.



The page is organized using a table; the right column starts here.

The page's text
begins with a heading

Defines a photo's title, source, and alt text.

```
1 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
2
3 <html xmlns="http://www.w3.org/1999/xhtml">
4 <head>
5 <meta http-equiv="Content-Type" content="text/html; charset=ISO-8859-1" />
6 <title>Tobin James Cellars - About</title>
7 <link href="css/main.css" rel="stylesheet" type="text/css" />
8 </head>
9 <body>
10
11 <div style="background-color:#333399; color:white; padding:10px; text-align:center; font-size:14px; font-weight:bold; margin-bottom:10px;">
12 Tobin James Cellars
13 </div>
14 <div style="display:flex; justify-content:space-between; align-items:center; margin-bottom:10px;">
15 <div style="flex:1; text-align:center; margin-right:20px;">
16 <img alt="Facebook Button" style="width:100%; height:100%; border:none; border-radius:50%; cursor:pointer;" href="https://www.facebook.com/TobinJamesCellars" target="_TOP"/>
17 <div style="font-size:12px; font-weight:bold; margin-top:5px; font-family:'Lucida Grande','Tahome,verdana,arial,sans-serif';">Join Us On Facebook</div>
18 </div>
19 <div style="flex:1; text-align:center; margin-right:20px;">
20 <img alt="Tobin Jones Photo" style="width:100%; height:100%; border:none; border-radius:50%; cursor:pointer;" href="#" title="Tobin Jones" data-bbox="106 350 250 450"/>
21 <div style="font-size:12px; font-weight:bold; margin-top:5px; font-family:'Lucida Grande','Tahome,verdana,arial,sans-serif';">Tobin Jones</div>
22 </div>
23 <div style="flex:1; text-align:center; margin-right:20px;">
24 <img alt="Lance & Claire Silver Photo" style="width:100%; height:100%; border:none; border-radius:50%; cursor:pointer;" href="#" title="Lance & Claire Silver" data-bbox="250 350 394 450"/>
25 <div style="font-size:12px; font-weight:bold; margin-top:5px; font-family:'Lucida Grande','Tahome,verdana,arial,sans-serif';">Lance & Claire Silver</div>
26 </div>
27 <div style="flex:1; text-align:center; margin-right:20px;">
28 <img alt="Tobin Jones & Lance Silver Photo" style="width:100%; height:100%; border:none; border-radius:50%; cursor:pointer;" href="#" title="Tobin Jones & Lance Silver" data-bbox="394 350 538 450"/>
29 <div style="font-size:12px; font-weight:bold; margin-top:5px; font-family:'Lucida Grande','Tahome,verdana,arial,sans-serif';">Tobin Jones & Lance Silver</div>
30 </div>
31 </div>
32 <div style="margin-top:20px; font-size:14px; font-weight:bold; font-family:'Lucida Grande','Tahome,verdana,arial,sans-serif';">
33 <h2>About Tobin James Cellars</h2>
34 <p>It all started with an extra six tons of grapes that a winery could not accept and process. Tobin (Toby) James, a lonely assistant winemaker at the time, asked the owner of the winery if he could have the grapes and make wine out of them for himself. The owner replied, "sure kid, knock yourself out!"</p>
35 <hr style="border:none; border-top:1px solid #ccc; margin-top:10px; margin-bottom:10px;" />
36 <div style="display:flex; justify-content:space-between; align-items:center; margin-bottom:10px;">
37 <div style="flex:1; text-align:center; margin-right:20px;">
38 <img alt="Tobin Jones Photo" style="width:100%; height:100%; border:none; border-radius:50%; cursor:pointer;" href="#" title="Tobin Jones" data-bbox="106 550 250 650"/>
39 <div style="font-size:12px; font-weight:bold; margin-top:5px; font-family:'Lucida Grande','Tahome,verdana,arial,sans-serif';">Tobin Jones</div>
40 </div>
41 <div style="flex:1; text-align:center; margin-right:20px;">
42 <img alt="Lance & Claire Silver Photo" style="width:100%; height:100%; border:none; border-radius:50%; cursor:pointer;" href="#" title="Lance & Claire Silver" data-bbox="250 550 394 650"/>
43 <div style="font-size:12px; font-weight:bold; margin-top:5px; font-family:'Lucida Grande','Tahome,verdana,arial,sans-serif';">Lance & Claire Silver</div>
44 </div>
45 <div style="flex:1; text-align:center; margin-right:20px;">
46 <img alt="Tobin Jones & Lance Silver Photo" style="width:100%; height:100%; border:none; border-radius:50%; cursor:pointer;" href="#" title="Tobin Jones & Lance Silver" data-bbox="394 550 538 650"/>
47 <div style="font-size:12px; font-weight:bold; margin-top:5px; font-family:'Lucida Grande','Tahome,verdana,arial,sans-serif';">Tobin Jones & Lance Silver</div>
48 </div>
49 </div>
50 </div>
51 </body>
```

FIGURE 10-18

An HTML Web page and its corresponding source code.



Multimedia Web Site Development

- Extensible Markup Language (XML)
 - A set of rules for exchanging data over the Web
 - Addresses the content but not the formatting
 - Uses XML tags to identify data
 - Allows data to be extracted and reused as needed
- Extensible Hypertext Markup Language (XHTML)
 - A newer version of HTML based on XML
 - Controls the appearance and format of a Web page like HTML
 - Stricter rules than HTML



Multimedia Web Site Development

- HTML5
 - Newest version is designed to replace the previous versions of both HTML and XHTML
 - Includes new tags and features that support the creation of more complex and dynamic Web pages
 - Is open standard
 - No proprietary software or plug-ins required
 - New tags include <video> and <audio> for media, <canvas> that creates a bitmapped surface to work with, and section tags to identify the parts of a Web page (<header>, <article>, <nav>, etc.)



Multimedia Web Site Development

The diagram illustrates the structure of an HTML5 file and how it appears in a browser. On the left, a Notepad window shows the source code. On the right, an Internet Explorer window shows the resulting web page.

- DECLARATION**: Indicates this is an HTML page.
- HEAD**: Indicates the page title and character set being used.
- BODY**: Contains the body of the Web page (header, sections, and footer).
- HTML closing tag ends the Web page.
- Comments don't display in a browser.
- Nav bar code contains hyperlinks.
- Video tag displays the specified video.
- Many tags are paired tags.
- HTML5 file being created in Notepad.
- HTML5 file being viewed in Internet Explorer.

Notepad Content (HTML5 Source Code):

```
<!DOCTYPE html>
<html>
  <head>
    <title>A Simple HTML5 Web Page</title>
    <meta charset="UTF-8">
  </head>
  <!--THIS IS A COMMENT - IT WON'T DISPLAY WHEN THE WEB PAGE IS VIEWED-->
  <body>
    <header>This is the header; it contains this text and the sample nav bar below.</header>
    <nav>
      <a href="http://mywebsite.com">Home</a>
      <a href="http://google.com">Google</a>
      <a href="http://dictionary.com">Dictionary.com</a>
    </nav>
    <section>
      <p>This is the first section of the page. It can be divided into articles.</p>
    </section>
    <section>
      <p>This is the second section of the page.</p>
      <p><b>This text is defined as Heading 2.</b></p>
      <p><b>This text is bold.</b></p>
      <p><img alt="A video player showing a video thumbnail with a play button." data-bbox="400 580 500 600"/> Did this is in a new paragraph. A video link comes next.</p>
      <video alt="video_sample.mp4" height="200" controls="controls">
        <source src="video_sample.mp4" type="video/mp4">
      </video>
      <p><img alt="A horizontal rule with a play button." data-bbox="400 620 500 640"/> This is another new paragraph. A horizontal rule comes next.</p>
    </section>
    <footer>This is the footer; it contains this text.</footer>
  </body>
</html>
```

Internet Explorer View (Resulting Web Page):

This is the header; it contains this text and the sample nav bar below.
[Home](http://mywebsite.com) [Google](http://google.com) [Dictionary.com](http://dictionary.com)

This is the first section of the page. It can be divided into articles.

This is the second section of the page.

This text is defined as Heading 1.

This text is bold.

This text is in a new paragraph. A video link comes next.



This is another new paragraph. A horizontal rule comes next.

This is the footer; it contains this text.

FIGURE 10-19
An example of HTML5 source code and its corresponding Web page.



Multimedia Web Site Development

- Cascading Style Sheets (CSSs)
 - Used to specify the styles used with a Web page or an entire Web site
 - Specified in an Internal style sheet (head section of Web page) or in an External style sheet
 - Normally used in an external style sheet and connected to web pages through a link statement in the head section of the desired pages
 - Styles are applied to all of the linked Web pages at one time
 - Improves consistency and efficiency



Multimedia Web Site Development

- Wireless Markup Language (WML)
 - Used to create Web pages to be displayed on WAP-enabled wireless devices, such some older mobile phones
- Scripting Languages
 - Used with Web pages with lots of dynamic content
 - Allows the inclusion of scripts (instructions) in the Web page code
 - JavaScript, VBScript, Perl



Multimedia Web Site Development

- AJAX
 - Creates faster, more efficient interactive Web applications
 - Only requests new data from the server, not the entire Web page, when the page is updated
 - Interactive Web pages built with AJAX run faster
 - Normally require less bandwidth than conventional Web applications



Multimedia Web Site Development

- ActiveX
 - Set of specifications for reusing software components that can be used to integrate multimedia and other interactive elements into Web pages
 - Extends OLE (Object Linking and Embedding) to integrate content from two or more programs
 - Allows a variety of types of Windows files to be viewed via Web pages
- Virtual Reality Modeling Language (VRML) and X3D
 - A language used to create 3D Web pages
 - Successor is X3D



Trend Box

Push Technology and xRTML

- Conventional Web pages have the user pull data from the server
- Push technology delivers content automatically as it becomes available
- One emerging option for Web sites and apps for all devices is xRTML
- Delivers data in a timely manner and saves data transfer costs

The screenshot shows a web application interface. On the left, a code editor displays xRTML code for a 'Poll' application. The code includes various xRTML tags like <xrtml>, <external-poll>, and <external-data>. A callout points to this code with the text: "xRTML code for a polling app." On the right, a bar chart titled "WHERE ARE YOU FROM?" shows data for five regions: USA, CANADA, RUSSIA, ASIA, and LATAM. The chart is labeled "THE ACME OF REALTIME" and has a button "Click here to open and test this application on a mobile device". A callout points to the chart with the text: "The graph changes automatically as votes are cast." A sidebar on the right lists "Browse our live demos" with options like Audio, Broadcast, Chart, Execute, Placeholder, Poll, Repeater, Scheduler, and Video. The sidebar also includes social media links for Twitter, Facebook, and LinkedIn, and a section "Stay in touch" with the text "We're all over the net. Follow us!".

Courtesy IBM



Multimedia Web Site Development

- Web Site Authoring Software
 - Used to create Web pages and entire Web sites (Dreamweaver)
 - Appropriate JavaScript or other code is automatically generated
 - Allows you to create an entire cohesive Web site, not just individual pages
 - Allows you to easily include forms and database connectivity
 - Often includes tests for broken links & accessibility tests
 - Web site builder – cloud versions



Multimedia Web Site Development

Adobe product screenshot(s) reprinted with permission.

The figure shows a screenshot of Adobe Dreamweaver interface. On the left, a preview window displays the 'Riverview Bed & Breakfast' website with a photo of a large house, a title, and navigation links. On the right, the code editor shows the current HTML code for the home page. A callout points from the text 'Home page being created.' to the preview window. Another callout points from the text 'Current HTML for the Home page.' to the code editor.

WEB SITE AUTHORIZING PROGRAMS
Allow you to create the Web site by inserting images, text, hyperlinks, and more; you can view and edit the HTML code as needed.

WEB SITE BUILDERS
Allow you to create the Web site online by inserting images, text, hyperlinks, and more; you typically cannot view and edit the HTML code.

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FIGURE 10-20

Creating a Web site.



Testing, Publishing, and Maintaining the Site

- Web site should be thoroughly tested prior to publishing
 - All hyperlinks should be clicked to ensure they take the user to the proper location
 - Complex animations (such as games and tutorials) should be tested individually
 - Proofread each page or screen carefully
 - Use Web page code validators built into Web site authoring programs or online validator services
 - Consider a “stress test”



Testing, Publishing, and Maintaining the Site

The figure consists of three side-by-side screenshots of the W3C Markup Validation Service. The left screenshot shows the 'Validate by File Upload' interface with a file selected for upload. The middle screenshot shows the validation results for that file, displaying errors and warnings. The right screenshot shows the validation results after corrections have been made, indicating a successful validation.

FIGURE 10-21

Validating a Web page. This Web site (validator.w3.org) can be used to validate HTML and XHTML Web pages.

Web pages can be checked before they are published by choosing the File Upload option.

Any coding errors on the Web page will be identified.

Once any coding errors have been corrected, the page will be declared valid.

Copyright 1994–2012 W3C®



Testing, Publishing, and Maintaining the Site

- Once thoroughly tested, Web site is ready to be published
 - Identify Web server
 - Upload files
- After publishing, the Web site must be maintained
 - Update content and check links on a regular basis
 - Site should be evaluated on a regular basis to locate areas needing improvement



The Future of Web-Based Multimedia

- Web-based multimedia will be more exciting and more embedded into everyday events
- Web-based content, cloud services, and home entertainment devices will likely continue to converge to allow seamless access to desired content on the user's device of choice
- Technology will evolve to support mobile multimedia
- Usage of multimedia applications that are tied to a geographical location or current status and that involve user-generated content will also likely continue to grow



Quick Quiz

1. Which of the following markup languages is most often used to create Web pages?
 - a. HTML
 - b. JavaScript
 - c. WML
2. True or False: Web site authoring software can typically be used to create all of the Web pages on a site, including adding animated elements, video clips, etc.
3. The HTML code _____ would begin to bold Web page text.

Answers:

- 1) a; 2) True; 3)



Summary

- What is Web-Based Multimedia?
- Multimedia Elements
- Multimedia Web Site Design
- Multimedia Web Site Development
- The Future of Web-Based Multimedia

15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 11

E-Commerce



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Charles S. Parker**

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Learning Objectives

1. Explain what e-commerce is and describe some of the advantages and disadvantages involved with implementing e-commerce.
2. Identify a variety of e-commerce business models and discuss their differences.
3. Discuss the types of Web sites that can be used to implement e-commerce.
4. List several strategies for implementing e-commerce using the Web, including some of the decisions that need to be made, the options available for accepting payments, and the process of designing and developing an effective Web site.



Learning Objectives

5. Outline some sales and marketing strategies that can be used in conjunction with an e-commerce Web site.
6. Discuss some security issues related to e-commerce sites.



Overview

- This chapter covers:
 - Potential advantages and disadvantages of e-commerce for both businesses and consumers
 - Types of e-commerce business models and Web sites
 - The issues a business needs to consider when implementing an e-commerce Web site
 - Sales and marketing strategies for e-commerce Web sites
 - E-commerce security issues



What Is E-Commerce?

- E-Commerce
 - The act of doing business transactions over the Internet or similar technology
 - Has existed for years via private networks (electronic funds transfers, etc.)
 - Now most often performed via the Internet
 - Dot-com
 - An Internet-only store with no physical presence
 - Brick-and-Mortar Store
 - A conventional store with a physical presence



What Is E-Commerce?

- M-Commerce
 - E-commerce carried out via smartphones and other mobile devices
 - Near Field Communications (NFC) uses RFID to facilitate communications between devices



 **FIGURE 11-1**
M-commerce



Advantages of E-Commerce

- For Businesses
 - Reduced costs
 - Dot-coms are less expensive than brick-and-mortar stores because there is no physical storefront to maintain
 - Increased customer satisfaction
 - Shopping experience is convenient (open all the time, no driving, etc.)
 - Can send customers personalized information
 - Broader customer base (less geographical restrictions)
 - Potentially higher sales



Advantages of E-Commerce

- For Customers
 - Convenience
 - Higher degree of selection
 - Easier comparison shopping
 - Higher number of merchants to choose from
 - Geographical location is not an issue
 - Shopping bots and other comparison shopping tools are available
 - Potential cost savings
 - Customized products



Technology and You Box

Mobile Payments

- You can make purchases and send money to others via a mobile device
- Mobile payment processing allows payments (typically credit card payments) to be collected via a mobile device
 - Field workers
 - Craft vendors
 - Sales personnel





Disadvantages of E-Commerce

- For Businesses
 - Pressure to be always open, site always working
 - Solid, well designed sites and hosting
 - Lost business due to some customer hesitation to shop online
 - Risk of fraudulent credit card transactions
 - Ease of entry for competitors



Disadvantages of E-Commerce

- For Customers
 - Potential for fraud and other potential security problems
 - Buyer protection programs and using credit card protection can help
 - Not being able to see or touch the goods
 - 3D online stores may help
 - Possible expense of returning merchandise
 - Some click-and-mortar stores allow returns to local stores



E-Commerce Business Models

- Business-to-Consumer (B2C) Business Model
 - An e-commerce model in which a business provides goods or services to consumers
- Business-to-Business (B2B) Business Model
 - An e-commerce model in which a business provides goods or services to other businesses
 - Intermediary Hubs
 - Bring buyers and sellers together
 - Vertical hubs
 - Horizontal hubs



E-Commerce Business Models

- Consumer-to-Consumer (C2C) Business Model
 - An e-commerce model in which a consumer provides goods or services to other consumers
 - Craigslist and online auctions are common means of C2C transactions
- Business-to-Government (B2G) Business Model
 - An e-commerce model in which a business provides goods and services to government organizations
 - Businesses or individuals paying taxes online etc. can be viewed as G2B and G2C transactions, respectively



E-Commerce Business Models

The image shows two side-by-side screenshots of website interfaces. On the left is the Dell website, featuring a search bar at the top and a main content area with a heading 'Welcome to Dell – Shop for Home PCs & Accessories'. It includes a product image of a laptop and a desktop tower. On the right is the Ricoh website, with a prominent red header containing the brand name 'RICOH' and a navigation menu. The main content area features a large purple 'PRINTERS' heading and a product image of a printer. Both sites appear to be selling similar products but have different branding and design philosophies.

FIGURE 11-4
E-commerce
business models.

A screenshot of two web pages side-by-side. The left page is Craigslist.org, showing a search results page for 'les sautes' in New Mexico. The right page is the New Mexico GOV website, specifically the Business section, featuring links to online services like Business Entity Search and Business Registration.

CONSUMER TO CONSUMER (C2C)	BUSINESS TO GOVERNMENT (B2G)
Transactions are between consumers and other consumers; this site helps individuals find items for sale in a specific geographic area.	Transactions are between businesses and the government; this site offers businesses a number of online services.



Quick Quiz

1. Which of the following is NOT an advantage of e-commerce for a business?
 - a. Reduced cost
 - b. Increased customer satisfaction
 - c. Reduced competition
2. True or False: Craigslist is an example of a C2C site.
3. A business following the _____ model sells products directly to consumers.

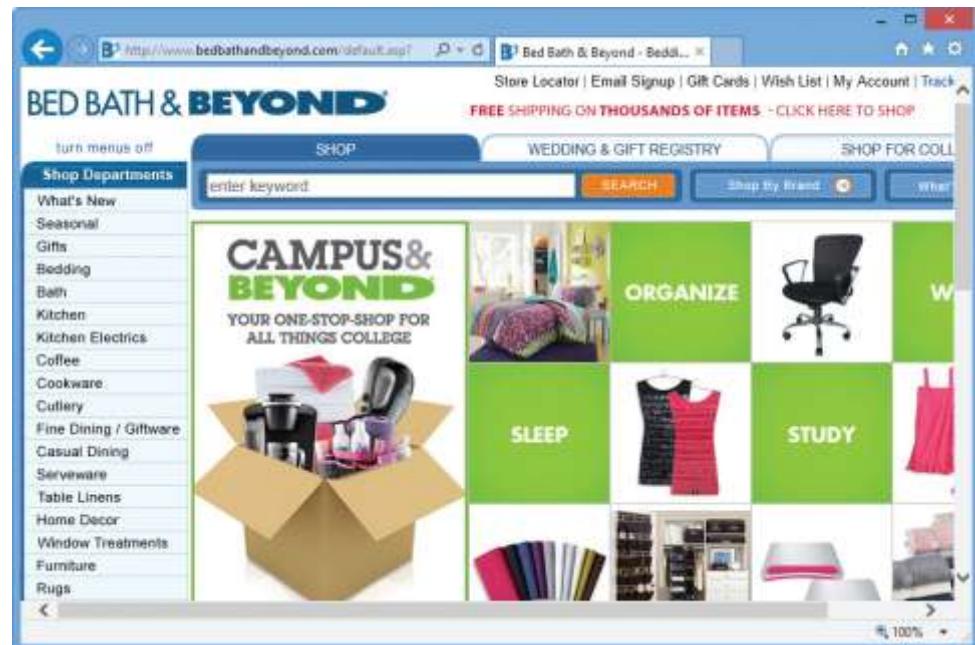
Answers:

- 1) c; 2) True; 3) Business-to-consumer (B2C)



Types of E-Commerce Web Sites

- Manufacturer and E-Tailer Sites
 - Manufacturers and online retailers sell directly to customers via their Web sites
- Subscription Sites
 - Sells access to its online content
 - Newspapers and journals
 - E-book rentals
 - Premium social networking services





Types of E-Commerce Sites

- Brokerage Sites
 - Bring buyers and sellers together and earn revenue by charging commissions on sales made via the site
 - Online Auctions
 - Allow consumers or businesses to auction products to consumers
 - Buyers bid and highest bidder at the time the auction closes buys the item
 - Seller pays a listing fee and a selling fee based on the final price
 - Some online auction sites have automatic bidding systems



Types of E-Commerce Sites

The screenshot shows an eBay auction page for a 'Raven Frameless Low Volume Dive Rack Freestyle BLUE'. The item is a purple diving mask. The auction details include:
- Time remaining: 10d 5hr 25m (ends Jun 26 at 21:52:48 PDT)
- Current bid: US \$11.50 (from 1)
- Bidder enters a bid: An input field where a bidder can enter a bid amount, with a note below stating "Your bid: \$12.00 or more".
- Shipping: \$8.38 Standard Shipping | view details
- Delivery: Estimated between Sat, Jun 29 and Wed, Jul 3
Annotations with arrows point to specific elements:

- Buyers can use the auction's search site feature to locate items they would like to bid on.
- Time remaining
- Current bid
- Bidder enters a bid; on eBay, the automatic bidding system will bid up to this amount.
- Shipping details

Copyright © 1995-2013 eBay Inc. All Rights Reserved.

FIGURE 11-6
How online auctions work.



Types of E-Commerce Sites

- Financial Brokerages
 - Allow individuals to sell stocks, bonds, futures, etc.
 - Generate revenue by charging commissions or transaction fees
- Real Estate, Travel, and Other Consumer Brokerages
 - Assist consumer in finding resources they desire
 - Real estate
 - Airline tickets
 - Hotel reservations



Types of E-Commerce Sites

- Market and Commodity Exchanges
 - Market Exchange
 - Matches organizations with goods or services to sell with potential buyers
 - Acts as an intermediary between buyer and seller
 - Commodity Exchange
 - Exchange of natural resources and raw goods
 - » Energy, cattle, chemicals, and metals
 - Some sites earn a fee for every transaction; some charge sellers an annual membership fee to participate



Quick Quiz

1. Which of the following is not a type of brokerage site?
 - a. E-tailer site
 - b. Online auction site
 - c. Market exchange
2. True or False: Both manufacturers and online retailers can sell directly to customers via their Web sites.
3. A(n) _____ site sells online content (music, articles, social networking access, etc.) to individuals.

Answers:

1) a; 2) True; 3) subscription



Implementing Web-Based E-Commerce

TYPICAL STEPS

1. Select appropriate business models and types of Web sites.
2. Select the desired e-commerce applications.
3. Develop procedures for handling electronic financial transactions.
4. Design and develop an effective e-commerce Web site.
5. Implement appropriate sales and marketing strategies.

FIGURE 11-8
Implementing Web-based e-commerce.

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Implementing Web-Based E-Commerce

- Step 1: Select Appropriate Business Models and Types of Web Sites
 - More than one type of site can be selected
- Step 2: Select the Desired E-Commerce Applications
 - Determine electronic customer relationship management (eCRM) activities to be included
 - Providing order and shipping information, social media sharing options, online support, etc.
 - Determine which other business systems the Web site will be linked to



Implementing Web-Based E-Commerce

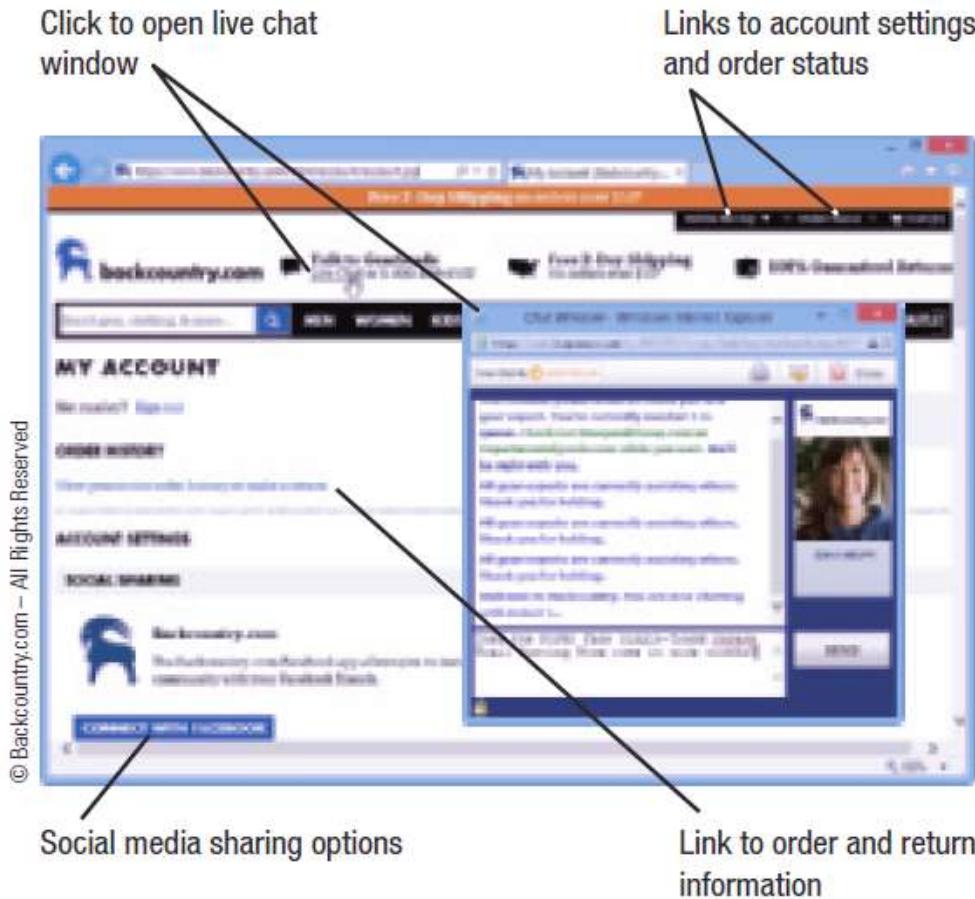


FIGURE 11-9

Common eCRM features include order status, return information, and live chat.



Implementing Web-Based E-Commerce

- Step 3: Develop Procedures for Handling Electronic Financial Transactions
 - Need to determine which types will be accepted
 - Order forms should be set up as secure Web pages
 - Credit and Debit Card Processing
 - Most common payment method used for online shopping
 - Most businesses open an e-commerce merchant account, usually from a U.S. bank
 - This bank handles all the credit and debit card transactions



Implementing Web-Based E-Commerce

- Virtual account numbers
 - Disposable credit card numbers used to purchase goods and services and to help alleviate customer's concerns about security and identity theft
 - Purchases will be charged to the customer's regular credit card
 - Typically these are single-use numbers
 - Useless if intercepted or stolen
- Other options
 - 3D Secure, OTPs, prepaid credit cards



Implementing Web-Based E-Commerce

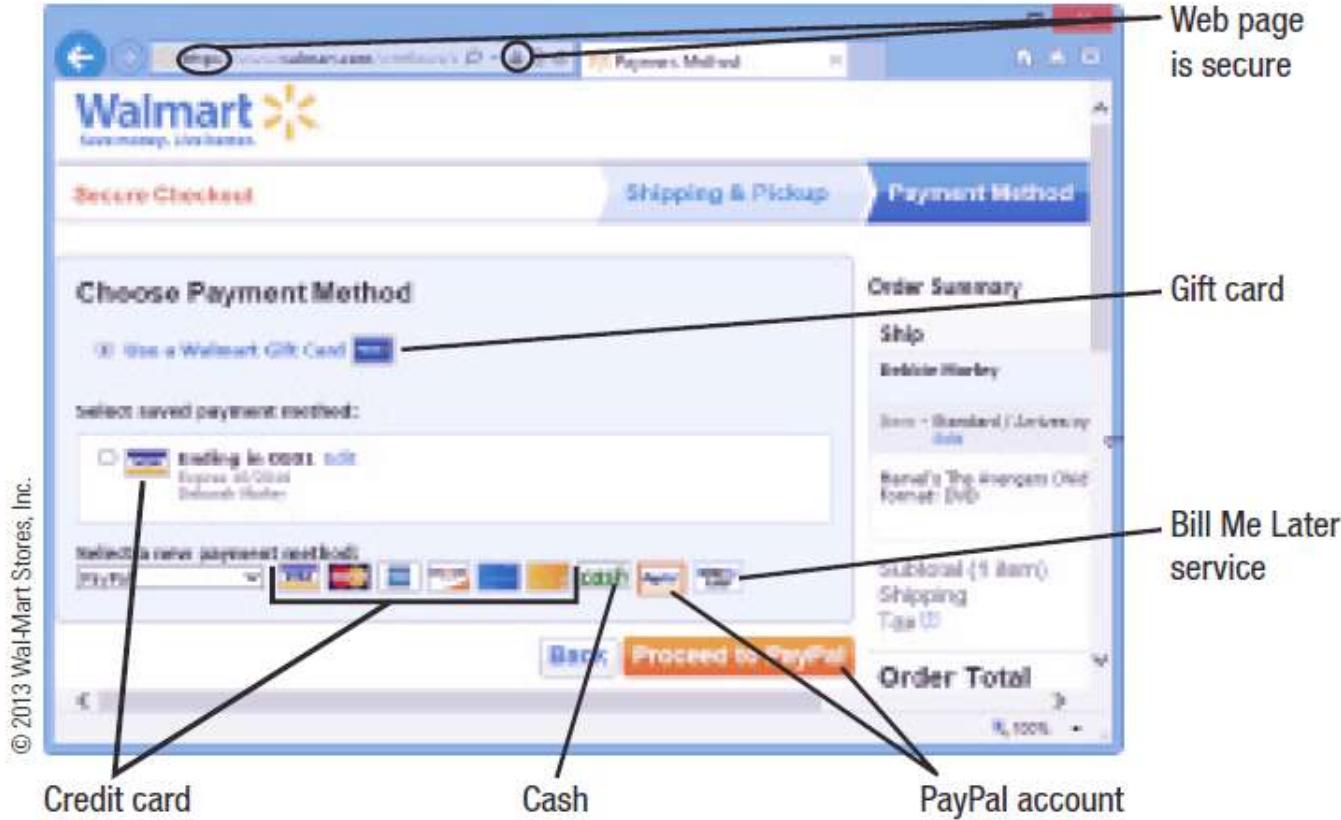


FIGURE 11-10
E-commerce payment options.
Each e-commerce site must decide the payment options to be supported.



Implementing Web-Based E-Commerce

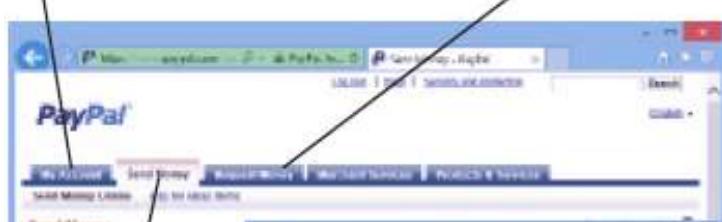
- Online Checkout Services
 - Enable e-commerce customers to check out using information associated with another e-commerce account (such as Amazon.com)
- Online Payment Services
 - Accessed via the Internet and used to make electronic payments to others
 - PayPal
 - Merchants pay a transaction fee
 - Fee is usually lower than regular credit or debit card fees
 - Individual's credit card number is not revealed to the merchant
 - Other online payment services are Bill Me Later and eBillme



Implementing Web-Based E-Commerce

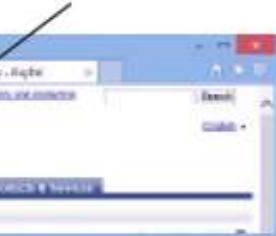
ADDING/WITHDRAWING MONEY

Add or withdraw money, as well as view your recent transactions.



REQUESTING MONEY

Send a money request or an invoice to others.



SENDING MONEY

Send money via an e-mail address or mobile phone number; the money is either deducted from the account's balance or charged to a credit card.



MERCHANT TOOLS

Add PayPal payment buttons to your site, send invoices, and more.

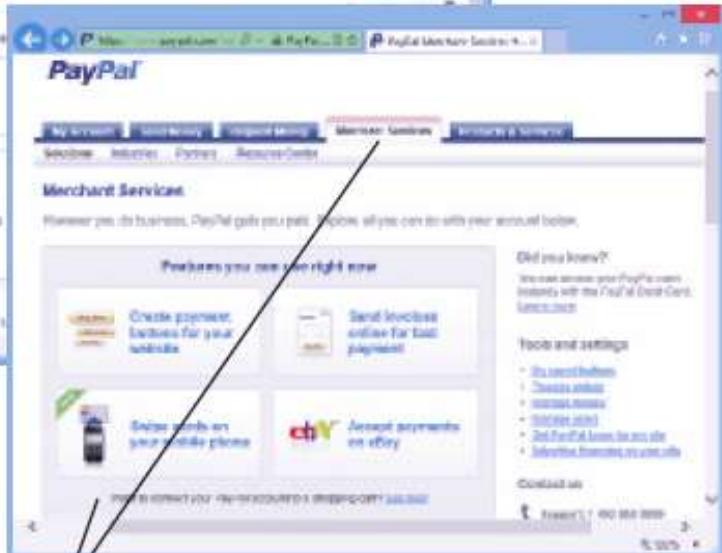


FIGURE 11-13

How PayPal works.



Implementing Web-Based E-Commerce

- Digital Gift Certificates, Gift Cards, and Coupons
 - Appropriate codes are entered into the Web site at time of purchase
- Digital Wallets
 - Holds a buyer's information that can be used to speed up online purchase transactions
 - Device-based digital wallets are typically mobile apps for smartphones and media tablets
 - Cloud-based digital wallets hold same type of information as a device-based digital wallet and are accessed online at checkout



Implementing Web-Based E-Commerce

- Site-specific digital wallets store checkout information in the customer's accounts this for use with purchases on that site only, e.g., Amazon.com

Courtesy Lemon, Inc.

DEVICE-BASED DIGITAL WALLETS
This app stores digital copies of all the cards in your wallet; you can use the stored data for both online and offline purchases.

CLOUD-BASED DIGITAL WALLETS
This site stores shipping, billing, and credit card information so that returning customers can place orders quickly and easily.

FIGURE 11-14
Digital wallets.



How It Works Box

NFC Digital Wallets

- Digital wallet stored on a smartphone or other mobile device
- Device must support NFC and the specific digital wallet being used (Google Wallet, etc.)
- To make a purchase the user taps the device on the NFC terminal
- Square Wallet just requires you to say your name
- Advantages: Faster checkout, include other items (ID cards, digital coupons, etc.)
- Disadvantages: Competing systems





Implementing Web-Based E-Commerce

- Special Considerations for B2B Financial Transactions
 - B2B Transaction Processing
 - Allows merchants to customize their payment processing plans to fit their needs
 - Can do credit checks, track expenses, do billing, provide escrow services, etc.
 - Order-Fulfillment Companies
 - Provide a distribution network for merchants
 - Can provide order management, customer relationship management services, marketing tools, etc.



Implementing Web-Based E-Commerce

- Step 4: Design and Develop an Effective E-Commerce Web Site
 - Ensure order forms and checkout pages are located on a secure Web server
 - Continue evaluation of security and collected data
 - E-commerce features can be created using:
 - Storefront software
 - Facilitates the creation of an online store
 - Available in installed and cloud versions
 - Shopping cart software
 - Designed to add ordering capabilities to an existing Web site



Implementing Web-Based E-Commerce

The figure illustrates the process of creating a web-based e-commerce site using a cloud storefront service. It shows three main stages:

- CREATING THE SITE:** A screenshot of the Shopify admin interface. On the left, a sidebar lists sections like Home, Products, Customers, and Orders. The main area shows a preview of a website for "Kapsel Contemporary" featuring a modern chair and desk. A color palette and theme settings are visible on the right.
- THE FINISHED SITE:** A screenshot of the "Kapsel Contemporary" website displayed on a laptop and a smartphone. The website features a clean design with a red "Start Shopping" button. The laptop screen also shows a "Welcome to Kapsel" message.
- THE THEME STORE:** A screenshot of the Shopify Theme Store interface, showing various pre-designed website templates for different industries like "Restaurants" and "Clothing".

Annotations with arrows point from the text descriptions to their corresponding screenshots.

CREATING THE SITE
Menu options and wizards are used to input the necessary information, such as the site theme, colors and appearance, products to be sold, checkout options, and more.

THE FINISHED SITE
Uses the content and appearance specified when the site was created; many services create both a desktop and mobile version of the site, as shown here.

FIGURE 11-15
Cloud storefront services can be used to quickly and easily create an e-commerce site.

Courtesy Shopify © Diagnosoft/Sutterstock.com; © Bombardier Parcyle ShutterStock.com



Implementing Web-Based E-Commerce

- Use good checkout design to avoid shopping cart abandonment
 - Make the checkout process fast and easy as possible
- Trust/security seals and return/guarantee information can encourage customer trust

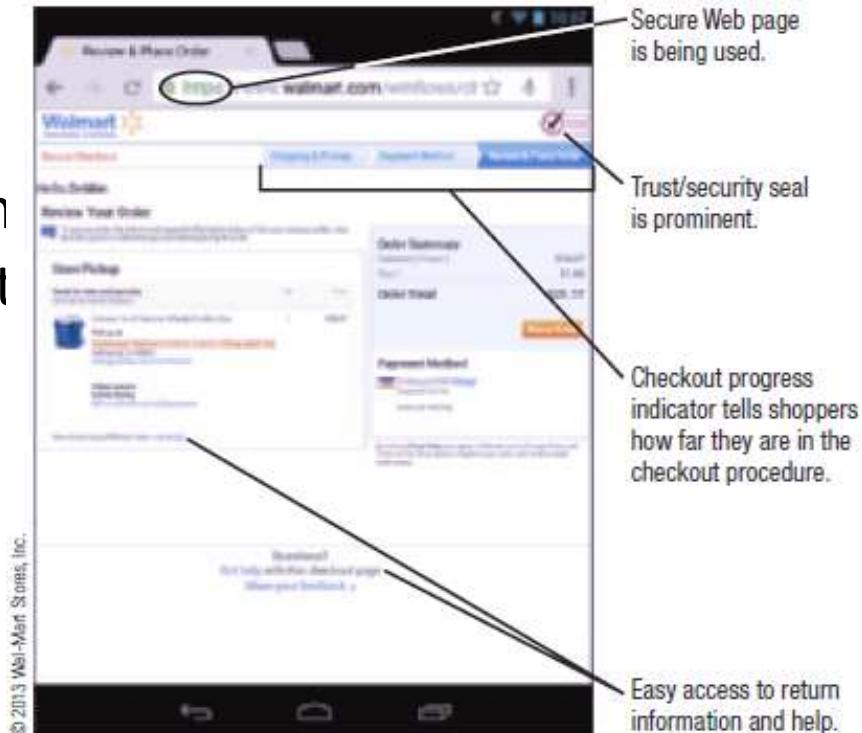


FIGURE 11-16

Good checkout design.

© 2013 Wal-Mart Stores, Inc.



Implementing Web-Based E-Commerce

- Step 5: Implement Appropriate Sales and Marketing Strategies
 - Use an Appropriate Domain Name and URL
 - URL should be easy to remember and type
 - Visitors should not have to type a page name (such as index.html) to view the home page of the site
 - Business trademarks are protected by the Anticybersquatting Consumer Protection Act



Trend Box

Social Commerce

- The use of social networking sites to promote online sales
- Can buy products within Facebook via Facebook services and Facebook pages (F-commerce)
- Businesses can place ads on social media pages
- Social media monitoring can provide useful information

Users can click an ad's close button to choose to remove ads they don't want to see again.



Facebook store; clicking an item brings you to the store's Web site to buy it.



Implementing Web-Based E-Commerce

- Include Adequate Customer Service Features
 - Online order tracking
 - Online versions of product instruction manuals
 - Customer service via email or live chat
 - eCRM services
 - Links to displays
 - FAQs
 - Order status
 - Warranty information
- Collect Taxes from Customers Only if Required by Law



Implementing Web-Based E-Commerce

- Display a Privacy Policy and Security Statement
- Promote Your Web Site Sufficiently
 - Use appropriate keyword and description meta tags
 - Submit your site to search sites
 - Consider sponsored links
 - Use social media marketing
 - Use search engine optimization (SEO) and Web analytics to improve your site and to increase search site visibility

The image displays three examples of social media advertising:

- Twitter Promoted Tweets:** An example from American Express (@AmericanExpress) introducing the #PassionProject. The tweet includes a link to amex.co/1305L and is marked as "Promoted by American Express".
- FACEBOOK TARGETED ADS:** Two examples of Facebook ads. The top one is a sponsored post featuring a photo of Paulette Volpa, Jamie Dornan McNew, and Morgan Cornell playing Candy Crush Saga, with a "Play" button. The bottom one is another sponsored post for Candy Crush Saga.

© 2013 Twitter, Inc.; Facebook © 2013

FIGURE 11-20

Examples of social media ads.



Implementing Web-Based E-Commerce

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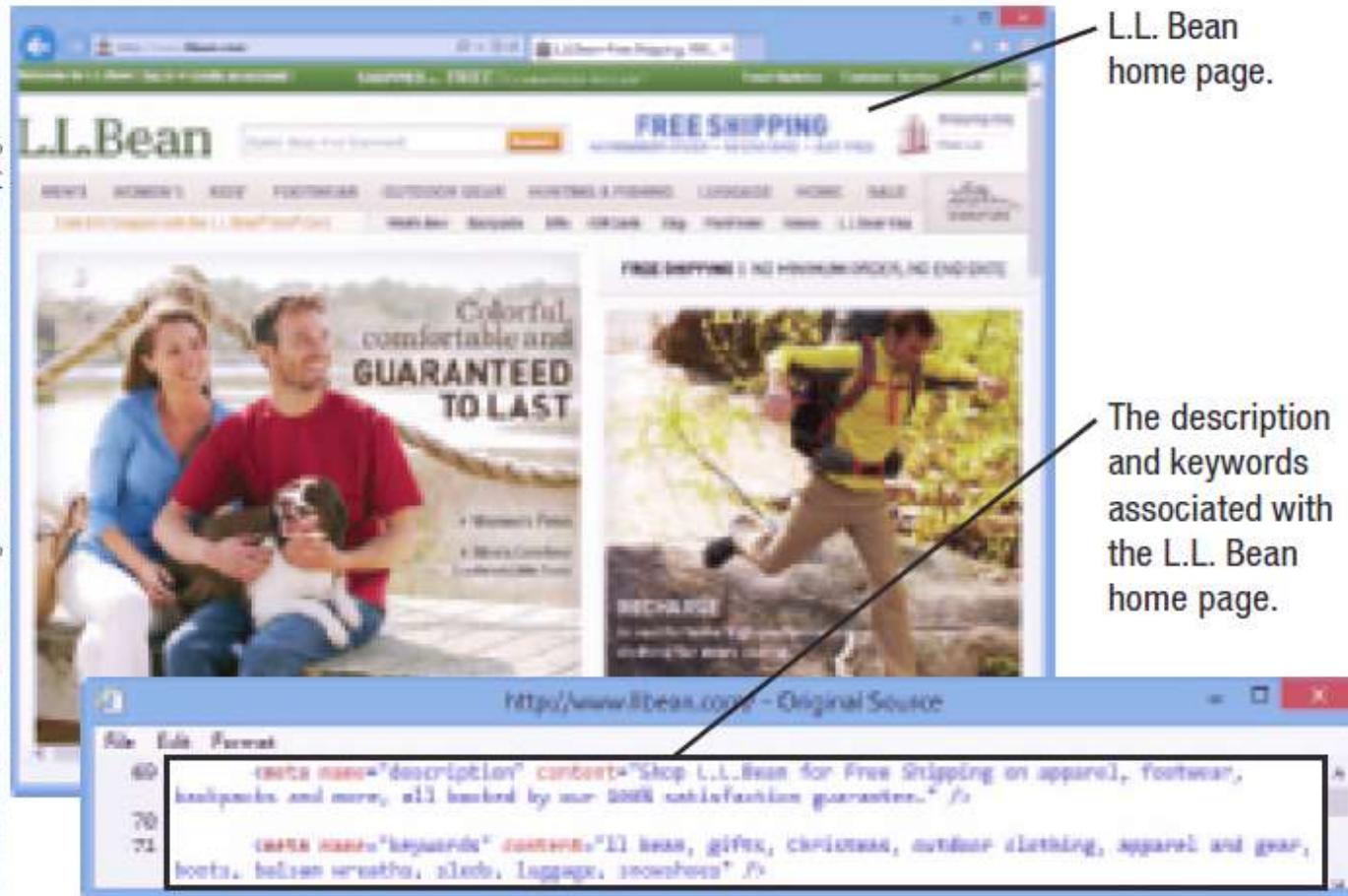


FIGURE 11-19

Meta tags. Are added to a Web page by the Web page author and are used by search sites when classifying that page in their search databases.



Implementing Web-Based E-Commerce

- Consider banner ads
 - Static ads
 - Dynamic (rich media) ads
 - Can be behavioral (targeted) ads
 - Consider ad retargeting services
 - Banner ad exchanges are an inexpensive option
- Update your site regularly and consider adding incentives for return visits (contests, coupons, etc.)
- Use e-mail marketing techniques (free shipping offers, new product notifications, etc.)



Implementing Web-Based E-Commerce



RICH MEDIA BANNER ADS
These ads contain animated components that play when viewed on a Web page.



STATIC BANNER ADS
These ads are not animated.



A video plays within this banner ad.

These ads are part of a set of banners that are displayed one after the other.

FIGURE 11-22

Banner ads. Are used for marketing purposes and are linked to their corresponding Web sites.



Inside the Industry Box

Click Fraud

- Occurs when sponsored links are clicked when there is no interest in that product or service
- Can be clicked by a person or via a botnet
- Typically the motivation is financial
 - Business depleting competitor's ad budget
 - Individuals clicking ads on their sites to fraudulently earn ad revenue
 - Captcha is being used to help fight click fraud

Sponsored ⓘ



[Nintendo Wii U Solution Bundle w/ Customer Choice
Wii U Game & Wii Plus Remote](#)
\$309.00 - [Walmart](#)
Free shipping on eligible \$45+ order



Security Issues

- Key security points for e-commerce sites
 - Secure transactions
 - Use a secure Web server
 - Secure sensitive documents and files
 - Use encryption
 - Authenticate online business partners
 - Use digital certificates and digital signatures to verify and authenticate the validity of each party involved in the Internet transaction



Quick Quiz

1. PayPal is an example of a(n) _____.
 - a. digital wallet
 - b. online payment service
 - c. order fulfillment service
2. True or False: A credit and a debit card work the same way on the consumers' side.
3. All online financial transactions should take place via a(n)
_____ Web server.

Answers:

1) b; 2) False; 3) secure



Summary

- What Is E-Commerce?
- E-Commerce Business Models
- Types of E-Commerce Web Sites
- Implementing Web-Based E-Commerce
- Security Issues

15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 12

Information Systems and System Development

Deborah Morley
Charles S. Parker

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Learning Objectives

1. Understand what information systems are and why they are needed.
2. Discuss who uses information systems in a typical organization.
3. Identify several types of information systems commonly found in organizations and describe the purpose of each.
4. Explain the individuals responsible for system development.
5. Identify and describe the different steps of the system development life cycle (SDLC).
6. Discuss several approaches used to develop systems.



Overview

- This chapter covers:
 - How information systems are used by different levels of employees
 - Common types of information systems
 - Computer professionals who develop systems and their primary responsibilities
 - The system development life cycle (SDLC)
 - The major approaches to system development



What Is an Information System?

- System
 - Collection of elements and procedures that interact to accomplish a goal
 - Football game, transit systems, etc.
- Information System
 - A system used to generate the information needed to support the users in an organization
- Digital Ecosystem
 - The collection of people, products, services, and business processes related to a digital element
 - Apple digital ecosystem = Apple hardware, software, and online services



What Is an Information System?

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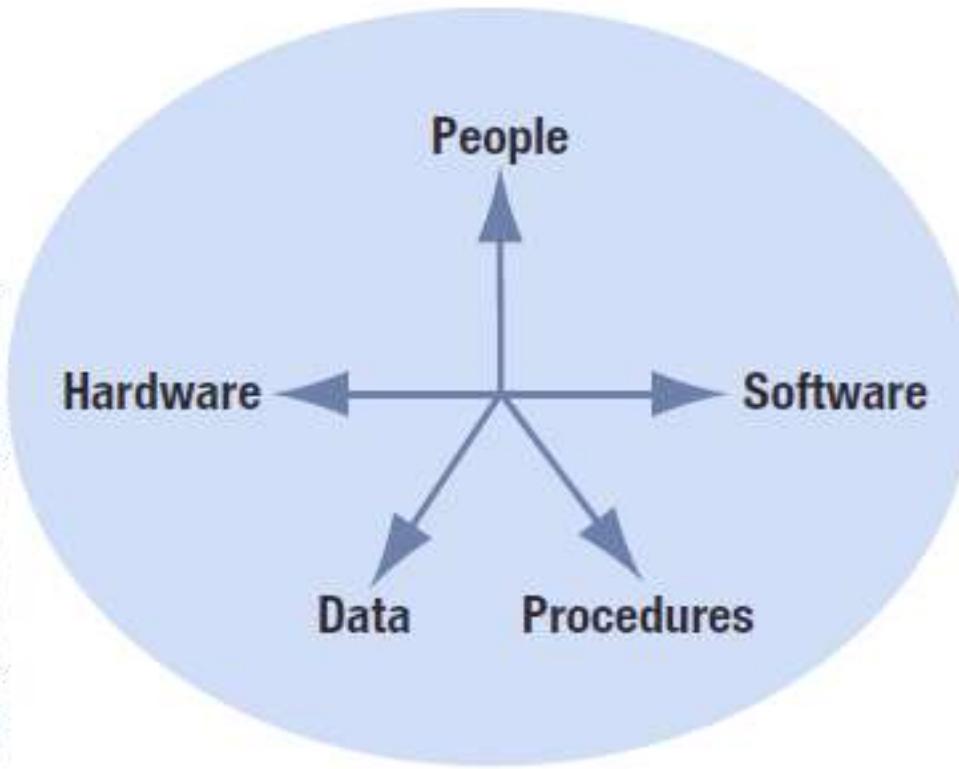


FIGURE 12-1

Components of an information system.



What Is an Information System?

- The Need for System Development
 - Systems development
 - Process of designing and implementing a new or modified system
 - System development may be required because of:
 - New laws (Sarbanes-Oxley Act, HIPAA etc.)
 - Changes to the legal requirements for retaining business data (e-disclosure, etc.)
 - Introduction of new technology



What Is an Information System?

- Enterprise Architecture
 - Provides a detailed picture of an organization, its function, its systems, and the relationship among them
 - Allows managers to organize and maximize the use of IT resources and make better decisions
 - Not easy to develop and requires time and effort, but once in place, it is an invaluable decision support tool



What Is an Information System?

- Business Intelligence (BI)
 - The process of gathering, storing, accessing, and analyzing data in order to make better business decisions
 - Business analytics (BA)
 - The process of analyzing data to evaluate a company's operations
 - Data Warehouse
 - Comprehensive collection of data about a company and its customers
 - Data mart is smaller and typically stores data related to a particular subject or department



What Is an Information System?

- Data Mining
 - The use of intelligent software to find subtle patterns that may not be otherwise evident
 - Can identify processes that need improvement
 - Can be used for customer profiling
 - Web Mining
 - Data mining used in conjunction with Web data
 - Text Mining
 - Analysis of text-based data (online forms, emails, call-center notes)



What Is an Information System?

- Social media analytics – mining and analyzing data from blogs and social media sites
 - Often used with the massive amounts of data generated today – called Big Data

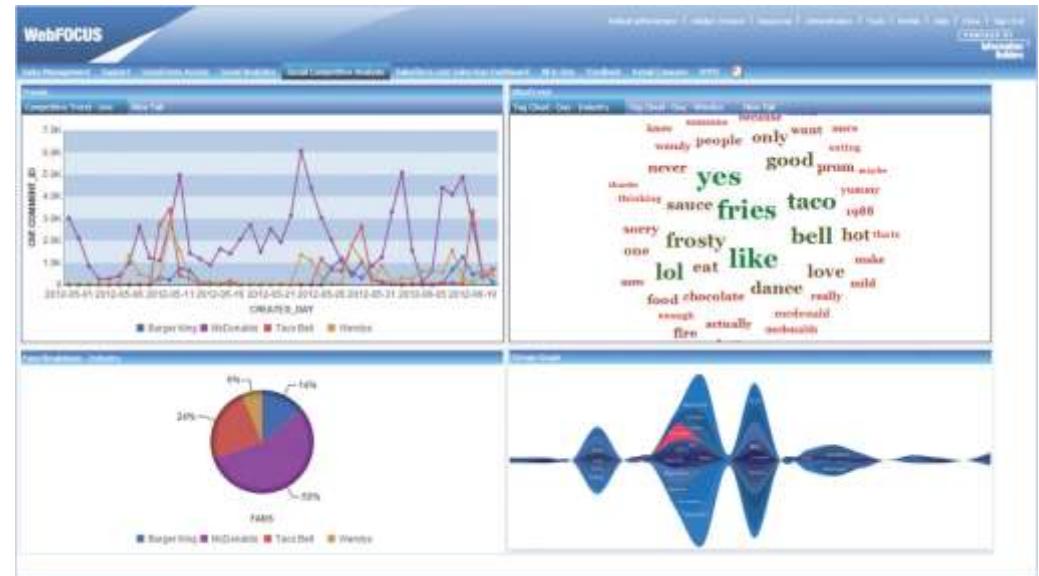


FIGURE 12-2 Social media analytics.



How It Works Box

Big Data ... For Everything

- Sports teams, casinos, airlines, museums, and more are gathering and analyzing big data
- Point Defiance Zoo & Aquarium uses big data analytics to uncover patterns and trends to help drive ticket sales, enhance visitor experiences, and raising awareness of wildlife conservation



AP Photo/Elaine Thompson

Analytics used at the Point Defiance Zoo & Aquarium has helped increase sales, enhance visitor experiences, and increase awareness of wildlife conservation.



What Is an Information System?

- Users of Information Systems
 - Used by one person or all employees
 - Enterprise Systems
 - A system that is used throughout an entire enterprise
 - Inter-enterprise Systems
 - Used by a business and its suppliers and other business partners
 - Some information systems are designed for management decision making



What Is an Information System?

- User Groups
 - Executive managers
 - Middle managers
 - Operational managers
 - Nonmanagement workers
 - External users

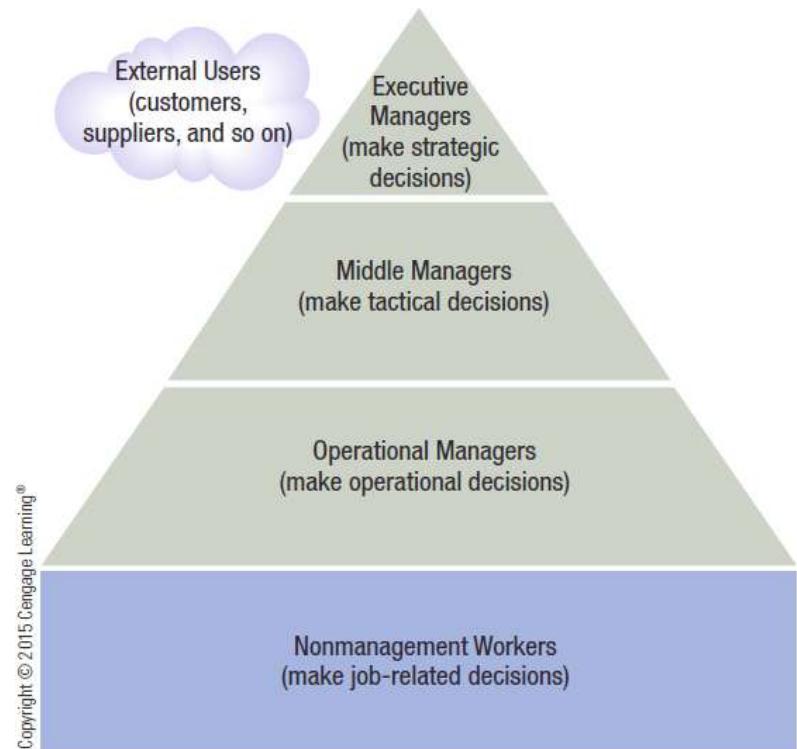


FIGURE 12-3

Information system users.

Include managers, nonmanagement employees, and external users.



Types of Information Systems

TYPE OF SYSTEM	DESCRIPTION
Office and user productivity systems	Facilitate communications and enhanced productivity in office tasks
Transaction processing systems	Process and record business transactions
Decision making support systems	Provide needed information to decision makers
Integrated enterprise systems	Integrate activities throughout an entire enterprise
Design and manufacturing systems	Help with the design and/or manufacturing of products
Artificial intelligence systems	Perform actions based on characteristics of human intelligence

FIGURE 12-4
Types of information systems.



Types of Information Systems

- Office and User Productivity Support Systems
 - Office System
 - A system used to facilitate communications and enhance productivity
 - Document Processing Systems
 - Hardware and software used to create electronic documents
 - Document Management Systems (DMSs)
 - Stores, organizes, and retrieves electronic documents



Types of Information Systems

- Content Management Systems (CMSs)
 - DMS that also includes multimedia files, images, and other content
- Communication Systems
 - Allow employees to communicate with each other, with business partners, and with customers



Courtesy Elation Inc.

FIGURE 12-5

Digital X-rays.

X-rays are one type of unconventional document now being created and stored in digital form.



Types of Information Systems

- Transaction Processing Systems (TPSs)
 - Processes and records data created by an organization's business transactions
 - Usually processed in real time
 - Contrasts with batch processing in which a set or batch of transactions are collected over a period of time and processed together
 - Specialty TPSs used in law enforcement, the military, etc.



Types of Information Systems

- Order Entry Systems
 - E-commerce systems
 - Financial transactions performed over the Internet
 - Point-of-sale (POS) systems
 - Used for purchases that occur in person, such as at a brick-and-mortar store
- Payroll Systems
 - Used to compute employee taxes, deductions, and pay
- Accounting Systems
 - Accounts receivable systems
 - Accounts payable systems
 - General ledger systems



Types of Information Systems

- Decision Making Support Systems
 - Help individuals make decisions
 - Management Information Systems (MISs)
 - Provides decision makers with regular, routine, and timely information that is used to make decisions
 - Usually provides information in the form of computer-generated reports
 - Detailed, summary, exception
 - Much of the time, this information is generated from data obtained from transaction processing
 - Most frequently used to make moderately structured, middle-management decisions



Types of Information Systems

- Decision Support Systems (DSSs)
 - Provides people with the tools and capabilities to organize and analyze their decision making information
 - Typically are interactive and provide information on demand
 - Most often used by middle and executive managers who require unstructured, unpredictable on-demand information
 - Incorporates internal and external data
 - Usually tailored to help with specific types of decisions such as sales and transportation
 - Executive Information system (EIS)
 - A DSS targeted directly to upper management



Types of Information Systems

- Geographic Information Systems (GISs)
 - Combines geographical information with other types of data to provide a better understanding of relationships among the data
 - Commonly used to make decisions about locations (e.g. new facility locations, disaster risk, geographical crime patterns)
 - Also used in emergency relief and disaster relief systems to create search and rescue maps, maps of where electrical power is restored, etc.



Types of Information Systems

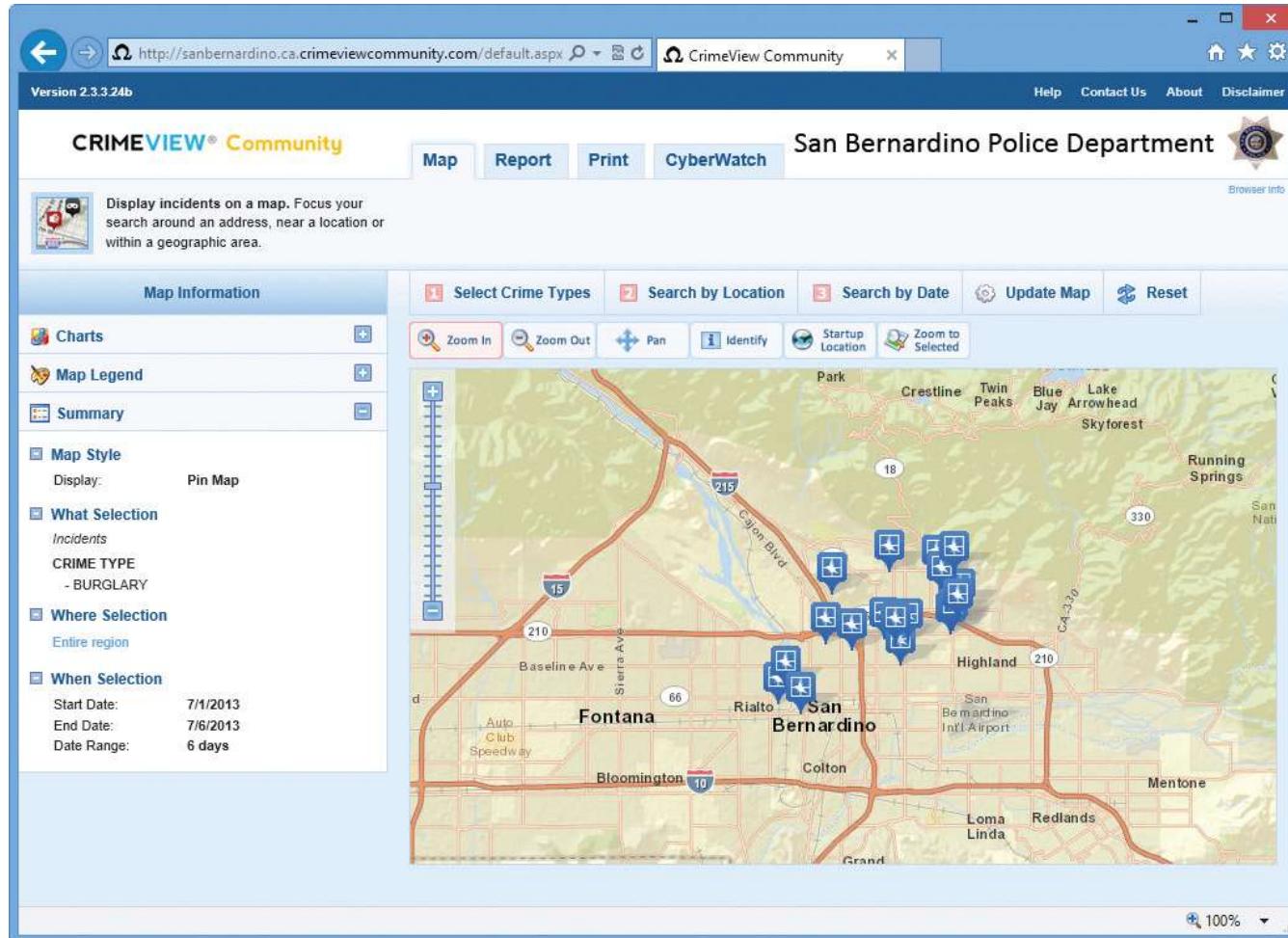


FIGURE 12-9
Geographic information systems (GISs). This GIS shows the locations of crime incidents based on the selected crime type, location, and date range.



Types of Information Systems

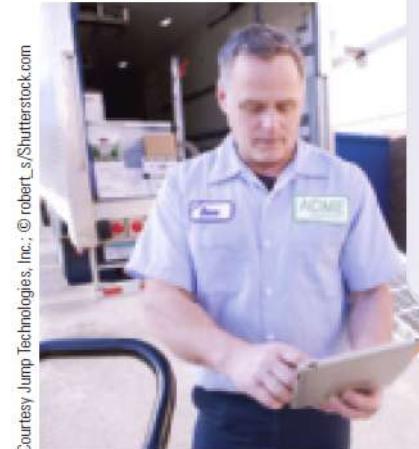
- Integrated Enterprise System
 - Electronic Data Interchange (EDI)
 - Transfers data between different companies using the Internet or another network
 - Often used to automate reordering materials and products
 - Enterprise Resource Planning (ERP)
 - Large integrated system that ties together all of a business's activities
 - Enterprise Application Integration (EAI)
 - Exchanging information from an ERP or other internal system among different applications and organizations



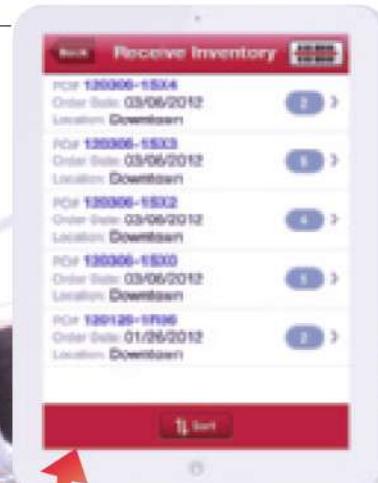
Types of Information Systems

- Inventory and Product Management Systems
 - Tracks and manages inventory
 - Can help optimize ordering
 - Supply Chain Management (SCM)
 - Oversees materials, information, and finances as they move from original supplier to the consumer

 **FIGURE 12-10**
Inventory management systems.



Courtesy Jimp Technologies, Inc.; © robert s/Shutterstock.com





Types of Information Systems

- Just-in-time (JIT)
 - Resources are limited to the right amount at the right time to fill orders
- Warehouse Management Systems (WMS)
 - Acts as a complete distribution system
- Product Lifecycle Management (PLM)
 - Organizes and correlates all information about a product from design to retirement

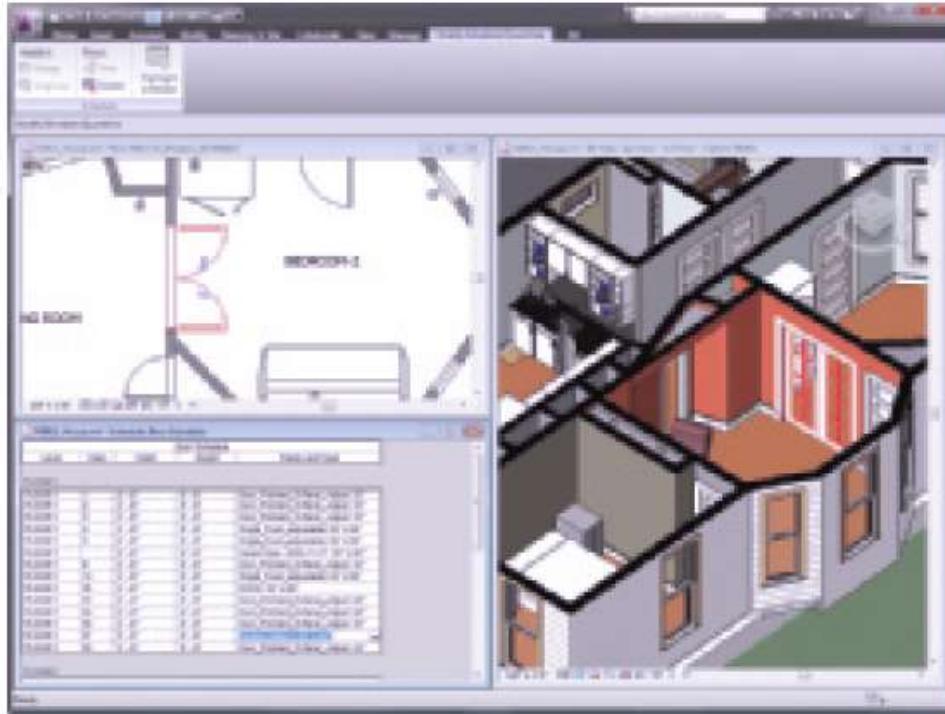


Types of Information Systems

- Design and Manufacturing Systems
 - Used to improve productivity at the product design stage and manufacturing stage
 - Computer-aided design (CAD)
 - Use of computer technology to automate design functions
 - Computer-aided manufacturing (CAM)
 - Use of computer technology to automate manufacturing functions



Types of Information Systems



Courtesy Autodesk Inc.

FIGURE 12-11

Computer-aided design (CAD). CAD programs can be used for a wide variety of design applications.



Types of Information Systems

- Artificial Intelligence Systems
 - A system in which a computer performs actions that are characteristic of human intelligence
 - Initial advances in AI made through chess-playing programs
 - Watson supports human interactions

FIGURE 12-12

AI and game playing.

Courtesy ChessBase.com



KRAMNIK VS. DEEP FRITZ

Deep Fritz beat world champion Vladimir Kramnik 4 games to 2 in 2006.

Courtesy of IBM Corporation



WATSON VS. JEOPARDY! CHAMPIONS

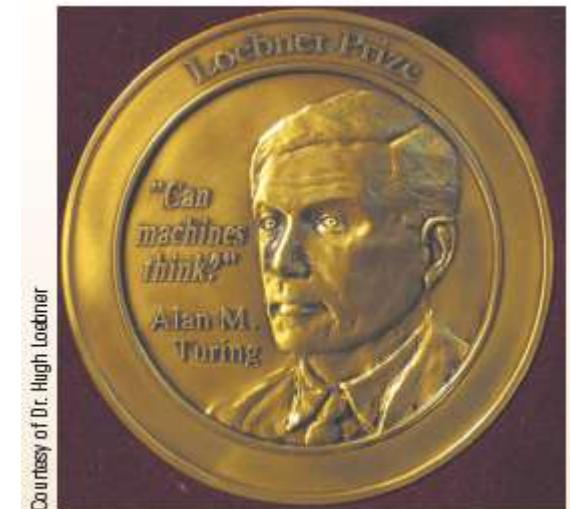
Watson easily beat both champions in 2011.



Inside the Industry Box

The Turing Test and the Loebner Prize

- AI researchers are working to create machines that think and act like people
- Alan Turing – one of the first AI researchers
 - Turing Test – if a computer could repeatedly fool a human into thinking it was human then it should be viewed as intelligent
- Loebner Prize – offered for the first computer who passes the Turing Test



The Loebner Prize gold medal.



Types of Information Systems

- Intelligent Agents
 - Programs that perform specific tasks to help to make a user's work environment more efficient or entertaining and that typically modifies its behavior based on the user's actions
 - Application assistants
 - Personal assistants (Google Now, Siri)
 - Shopping bots
 - Entertainment bots
 - Chatterbots
 - May be part of Semantic Web

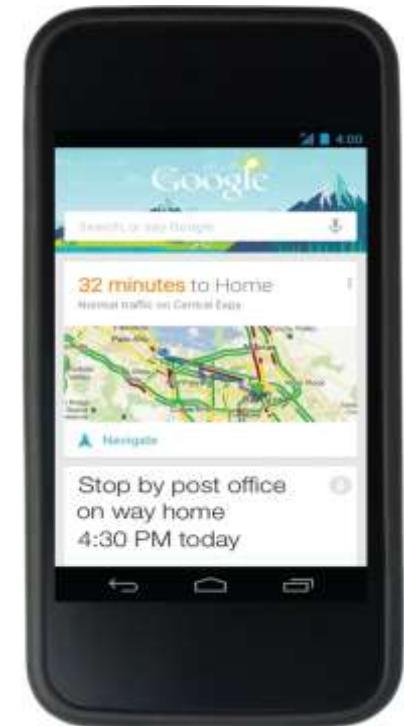


FIGURE 12-13

Mobile personal assistants.



Types of Information Systems

- Expert Systems
 - Provides the type of advice that would be expected from a human expert and has two main components
 - Knowledge Base
 - Database containing facts provided by human experts and rules the system should use to make decisions based on those facts
 - Inference Engine
 - Program that applies the rules to the data stored in the knowledge base, in order to reach decisions
 - Is only as good as the knowledge base and inference engine; also needs honest, correct information from the user in order to work correctly



Types of Information Systems

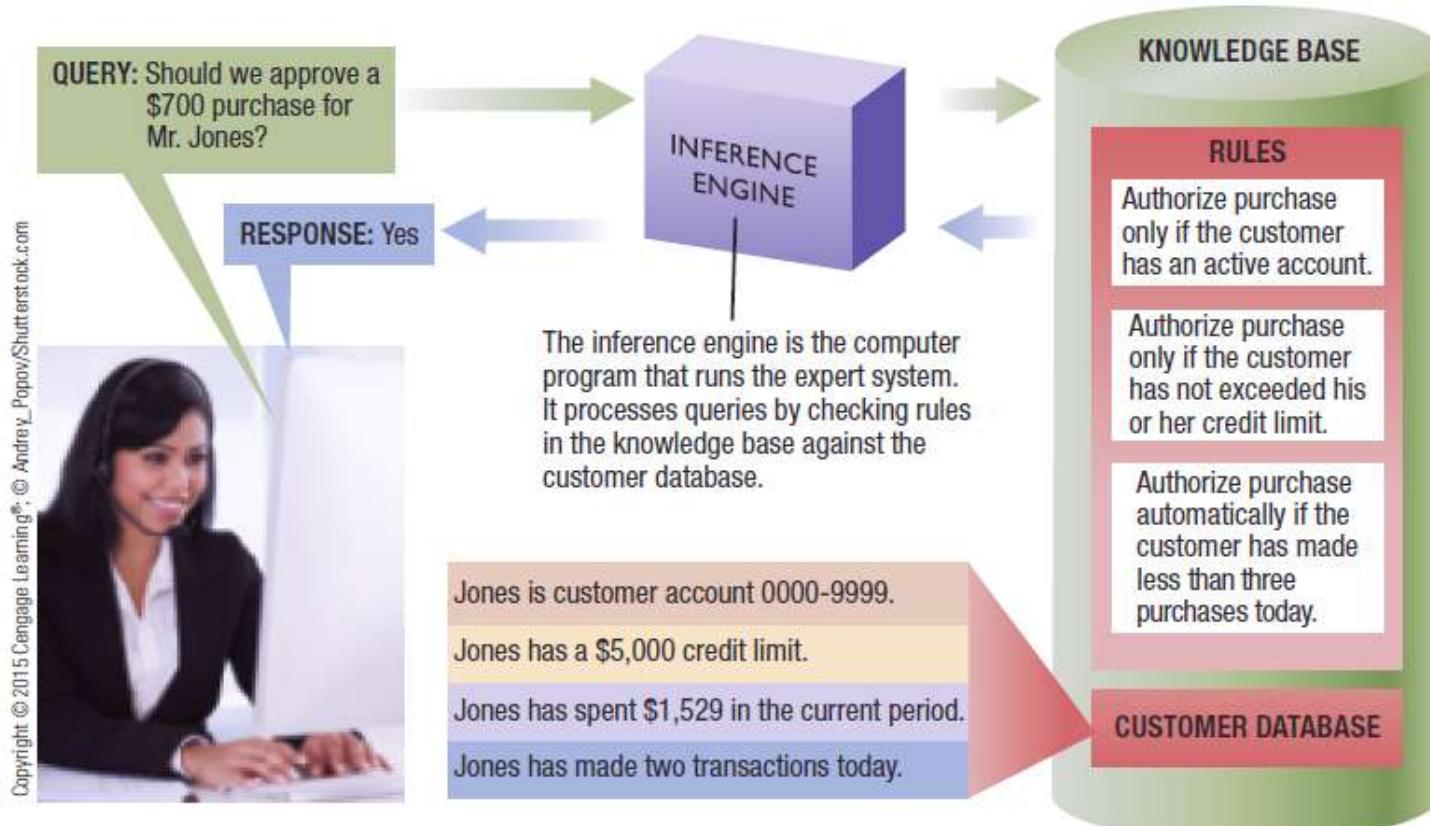


FIGURE 12-15

An expert system
at work.



Types of Information Systems

– Neural Networks

- A system in which the human brain's pattern-recognition process is emulated by the computer
- Used in:
 - Handwriting, speech, and image recognition
 - Medical imaging
 - Crime analysis
 - Biometric identification
 - Vision systems

FIGURE 12-16

Neural network systems. Neural networks are often used in biometric identification systems, such as to analyze fingerprints.



Courtesy of Crossmatch



Types of Information Systems

- Robotics
 - The study of robot technology
 - Robot
 - A device, controlled by a human operator or a computer, that can move and react to sensory input
 - Military Robots
 - Investigate caves, buildings, trails, etc., before soldiers enter
 - Locate and defuse explosive devices
 - Provide surveillance
 - Used in Unmanned Aerial Vehicles (UAVs)



Types of Information Systems

– Exoskeleton Suit

- » Wearable robotic systems designed to give an individual additional physical capabilities and protection



PACKBOT ROBOT

Designed to investigate dangerous, hostile, or inaccessible areas prior to human entry.



HULC EXOSKELETON

Designed to give soldiers enhanced mobility and endurance while carrying heavy loads.

FIGURE 12-17
Military robotic applications.



Types of Information Systems

- Business and Industrial Robots
 - Look for gas leaks, intruders, other hazards
 - Work on factory assembly lines
 - Mine coal, repair oil rigs
 - Locate survivors in collapsed mines
 - Facilitate video-conferencing and other remote presence applications

FIGURE 12-18

Business robots.



ASSEMBLY LINE ROBOTS



REMOTE PRESENCE ROBOTS



Types of Information Systems

- Personal Robots (Service Robots)
 - Entertainment robots
 - Toy robots
 - Robots designed for household tasks
 - Mow lawns, clean floors, etc.
 - Expected to be more humanoid in the future



TOY ROBOTS

This robot is designed to be **built** and used by children.



HELPER ROBOTS

This robot is designed to automatically mow the lawn within a prescribed area.



Technology and You Box

Self-Driving Cars

- Google's self-driving car has logged half a million miles during testing
- Need to determine laws and policies regarding autonomous vehicles before they are sold
- Issues include:
 - How cars and riders should be licensed
 - Limitations on use for safety
 - How cars will be insured
 - How to protect cars against hackers





Types of Information Systems

- Societal Implication of Robots
 - Adds convenience to our lives
 - Replaces humans for dangerous tasks
 - Monitors and assists the disabled and elderly
 - Concern exists that as true artificial intelligence becomes closer to reality, a class of robots with the potential for great harm could be created



Quick Quiz

1. A system using knowledge from medical experts that is used to help diagnose patients would be a type of
 - a. neural network
 - b. natural language system
 - c. expert system
2. True or False: An order-entry system would be classified as a management information system.
3. A(n) _____ is a device, controlled by a human, that can move and react to sensory input.

Answers:

- 1) c; 2) False; 3) robot



Responsibility for System Development

- The Information Systems (IS) Department
 - Responsible for an organization's computers, systems, and other technology
 - Also called the Information Technology (IT) department
 - Systems Analyst
 - Studies systems in order to determine what work needs to be done, and how this work may best be achieved
 - Other IT personnel include:
 - Business analysts, application programmers, operations personnel, and security specialists



Responsibility for System Development

Application programmer Codes application software.	Multimedia developer Develops multimedia content for Web sites and applications.
Business analyst Identifies the business needs of a system and makes sure systems meet those needs.	Network and computer system administrator Responsible for planning and implementing computers and networks within an organization.
Chief information officer (CIO) Oversees routine transaction processing and information systems activities, as well as other computer-related areas. Also known as the vice president of information systems .	Network engineer Responsible for the overall implementation, maintenance, and optimization of network hardware, software, and communications; called cloud network engineer when the infrastructure is cloud based.
Cloud architect Evaluates a company's computing needs and deploys appropriate cloud solutions to meet them.	Network operator/troubleshooter Responsible for overseeing the day-to-day activities for a network, such as troubleshooting problems, documenting network events, and performing necessary duties to keep the network operating smoothly.
Cloud engineer Plans and conducts technical tasks associated with the implementation and maintenance of virtualized or cloud systems.	Network systems and data communications analyst Manages the networks in an organization and determines what changes, if any, are needed. Also known as a network architect .
Cloud product manager Plans the concepts, strategies, positions, and sales used with cloud-based products.	Network technician Installs, maintains, and upgrades networking hardware and software.
Cloud services developer Designs and builds the end-user interfaces and tools used with cloud services.	Security specialist Responsible for seeing that an organization's hardware, software, and data are protected from hackers, malware, natural disasters, accidents, and the like. Also known as the chief security officer (CSO) .
Communications analyst Analyzes, maintains, and troubleshoots data communications networks and assists with connectivity.	Software engineer Designs and builds complex software applications. Also known as an application software engineer or a systems software engineer ; called a cloud software engineer when the software is cloud based or integrates with cloud services.

FIGURE 12-20

Computer and networking jobs.



Responsibility for System Development

Computer operations manager Oversees the computer operations staff and facility.	System administrator Responsible for maintaining a large, multiuser system; called cloud systems administrator when the system is cloud based.
Database administrator Responsible for setting up and managing large databases within an organization.	System programmer Codes system software, fine-tunes operating system performance, and performs other system software-related tasks.
Database analyst Responsible for designing and developing an organization's data flow models and database architecture.	Systems analyst Studies systems in an organization to determine what changes need to be made and how to best accomplish these changes.
Data center architect Manages the whole data center environment, including servers, virtualization, power, cooling, security, and so on.	Systems engineer Oversees and coordinates the various engineering tasks performed during systems development.
Data entry operator Responsible for keying data into a computer system.	Trainer Trains users about a particular program, system, or technology.
Help desk technician Assists users in solving software and hardware problems.	Webmaster Responsible for all technical aspects of a Web site.
Information engineer Analyzes an organization's data to locate trends, problems, and other useful information for management.	Web designer/developer Designs and develops Web sites.
Knowledge engineer Responsible for setting up and maintaining the expert knowledge base used in expert system applications.	Web programmer Writes the program code necessary for a Web site, such as to provide animation and database connectivity.

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 **FIGURE 12-20**

Computer and networking jobs.



Responsibility for System Development

- Outsourcing
 - Hiring outside vendors to perform specific business tasks
 - Offshore
 - Outsourced to another country
 - Nearshoring
 - Outsourcing to nearby countries
 - Homesourcing (homeshoring)
 - Outsourcing to home-based workers



Responsibility for System Development

- Crowdsourcing
 - Taking job traditionally performed by an employee and outsourcing it to a large, undefined group of people
 - Often performed via the Web
- Advantages
 - Lower costs
 - Flexible staffing
 - Global sourcing
 - Strategic sourcing
 - Socially responsible outsourcing



Responsibility for System Development

- Disadvantages
 - Personnel changes at the outsourcing company
 - Conflicts between in-house and outsourcing personnel
 - Communication problems
 - Cultural differences
 - Quality control and security
- Captive offshoring
 - U.S. companies own facilities in other countries and hire employees in that country
 - Gives company more control over employees and procedures than with conventional outsourcing



Trend Box

Digital Badges

- Consist of icons that represent academic achievements or acquired skills
- Offered by educational institutions, Web sites, companies, etc.
- Can be standard or customized
- Displayed via a digital badge system





Quick Quiz

1. Which term refers to outsourcing work to another country?
 - a. Homeshoring
 - b. Offshoring
 - c. System development
2. True or False: The IT worker who codes computer programs is called the computer operator.
3. The IT employee most involved with system development is the _____.

Answers:

1) b; 2) False; 3) systems analyst



The System Development Life Cycle (SDLC)

- SDLC = The development of a system from the time it is first studied until the time it is updated or replaced



FIGURE 12-22

The system development life cycle (SDLC). Each phase of the system development life cycle produces some type of documentation to pass on to the next phase.



The System Development Life Cycle (SDLC)

- Preliminary Investigation
 - A feasibility study is performed to assess whether or not a full-scale project should be undertaken
 - Documentation: Feasibility Report
 - Contains findings on status of existing system and benefits/feasibility of changing to a new system
 - Includes system analysts' recommendations regarding whether or not the project should move on to the next stage in the SDLC



The System Development Life Cycle (SDLC)

- System Analysis
 - Examines the problem area to determine what should be done
 - Data Collection
 - Gathering information about the system (organizational chart, observation, interviewing users, etc.)
 - Data Analysis
 - Analyzing information to determine the effectiveness and efficiency of current system and/or requirements for new or modified systems



The System Development Life Cycle (SDLC)

- Entity-Relationship Diagrams (ERDs) and Data Flow Diagrams (DFDs)
 - Used to model the entities in a system and the flow of data within the system
 - Provides a visual representation of the data movement in an organization
- Decision Tables and Decision Trees
 - Useful for identifying procedures and summarizing the decision making process of one step of a system



The System Development Life Cycle (SDLC)

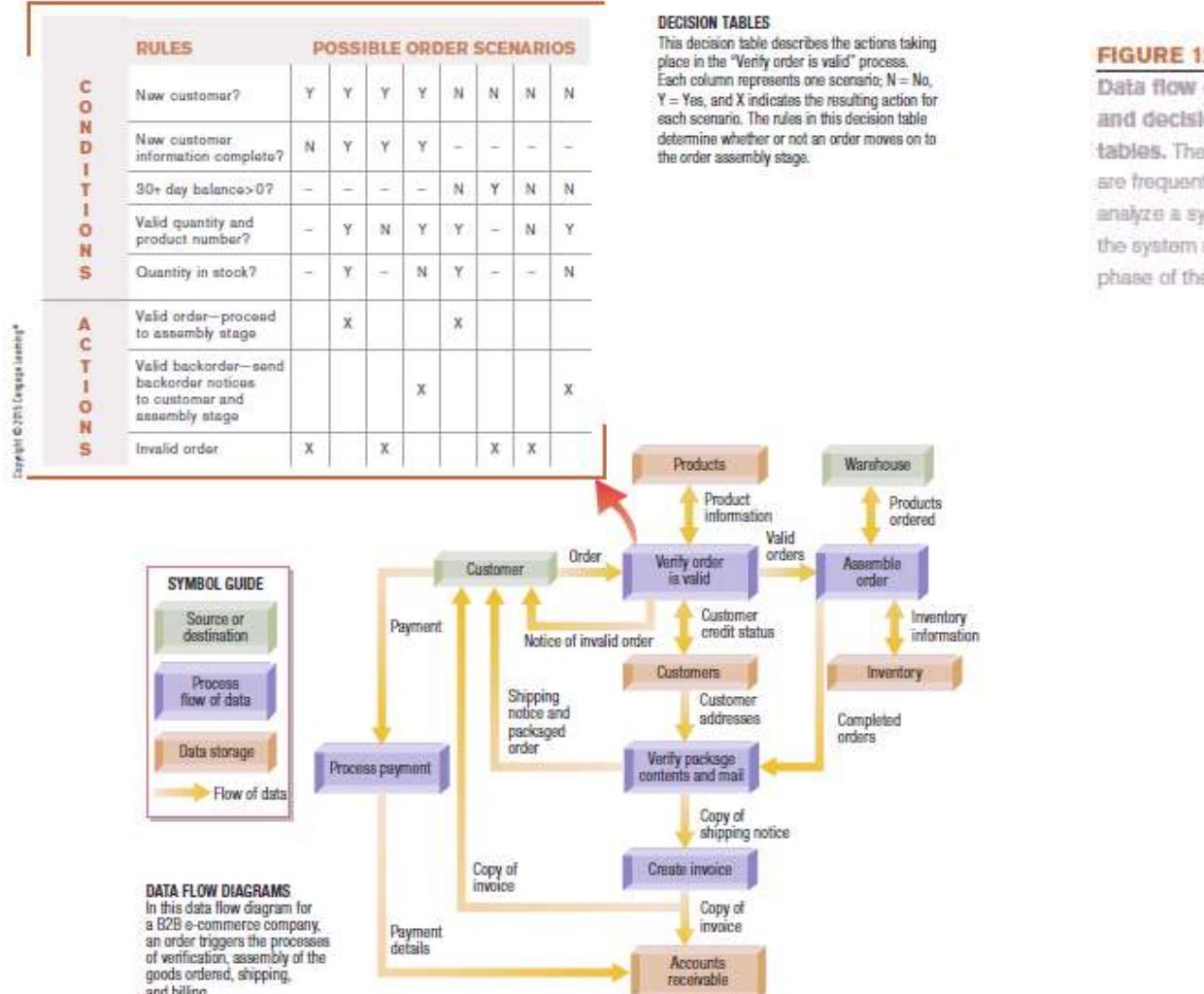


FIGURE 12-24

Data flow diagrams and decision tables. These tools are frequently used to analyze a system during the system analysis phase of the SDLC.



The System Development Life Cycle (SDLC)

- Business Process Modeling Notation (BPMN)
 - A graphical, standardized notation used to model business processes
 - Used to model the business processes used within systems
 - Designed to be understood by all individuals involved in the system
 - Expresses processes graphically using diagrams similar to flowcharts

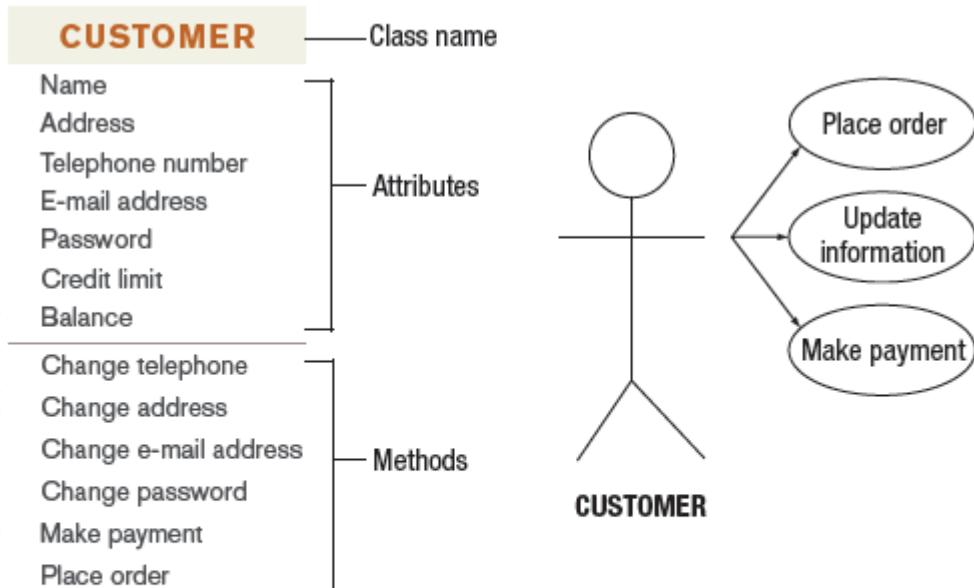


The System Development Life Cycle (SDLC)

- Class Diagrams and Use Case Diagrams
 - Used to illustrate systems that are based on the concept of objects

FIGURE 12-25

Class and use case diagrams. These tools are frequently used to model object-oriented systems.



CLASS DIAGRAM

Lists the attributes and methods that all instances in the class (in this case the Customer class) possess.

USE CASE DIAGRAM

Lists a user of the system (in this case a real customer) and its use cases (the actions the user may take).



The System Development Life Cycle (SDLC)

- Documentation: Diagrams, Tables, Trees, and Models
 - Consists of any instruments used for data gathering and the resulting diagrams, trees, models, and other tools used to summarize and analyze the data
 - Questionnaires
 - Interview questions
 - Diagrams, models, etc.



The System Development Life Cycle (SDLC)

- System Design
 - Specifies what the new system will look like and how it will work
 - Developing the Design and Specifications for the New System
 - Model of new system is developed
 - Diagrams can include:
 - Data dictionary: describes all data in a system
 - Data flow and/or class diagrams of the new system
 - User interface (UI) designs



The System Development Life Cycle (SDLC)

Used with permission from Microsoft Corporation

PAPER DESIGNS
Can be sketched on paper.

DIGITAL DESIGNS
Can be created using a variety of software programs.

The figure shows two examples of user interface design. On the left, a "NEW STUDENT ENTRY FORM" is displayed as a paper sketch with various input fields like Campus ID Number, Name, Address, City, State, Zip, Phone, Email, and checkboxes for Financial Aid and Major. On the right, a digital wireframe or mockup is shown in a software application, featuring a search bar, several buttons labeled "Label", and a sidebar for styling options.

FIGURE 12-26

User interface (UI) designs are created during the system design phase.

Courtesy Bohemian Coding



The System Development Life Cycle (SDLC)

- Cost-Benefit Analysis
 - Considers both tangible and intangible benefits to determine if the benefits of the new system outweigh the cost
- Documentation: System Design/Specifications
 - Developed during the system design phase
 - Consists of all documentation necessary to illustrate the new system



The System Development Life Cycle (SDLC)

- System Acquisition
 - System analysts determines where to obtain the necessary hardware, software, and other system components
 - The Make-or-Buy Decision
 - Determining if the software needed will be purchased from a vendor or developed in-house
 - If developed in-house, software to be developed moves into the program development process (Chapter 13)



The System Development Life Cycle (SDLC)

- RFPs and RFQs
 - RFP is a Request for Proposal
 - » Contains list of technical specifications for equipment, software, and services needed
 - RFQ is a Request for Quotation
 - » Names desired items needed and asks for a quote
- Evaluating Bids
 - Most companies have procedures for evaluating bids
 - Benchmark test



The System Development Life Cycle (SDLC)

- Documentation: RFPs, RFQs, and Vendor Evaluation Materials
 - Includes RFP or RFQ sent to potential vendors
 - Proposals received
 - Documentation produced during the evaluation of bids
- System Implementation
 - The new system is installed, tested, and made operational
 - Data migration
 - System must be thoroughly tested
 - Test data should be realistic and include incorrect data



The System Development Life Cycle (SDLC)

- System Conversion
 - Once testing phase is completed, system is installed
 - Direct conversion
 - » Old system deactivated and new system is immediately implemented
 - Parallel conversion
 - » Both systems are operated simultaneously until it is determined that the new system works properly
 - Phased conversion
 - » System is implemented by module



The System Development Life Cycle (SDLC)

- Pilot conversion
 - » New system used at just one location within the organization
- User Training
 - All training manuals should be developed and given to users
 - Training takes place on the actual system
 - Can occur one-on-one or in groups
- Documentation: Implementation Schedule, Test Data and Results, and Training Materials
 - Implementation schedule, test data, test results, training materials should be saved for future reference



The System Development Life Cycle (SDLC)

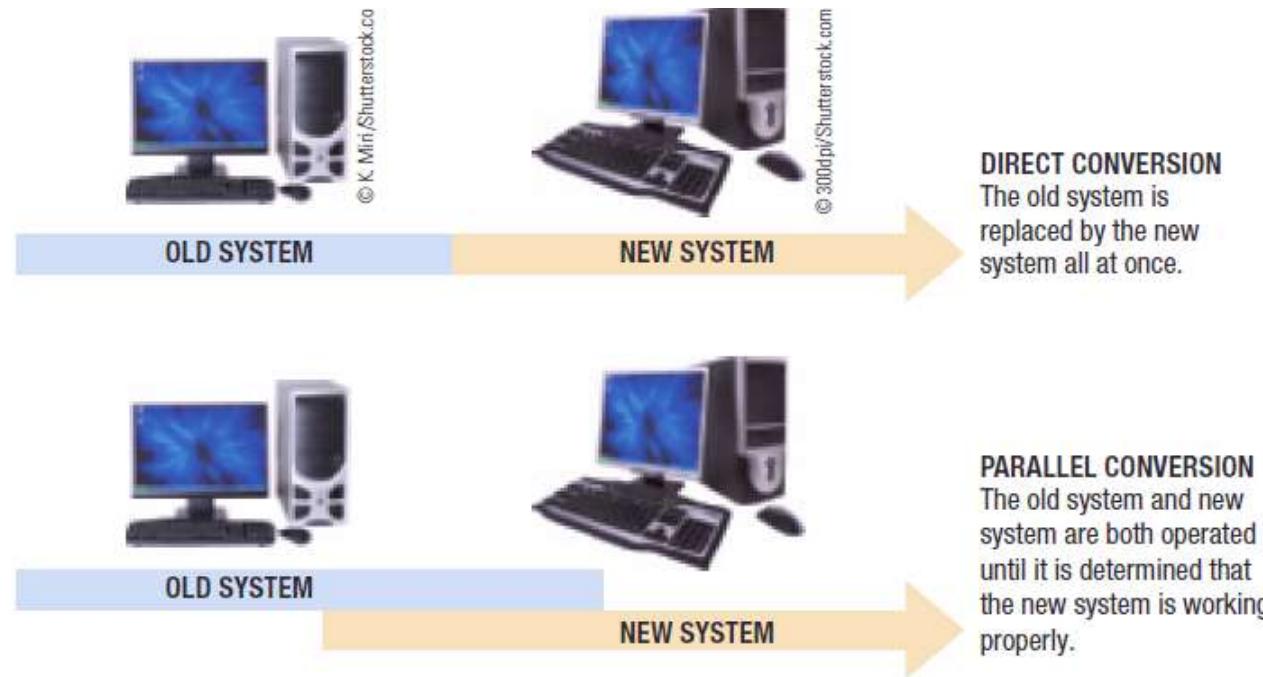


FIGURE 12-28

System conversion.
Converting from an old system to the new one often follows one of these four approaches.



The System Development Life Cycle (SDLC)

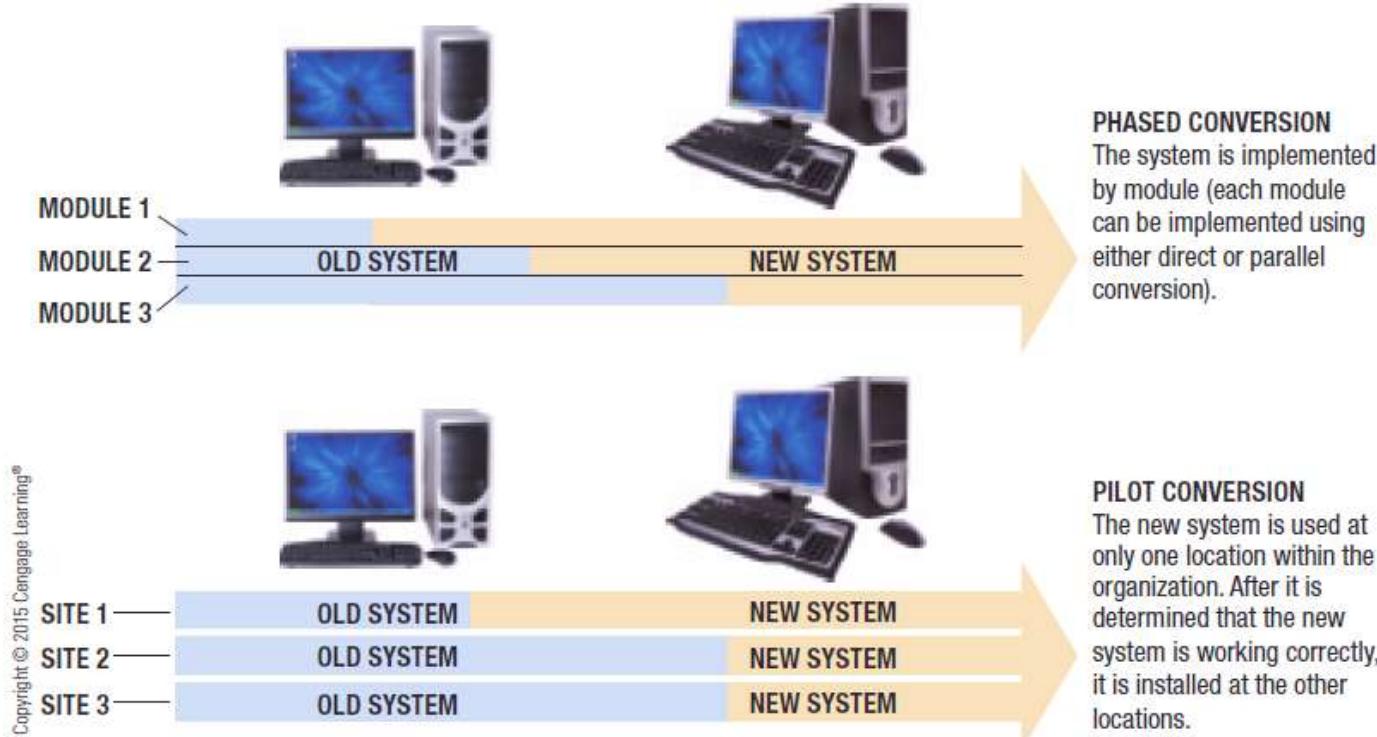


FIGURE 12-28

System conversion.
Converting from an old system to the new one often follows one of these four approaches.



The System Development Life Cycle (SDLC)

- System Maintenance
 - Maintenance is an ongoing process
 - Minor adjustments are made to the finished system to keep it operational until the end of the system's life or until the time that the system needs to be redesigned
 - Post-Implementation Review
 - Identifies any glitches in the new system that need to be fixed
 - When a major change is needed, the project goes through the SDLC again



The System Development Life Cycle (SDLC)

- Documentation: Completed Project Folder
 - Results of the post-implementation review are added to the accumulated documentation
 - Information can be useful to auditors who may check to see that proper procedures were followed



Approaches to System Development

- The Traditional Approach
 - SDLC phases are carried out in a preset order
 - Preliminary investigation
 - System analysis
 - System design
 - System acquisition
 - System implementation
 - System maintenance



The System Development Life Cycle (SDLC)

- Referred to as the waterfall model
 - Each phase begins only when previous one is completed
- Time-consuming
- The Iterative Approach
 - System is developed incrementally
 - Steps are repeated until the system is finalized
 - Prototyping
 - Small model, or prototype, of the system is built before the full-scale development effort is undertaken



The System Development Life Cycle (SDLC)

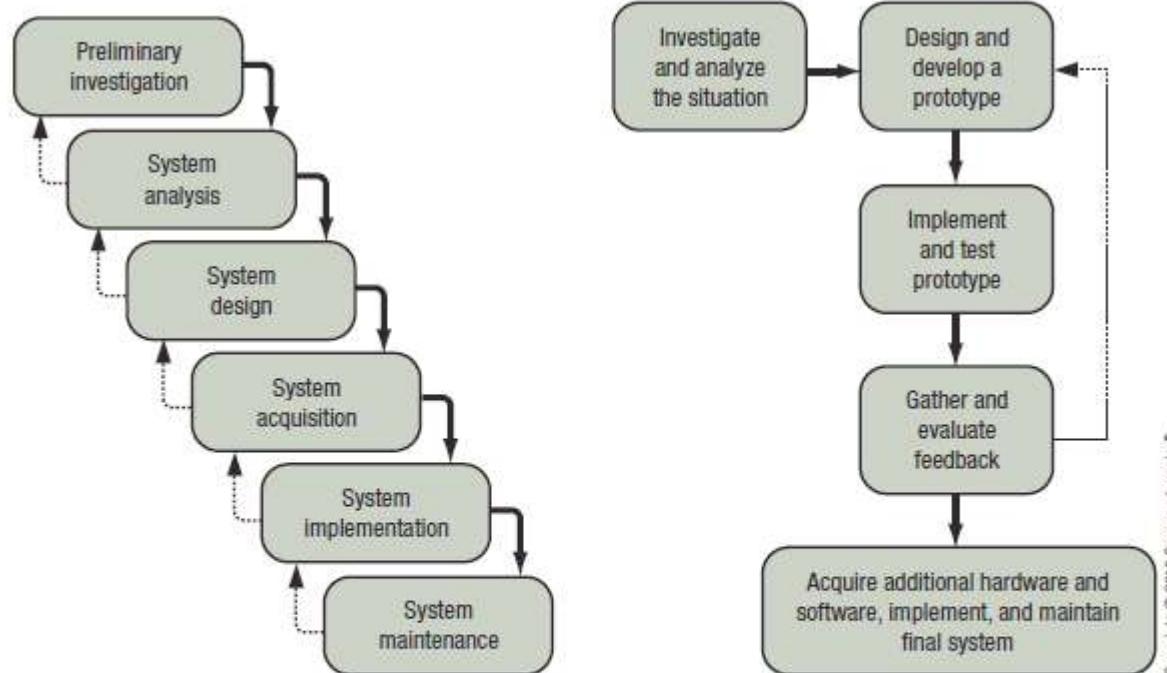


FIGURE 12-29

Two different approaches to system development.

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WATERFALL METHOD (TRADITIONAL APPROACH)
Each step in the SDLC is carried out in order, although some interaction typically occurs.

PROTOTYPING (ITERATIVE APPROACH)
An iterative process in which a prototype is designed, developed, and tested, and then an improved prototype is developed and tested, and the process is repeated until the final version is reached.



The System Development Life Cycle (SDLC)

- The End-User Development Approach
 - User is primarily responsible for the development of the system
 - Most feasible when system being developed is small and inexpensive
 - Measures must be taken to ensure that the system is compatible with existing systems and no new problems are introduced



Quick Quiz

1. The first step of in the system development life cycle is _____.
 - a. to design the system
 - b. to perform a preliminary investigation
 - c. to implement the system
2. True or False: The traditional approach to systems development also is referred to as the waterfall model.
3. A test used to evaluate or measure a systems performance is called a(n) _____.

Answers:

- 1) b; 2) True; 3) benchmark test



Summary

- What Is an Information System?
- Types of Information Systems
- Responsibility for System Development
- The System Development Life Cycle (SDLC)
- Approaches to System Development

15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 13:

Program Development and Programming Languages

Deborah Morley
Charles S. Parker

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Learning Objectives

1. Understand the differences between structured programming, object-oriented programming (OOP), aspect-oriented programming (AOP), and adaptive software development.
2. Identify and describe the activities involved in the program development life cycle (PDLC).
3. Understand what constitutes good program design and list several tools that can be used by computer professionals when designing a program.
4. Explain the three basic control structures and how they can be used to control program flow during execution.



Learning Objectives

4. Discuss some of the activities involved with debugging a program and otherwise ensuring it is designed and written properly.
5. List some tools that can be used to speed up or otherwise facilitate program development.
6. Describe several programming languages in use today and explain their key features.



Overview

- This chapter covers:
 - The most common approaches to program design and development
 - The phases of the program development life cycle (PDLC)
 - Tools that can be used to design and develop a program
 - Good program design techniques and types of program errors
 - Popular programming languages



Approaches to Program Design and Development

- Procedural Programming
 - An approach to program design in which a program is separated into small modules that are called by the main program or another module when needed
 - Procedure call—locating specific tasks in procedures (modules or subprograms) that are called by the main program when needed
 - Allows each procedure to be performed as many times as needed; multiple copies of code not needed
 - Prior to procedural programming, programs were one large set of instructions (used GOTO statements)



Approaches to Program Design and Development

- Structured Programming
 - Goes even further, breaking the program into small modules (Top-down design)
- Variables
 - Named memory locations that are defined for a program
 - Used to store the current value of data items used in the program



Approaches to Program Design and Development

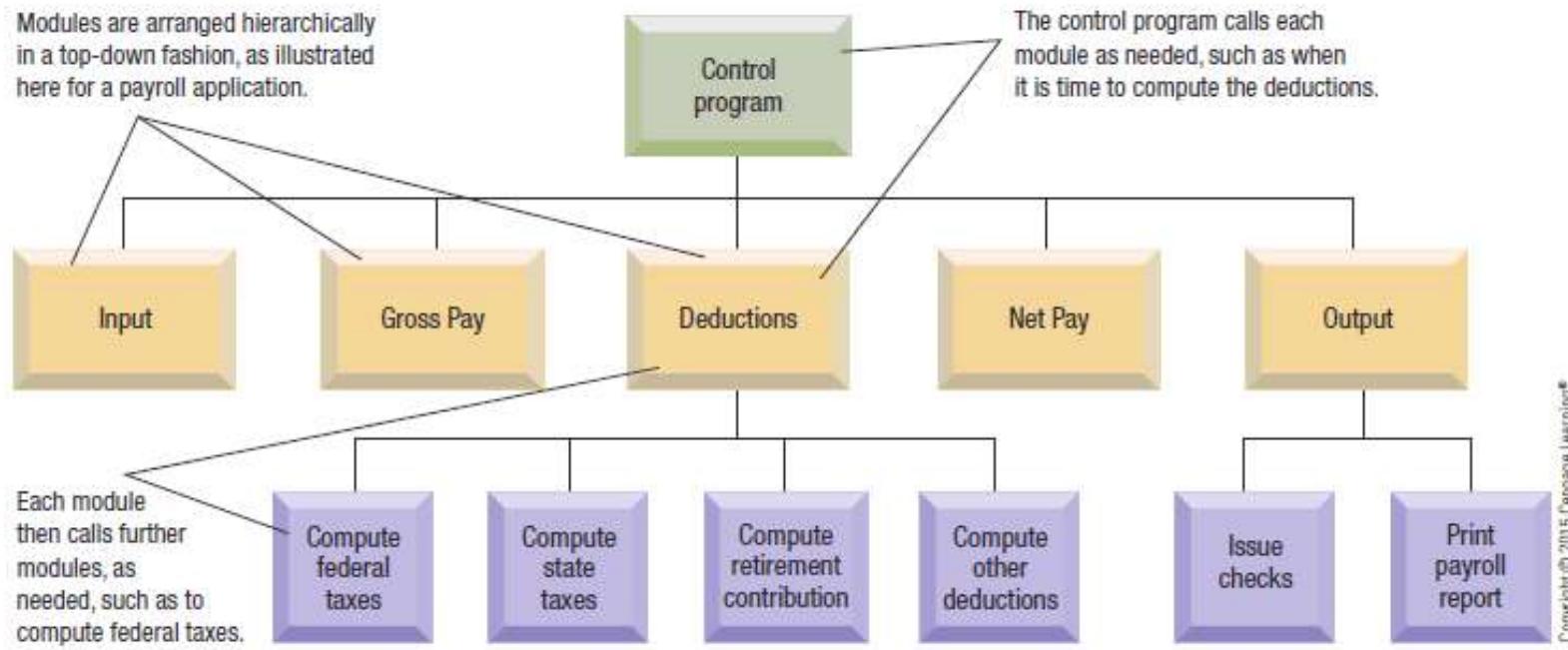


FIGURE 13-1

Structured programming.

A structured program is divided into individual modules; each module represents a very specific processing task.



Approaches to Program Design and Development

- Object-Oriented Programming (OOP)
 - Programs consist of a collection of objects that contain data and methods to be used with that data
 - Class
 - Group of objects that share some common properties
 - Instance
 - An individual object in a class
 - Inherits the attributes and methods of the class



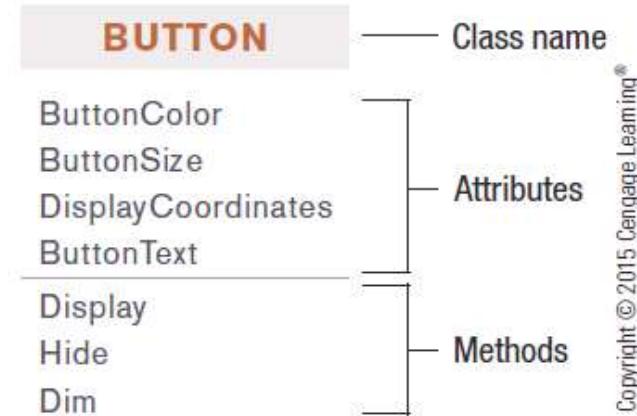
Approaches to Program Design and Development

- Attributes
 - Data that describes the object
 - Can be in a variety of formats
- Methods
 - Perform actions on an object
 - Can be used with different types of objects
- Objects can be accessed by multiple programs
 - Class libraries

FIGURE 13-2

Button class.

This class diagram illustrates that each object (instance) in the Button class has four attributes to hold data about the current state of the button and three methods to perform actions when messages are received.



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Approaches to Program Design and Development

- Aspect-Oriented Programming (AOP)
 - Separates functions so program components can be developed and modified individually from one another
 - The components can be easily reused with separate nonrelated objects
- Adaptive Software Development
 - Designed to make program development faster and more efficient and focuses on adapting the program as it is being written
 - Features iterative and/or incremental development



Approaches to Program Design and Development

- Agile Software Development
 - Goal is to create software quickly
 - Focuses on building small functional program pieces as the project progresses
 - Emphasizes teams of people working closely together (programmers, managers, business experts, customers, and so forth)
 - Some mobile developers are using continuous mobile innovation



The Program Development Life Cycle (PDLC)

- Program Development (application software development)
 - The process of creating application programs
- Program Development Life Cycle (PDLC)
 - The five phases of program development



The Program Development Life Cycle (PDLC)

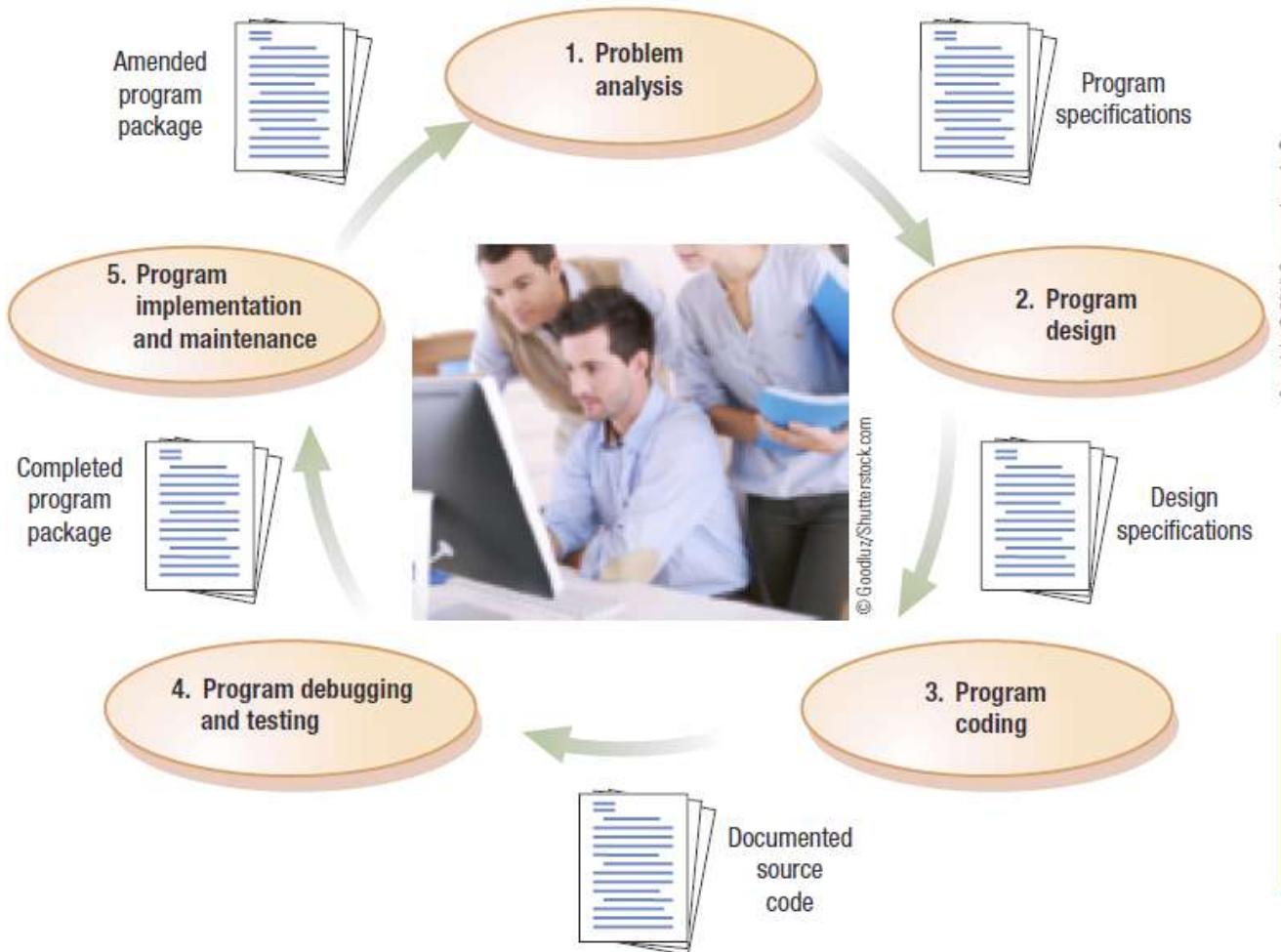


FIGURE 13-3
The program development life cycle (PDLC). Each phase of the program development life cycle produces some type of documentation to pass on to the next phase.

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The Program Development Life Cycle (PDLC)

- Problem Analysis
 - The problem is considered and the program specifications are developed
 - Specifications developed during the PDLC are reviewed by the systems analyst and the programmer (the person who will code the program)
 - Goal is to understand the functions the software must perform
 - Documentation: Program Specifications
 - Result of the first phase of the PDLC outlining what the program must do



The Program Development Life Cycle (PDLC)

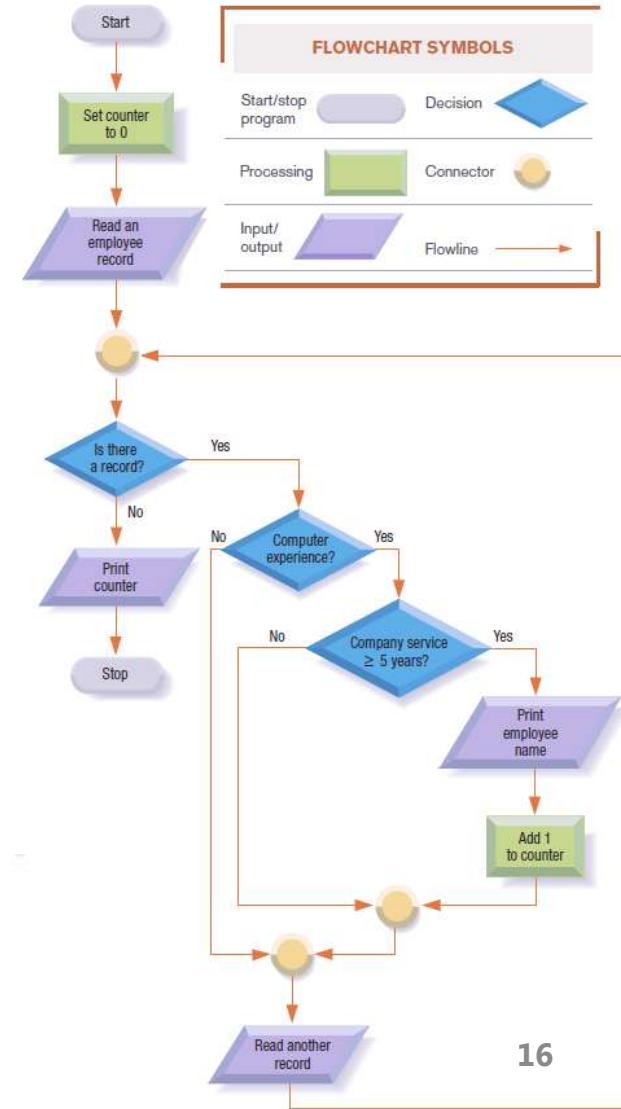
- Program Design
 - The program specifications are expanded into a complete design of the new program
 - Algorithm for the program is developed
 - Careful planning and design of a computer program are extremely important
 - Program Design Tools
 - Planning tools that include diagrams, charts, tables, and models
 - Structure Charts (hierarchy charts)
 - Depict the overall organization of a program



The Program Development Life Cycle (PDLC)

- Flowcharts
 - Show graphically, step-by-step, the actions a computer program will take
 - Use special symbols and relational operators
 - Can be drawn by hand or with flowcharting software

 **FIGURE 13-4**
A flowchart example.





The Program Development Life Cycle (PDLC)

- Wireframes
 - Visual representation of the overall design and logic of an app or Web site

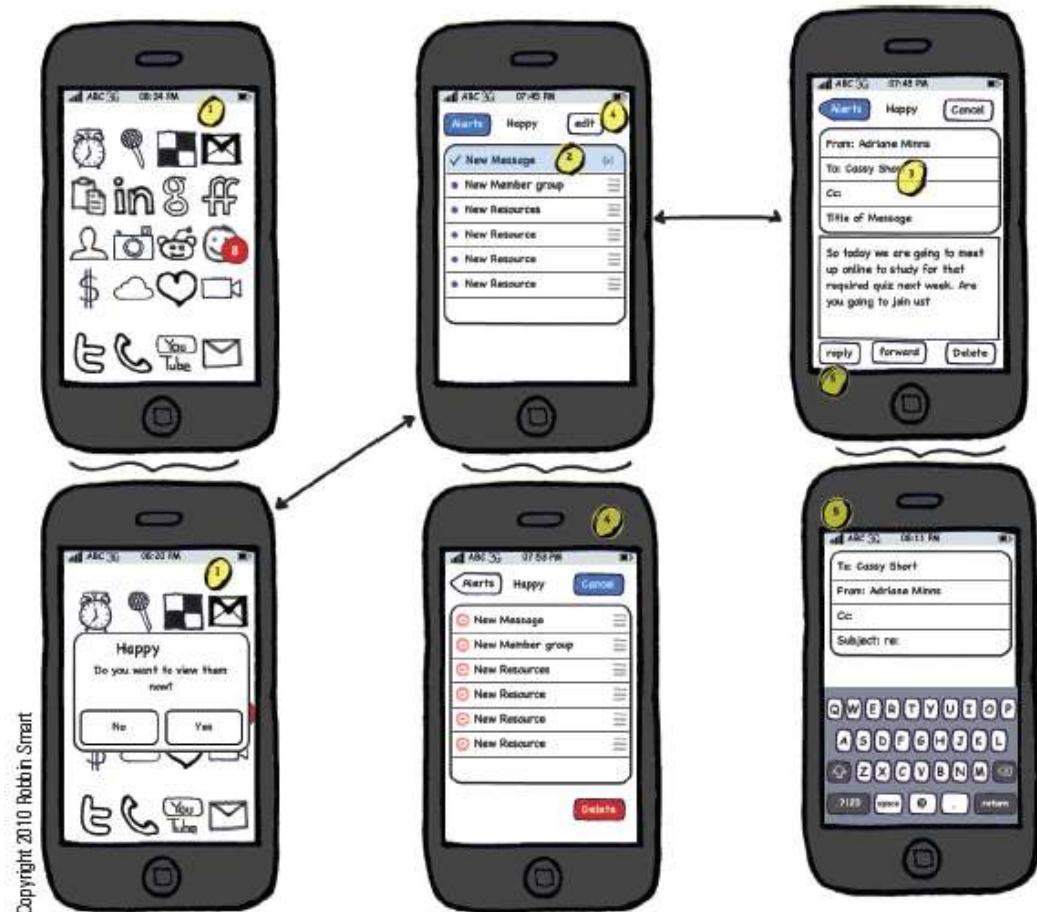


FIGURE 13-5
Wireframes.

Copyright 2010 Robin Smart



The Program Development Life Cycle (PDLC)

- Pseudocode
 - Uses English-like statements to outline the logic of a program rather than the flowchart's graphical symbols

FIGURE 13-6

Pseudocode. For the flowchart logic shown in Figure 13-4.

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```
Start
counter = 0
Read a record
DO WHILE there are records to process
    IF computer_experience
        IF company_service ≥ 5 years
            Print employee_name
            Increment counter
        ELSE
            Next statement
        END IF
    ELSE
        Next statement
    END IF
    Read another record
END DO
Print counter
Stop
```



The Program Development Life Cycle (PDLC)

- Unified Modeling Language (UML) Models
 - Set of standard notations for creating business models
 - Widely used in object-oriented programs
 - Includes class diagrams and case diagrams

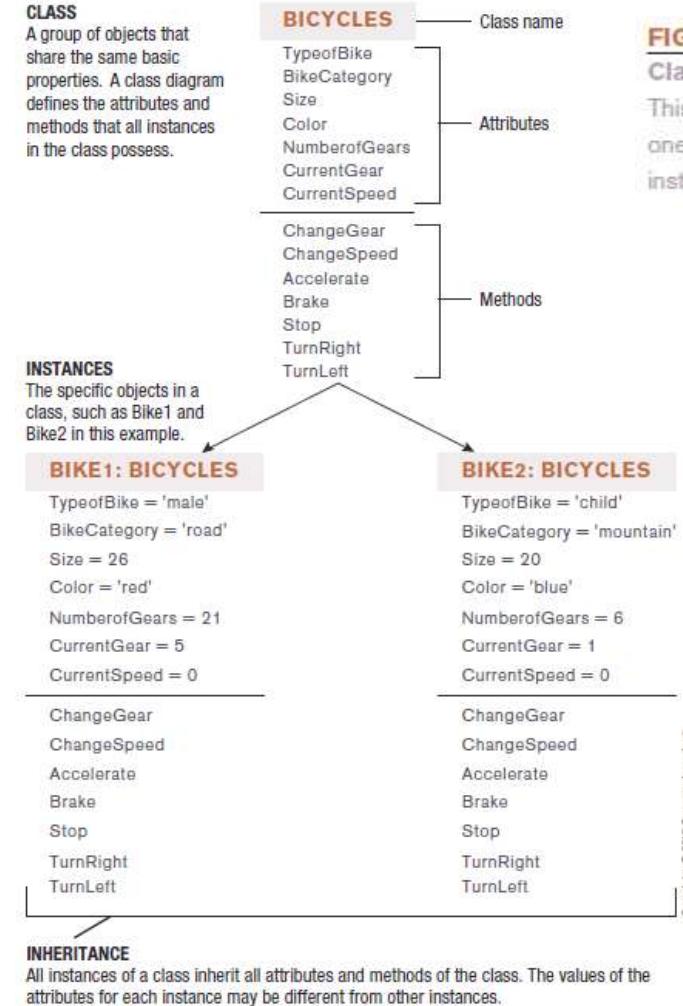


FIGURE 13-7
Class diagrams.
This example shows one class and two instances of that class.

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The Program Development Life Cycle (PDLC)

- Control Structures
 - A pattern for controlling the flow of logic in a computer program, module, or method
 - The Sequence Control Structure
 - Series of statements that follow one another
 - The Selection Control Structure
 - Multiple paths, direction depends on result of a certain condition
 - » If-then-else
 - » Case control structure



The Program Development Life Cycle (PDLC)

- Repetition Control Structure (iteration control structure)
 - Series of statements in a loop that are repeated until a particular condition is met
 - Two forms
 - » Do while structure
 - » Do until structure



The Program Development Life Cycle (PDLC)

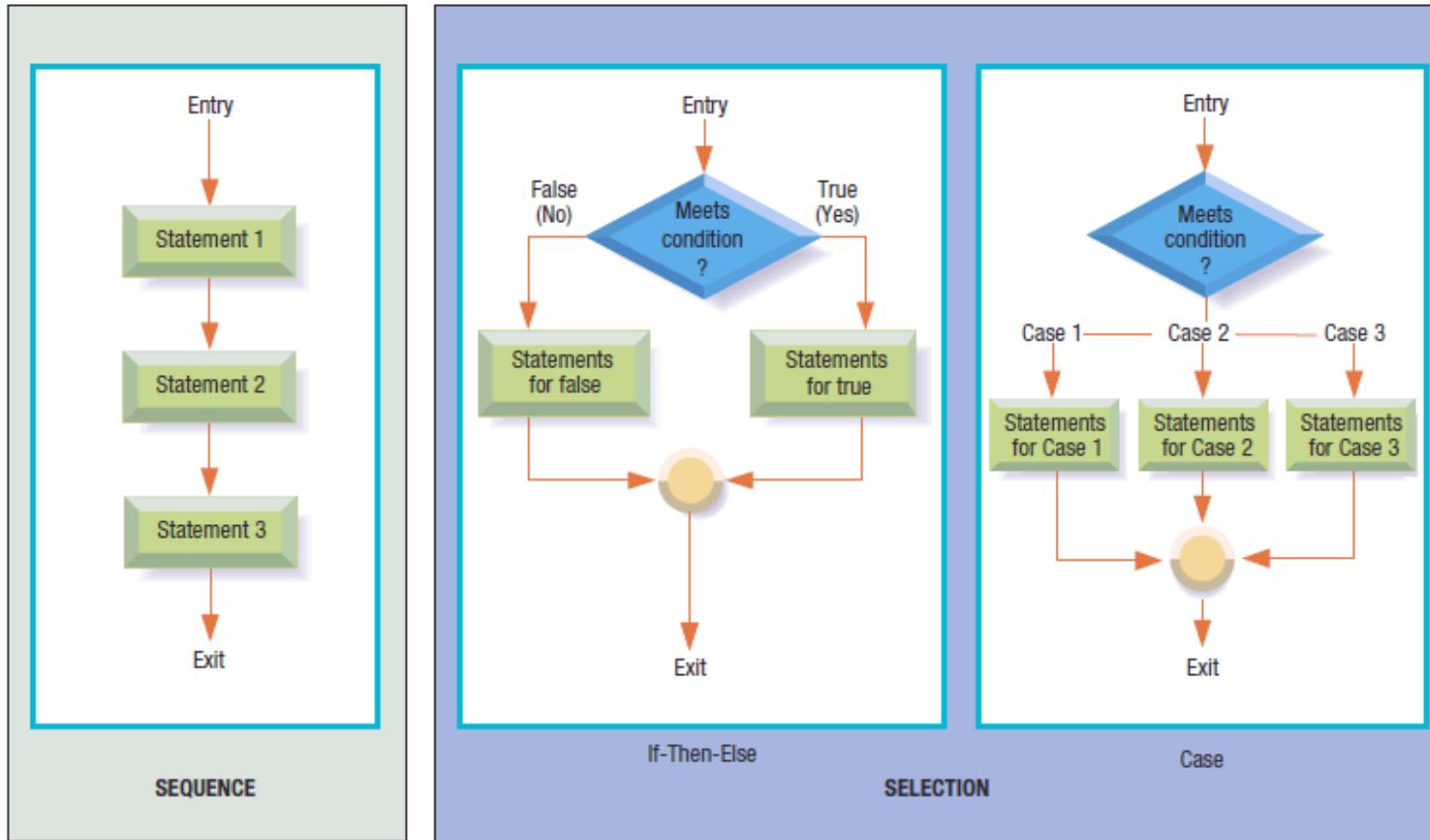


FIGURE 13-8
The three fundamental control structures. Note that each structure has only one entry point and only one exit point.



The Program Development Life Cycle (PDLC)

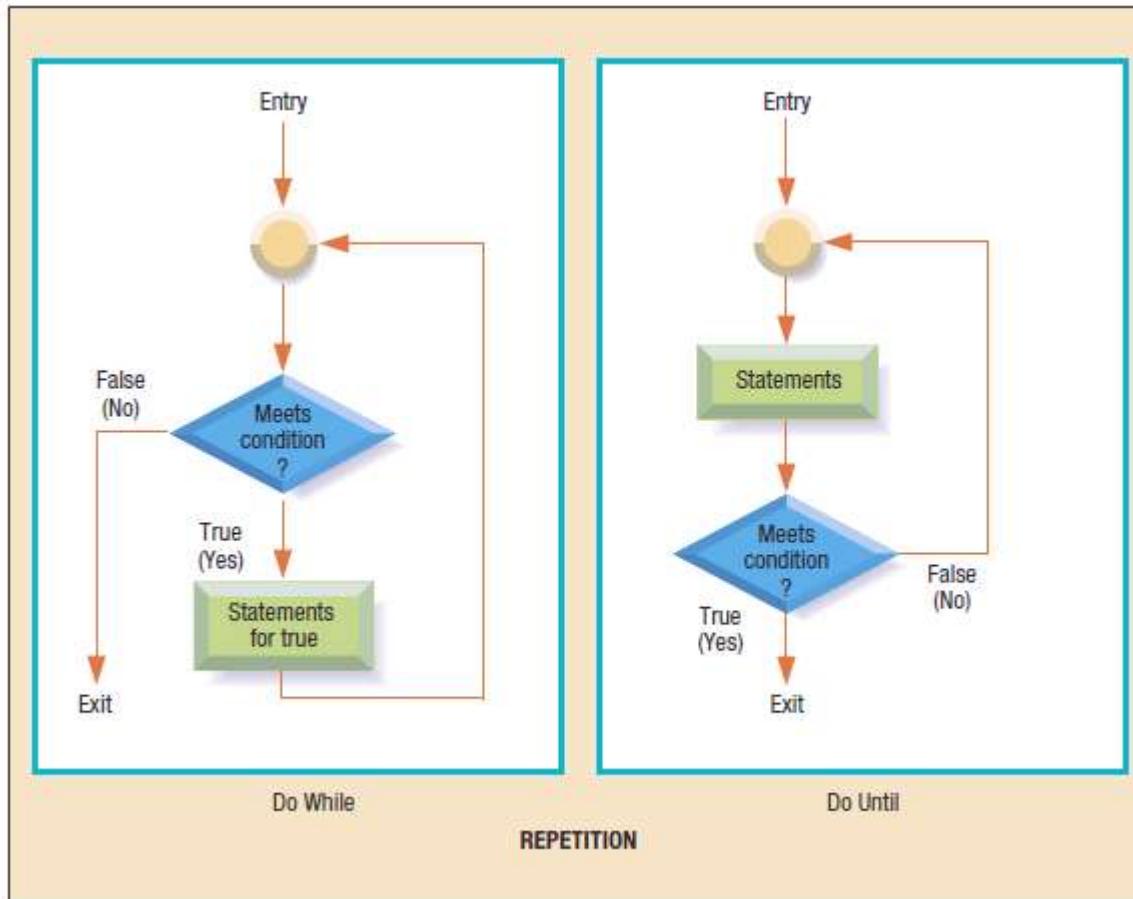


FIGURE 13-8
The three fundamental control structures. Note that each structure has only one entry point and only one exit point.

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The Program Development Life Cycle (PDLC)

- Good Program Design
 - Is essential
 - Saves time
 - Good Program Design Principles
 - Be Specific
 - » All things the program must do or consider must be specified
 - Follow the One-Entry-Point/One-Exit-Point Rule
 - No Infinite Loops or Logic Errors
 - » Infinite loop is a series of steps that repeat forever



The Program Development Life Cycle (PDLC)

DIRECTIONS FOR PERSON

1. Please make a piece of toast with margarine for me.



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DIRECTIONS FOR COMPUTER

1. Take one slice of bread out of the bag of bread.
2. Put the bread into the slot on the toaster, narrow edge first with the widest part of the bread fitting into the widest part of the slot.
3. Push the start lever on the toaster down.
4. When the toast pops up, remove the toast from the toaster.
5. Place the toast on a plate.
6. Open the silverware drawer, take out a knife, then close the silverware drawer.
7. Open the refrigerator, remove the margarine, then shut the refrigerator.
8. Take the lid off the margarine.
9. Scoop out one teaspoon of margarine with the knife.
10. Spread the margarine on the top side of the toast, evenly covering that surface of the toast.
11. Place the lid back on the margarine.
12. Open the refrigerator, replace the margarine, then shut the refrigerator.

FIGURE 13-9

Writing instructions
for a computer
versus a person.
A computer requires
step-by-step
instructions.



The Program Development Life Cycle (PDLC)

- Program Design Testing
 - Design should be tested to ensure logic is correct
 - Desk check
 - Tracing tables
- Documentation: Design Specifications
 - Illustrates the program needed to fulfill the program requirements
 - Expressed using structure charts, flowcharts, wireframes, pseudocode, and UML models
 - Include any test data and results from desk checking



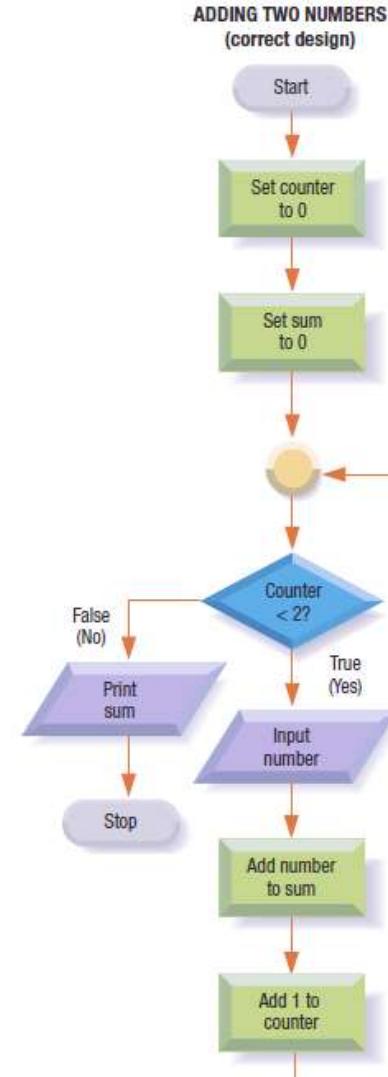
The Program Development Life Cycle (PDLC)

DESK CHECK RESULTS FOR CORRECT FLOWCHART				
Flowchart Stage	Counter	Decision Test Results (Counter < 2)		Sum
		Number		
Initialization	0	-	-	0
First decision test	0	T (enters loop)	-	0
After first loop	1	-	6	6
Second decision test	1	T (enters loop)	6	6
After second loop	2	-	3	9
Third decision test	2	F (exits loop)	3	9

Test data: 6, 3; Expected results: Sum = 9; Actual results: Sum = 9

FIGURE 13-10

Desk checking a flowchart.





The Program Development Life Cycle (PDLC)

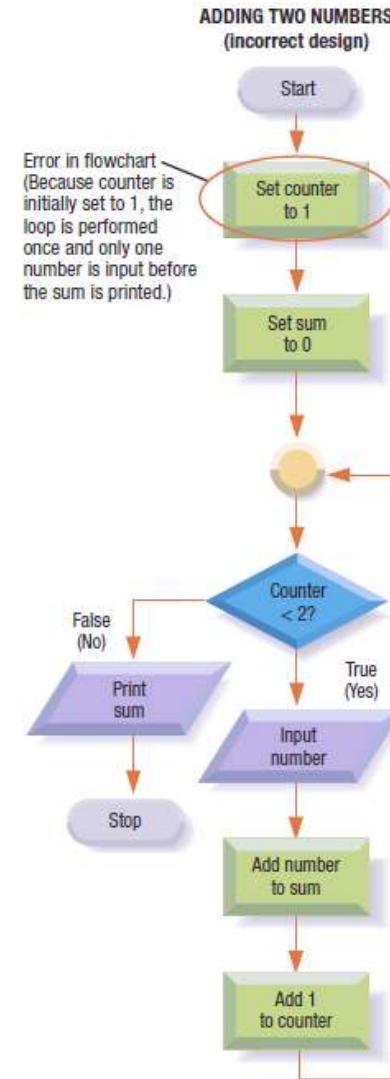
DESK CHECK RESULTS FOR INCORRECT FLOWCHART

Flowchart Stage	Counter	Decision Test Results (Counter < 2)		Number	Sum
		Test	Result		
Initialization	1	-	-	-	0
First decision test	1	T	-	-	0
		(enters loop)			
After first loop	2	-	6	6	6
Second decision test	2	F	6	6	6
		(exits loop)			

Test data: 6, 3; Expected results: Sum = 9; Actual results: Sum = 6

FIGURE 13-10

Desk checking a flowchart.





The Program Development Life Cycle (PDLC)

- Program Coding
 - The program code is written using a programming language
 - Choosing a Programming Language
 - Suitability to the application
 - Integration with other programs
 - Standards for the company
 - Programmer availability
 - Portability if being run on multiple platforms
 - Development speed



The Program Development Life Cycle (PDLC)

- The Coding Process
 - The source code is the computer program before it is compiled
- Coding Standards
 - Rules designed to standardize programming
 - Makes programs more readable and easier to maintain
 - Includes the proper use of comments to:
 - » Identify the programmer and last modification date
 - » Explain variables used in the program
 - » Identify the main parts of the program



The Program Development Life Cycle (PDLC)

COMMENTS

Comments are usually preceded by a specific symbol (such as *, C, ', #, or //); the symbol used depends on the programming language being used.

Anything else in a comment line is ignored by the computer.

Comments at the top of a program should identify the name and author of the program, date written and last modified, purpose of the program, and variables used in the program.

Comments in the main part of a program should indicate what each section of the program is doing. Blank comment lines can also be used to space out the lines of code, as needed for readability.

```
*****
* This program inputs two numbers, computes their sum,
* and displays the sum.
*
* Written by: Deborah Morley 3/12/14
*****
* Variable list
* SUM: Running sum
* CNTR: Counter
* NUM: Number inputted
*
      REAL SUM, CNTR, NUM
*****
* INITIALIZE VARIABLES
      SUM = 0
      CNTR= 0
*
* INPUT NUMBER, ADD IT TO THE SUM, INCREMENT COUNTER, AND THEN
* REPEAT UNTIL TWO NUMBERS HAVE BEEN ENTERED
      DO 10 CNTR = 1, 2
```



FIGURE 13-11

Program comments.



The Program Development Life Cycle (PDLC)

- Reusable code
 - Pretested, error-free code segments that can be used over and over again with minor modifications
 - Can greatly reduce development time
- Documentation: Documented Source Code
 - Program coding phase results in the program written in the desired programming language
 - Should include enough comments (internal documentation) so that the source code is easy to understand and update



Technology and You Box

Programming Contests

- One example is the TopCoder Open
 - Six competitions
 - Initial qualifying rounds are online
 - 48 semifinalists compete on site
 - \$300,000 in prizes
 - Other competitions are available online



A semifinalist competing in the TopCoder Open Algorithm contest.



The Program Development Life Cycle (PDLC)

- Program Debugging and Testing
 - The process of ensuring a program is free of errors (bugs) and works as it is supposed to
 - Translating Coded Programs into Executable Code
 - Coded programs need to be translated from source code written by the programmer to object code the computer can execute
 - Converted using a language translator
 - Program that converts source code to object code



The Program Development Life Cycle (PDLC)

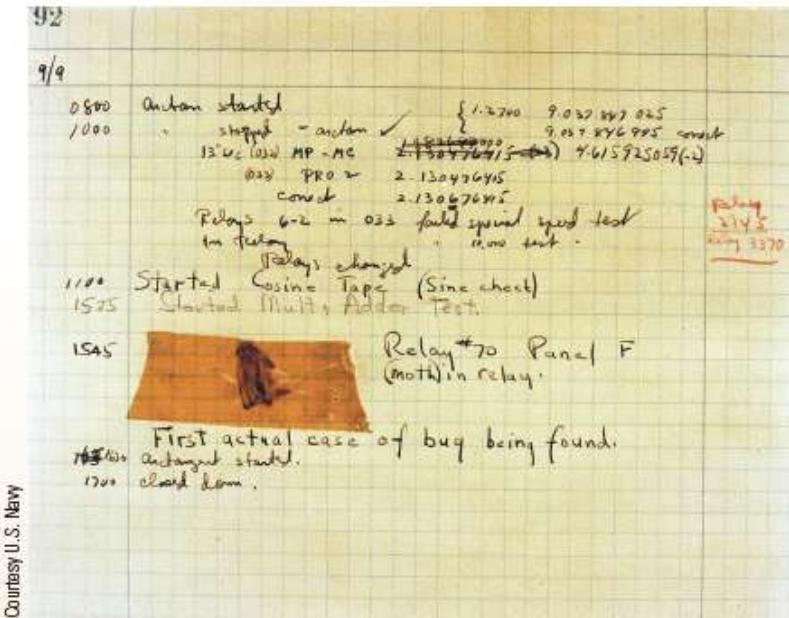
- Compilers
 - Language translator that converts an entire program into machine language before executing it
 - Designed for specific programming languages such as Java or Python
- Interpreters
 - Translates one line of code at one time
- Assemblers
 - Convert assembly language programs into machine language



Inside the Industry Box

The Original Program “Bug”

- A bug is an error that causes a program to malfunction
- First recorded instance of the term “bug” occurred in 1945
- Short circuit caused by a moth caught between two contacts in one of the computer’s relays



Courtesy U.S. Navy

The dead moth that caused the temporary failure of the Mark II computer in 1945, thought to be the origin for the computer term *bug*, was taped into the actual log book for that computer.



The Program Development Life Cycle (PDLC)

- Preliminary Debugging
 - Compiler and Syntax Errors
 - As programs are compiled or interpreted, errors occur which prevent the program from running properly
 - Syntax errors occur when the programmer has not followed the rules of the programming language
 - Run Time and Logic Errors
 - Run time errors occur when the program is running
 - Logic errors are errors in the logic of the program
 - » Program will run but produces incorrect results



The Program Development Life Cycle (PDLC)

1. Clicking the Start button with the Debug option selected starts the compilation and debugging process.

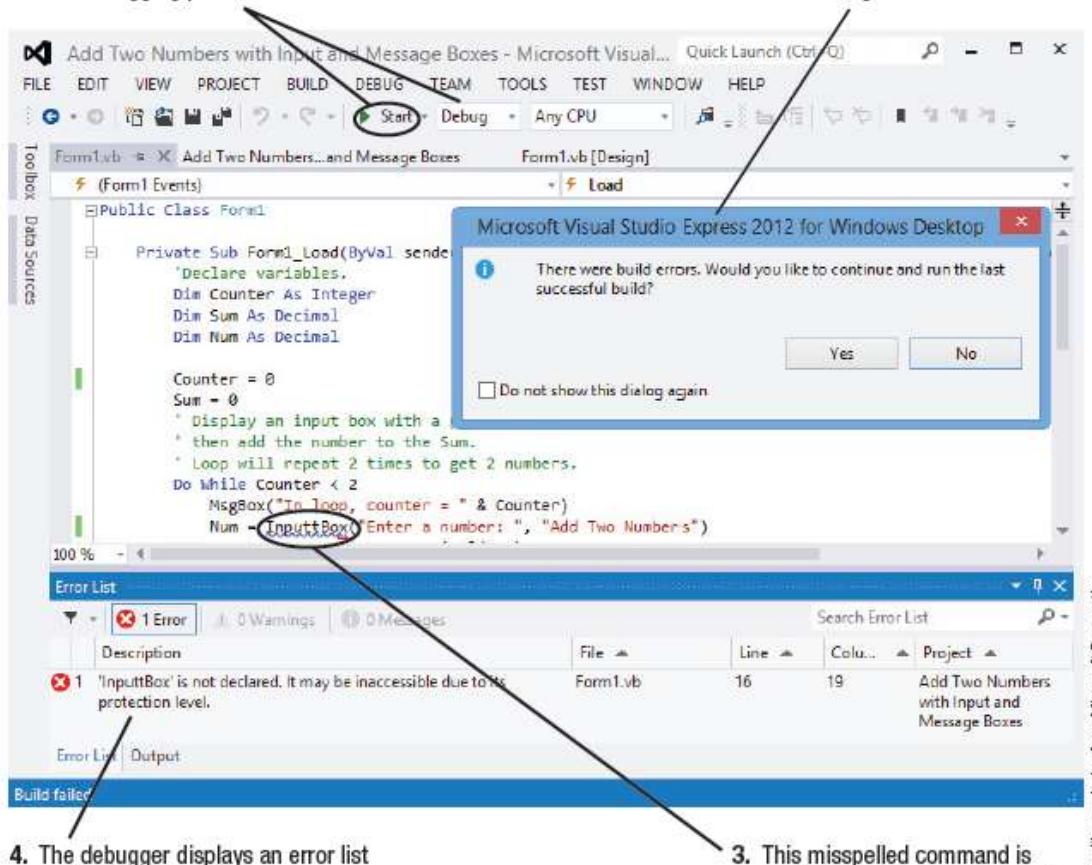


FIGURE 13-13

Syntax errors. Occur when the syntax (grammar rules) for a program is not followed precisely; they become obvious when compiling a program.



The Program Development Life Cycle (PDLC)

- With logic errors, such as initializing a counter to the wrong number as shown here, the program will run but the output will be wrong.

The screenshot shows the Microsoft Visual Studio IDE. On the left is the code editor for Form1.vb, which contains the following VB.NET code:

```
Public Class Form1
    Private Sub Form1_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load
        'Declare variables.
        Dim Counter As Integer
        Dim Sum As Decimal
        Dim Num As Decimal
        Counter = 1
        Sum = 0
        'Display an input box with a prompt to input a number.
        'then add the number to the Sum.
        'Loop will repeat 2 times to get 2 numbers.
        Do While Counter < 2
            MsgBox("In loop, counter = " & Counter)
            Num = InputBox("Enter a number: ", "Add Two Numbers")
            Sum = Sum + Convert.ToDecimal(Num)
            Counter = Counter + 1
            MsgBox("At bottom of loop, counter = " & Counter)
        Loop
        'Display the sum in a message box and then close the program.
        MsgBox(Sum, 0, "Your sum is: ")
        Me.Close()
    End Sub
End Class
```

The status bar at the bottom indicates "Ln 27 Col 1 Ch 1 INS".

Three message boxes are displayed:

- "In loop, counter = 1"
- "Enter a number: 6"
- "At bottom of loop, counter = 2"
- "Your sum is: 6"

- Adding dummy print statements to display the values of key variables and key locations in the program can help to determine the error.

- The dummy print statements, as well as the regular input and output messages belonging to the program, are displayed at the appropriate times when the program is executed.

- The dummy print statements reveal that the loop is performed only once before the sum is displayed and help the programmer locate the counter initialization error.

FIGURE 13-14

Logic errors. Are more difficult to identify; dummy print statements can help determine the error.



The Program Development Life Cycle (PDLC)

- Testing
 - Occurs after the preliminary debugging process to find additional errors
 - Uses good test data—data that is very similar to the actual data that will be used in the finished program
 - Tests conditions that will occur when the program is implemented
 - Checks for nonstandard situations or possible input errors



The Program Development Life Cycle (PDLC)

- Two stages
 - Alpha test—internal on-site test
 - Beta test—outside test
- Documentation: Completed Program Package
 - Copy of the test data, test results, finished program code, and other documentation generated during the testing phase should be added to the program package
 - Developer documentation
 - User documentation



The Program Development Life Cycle (PDLC)

- Program Implementation and Maintenance
 - Once the system containing the program is up and running, the implementation process is complete
 - Program maintenance
 - Process of updating software so it continues to be useful
 - Very costly
 - Documentation: Amended program package
 - Program package should be updated to reflect new problems or issues that occur and what changes to the program were necessary



Quick Quiz

1. Which approach to programming uses the concept of inheritance?
 - a. Procedural
 - b. Object-oriented
 - c. Aspect-oriented
2. True or False: An infinite loop is an example of a logic error.
3. A(n) _____ is a program design tool that shows graphically step-by-step the actions a computer program will take.

Answers:

1) b; 2) True; 3) flowchart



Tools for Facilitating Program Development

- Application Lifecycle Management (ALM) Tools
 - Creating and managing an application during its entire lifecycle, from design through retirement
 - Tools include:
 - Requirements management
 - Keeping track of and managing the program requirements as they are defined and then modified
 - Configuration management
 - Keeping track of the progress of a program development project



Tools for Facilitating Program Development

- Issue tracking
 - Recording issues such as bugs or other problems that arise during development or after the system is in place
- Application Generators
 - Software program that helps programmers develop software
 - Macros
 - Sequence of saved actions that can be replayed when needed
 - Programmers write them in a macro programming language such as Visual Basic for Applications



Tools for Facilitating Program Development

- Report Generators and User Interface (UI) Builders
 - Report generator
 - Tool that prepares reports to be used with a software program quickly and easily
 - User interface (UI) builders
 - Create the menus, forms, and input screens used with a program or database
 - Integrated development environment (IDE)
 - A set of programming tools for writing software applications



Tools for Facilitating Program Development

Courtesy of OpenGate Software

IDEs — This program creates both the UI and the code used in a Visual Basic program.

STAND-ALONE PROGRAMS — This program is used to design input screens for Microsoft Access.

Used with permission from Microsoft Corporation

FIGURE 13-16
User interface (UI) builders.



Tools for Facilitating Program Development

- Device Development Tools
 - Assist with developing embedded software to be used on devices, such as cars, ATM machines, and consumer devices
- Integrated Development Environments (IDEs)
 - Collection of tools used with a particular programming language to develop and test software
- Software Development Kits (SDKs)
 - Programming package designed for a particular platform
 - Enables programmers to develop applications for that platform more quickly and easily



Tools for Facilitating Program Development

- Application Program Interfaces (APIs)
 - Help applications interface with a particular operating system
 - Often used in conjunction with Web sites
 - Google's Maps API and Google's OpenSocial API allow developers to add Google Maps or social networking applications easily to Web sites, respectively



Trend Box

Mobile App Builders

- Many tools are available to help develop mobile apps and deploy them on various platforms
- One example is appsbar
- After the app is created, appsbar tests it and then submits it to major app markets for publication



Courtesy of APPSBAR



Quick Quiz

1. Which of the following is not an Application Lifecycle Management (ALM) tool?
 - a. Requirements definition software
 - b. Code generator
 - c. Application program interface (API)
2. True or False: A software development kit (SDK) is designed for a particular platform and allows programmers to develop applications quickly for that platform.
3. A(n) _____ is a sequence of saved actions (such as keystrokes, mouse clicks, and menu selections) that can be replayed whenever needed within the application program in which it was created.

Answers:

1) c; 2) True; 3) macro



Programming Languages

- What Is a Programming Language?
 - A set of rules, words, symbols, and codes used to write computer programs
 - To write a program, you need the appropriate software for the programming language being used
- Categories of Programming Languages
 - Classified by the types of programs they are designed to create: procedural or object-oriented languages
 - Often categorized by their level or generation



Programming Languages

- Low-Level Languages (earliest programming languages)
 - Machine language
 - Written at a very low level, just using 1s and 0s
 - First generation of programming languages
 - Assembly language
 - Uses names and other symbols to replace some of the 1s and 0s in machine language
 - Second generation of programming languages
 - Programs take longer to write and maintain



Programming Languages

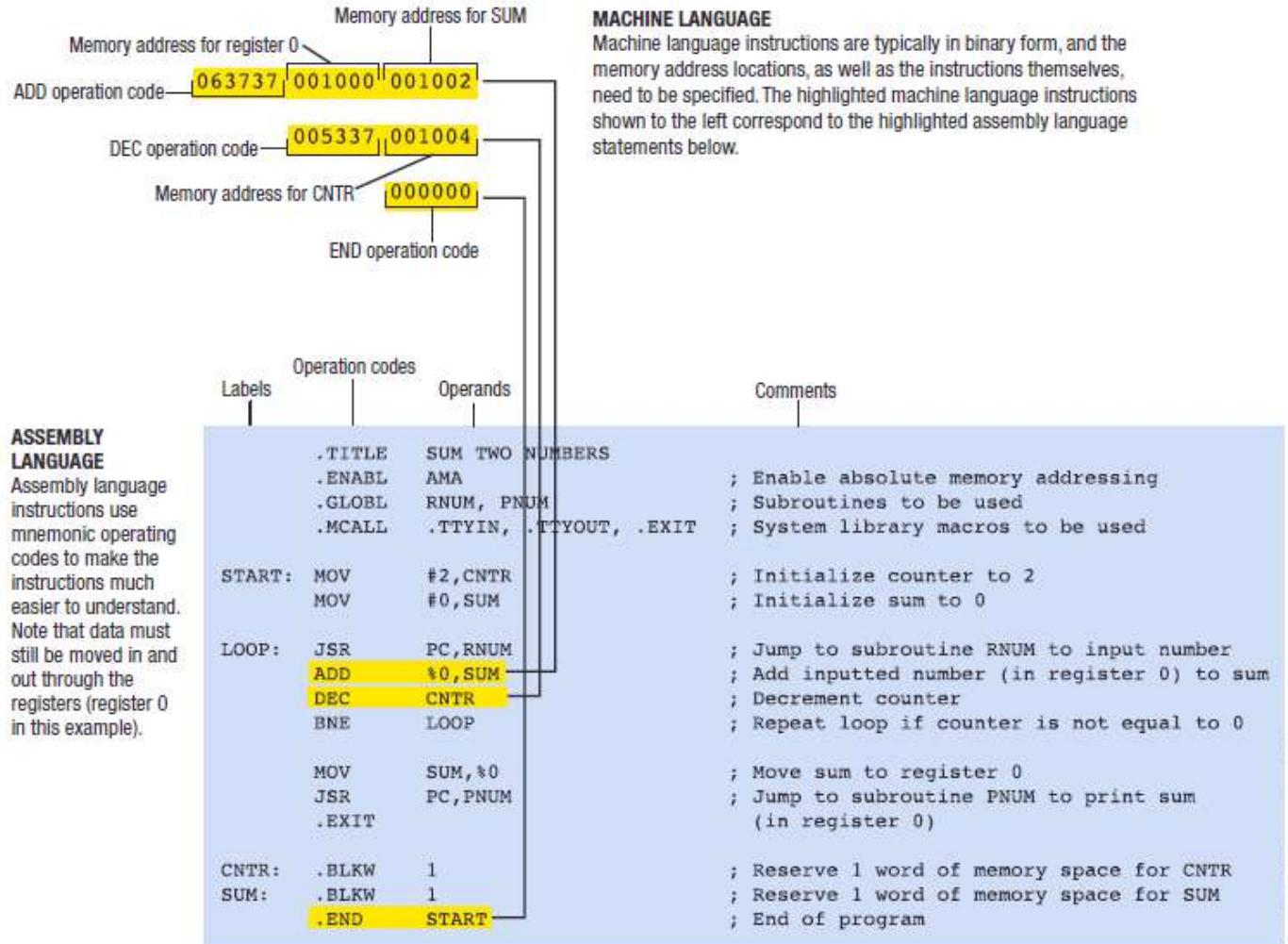


FIGURE 13-18
Assembly and machine language



Programming Languages

- High-Level Languages
 - Closer to natural languages
 - Machine independent
 - Includes 3GLs (FORTRAN, BASIC, COBOL, C, etc.) and object-oriented languages (Visual Basic, C#, Python, Java, etc.)
 - Visual programming environments (VPEs)
 - Use graphical interface to create programs
 - Some are designed for educational purposes
 - Scratch



Programming Languages

Scratch is developed by the Lifelong Kindergarten Group at the MIT Media Lab.
See <http://scratch.mit.edu>



FIGURE 13-19

The Scratch graphical programming language.



Programming Languages

- Fourth-Generation Languages (4GLs)
 - Even closer to natural languages and easier to work with than high-level languages
 - Declarative rather than procedural
 - Commonly used to access databases



Common Programming Languages

- FORTRAN
 - High-level programming language used for mathematical, scientific, and engineering applications
 - Still used today for high-performance computing tasks (weather forecasting)
 - Fortress
 - Version designed for high-performance computing
 - Takes advantage of multi-core processors and computers with multiple processors
 - Not being updated



Common Programming Languages

Comments are preceded by an asterisk or a C.

The screenshot shows a Windows Notepad window with a blue border. Inside, a FORTRAN program is written. The code includes comments starting with asterisks (*), variable declarations (REAL SUM, CNTR, NUM), initialization (SUM = 0), input (READ(*,*)), a loop control statement (DO 10 CNTR = 1, 2), and output (WRITE(*,*)). A circled '10' is next to the DO statement, and another circled '10' is next to the CONTINUE statement. The program ends with an END statement. A vertical copyright notice 'Copyright © 2015 Cengage Learning®' is visible along the left edge of the window.

```
REAL SUM, CNTR, NUM
*
* INITIALIZE VARIABLES
    SUM = 0
*
* INPUT NUMBER, ADD IT TO THE SUM, AND THEN
* REPEAT UNTIL TWO NUMBERS HAVE BEEN ENTERED
    DO 10 CNTR = 1, 2
        WRITE(*,*) 'Enter number'
        READ(*,*) NUM
        SUM = SUM + NUM
    CONTINUE
10
* PRINT THE SUM
    WRITE(*,*) 'SUM IS ', SUM
*
END
```

Program statements can be numbered in order to control loops and other types of branching.

FIGURE 13-20

The adding-two-numbers program written in FORTRAN.



Common Programming Languages

- COBOL
 - Designed for business transaction processing
 - Makes extensive use of modules
 - Strength lies in batch processing and its stability
 - Programs are lengthy and take a long time to write
 - Considered to be outdated by some
 - New versions are evolving
 - COBOL.NET



Common Programming Languages

Comments are preceded by an asterisk.

Most COBOL programs use a number of modules to break the program into manageable pieces. These submodules are called from the main control module using these statements.

Three submodules are used in this program.

```
ENVIRONMENT DIVISION.  
DATA DIVISION.  
WORKING-STORAGE SECTION.  
01 RESULT      PIC 9(3) VALUE ZERO.  
01 CNTR        PIC 9(1) VALUE ZERO.  
01 NUM         PIC 9(2) VALUE ZERO.  
  
*****  
PROCEDURE DIVISION.  
*****  
    PERFORM InitVariables  
    PERFORM GetNumber UNTIL CNTR = 2  
    PERFORM PrintSum  
    STOP RUN.  
  
*****  
InitVariables.  
*****  
    * This module initializes the RESULT and CNTR variables to 0.  
    MOVE 0 TO RESULT  
    MOVE 0 TO CNTR.  
    *End of InitVariables  
  
*****  
GetNumber.  
*****  
    * This module inputs a number, adds it to the result, and  
    * increments the counter.  
    DISPLAY "Enter Number: " WITH NO ADVANCING  
    ACCEPT NUM  
    COMPUTE RESULT = RESULT + NUM  
    COMPUTE CNTR = CNTR + 1.  
    *End of GetNumber module.  
  
*****  
PrintSum.  
*****  
    * This module prints the final RESULT.  
    DISPLAY "The sum of the numbers you entered is " RESULT.  
    *End of PrintSum module.
```

FIGURE 13-21

The adding-two-numbers program written in COBOL.



Common Programming Languages

- Pascal
 - Named after mathematician Blaise Pascal
 - Created as a teaching tool to encourage structured programming
 - Contains a variety of control structures used to manipulate modules systematically
- BASIC and Visual Basic
 - Easy-to-learn, high-level programming language that was developed to be used by beginning programmers
 - Visual Basic
 - Object-oriented version of BASIC; uses a visual environment



Common Programming Languages

Comments are enclosed in {} braces.

The symbol := is used instead of the equal sign.

Semicolons mark the end of command statements.

```
program sum_numbers;

var
    Num, Sum : real;
    Cntr : integer;

begin
    { Initialize variables }
    Sum := 0;

    { Input a number, add it to the sum, and repeat }
    { until two numbers have been entered           }
    for Cntr := 1 to 2 do
        begin
            write('Enter number: ');
            readln(Num);
            Sum:= Sum + Num;
        end;

    { Print the sum }
    writeln('The sum of the numbers you entered is ',Sum);
end.
```

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FIGURE 13-22

The adding-two-numbers program written in Pascal.



Common Programming Languages

Comments are preceded by a single quotation mark.

Programs typically include input statements that pause the program until the user supplies the appropriate data.

```
'Clear the screen
CLS
'

'Initialize variables
SUM = 0
CNTR = 0
'

'Input number and add it to sum until two numbers have been
'entered.
DO
    INPUT "Enter number: ", NUM
    SUM = SUM + NUM
    CNTR = CNTR + 1
LOOP UNTIL CNTR = 2
'

'When done looping, display Sum on screen
PRINT "The sum of the numbers you entered is "; SUM
END
```

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FIGURE 13-23

The adding-two-numbers program written in BASIC.



Common Programming Languages

- C, C++, and C#
 - C : Much closer to assembly language than other high-level languages
 - C++: Object-oriented version of C
 - Very popular for graphical applications
 - C# (C sharp): Hybrid of C and C++
 - Used to create Web applications, XML-based Web services, and Windows apps
 - Objective-C: For iPhone and other Apple applications



Programming Languages

Comments are preceded by two slashes //.

The instructions in a function or loop are enclosed in {} braces.

```
#include <iostream.h>

void main ()
{
    // Declare and initialize variables
    float fSum = 0;
    float fNum;
    int iCntr = 0;

    // Input a number, add it to the sum, and repeat
    // until two numbers have been entered
    do
    {
        cout << "Enter number: "; // Prompt for input
        cin >> fNum;
        fSum = fSum + fNum;
        iCntr = iCntr + 1;
    }
    while(iCntr < 2);

    // Print the sum
    cout << "The sum of the numbers you entered is " << fSum;
}
```

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FIGURE 13-24
The adding-two-numbers program written in C++.



Common Programming Languages

- Java
 - High-level, object-oriented programming language frequently used for Web-based applications
 - Java programs are compiled into bytecode
 - Can run on any computer that includes Java Virtual Machine (Java VM)
 - Can be used to write Java applets
- Dart
 - High-level, open source, object-oriented programming language developed by Google
 - Designed to replace JavaScript in Web applications



Common Programming Languages

The `java.io` package will handle the user input; * indicates all classes will be available.

Comments within the code are preceded by two slashes //.

The `out` attribute and `println` method in the `System` class of the `java.io` package are used to output the results.

```
import java.io.*;
public class AddTwo {
    public static void main(String[] args) throws IOException {
        BufferedReader stdin =
            new BufferedReader ( new InputStreamReader( System.in ) );
        String inData;
        int iSum = 0;
        int iNum = 0;
        int iCntr = 0;

        // Input a number, add it to the sum, and repeat
        // until two numbers have been entered
        do
        {
            System.out.println("Enter number: ");
            inData = stdin.readLine();           // get number in character form
            iNum = Integer.parseInt( inData );   // convert inData to integer
            iSum = iSum + iNum;
            iCntr = iCntr + 1;
        }
        while (iCntr < 2);

        // Print the sum
        System.out.println("The sum of the numbers you entered is " + iSum);
    }
}
```

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FIGURE 13-25

The adding-two-numbers program written in Java.



Common Programming Languages

Comments start with `/**`

Comments end with `*/.`

```
import 'dart:html';

/**Declare function to add 2 numbers and display sum*/
void addTwo(MouseEvent event) {
    num x = (query("#firstnum") as InputElement)
    .valueAsNumber;
    num y = (query("#secondnum") as InputElement)
    .valueAsNumber;
    num sum = x+y;
    query("#sum").text="The sum of your two numbers
    is: $sum";
}
/**Execute function when Get Sum button is clicked*/
void main() {
    query("#GetSum").onClick.listen(addTwo);
}
```

The screenshot shows a Dart code editor with the above code. Two annotations point to specific parts of the code: one points to the opening of a multi-line comment block with `/**`, and another points to the closing of the block with `*/.`. Below the editor is a screenshot of a web browser window titled "AddTwoNumbers". The address bar shows the URL `127.0.0.1:3030/C:/Users/Debbie/dart/addTv`. The page content includes an instruction "Enter 2 numbers and then press the Get Sum button to see the sum", two input fields containing "3.5" and "6", a "Get Sum" button, and a result message "The sum of the two numbers you entered is: 9.5".

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FIGURE 13-26
The adding-two-numbers program written in Dart.



Common Programming Languages

- Ruby
 - High-level, open source, object-oriented programming language that is often used to develop Web applications
- Python
 - Open-source, dynamic, object-oriented language that can be used to develop a variety of applications: e.g., gaming, scientific, and databases
 - Used by large organizations and some colleges, such as MIT



Common Programming Languages

A screenshot of a Windows-style code editor window. The code in the editor is:

```
# Initialize variable
total = 0.0

# Input a number, add it to the total, and repeat
# until two numbers have been entered
for iteration in range(2):
    text = raw_input("Enter number: ")
    total = total + float(text)

# Print the sum
print "The sum of the numbers you entered is", total
```

The code uses pound symbols (#) for comments and a for loop to add two numbers entered by the user. The print statement outputs the total sum.

Comments are preceded
by a pound symbol #.

The indented statements in this for
statement will be executed two times.

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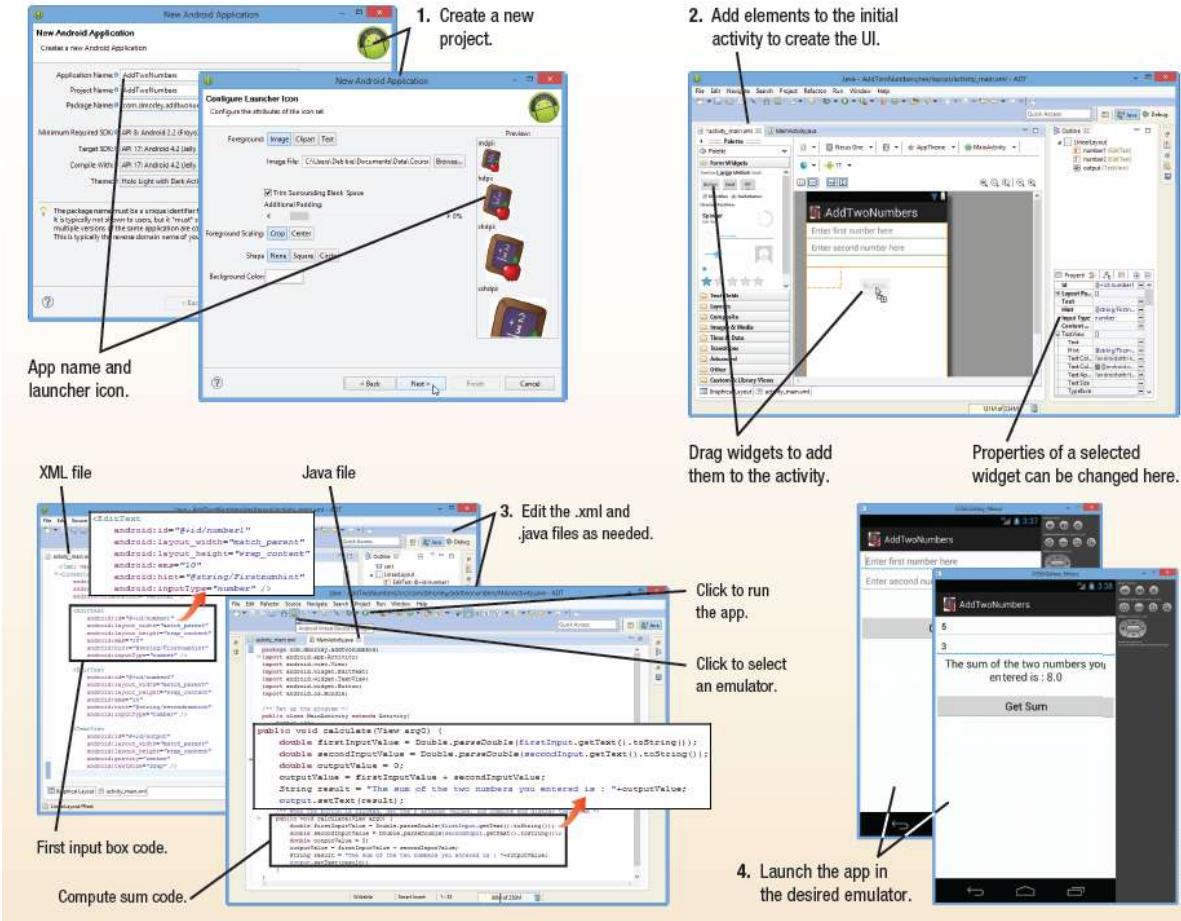
FIGURE 13-27

The adding-two-numbers program
written in Python.



How It Works Box

Creating Apps Using the Android SDK and Eclipse





Quick Quiz

1. An example of a high-level programming language is _____.
 - a. Pascal
 - b. Assembly language
 - c. Machine language
2. True or False: Visual Basic is an object-oriented version of COBOL.
3. Java applets are small programs written in the _____ programming language.

Answers:

- 1) a; 2) False; 3) Java



Summary

- Approaches to Program Design and Development
- The Program Development Life Cycle (PDLC)
- Tools for Facilitating Program Development
- Programming Languages

15th Edition

Understanding Computers

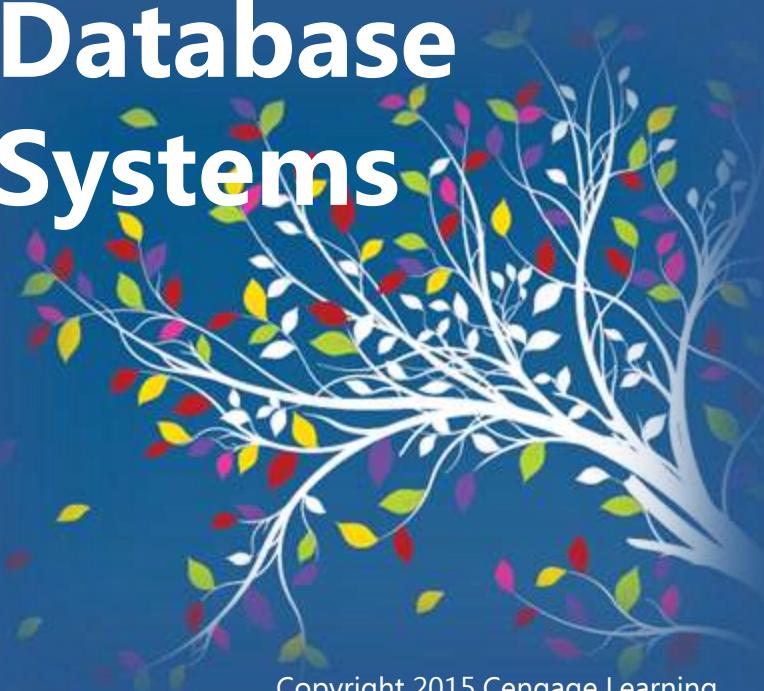
Today and Tomorrow
Comprehensive

Chapter 14:

Databases and Database Management Systems

**Deborah Morley
Charles S. Parker**

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Learning Objectives

- Explain what a database is, including common database terminology, and list some of the advantages and disadvantages of using databases.
- Discuss some basic concepts and characteristics of data, such as data hierarchy, entity relationships, and data definition.
- Describe the importance of data integrity, security, and privacy and how they affect database design.
- Identify some basic database classifications and discuss their differences.



Learning Objectives

4. List the most common database models and discuss how they are used today.
5. Understand how a relational database is designed, created, used, and maintained.
6. Describe some ways databases are used on the Web.



Overview

- This chapter covers:
 - What a database is, the individuals who use them, and how databases evolved
 - Important database concepts and vocabulary
 - Database classifications and models
 - The relational database
 - How databases are used on the Web



What Is a Database?

- Database
 - A collection of related data stored in a manner that enables information to be retrieved as needed
- Database Management System (DBMS)
 - Used to create, maintain, and access databases
 - Database engine
 - The part of the program that actually stores and retrieves data
 - Microsoft Access, OpenOffice Base, Corel Paradox, Oracle Database, etc.



What Is a Database?

- A database typically consists of:
 - Tables
 - Collection of related records
 - Fields (columns)
 - Single category of data to be stored in a database
(name, telephone number, etc.)
 - Records (rows)
 - Collection of related fields in a database (all the fields
for one customer, for example)



What Is a Database?

- A Simple Relational Database Example

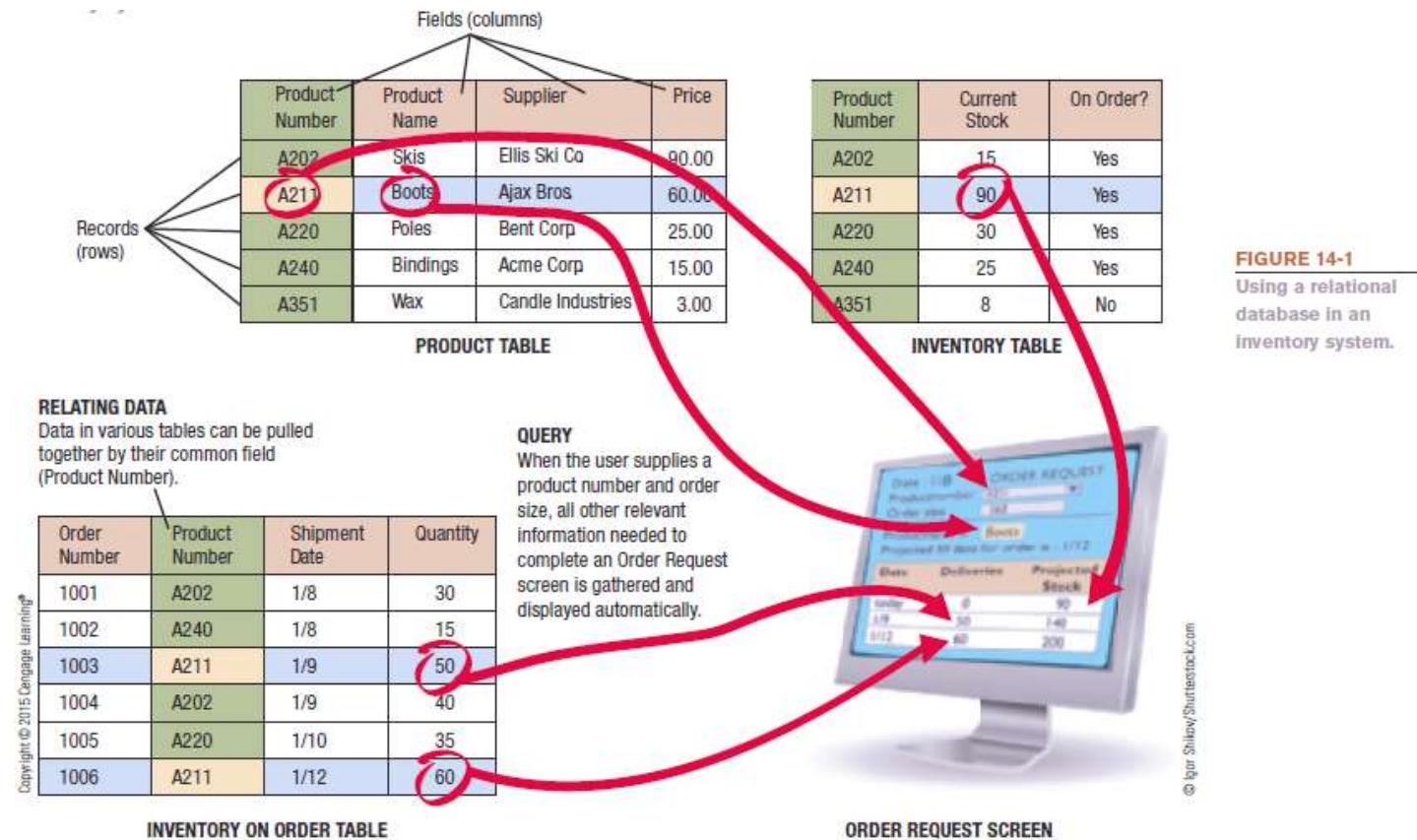


FIGURE 14-1
Using a relational database in an inventory system.



What is a Database?

- Primary Key
 - Field that uniquely identifies the records in a table
 - Field in a table that is used to relate that table to other tables

The yellow fields will always contain unique data and so are good to use as primary keys.

The blue fields will not always contain unique data and so are not good to use as primary keys.

Product Number	Product Name	Supplier	Price
Student ID Number	Student Name	Address	Phone
Customer Number	Address	Phone	Balance

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FIGURE 14-2

Primary key fields.
A primary key field must contain unique data so it can be used to identify each record in the table.



What Is a Database?

- Individuals Involved with a Database Management System
 - Database Designers
 - Design the database
 - Database Developers
 - Create the database
 - Database Programmers
 - Write the programs needed to access the database or tie the database to other programs



What Is a Database?

- Database Administrators
 - Responsible for managing the databases within an organization
- Users
 - Individuals who enter data, update data, and retrieve information from the database



What Is a Database?

- The Evolution of Databases

Model	Flat Files	Hierarchical	Network	Relational	Object-Oriented	Multidimensional
Year Begun	1940s	1960s	1960s	1970s	1980s	1990s
Data Organization	Flat files	Trees	Trees	Tables and relations	Objects	Data cubes, tables and relations, or a combination
Data Access	Low-level access	Low-level access with a standard navigational language	Low-level access with a standard navigational language	High-level, nonprocedural languages	High-level, nonprocedural, object-oriented languages	OLAP tools or programming languages
Skill Level Required to Access Data	Programmer	Programmer	Programmer	User	User	User
Entity Relationships Supported	One-to-one	One-to-one, one-to-many	One-to-one, one-to-many, many-to-many	One-to-one, one-to-many, many-to-many	One-to-one, one-to-many, many-to-many	One-to-one, one-to-many, many-to-many
Data and Program Independence	No	No	No	Yes	Yes	Yes

FIGURE 14-3
The evolution of databases. Databases have evolved over the years, becoming more flexible, more capable, and easier to use.

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What Is a Database?

- Advantages and Disadvantages of the DBMS Approach
 - Advantages
 - Low level of redundancy
 - Faster response time
 - Lower storage requirements
 - Easier to secure
 - Increased data accuracy
 - Disadvantages
 - Increased vulnerability (backup is essential)



Inside the Industry Box

File Management Systems

- Tables are not related so more time-consuming and more redundancy

PRODUCT NUMBER	PRODUCT NAME	SUPPLIER	PRICE
A202	Skis	Ellis Ski Co.	90.00
A211	Boots	Ajax Bros.	60.00
A220	Poles	Bent Corp.	25.00
A240	Bindings	Acme Corp.	15.00
A351	Wax	Candle Industries	3.00

PRODUCT TABLE

PRODUCT NUMBER	PRODUCT NAME	SUPPLIER	PRICE	CURRENT STOCK	ON ORDER?
A202	Skis	Ellis Ski Co.	90.00	15	Yes
A211	Boots	Ajax Bros.	60.00	90	Yes
A220	Poles	Bent Corp.	25.00	30	Yes
A240	Bindings	Acme Corp.	15.00	25	Yes
A351	Wax	Candle Industries	3.00	8	No

INVENTORY TABLE

ORDER NUMBER	PRODUCT NUMBER	SHIPMENT DATE	PRODUCT NAME	SUPPLIER	PRICE	QUANTITY
1001	A202	1/8	Skis	Ellis Ski Co.	90.00	30
1002	A240	1/8	Bindings	Acme Corp.	15.00	15
1003	A211	1/9	Boots	Ajax Bros.	60.00	50
1004	A202	1/9	Skis	Ellis Ski Co.	90.00	40
1005	A220	1/10	Poles	Bent Corp.	25.00	35
1006	A211	1/12	Boots	Ajax Bros.	60.00	60

INVENTORY ON ORDER TABLE

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REDUNDANT FIELDS

Instead of just having one field duplicated like in the databases created using a DBMS (green shaded columns), flat files created using file management systems require many more fields to be duplicated (green and blue shaded columns). Notice that the blue shaded columns shown here appear only in the Product table in Figure 14-1; when using a DBMS, these fields are not included in the Inventory and Inventory on Order tables.

Because file management systems cannot retrieve data from more than one table at a time, there is a much higher level of redundancy.



Data Concepts and Characteristics

- Data Hierarchy
 - Fields/columns
 - Hold single pieces of data
 - Records/rows
 - Groups of related fields
 - Tables
 - Collection of related records
 - Database
 - Contains a group of related tables



Data Concepts and Characteristics

- Entities and Entity Relationships
 - Entity
 - A person, object, or event of importance to the organization
 - Entities that the organization wants to store data about typically becomes a database table
 - Attributes
 - Characteristics of an entity
 - Typically become fields in the entity's database table
 - Relationship
 - An association between two or more entities



Data Concepts and Characteristics

- One to One (1:1) Entity Relationships
 - One entity is related to only one other entity of a particular type
 - Not a common type of relationship
- One to Many (O:M) Entity Relationship
 - Most common type of relationship
 - One entity can be related to more than one other entity
 - A supplier can supply more than one product to a company
- Many to Many (M:M) Entity Relationships
 - One entity can be related to more than one other entity, and those entities can be related to multiple entities of the same type as the original entity



Data Concepts and Characteristics

- Data Definition
 - The process of describing the properties of data to be included in a database table
 - During data definition, each field is assigned:
 - Name (must be unique within the table)
 - Data type (such as Text, Number, Currency, Date/Time)
 - Description (optional description of the field)
 - Properties (field size, format of the field, allowable range, if field is required, etc.)
 - Finished specifications for a table become the table structure



Data Concepts and Characteristics

The screenshot shows two windows of Microsoft Access. The left window, titled 'Inventory', is in 'DESIGN' mode, displaying the 'ProductNumber' field properties. The right window, also titled 'Inventory', is in 'DATA' mode, showing a table with six records.

TABLE STRUCTURE
The table structure specifies the fields and their characteristics.

Properties of current field (Product Number).

Indicates this field is the primary key.

Fields and data types.

Field size for Product Number.

Indicates the pattern Product Number data must follow (one letter followed by three numbers).

A validation rule can be entered here.

Product Number field is required and cannot be left blank.

ProductNumber	CurrentStock	OnOrder?	Comments
A201	10	5	
A202	30	10	
A203	20	0	
A204	15	2	
A205	0	0	
A206	8	0	

FIGURE 14-4

Data definition. Each field in a database has a defined data type and properties that can be assigned to that field.

Used with permission from Microsoft Corporation



Data Concepts and Characteristics

- The Data Dictionary
 - Contains all data definitions in a database, including:
 - Table structures
 - Security information (passwords, etc.)
 - Relationships between the tables in the database
 - Basic information about each table, such as the current number of records
 - Does not contain any of the data in the tables
 - Does contain metadata, which is information about the database tables
 - Ensures that data being entered into the database does not violate any specified criteria



Data Integrity, Security, and Privacy

- Data Integrity
 - Accuracy of Data
 - Quality of data entered determines the quality of generated information
 - Data Validation
 - Process of ensuring that data entered into the database is valid
 - Record validation rules
 - Checks all fields before changes to a record are saved
 - Can be enforced on a per transaction basis so the entire transaction will fail if one part is invalid



Data Integrity, Security, and Privacy

- Database Locking
 - Prevents two individuals from changing the same data at the same time

WRONG DATA TYPE
Only data matching a field's assigned data type may be entered into that field.

Used with permission from Microsoft Corporation

The screenshot shows a Microsoft Access database window with a table named 'Inventory'. A row for product A500 has a value 'A500' entered into the 'CurrentStock' field, which is defined as a Number data type. A validation error message box is displayed, stating: 'One or more values are prohibited by the validation rule >=0 set for Inventory.CurrentStock. Enter a value that the expression for this field can accept.' Below the table, a message box says: 'The value you entered does not match the Number data type in this column. Enter new value.' A red horizontal bar across the bottom of the table area displays the text 'NASH LOCK'.

FIGURE 14-5
Data validation.
Good data validation rules can prevent invalid data from being entered into a database table.

VALIDATION RULE VIOLATION
Only data conforming to a field's assigned validation rule may be entered into that field.



Data Integrity, Security, and Privacy

- Data Security
 - Protects data against destruction and misuse
 - Protects against unauthorized access to and unauthorized use of a database
 - Database activity monitoring programs can be used to detect possible intrusions and risks
 - Prevents data loss
 - Should include strict backup and disaster-recovery procedures (disaster-recovery plan)
 - Should be used with both in-house and cloud databases



Data Integrity, Security, and Privacy

The screenshot shows the DbProtect™ software interface. At the top, there's a navigation bar with tabs: REPORT, MANAGE, and SET UP. Under REPORT, the sub-tabs are Dashboard, Library, History, Assets, Monitoring, Jobs, Users & Orgs, and System Settings. The Assets tab is selected, showing sub-options: Security Position, Rights Review, Activity Monitoring, and Asset Inventory. The main content area displays two reports:

Most Hackable Assets
as of Sep 25, 2013 3:44:42 PM EDT

Asset	Misconfigured	Unpatched
MSSQLSERVER@172.16.32.209	●	●
MSSQLSERVER@172.16.32.208	●	●
172.16.32.228:3306	●	●
AT5YBTRGT@172.16.32.213	●	●
demo@172.16.32.212	●	●
erik9R2@192.168.2.49	●	●
dir9R1@dir.nycapt35k.com	●	●
172.18.0.169[SQL2K8R2]	●	●

Highly Privileged Users with Weak Passwords
as of Sep 25, 2013 3:48:57 PM EDT

Asset	Users	Admin Likeness Scores	
		Avg.	Peak
MSSQLSERVER@172.16.32.209	2	95.52%	95.95%
erik9R2@192.168.2.49	6	61.62%	68.14%

In the bottom right corner, there's a pop-up message: "DbProtect now scans Hadoop!" with a "x" button. It includes the Hadoop logo and links: "Click here to learn about Hadoop security checks." and "Don't show again."

FIGURE 14-6

Database security tools. This program secures databases and displays alerts for vulnerabilities and attacks.



Data Integrity, Security, and Privacy

- Data Privacy
 - Growing concern because of the vast amounts of personal data stored in databases today
 - Many states require businesses to notify customers when their personal data has been compromised
 - Data breaches can be costly
 - One estimate is \$200 per breached record



Data Organization

- Data Organization
 - Arranging data for efficient retrieval
 - Indexed organization
 - Uses an index to keep track of where data is stored in a database
- Direct Organization
 - Uses hashing algorithms to specify the exact storage location
 - Algorithms should be designed to limit collisions
 - Some systems use a combination of both indexed and direct organization



Data Organization

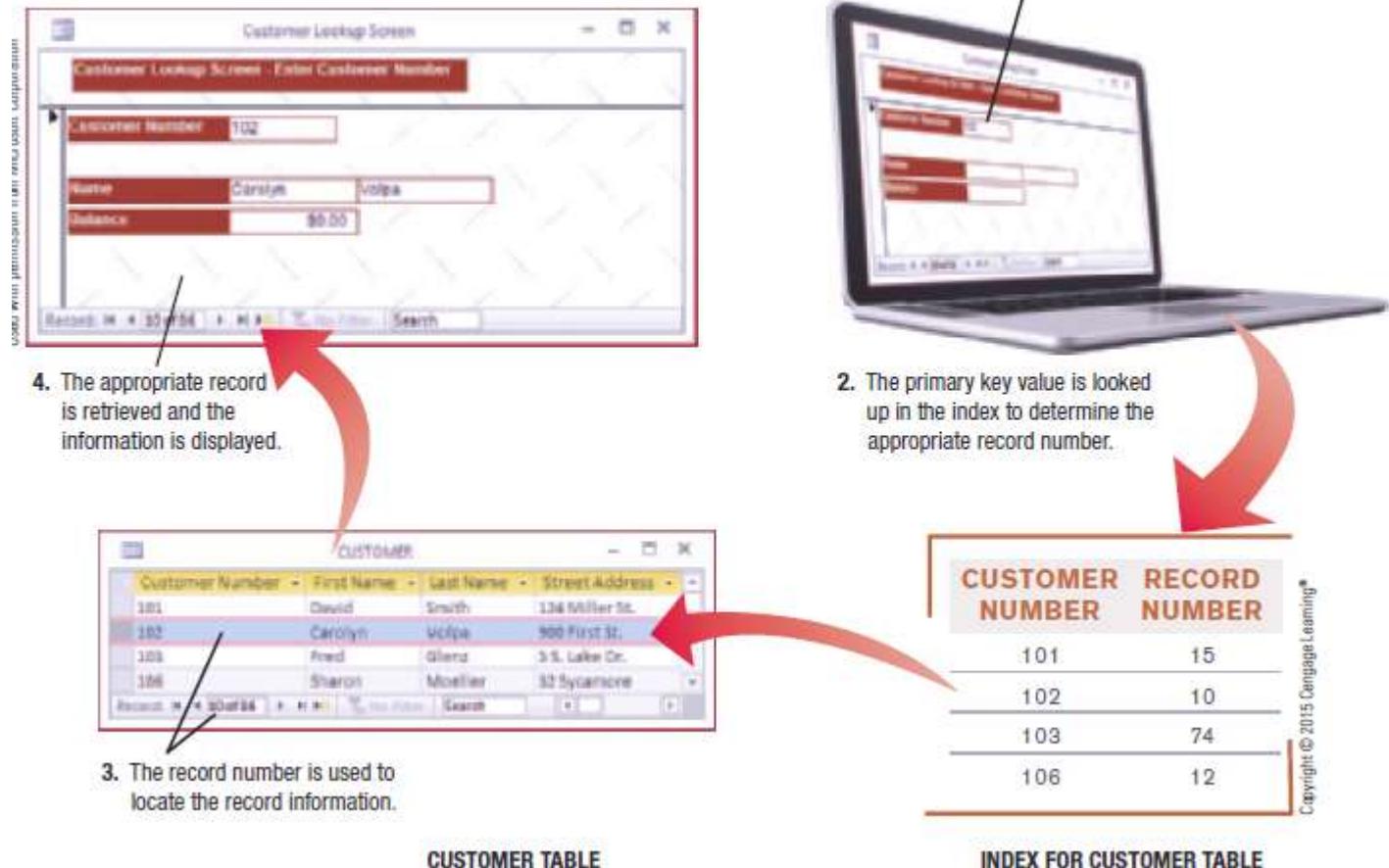


FIGURE 14-7
Indexed organization is often used for real-time transaction processing.



Data Organization

HASHING PROCEDURE

Prime number

$$\begin{array}{r} 23 \\ \times 4 \\ \hline 92 \\ \text{Remainder: } 10 \end{array}$$

1. The primary key value (in this case the Customer Number) is divided by a prime number.
2. The remainder indicates the location to be used for that record (in this case, 10).

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FIGURE 14-8
Direct organization
is frequently used
for faster real-time
processing.

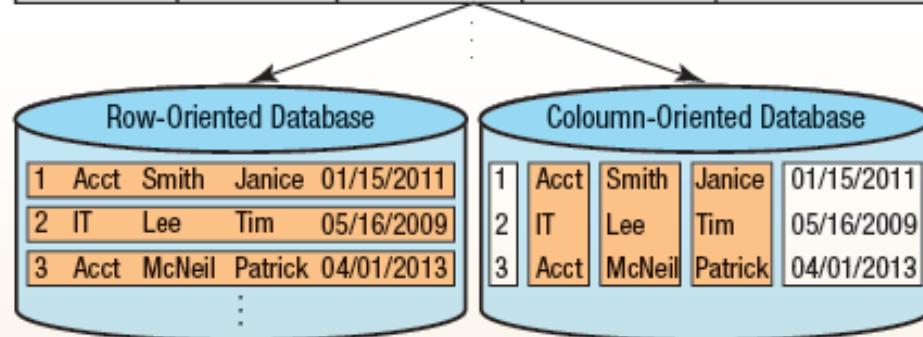


How It Works Box

Column Databases

- Stores data by columns instead of rows
- Improves performance by minimizing the time needed to read the disk
- Used with data warehouses and other big data applications

Emp_no	Dept	Emp_last	Emp_first	Hire_date
1	Acct	Smith	Janice	01/15/2011
2	IT	Lee	Tim	05/16/2009
3	Acct	McNeil	Patrick	04/01/2013
4	Sales	Wilson	Sammy	08/11/2012
5	IT	Morales	Jack	11/16/2013



Database needs to read all columns (because data is read by rows) to access the requested data.

Database needs to read only three columns to access the requested data.

Example of retrieving the names of all IT employees using a row vs. a column database.



Quick Quiz

1. A column in a database in which customer names are stored would be referred to as a _____.
 - a. field
 - b. record
 - c. table
2. True or False: Data validation procedures are used to ensure that data entered into a database matches the specified type, format, and allowable value.
3. The _____ contains metadata about the database tables in a database.

Answers:

1) a; 2) True; 3) data dictionary



Database Classifications

- Single-User vs. Multiuser Database Systems
 - Single-User Database System
 - Located on a single computer
 - Designed to be accessed by one user
 - Widely used for personal applications and very small businesses
 - Multiuser Database System
 - Designed to be accessed by multiple users (most business databases today)



Database Classifications

- Client-Server and N-Tier Database Systems
 - Client-Server Database Systems
 - Has both clients (front end) and at least one database server (back end)

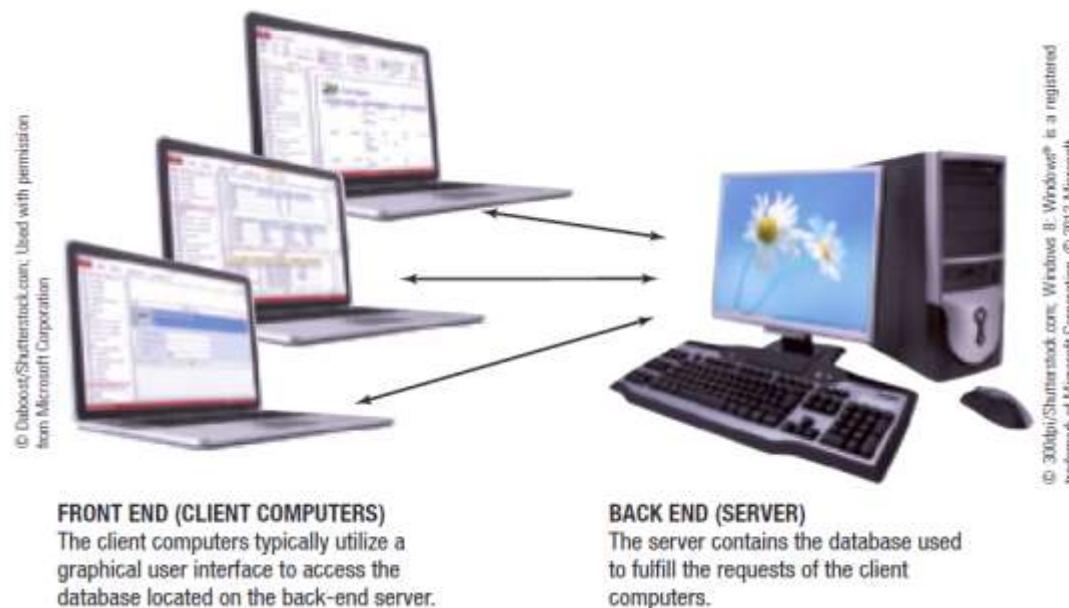
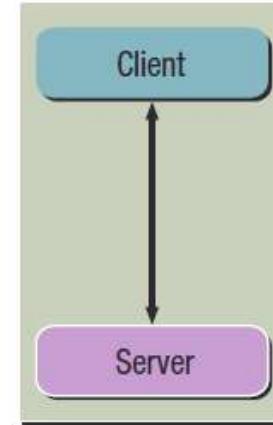


FIGURE 14-9
Client-server
database systems.

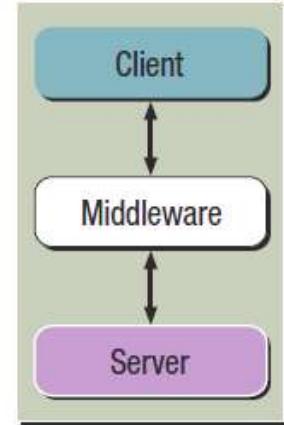


Database Classifications

- N-Tier Database System
 - Has more than two tiers
 - Additional tiers typically contain software referred to as middleware
 - Allows program code to be separate from the database
 - Code can be divided into any number of logical components



2-TIER MODEL
Has just a client and a server.



N-TIER MODEL
Includes middleware, which contains additional programs used to connect the client and server.

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FIGURE 14-10
A 2-tier vs. an n-tier database model.



Database Classifications

- Centralized vs. Distributed Database Systems
 - Centralized Database System
 - Database is located on a single computer, such as a server or mainframe
 - Distributed Database System
 - Data is physically divided among several computers connected by a network, but the database logically looks like it is a single database



Database Classifications

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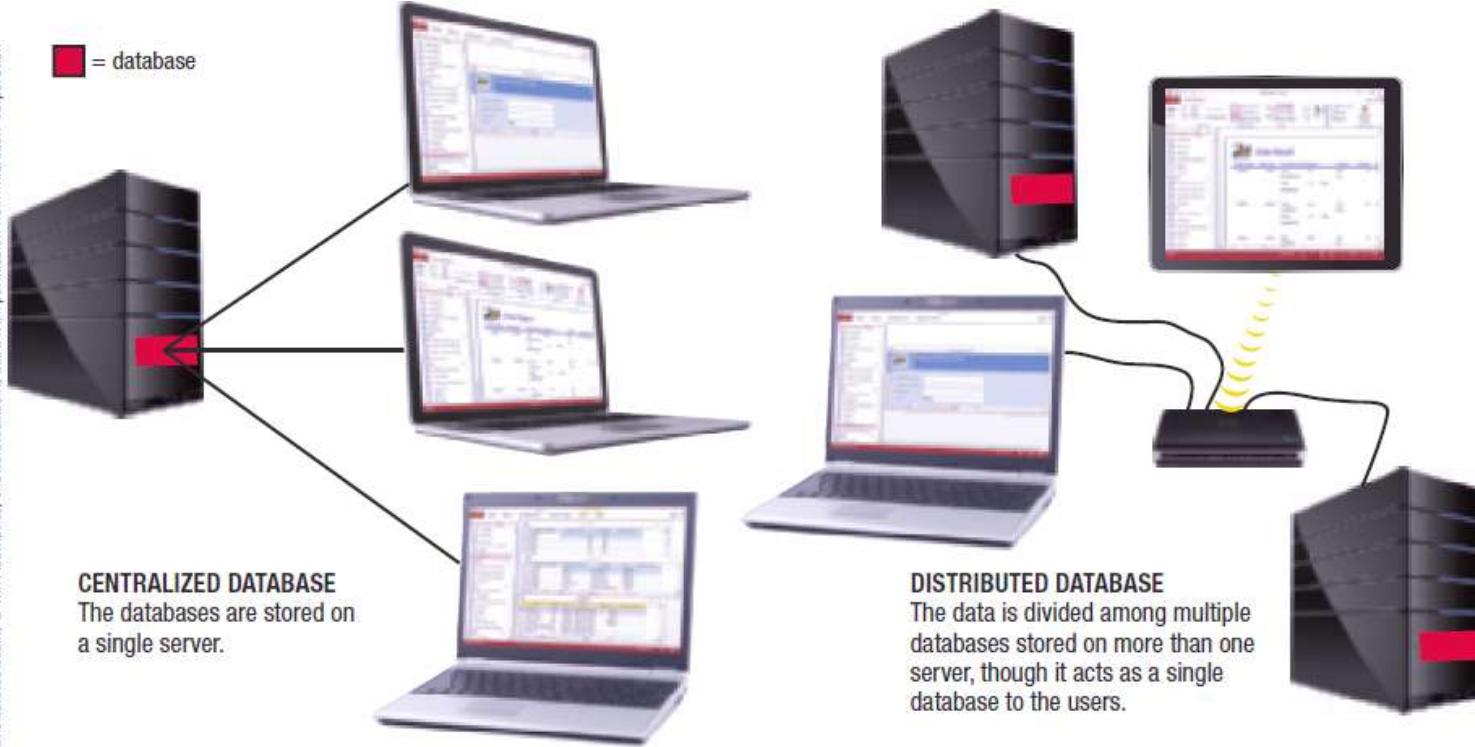


FIGURE 14-11
Centralized vs.
distributed
databases.



Database Classifications

- Disk-Based vs. In-Memory Database Systems
 - Disk-Based Systems
 - Data is stored on hard drives
 - In-Memory Databases (IMDBs)
 - Data is stored in main memory
 - Dramatically faster than disk-based databases
 - Good backup procedures are essential
 - Used both in high-end systems where performance is crucial and in small-footprint, embedded applications



Quick Quiz

1. Which type of database system is beginning to be used in high-end systems where performance is crucial?
 - a. In-memory databases
 - b. Disk-based databases
 - c. Single-user databases
2. True or False: With the n-tier database model, there is at least one middle piece of software between the client and the server.
3. With a(n) _____ database system, the databases used by the system are all located on a single computer.

Answers:

1) a; 2) True; 3) centralized



Database Models

- The Hierarchical and Network Database Models
 - Hierarchical Databases
 - Organizes data in a tree structure
 - Typically a one-to-many relationship between data entities
 - Network Databases
 - Allow both one-to-many and many-to-many relationships between data elements
 - Most databases today are neither hierarchical or network models



The Relational Database Model (RDBMS)

- The Relational Database Model (RDBMS)
 - Data is organized in tables related by common fields
 - Most widely used database model today
 - Designing a Relational Database
 - Identify the purpose of the database
 - Determine the tables and fields
 - Assign the fields to a table and reorganize as needed to minimize redundancy (normalization – most databases stop at 3NF)
 - Finalize the structure (primary keys, field properties, etc.)



The Relational Database Model (RDBMS)

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PRODUCT TABLE

Product Number	Product Name	Supplier	Price
----------------	--------------	----------	-------

CUSTOMER TABLE

Customer Number	First Name	Last Name	Street Address	City	State	ZIP	Phone	Balance
-----------------	------------	-----------	----------------	------	-------	-----	-------	---------

ORDER TABLE

Order Number	Customer Number	Order Date	Ship Date	Product Number	Quantity
--------------	-----------------	------------	-----------	----------------	----------

Each table contains
a key field.

The key fields are repeated in other tables
as needed to tie the tables together.

FIGURE 14-14

A preliminary design
for three tables
in the Inventory
database.



The Relational Database Model (RDBMS)

- Creating a Relational Database
 - Creating the Tables
 - Each table is created using the table structure developed during the database design process
 - In Access, can use Design view or Datasheet view
 - Entering and Editing Data
 - Existing data can be migrated to the new database
 - New data can be added via a form or Datasheet view
 - In either case, the same data is being manipulated



Database Models

Use the View button to select the desired view.

You specify the name of the database file when the database file is created.

The screenshot shows the Microsoft Access ribbon with the 'DESIGN' tab selected. In the left pane, 'Design View' is highlighted. The main area displays the 'Inventory' table structure with fields: ProductNumber (Short Text), CurrentStock (Number), and OnOrder? (Yes/No). Below the table, the 'General' properties pane is open for the 'ProductNumber' field. A callout points to the 'View' button in the ribbon with the text 'Use the View button to select the desired view.' Another callout points to the status bar with the text 'You specify the name of the table when the table is saved.' In the bottom right, a second screenshot shows the 'Datasheet View' ribbon with the 'TABLE' tab selected. The 'Inventory' table is shown as a grid with columns ID, Field1, Field2, and Field3. An entry for ID 2, Field1 202, Field2 15, and Field3 Yes is selected. A callout points to this entry with the text 'Entering data creates appropriate fields that you can rename; an ID field primary key is created by default.' The status bar at the bottom of this screenshot also contains the text 'Used with permission from Microsoft Corporation.'

FIGURE 14-15

Tables can be created using Design view or Datasheet view.



Database Models

FIGURE 14-16

Forms. Forms can be used to view and edit table data.

1. Select the Product table, then click the Form button to create a form for the Product table.
2. A form containing all fields in the Product table is created and displayed in Form view.
3. Design view can be used to edit and format the form, including rearranging the fields, adding headings and logos, and so forth.
4. The finished form can be used to view and edit the data in the Product table.

Current record; can be edited or deleted.

Click to add a new record.

Used with permission from Microsoft Corporation



The Relational Database Model (RDBMS)

– Relating Tables

- Once all tables have been created, they can be related to one another using their primary keys

Used with permission from Microsoft Corporation.

- Click to open Relationships.
- Drag a primary key field to a related table and then click the Create button to create the relationship between those two tables.
- Once the tables are related, data from one table (Order table, in this example) can be displayed within a related table (Customer table, in this example).

The screenshot shows the Microsoft Access ribbon with the "RELATIONSHIPS" tab selected. The "Relationships" dialog box is open, showing a relationship between the "CUSTOMER" and "ORDER" tables. A red arrow points from the "CustomerNumber" field in the "CUSTOMER" table to the "CustomerNumber" field in the "ORDER" table. The "Create" button is highlighted. Below the dialog box, the "Customer" and "Order" datasheets are shown. The "Customer" datasheet displays customer information like First Name, Last Name, and Street Address. The "Order" datasheet displays order details like Order Number, Order Date, and Product Number. A red arrow points from the "Customer" table in the relationship diagram to the "Customer" table in the "Customer" datasheet, indicating that related data is being displayed.

FIGURE 14-17
Relating tables.



The Relational Database Model (RDBMS)

- Retrieving Information from a Relational Database
 - Query
 - A request to see information from a database that matches specific criteria
 - Every DBMS provides tools users can use to query the database for information
 - Can also write in structured query language (SQL)
 - Must be designed to extract information as efficiently as possible
 - Poorly written queries can impact the overall performance of the system



The Relational Database Model (RDBMS)

Queries are saved; click a saved query to see the results.

Click to open the query design screen.

The screenshot shows the Microsoft Access ribbon with the 'HOME' tab selected. In the 'CREATE' section, the 'Query Design' icon is highlighted. The 'All Access Objects' pane on the left lists tables like CUSTOMER, INVENTORY, and PRODUCT, and queries like 'Products Less than \$20'. The main area displays the 'Products Less than \$20' query design screen. It shows a query named 'Products Less than \$20' with a single table 'PRODUCT' selected. The query results grid shows fields: Product Name, Product Number, and Price. A sorting option 'Sort Ascending' is applied to the Product Name field. The status bar at the bottom indicates '1 row(s) found'.

The three specified fields will be displayed.

The records in the query results will be sorted in alphabetical order by Product Name.

The query result will display only the records for which the price is less than \$20.

1. ORIGINAL TABLE

The original table contains data for all records.

PRODUCT NUMBER	PRODUCT NAME	SUPPLIER	PRICE
A202	Skis	Bills Ski Co.	\$60.00
A211	Boots	Ajax Bros.	\$65.00
A220	Poles	Bent Corp.	\$25.00
A230	Bindings	Acme Corp.	\$13.00
A301	Wax	Candle Industries	\$8.00

2. CREATING THE QUERY

Queries can be created using the query design screen or by typing SQL code.

The query design screen is used to specify the fields and records that should be displayed in the query results.

The underlying SQL code for a query can be viewed and edited using the View button on the HOME tab.

Products Less than \$20

```
SELECT PRODUCT.[Product Name], PRODUCT.[Product Number], PRODUCT.Price  
FROM PRODUCT  
WHERE (PRODUCT.Price) < 20  
ORDER BY PRODUCT.[Product Name];
```

Product Name	Product Number	Price
Bindings	A240	\$15.00
Wax	A351	\$3.00

Used with permission from Microsoft Corporation

FIGURE 14-18

Querying a database. This example pulls information from the Product table in the Inventory database.



The Relational Database Model (RDBMS)

- Reports
 - Formatted way of looking at a database table or the results of a query
 - Can pull data from more than one table
 - Many programs have wizards or other tools to make it easy to create a report
 - Can be modified and customized using the Design view
 - Reports in Microsoft Access are saved as objects in the database file



The Relational Database Model (RDBMS)

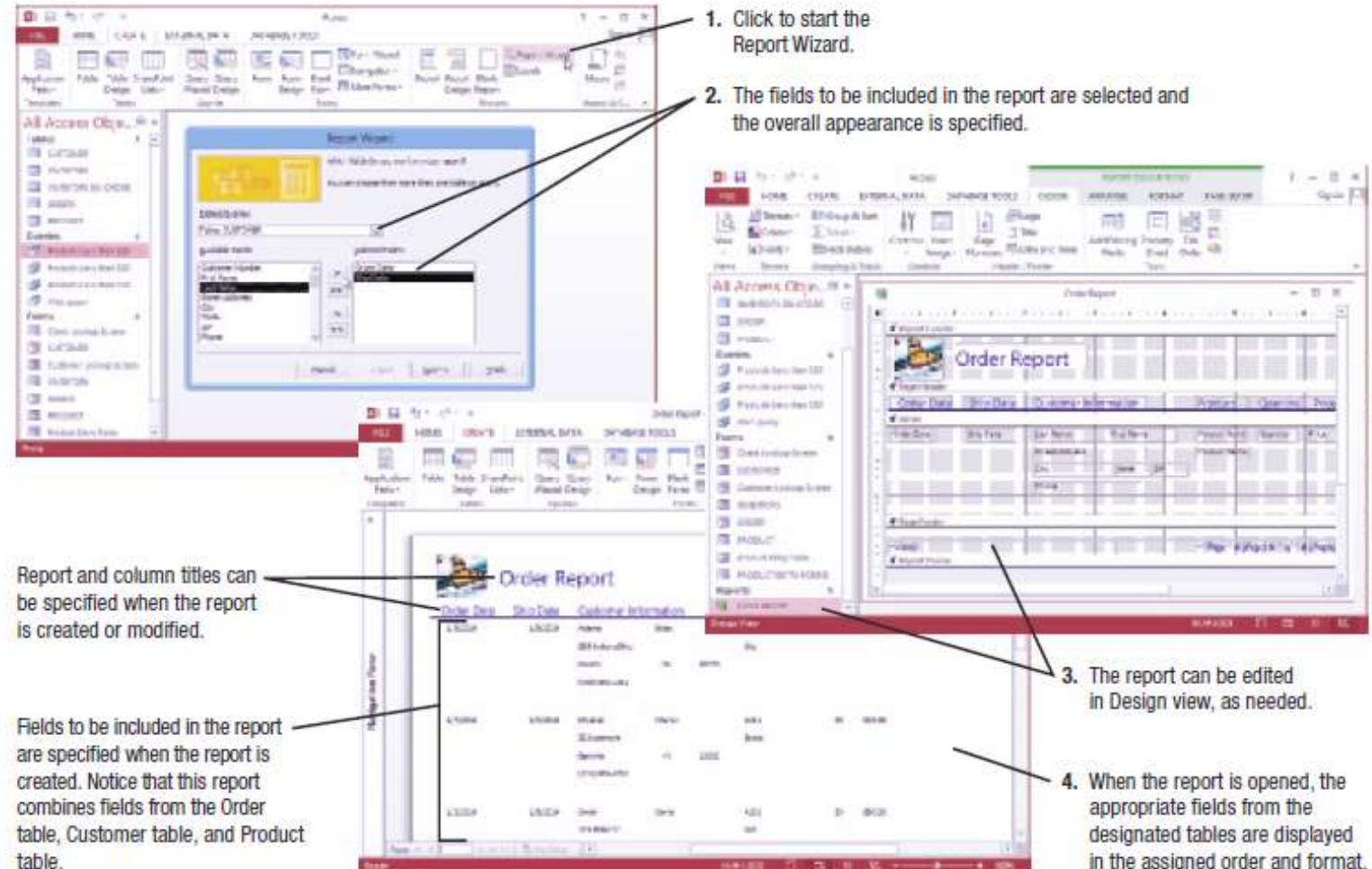


FIGURE 14-19

Reports. Display table information with a more formal, businesslike appearance.

Used with permission from Microsoft Corporation



The Relational Database Model (RDBMS)

- Maintaining a Relational Database
 - Table structures can be modified when needed
 - Other possible modifications:
 - Adding new indexes to speed up queries
 - Deleting obsolete data
 - Upgrading database software, installing patches
 - Repairing/restoring data that has become corrupt
 - Continuing to evaluate and improve security



The Object-Oriented Database Model

- The Object-Oriented Database Model
 - Object-Oriented Database Management System (OODBMS)
 - Database system in which multiple types of data are stored as objects along with their related code
 - Can contain virtually any type of data (video clip, text with music, etc.) along with the methods to be used with that data
 - Objects can be retrieved using queries (object query language or OQL)
 - Objects can be reused in other applications to create new applications quickly



Trend Box

Law Enforcement Databases

- Have been used for years but new database are now emerging that hold non-traditional data like photos and biometric data
 - Next Generation Identification (NGI)
 - Includes AFIT to store and match fingerprints
 - Includes support for photos and face-matching
 - Future improvements include support for voice, iris, DNA, palm prints, etc.



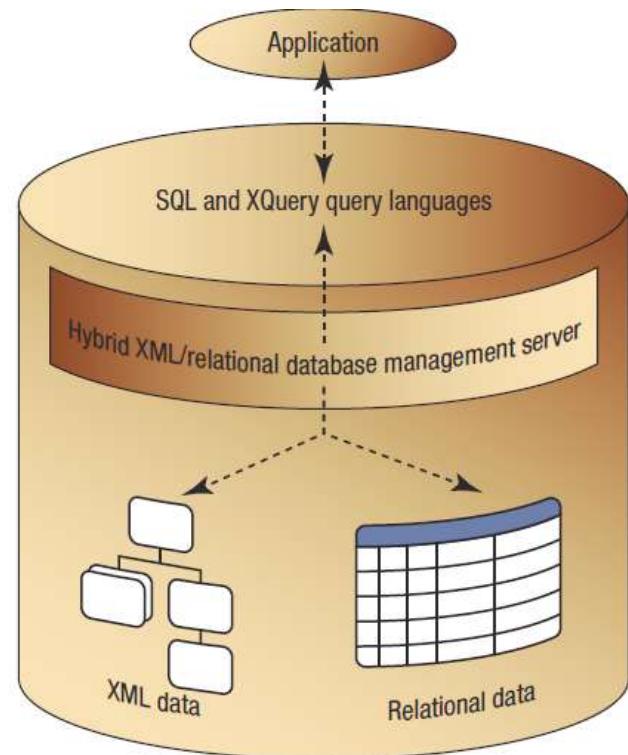
Courtesy FBI



Hybrid Database Models

- Hybrid Database Models
 - A combination of two or more database types or models
 - Hybrid XML/Relational Database
 - Can store and retrieve both XML data and relational data

FIGURE 14-21
Hybrid XML/
relational databases.



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Multidimensional Databases (MDDB)

- Multidimensional Databases (MDDB)
 - Designed to be used with data warehousing
 - Often used in conjunction with Online Analytical Processing (OLAP)
 - MOLAP (Multidimensional OLAP)
 - Data is stored in single structures called data cubes
 - ROLAP (Relational OLAP)
 - Data is stored in an existing relational database using tables to store the summary information
 - HOLAP (Hybrid OLAP)
 - Combination of MOLAP and ROLAP technologies



Cloud Databases

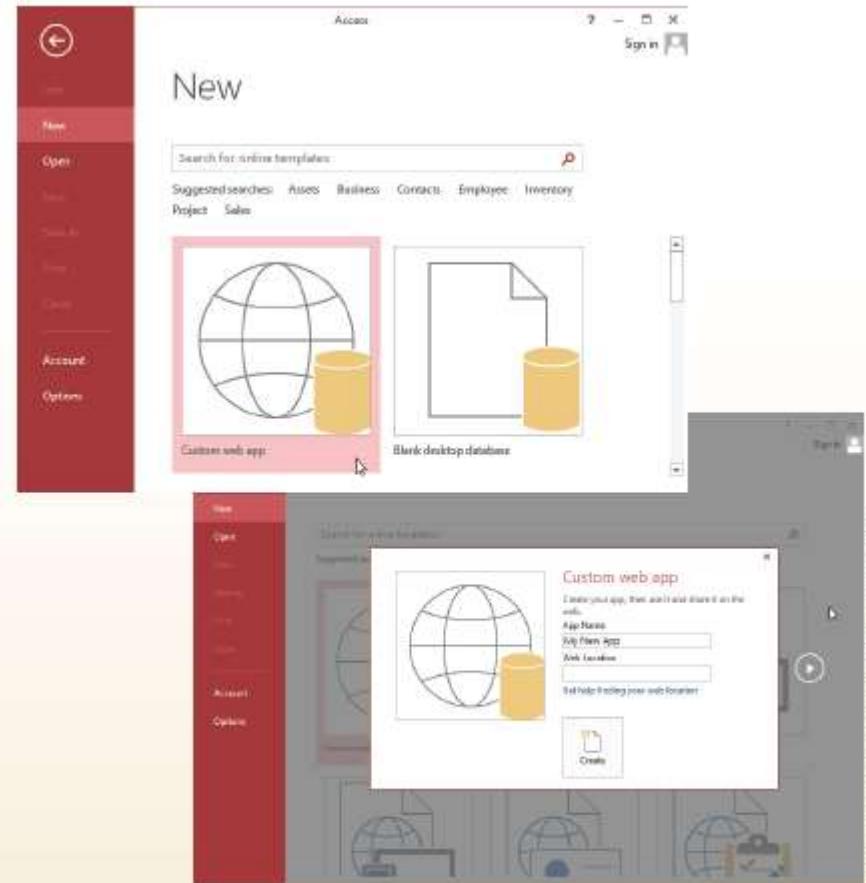
- Typically hosted on a cloud database provider's servers that is accessible to users via the Web
- Examples of Cloud Databases in Use
 - Information retrieval
 - Data to be accessed and displayed on a Web page is often stored in a database, i.e., Search sites
 - Support and facilitate e-commerce
 - Display product information, pricing, customer information, shopping cart content, etc.
 - Cloud databases allow Web pages to be dynamic Web pages



Technology and You Box

Cloud Databases

- Use growing rapidly
- Typically built using a cloud provider (Windows Azure, Amazon SimpleDB, or Google Cloud SQL)
- Requires less in-house hardware and maintenance
- Individuals can create via Microsoft Access web apps



With Microsoft Access, you can create custom cloud databases.



Cloud Databases

- How Cloud Databases Work
 - Visitor makes request by
 - Filling out a Web page form
 - Selecting an option from a menu displayed on a Web page form
 - Web server converts the request into a database query, passes it onto the database server, and then sends the results back to the visitor



Cloud Databases

- Middleware
 - Software used to connect two otherwise separate applications, such as a Web server and a database management system
 - Commonly written as scripts
 - Common languages include
 - JavaScript
 - VBScript
 - CGI Scripts
 - Active Server Pages (ASPs)
 - PHP Scripts



Cloud Databases

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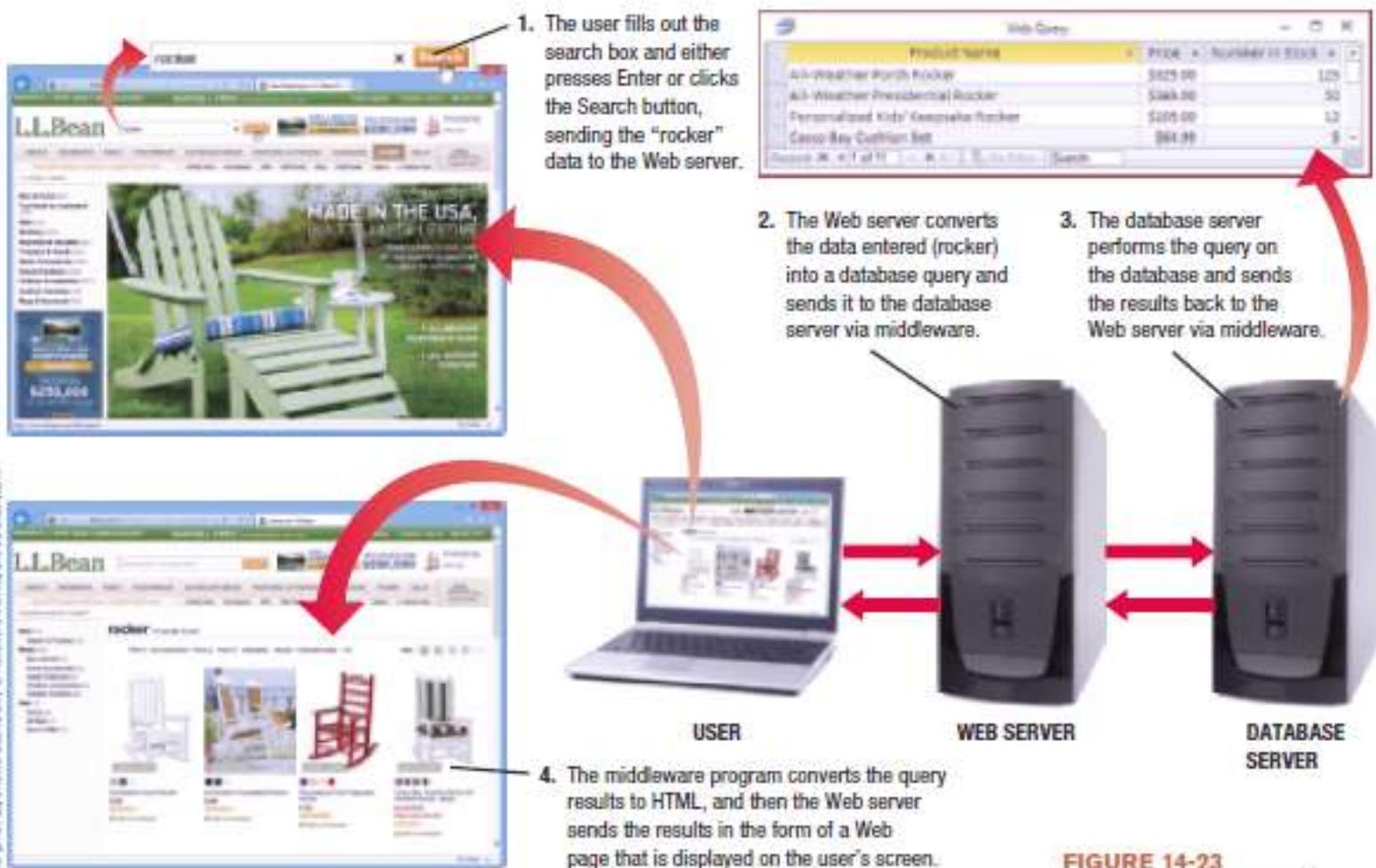


FIGURE 14-23

A cloud database in action.



Quick Quiz

1. Which of the following is the most widely used type of database today?
 - a. Network
 - b. Relational
 - c. Object-oriented
2. True or False: Databases are often used in conjunction with dynamic Web pages.
3. A(n) _____ is used to extract specific information from a database by specifying particular conditions about the data to be retrieved.

Answers:

1) b; 2) True; 3) query



Summary

- What Is a Database?
- Data Concepts and Characteristics
- Database Classifications
- Database Models
- Cloud Databases

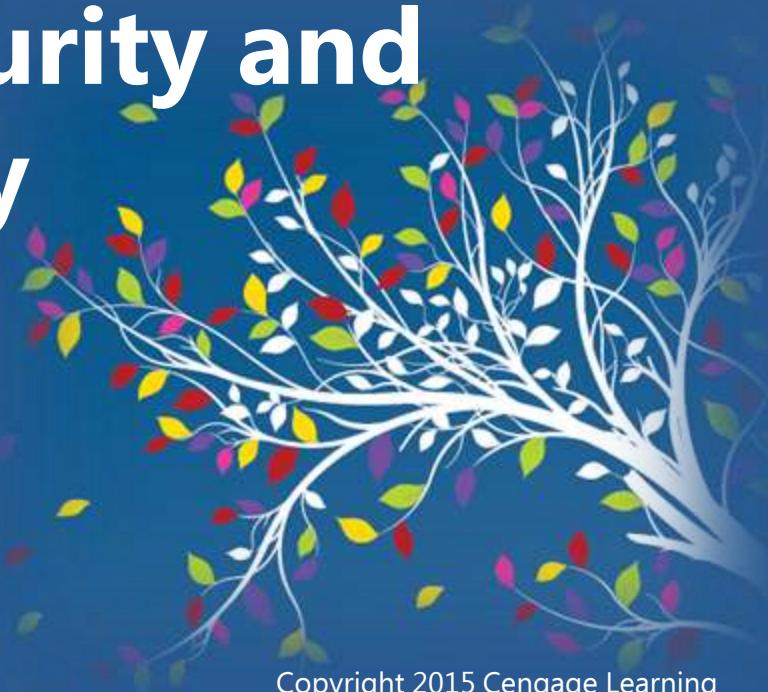
15th Edition

Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 15: Computer Security and Privacy

**Deborah Morley
Charles S. Parker**



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Learning Objectives

1. Explain why all computer users should be concerned about computer security.
2. List some risks associated with hardware loss, hardware damage, and system failure, and understand ways to safeguard a computer against these risks.
3. Define software piracy and digital counterfeiting, and explain how they can be prevented.
4. Explain what information privacy is and why computer users should be concerned about it.



Learning Objectives

5. Describe some privacy concerns regarding databases, electronic profiling, spam, and telemarketing, and identify ways individuals can protect their privacy.
6. Discuss several types of electronic surveillance and monitoring, and list ways individuals can protect their privacy.
7. Discuss the status of computer security and privacy legislation.



Overview

- This chapter covers:
 - Hardware loss, hardware damage, and system failure, and the safeguards that can help reduce the risk of a problem occurring due to these concerns
 - Software piracy and digital counterfeiting and steps that are being taken to prevent these computer crimes
 - Possible risks for personal privacy and precautions that can be taken to safeguard one's privacy
 - Legislation related to computer security and privacy



Why Be Concerned About Computer Security?

- There are a number of security concerns related to computers that users should be concerned about, including:
 - Having a computer or other device stolen
 - Losing important documents
 - Losing a smartphone containing contacts and other important data
 - Buying pirated or counterfeited products



Hardware Loss, Hardware Damage, and System Failure

- Hardware Loss
 - Can occur when a personal computer, USB flash drive, mobile device, or other piece of hardware is stolen, lost, damaged, or experiences a system failure
 - Hardware Theft
 - Most common type of hardware loss
 - Occurs when hardware is stolen from an individual or an organization
 - Often stolen from businesses, schools, and luggage or packages lost by airlines or shipping companies



Hardware Loss, Hardware Damage, and System Failure

- Often occurs for the value of the hardware, but increasingly for the information that might be contained on the hardware
- C-level attacks, those targeting CEOs and CIOs, are growing
- Hardware Damage
 - Can occur from power fluctuations, heat, dust, static, electricity, water, and abuse
 - Can be accidental or intentional



Hardware Loss, Hardware Damage, and System Failure

- System Failure and Other Disasters
 - The complete malfunction of a computer system
 - Can be due to a hardware problem, software problem, or computer virus
 - Can be due to a natural disaster or planned attack



Courtesy of Verizon Communications

FIGURE 15-1
System destruction.
The 9/11 attacks killed nearly 3,000 people and destroyed hundreds of business offices, including critical cables located in this Verizon office adjacent to Ground Zero.



Hardware Loss, Hardware Damage, and System Failure

- Protecting Against Hardware Loss, Hardware Damage, and System Failure
 - Door and Computer Equipment Locks
 - Prevent access to equipment
 - Cable locks, security slots, cable anchors
 - Security cases
 - Laptop alarm software
 - Lock up USB flash drives, external hard drives, and other media
 - Businesses can run social engineering tests to assess the vulnerability of their facility and employees



Hardware Loss, Hardware Damage, and System Failure

Courtesy of Kensington Computer Products Group



NOTEBOOK LOCKS

This combination cable lock connects to the security slot built into the notebook computer.



SECURITY CASES

This iPad security case/stand encloses the iPad and secures it via a keyed cable lock.

FIGURE 15-3

Cable locks secure computers and other hardware.



Trend Box

Self-Healing Devices

- Repair themselves when damaged
- New plastic that mimics our skin's ability to repair itself
 - Turns red until it reforms
- Special paint that can repair scratches or cuts
 - Scratch Shield iPhone case



This Scratch Shield case from Nissan can repair itself when scratched.

Courtesy Nissan



Hardware Loss, Hardware Damage, and System Failure

- Encryption and Self-Encrypting Hard Drives
 - Use encryption to protect data
 - Increasingly used with USB flash drives, portable computers, smartphones, etc.
 - Full Disk Encryption (FDE)
 - Everything on the storage medium is encrypted
 - Self-Encrypting Hard Drive
 - A hard drive using FDE
 - Used most often with portable computers

FIGURE 15-4
Encrypted devices.
The data on this encrypted USB flash drive cannot be accessed until the user enters the appropriate PIN.





Hardware Loss, Hardware Damage, and System Failure

- Device Tracking Software and Antitheft Tools
 - Used to find a computer or other device after it is lost or stolen
 - Sends out identifying data via the Internet
 - Law enforcement can use this data to recover the device
 - Kill Switch
 - Causes the device to self-destruct
 - Asset Tags (permanently attached)
 - Tamper Evident Labels
 - Change their appearance if someone tries to remove them



Courtesy BullGuard

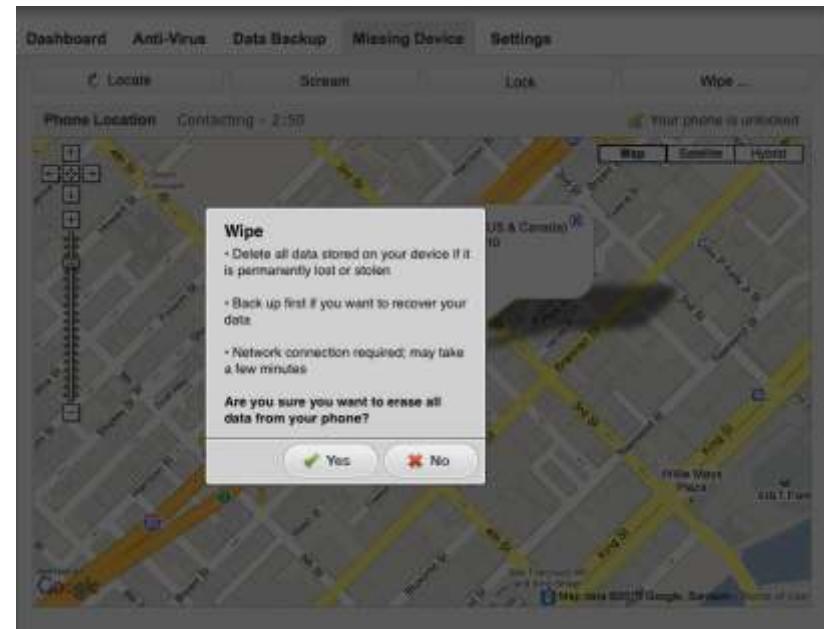
FIGURE 15-5
Device tracking software.



How It Works Box

Self-Destructing Devices

- Contain a kill switch that can be used to destroy the device or data stored on it to prevent access
- Activated by the customer or a tracking company upon customer request
- Activated when the device accesses the Internet or when a remote trigger (like a number of logon attempts) is activated
- Can be used with some cloud services





Hardware Loss, Hardware Damage, and System Failure

- Additional Precautions for Mobile Users
 - Mobile Device Management (MDM) software
 - Used by businesses to manage mobile devices used by employees
 - Locks down or wipes a lost or stolen phone
 - Displays a message with instructions for returning the device
 - Displays the current location of the device
 - Wireless Tether System
 - Ties phone to a key fob in order to sound an alarm and lock the phone if further away than the specified allowable distance



Hardware Loss, Hardware Damage, and System Failure

- Use common sense and do not leave personal computers and mobile devices unattended
- Use cloud services so data will not be stored on your devices
- Disable wireless connections when they are not needed

FIGURE 15-6
Common-sense precautions for portable computer and mobile device users.

MOBILE COMPUTING PRECAUTIONS

Install and use encryption, antivirus, antispyware, and firewall software.

Secure computers with boot passwords; set your mobile phone to autolock the screen after a short period of time and require a passcode to unlock it.

Use only secure Wi-Fi connections and disable Wi-Fi and Bluetooth when they are not needed.

Never leave usernames, passwords, or other data attached to your computer or inside its carrying case.

Use a plain carrying case to make a portable computer less conspicuous.

Keep an eye on your devices at all times, especially when going through airport security.

Avoid setting your devices on the floor or leaving them in your hotel room; use a cable lock to secure the device to a desk or other object whenever this is unavoidable.

Back up the data stored on the device regularly, but don't carry the backup media with your device and don't store unencrypted sensitive data on your device.

Consider installing tracking or kill switch software.



Hardware Loss, Hardware Damage, and System Failure

- Proper Hardware Care
 - Do not harm hardware physically
 - Use protective cases



FIGURE 15-7

Protective cases.



Hardware Loss, Hardware Damage, and System Failure

- Ruggedized devices are available
 - Designed to withstand much more physical abuse than conventional computers

© iStockPhoto.com/ajjohn784



RUGGED LAPTOPS



RUGGED TABLETS

Courtesy Xplore Technologies Corp.



RUGGED PHONES

Courtesy Kyocera



Hardware Loss, Hardware Damage, and System Failure

- Use surge suppressors
- Use uninterruptible power supplies (UPSs)
 - Provide continuous power to a computer system after the power goes off
- Avoid exposing devices to dust, moisture, static, and heat
- Avoid a head crash
- Stop USB devices before removing them
- Use screen protectors, jewel cases, etc.



Hardware Loss, Hardware Damage, and System Failure

Courtesy of Schneider Electric



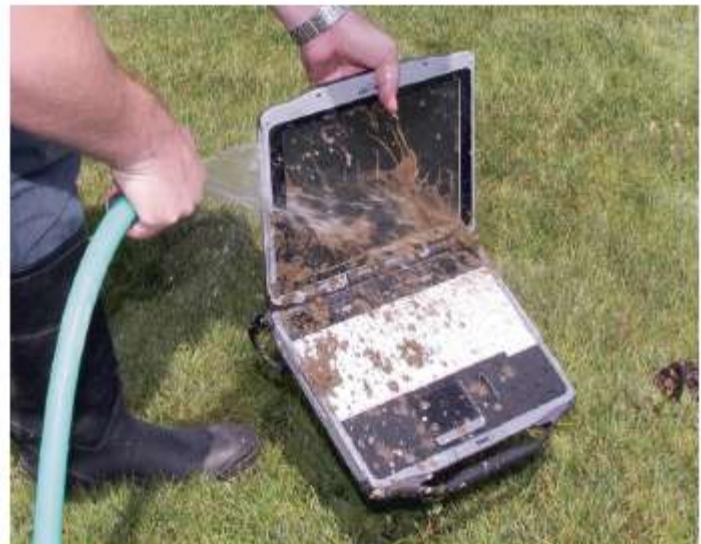
SURGE SUPPRESSOR



UPS

FIGURE 15-9

Surge suppressors and uninterruptible power supplies (UPSs).



Courtesy General Dynamics IronK



Hardware Loss, Hardware Damage, and System Failure

- Backups and Disaster Recovery Plans
 - Essential for both businesses and individuals
 - Backup media needs to be secured
 - Data storage companies store backup media at secure remote locations
 - Online backup is another possibility
 - Continuous data protection (CDP)
 - Enables data backups to be made on a continual basis
 - Disaster-recovery plan
 - Describes the steps a company will take following the occurrence of a disaster
 - Hot site can be used if facilities are destroyed
 - Emergency or Web-based mail provider



Technology and You Box

Protecting Your PC

- Step 1: Protect your hardware.
- Step 2: Install and use security software.
- Step 3: Back up regularly.
- Step 4: Update your operating system, browser, and e-mail program regularly.
- Step 5: Test your system for vulnerabilities.



Continuous data protection (CDP) protects your data on an ongoing basis.



Quick Quiz

1. Which of the following would not likely be a reason for stealing a notebook computer?
 - a. For the data contained on the computer
 - b. To use in a denial of service (DoS) attack
 - c. For the value of the hardware
2. True or False: It is only important to use a surge suppressor during bad weather, when a lightning strike may occur.
3. A copy of a file that is created in case the original is damaged is called a(n) _____.

Answers:

1) b; 2) False; 3) backup

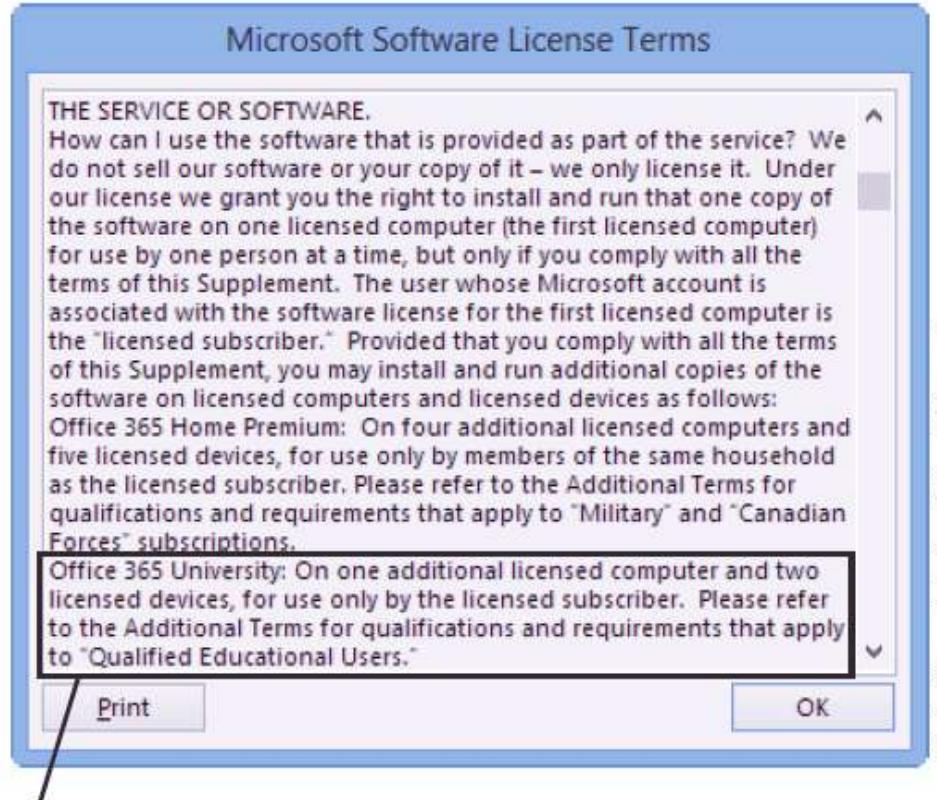


Software Piracy and Digital Counterfeiting

- Software Piracy
 - Unauthorized copying of a computer program occurs when:
 - Individuals make illegal copies of software to give to friends
 - Businesses or individuals install software on more than the number of computers allowed according to the end-user license agreement (EULA)
 - Sellers install unlicensed copies on computers sold to consumers
 - Large-scale operations in which programs and packaging are illegally duplicated and sold as supposedly legitimate products



Software Piracy and Digital Counterfeiting



Used with permission from Microsoft Corporation

FIGURE 15-11

An end-user license agreement (EULA). Specifies the number of computers on which the software can be installed and other restrictions for use.



Software Piracy and Digital Counterfeiting

- Digital Counterfeiting
 - The use of computers or other types of digital equipment to make illegal copies of documents
 - Currency, checks, collectibles and other items
 - Often scanned and printed or color-copied
 - Illegal in the United States

FIGURE 15-12

Digitally counterfeited documents.



Courtesy of United States Secret Service



Software Piracy and Digital Counterfeiting

- Protecting Against Software Piracy and Digital Counterfeiting
 - Software Antipiracy Tools
 - Educating businesses and consumers
 - Requiring a unique registration code or product key
 - Checking validity of a software installation before upgrades or other resources related to the program can be used
 - Watching online auction sites and requesting removal of suspicious items
 - Incorporating code into applications to inform the vendor when pirated copies are being used, or are in violation of the license



Software Piracy and Digital Counterfeiting

The screenshot displays a software interface for monitoring network traffic, likely related to software piracy. The main window shows various fields such as 'Net Connection ID', 'Egress IP', 'Account', 'Regional Info', 'Gateway Source', 'Latitude', 'Longitude', and 'Custom Links'. A red circle highlights the 'Custom Links' section, which contains a link labeled 'NCO Location via Google Map'. Below this, a detailed view of a specific connection is shown, including 'Address 1', 'City', and 'Country'. To the right, a separate window shows a Google Map with a red marker indicating a location in Buffalo, New York.

FIGURE 15-13
Antipiracy software.

Courtesy Vi Labs; Google screenshot © Google Inc. and used with permission.



Software Piracy and Digital Counterfeiting

- Digital Counterfeiting Prevention
 - New currency designs released every seven to ten years by the U.S. Treasury Department
 - Microprinting, watermarks, a security thread, color-shifting ink, and raised printing are used
 - Digital watermarks and RFID tags can also be used to deter counterfeiting checks and ID cards
 - Digital watermark
 - » Subtle alteration to a digital item that is not noticeable but that can be retrieved to identify the owner of the item



Software Piracy and Digital Counterfeiting

SECURITY THREAD

Embedded in the paper and contains USA and 100s; glows pink when placed in front of an ultraviolet light.

SECURITY RIBBON

Woven into the paper and displays bells and then 100s when the bill is moved.

MICROPRINTING

Extremely small print that is very difficult to reproduce appears in three different locations on the front of the bill (on the jacket collar, around the black space containing the watermark, and along the golden quill), though it is hard to see without a magnifying glass.



Photo courtesy of United States Secret Service

FIGURE 15-14

Anticounterfeiting measures used with U.S. currency.



Quick Quiz

1. Using a computer to make illegal copies of currency to circulate as real currency is a form of _____.
 - a. software piracy
 - b. computer sabotage
 - c. digital counterfeiting
2. True or False: Software piracy is rarely performed today.
3. The use of computers or other types of digital equipment to make illegal copies of currency, checks, collectibles, and other items is known as _____.

Answers:

1) c; 2) False; 3) digital counterfeiting



Why Be Concerned About Information Privacy?

- Privacy
 - State of being concealed or free from unauthorized intrusion
- Information Privacy
 - Rights of individuals and companies to control how information about them is collected and used
- Computers add additional privacy challenges
 - Cookies and spyware are possible privacy risks
 - Databases, spam, electronic surveillance, electronic monitoring present additional privacy concerns



Databases, Electronic Profiling, Spam, and Other Marketing Activities

- Databases and Electronic Profiling
 - Unless data stored in databases is sufficiently protected, security breaches can occur
 - Marketing databases, government databases, and educational databases are at higher risk for personal privacy violations
 - Marketing Databases
 - Collection of marketing and demographic data about people and used for marketing purposes
 - Data obtained through online and offline purchases, public information, etc.



Databases, Electronic Profiling, Spam, and Other Marketing Activities

- Data is also gathered from Web and social media activities
 - » Facebook, MySpace, Google+, and location services such as Foursquare
- Government Databases
 - Collection of data about people, collected and maintained by the government
 - Some information is confidential, other is public
 - » Tax information, and Social Security earnings are private
 - » Birth records, marriage, and divorce information are public



Databases, Electronic Profiling, Spam, and Other Marketing Activities

- Real ID Act of 2005
 - » Mandates the development of a national ID system that links driver's license databases across the country
- The emerging Federal Services Data Hub database
 - » Will be used to connect healthcare insurance exchanges with numerous federal databases
- Much information about an individual is available for free on the Internet



Databases, Electronic Profiling, Spam, and Other Marketing Activities

Courtesy of the Town of Dartmouth, Massachusetts

PROPERTY VALUE SEARCH
Some local governments permit searches for property located in that area, such as displaying the owner's name, address, and a link to additional information including property value and tax information.

VITAL RECORDS SEARCH
Some counties and states allow searches for documents related to marriages, divorces, births, legal judgments, deeds, liens, powers of attorney, and so forth.

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PEOPLE SEARCH
Many sites allow you to look up information (such as address, phone number, relatives, and criminal convictions) about individuals; some information requires a fee.

FIGURE 15-15
A variety of searchable databases are available via the Internet.

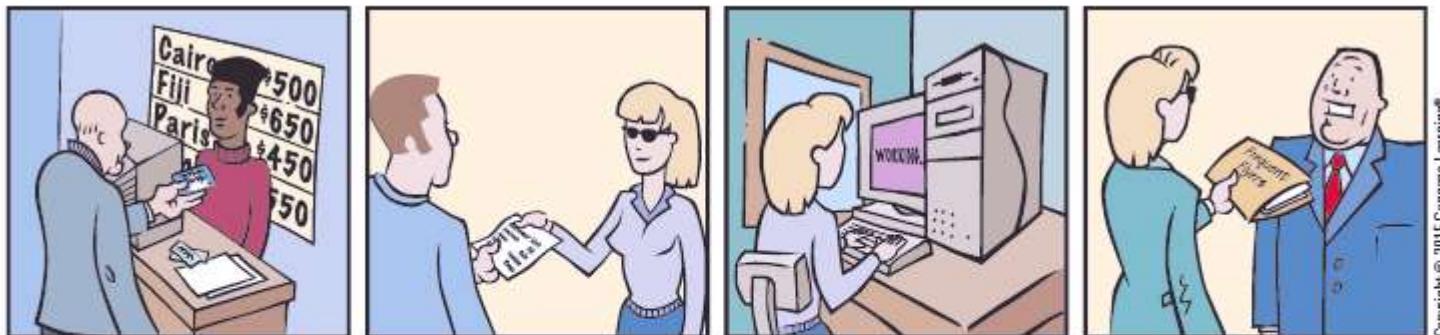
Office of the Secretary of State of Washington State



Databases, Electronic Profiling, Spam, and Other Marketing Activities

– Electronic Profiling

- Using electronic means to collect a variety of in-depth information about an individual
- Designed to provide specific information which is then sold to companies to be used for marketing purposes



When you make an electronic transaction, information about who you are and what you buy is recorded, usually in a database.

Databases containing the identities of people and what they buy are sold to marketing companies.

The marketing companies add the new data to their marketing databases; they can then reorganize the data in ways that might be valuable to other companies.

The marketing companies create lists of individuals matching the specific needs of companies; the companies buy the lists for their own marketing purposes.

FIGURE 15-16
How electronic profiling might work.



Databases, Electronic Profiling, Spam, and Other Marketing Activities

– Privacy Policy

- Included on many Web sites
- Dictates how supplied information will be used, but can be changed and often without notice

A screenshot of a web browser displaying the Facebook Data Use Policy. The URL in the address bar is <https://www.facebook.com/privacy/policy/>. The page title is "Data Use Policy | Facebook". The main content area is titled "How we use the information we receive". It explains that Facebook uses information received from users and others to provide services, protect rights, offer location features, measure ads, and make suggestions. A scroll bar is visible on the right side of the page.

This section explains how your information may be used, such as to provide location services and to make suggestions based on Facebook activity.

Scroll to read other sections of the policy that explain how the data may be shared, how long it is kept, and more.

FIGURE 15-17
Privacy policies.
Web site privacy policies explain how your personal information might be used.



Databases, Electronic Profiling, Spam, and Other Marketing Activities

- Spam and Other Marketing Activities
 - Unsolicited, bulk e-mail sent over the Internet
 - Often involves health-related products, counterfeit products, fraudulent business opportunities, pornography, etc.
 - Marketing e-mails from companies a person has done business with
 - Can be delivered via instant messaging (spim), text messages (mobile phone or SMS spam), social networking sites, phones, and fax machines
 - Wastes time, bandwidth, and productivity
 - CAN-SPAM Act of 2003 enacted some requirements and penalties for commercial e-mailers

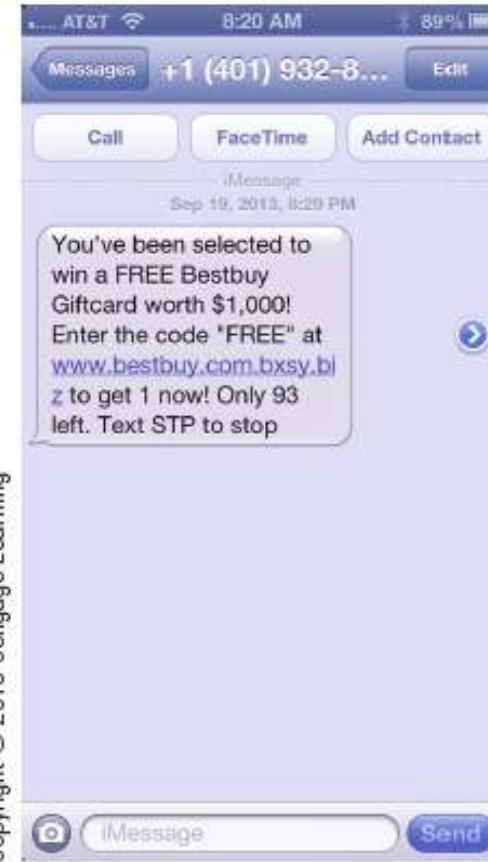


Databases, Electronic Profiling, Spam, and Other Marketing Activities

Used with permission from Microsoft Corporation



E-MAIL SPAM



TEXT MESSAGE SPAM

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FIGURE 15-18
Examples of spam.



Protecting the Privacy of Personal Information

- Safeguard Your E-Mail Address
 - Use one private e-mail address for trusted sources like friends, family, and colleagues
 - Use a throw-away (disposable) e-mail address for online shopping, forums, product registration, sweepstakes, etc.

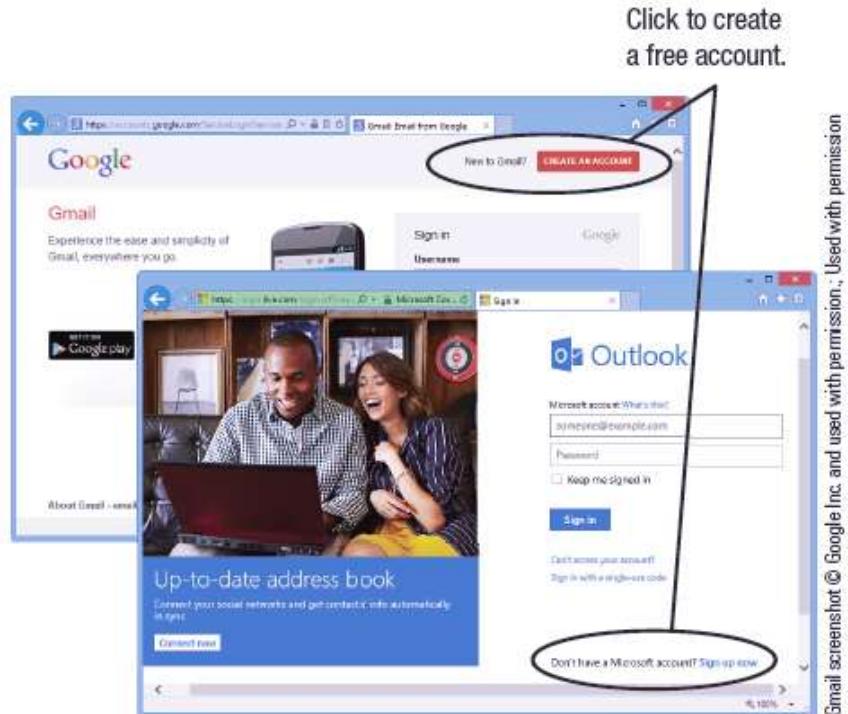


FIGURE 15-19

Free e-mail accounts. Can be used for throw-away e-mail addresses.



Protecting the Privacy of Personal Information

- Be Cautious of Revealing Personal Information
 - Read a Web site's privacy policy
 - Avoid putting too many personal details on your Web sites and social media pages; restrict access to friends and family
 - Use a throw-away email address when signing up for free trials or other services than may result in spam
 - Consider using privacy software, such as Privacy Guardian to hide personal information while browsing the Web
 - Supply only the required information in registration forms
 - Delete your browsing history and e-mail settings when using a public computer; use private browsing



Protecting the Privacy of Personal Information

Facebook (use Privacy Settings)	<p>Limit who can see your posts to <i>Friends</i> only.</p> <p>Limit who can look you up to <i>Friends</i> or <i>Friends of Friends</i> only.</p> <p>Disable search engines linking to your timeline.</p> <p>If you allow friends to post on your timeline, enable the settings to review the posts first.</p> <p>On your profile's <i>About</i> page, click each section and limit viewing to <i>Friends</i> only.</p>
Google+ (use Profile Settings)	<p>Organize your contacts into <i>circles</i> based on the content you will share with them (such as work, friends, and family) and then post or share content only with the appropriate circle.</p> <p>On your profile's <i>About</i> page, click each section and limit viewing to <i>Your circles</i> only.</p>
Twitter (use Account Settings)	<p>Enable <i>Tweet privacy</i> so only those who you approve will receive your tweets.</p> <p>Keep location information disabled so your location won't be added to your tweets.</p>

FIGURE 15-20
Social media privacy tips.



Protecting the Privacy of Personal Information

- Use Filters and Opt Out
 - Use an e-mail filter to automatically sort e-mail messages and route possible spam into a special folder to deal with later
 - Be sure to check spam folders for important messages
 - Spam filters can be used to catch spam
 - Mobile spam apps can be used with mobile devices

FIGURE 15-23

Mobile spam filtering. Can detect both spam texts and spam calls.

© Chardchan / Shutterstock.com; Courtesy Numbercop





Protecting the Privacy of Personal Information

- Opt out of marketing activities
 - Request to be removed from marketing lists or that personal information not be shared with other companies
 - Can contact companies directly
 - Opt-out tools are available online
 - Opt-out cookies prevent marketing cookies from being stored on your computer
 - Some privacy groups want individuals to have to opt in to activities instead
 - Proposed Do Not Track legislation



Protecting the Privacy of Personal Information

- Can enable tracking protection in browsers



FIGURE 15-24
Enabling tracking protection in Internet Explorer.

Used with permission from Microsoft Corporation



Protecting the Privacy of Personal Information

- Secure Servers and Otherwise Protect Personal Information
 - Automatic encryption systems for e-mail can help sensitive data from accidentally being revealed
 - Chief Privacy Officer (CPO)
 - Ensures that the private data stored by businesses is adequately protected
 - Ensures privacy laws are complied with
 - Identifies the data in a company that needs to be protected
 - Develops policies to protect the data



Protecting the Privacy of Personal Information

- Properly Dispose of Hardware Containing Data
 - Wipe (not just delete) data on hard drives before disposing of a computer or hard drive
 - Storage media containing sensitive data should be shredded
 - Businesses should have a media sanitation/data destruction policy



Courtesy Fellowes, Inc.

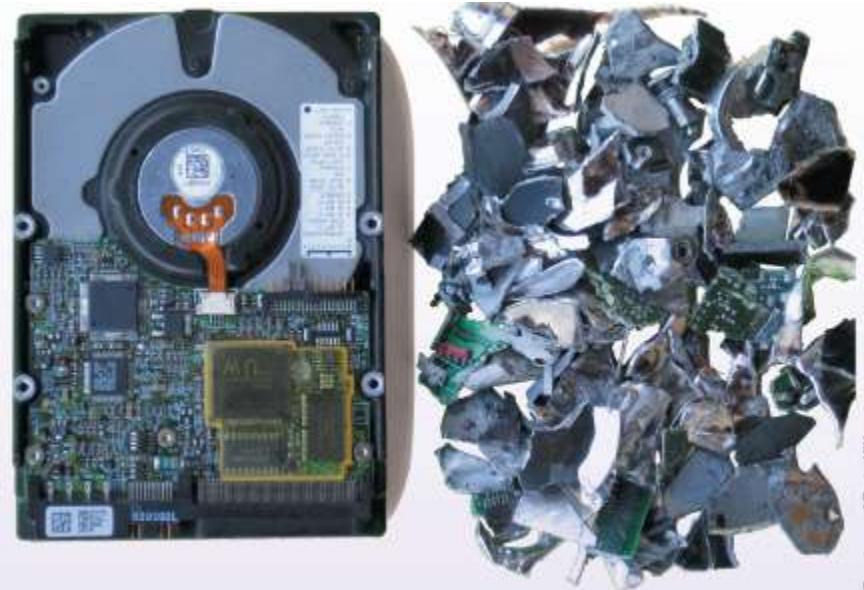
FIGURE 15-25

Media disposal.
When disposing of CDs, DVDs, and other storage media, the media should be shredded to ensure the information on the media is destroyed.



Inside the Industry Box

- Data Killers
 - Data destruction services can be used to destroy data contained on storage media
 - Magnetic hard drives can be wiped or degaussed (demagnetized)
 - Other media can be shredded
 - Method depends on the type of media and where the hardware is going



Hard drive before (left) and after (right) shredding.



Electronic Surveillance and Monitoring

- Computer Monitoring Software
 - Records an individual's computer usage by capturing images of the screen, recording the actual keystrokes used, or creating a summary of Web sites visited
 - Can be used in homes by adults to monitor computer usage of children or spouse
 - Can be used in businesses to monitor employee computer usage
 - Also used by government agencies
 - Keystroke-logging systems
 - Used to capture keystrokes
 - Can be used by hacker to capture usernames, passwords, and other sensitive information entered into a computer via the keyboard



Electronic Surveillance and Monitoring

The figure displays four windows of the ActivTrak software interface:

- Screenshots:** A grid of thumbnail images showing various computer screens, with a large red arrow pointing from this window to a screenshot of a web browser.
- Reports:** A dashboard showing application usage and website visit statistics, with a callout pointing to the "Top Websites" report table.
- Activity Log:** A detailed log of user activities, showing a list of tasks and their details.
- Web Browser:** A screenshot of a web browser displaying the ESPN website, with a callout pointing to the browser tab.

Courtesy of ActivTrak.com

Records screenshots of monitored computers, which can be viewed to re-enact a user's activities.

Records all activity by each user; users can be locked out of specific applications or Web sites as needed.

Records statistics on application use and Web sites visited; reports summarize activity, such as the Top Websites report shown here.

FIGURE 15-26
Computer monitoring software. Can be used to monitor employee computer activity, as shown here.



Electronic Surveillance and Monitoring

- Video Surveillance
 - The use of video cameras to monitor activities of individuals
 - Used to monitor employees
 - Used in public locations for law enforcement purposes
 - Stores and other businesses, public streets, subways, airports, etc.
 - Can be used with face recognition software
 - Identify terrorists and other known criminals
 - Privacy advocates object to the use of video surveillance and face recognition technology in public places
 - Privacy concerns also exist regarding digital cameras capabilities in smartphones, Google Glass, etc.



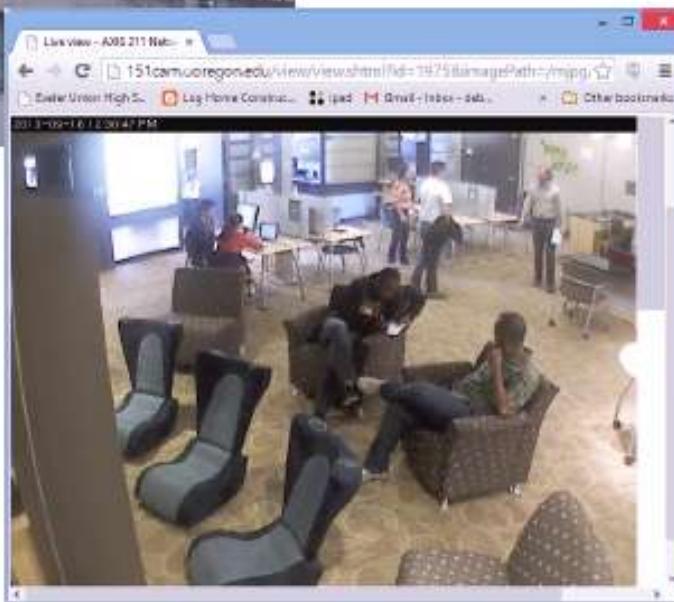
Electronic Surveillance and Monitoring

Image source: EHC.org project LearningSurveillance



OUTDOOR SURVEILLANCE

Many cameras placed in public locations are designed to blend into their surroundings to be less intrusive, such as the camera inside this light fixture on a Washington, D.C., street.



Courtesy University of Oregon

INDOOR SURVEILLANCE

Many cameras are placed inside businesses, schools, and other locations; a snapshot from a video camera located at a university in Oregon is shown here.

FIGURE 15-27
Examples of public video surveillance.



Electronic Surveillance and Monitoring

- Employee Monitoring
 - Observing or recording employees' actions while they are on the job; legal and quite common
 - Can monitor computer usage, phone calls, e-mail, etc.
 - To monitor physical location, use
 - Video cameras
 - GPS monitoring systems
 - Proximity cards and apps
 - Can be used for access control
 - Businesses should inform employees



© iStockPhoto.com/Skrow; Courtesy Appus, Inc. All rights reserved; Courtesy Apple

FIGURE 15-29

Proximity apps.

This app locks and unlocks your computer automatically as your iPhone moves in and out of range.



Electronic Surveillance and Monitoring

- Presence Technology
 - Enables one computing device on a network to locate and identify the current status of another device on the same network
 - Can tell if a someone is using his/her computer or mobile phone
 - Built into IM and some social networking sites
 - May also be used for marketing activities in the future
 - Potential privacy concerns



Modality Systems Ltd./Ignition Industries Inc.

FIGURE 15-30

Presence technology. Presence icons indicate the status of individual contacts.



Electronic Surveillance and Monitoring

- Protecting Personal and Workspace Privacy
 - Can use antispyware software to detect and remove some types of illegal computer monitoring and spyware software
 - The Employer's Responsibilities
 - Keep employee, company, and customer information private and secure
 - Monitor employees' activities to ensure they are productive
 - Have an employee policy that informs employees about company's monitoring activities



Electronic Surveillance and Monitoring

- The Employees’ Responsibilities
 - Read the company’s employee policy and review it periodically to ensure
 - Do not violate any company rules
 - Avoid personal activities at work
 - Sending jokes via e-mail to coworkers might be interpreted as harassment



Computer Security and Privacy Legislation

- A variety of laws have been passed since the 1970s due to the high level of concern about computer security and personal privacy
 - Congress has had difficulty passing new legislation because
 - It is difficult for legal system to keep pace with technology changes
 - Privacy is difficult to define and there is a struggle to balance freedom of speech with the right to privacy
 - Recent proposed actions
 - Do-Not-Track Online Act of 2013
 - Consumer Privacy Bill or Rights



Computer Security and Privacy Legislation

DATE	LAW AND DESCRIPTION
2009	American Recovery and Reinvestment Act Requires HIPAA covered entities to notify patients and/or customers when protected health information has been compromised.
2006	U.S. SAFE WEB Act of 2006 Grants additional authority to the FTC to help protect consumers from spam, spyware, and Internet fraud and deception.
2005	Real ID Act Establishes national standards for state-issued driver's licenses and identification cards.
2005	Junk Fax Prevention Act Requires unsolicited faxes to have a highly visible opt-out notice.
2003	CAN-SPAM Act Implements regulations for unsolicited e-mail messages and lays the groundwork for a federal Do Not E-Mail Registry.
2003	Do Not Call Implementation Act Amends the Telephone Consumer Protection Act to implement the National Do Not Call Registry.
2003	Health Insurance Portability and Accountability Act (HIPAA) Includes a Security Rule that sets minimum security standards to protect health information stored electronically.
2002	Sarbanes-Oxley Act Requires archiving a variety of electronic records and protecting the integrity of corporate financial data.
2001	USA PATRIOT Act Grants federal authorities expanded surveillance and intelligence-gathering powers, such as broadening the ability of federal agents to obtain the real identity of Internet users and to intercept e-mail and other types of Internet communications.

FIGURE 15-31

Federal legislation related to computer security and privacy.



Computer Security and Privacy Legislation

1999	Financial Modernization (Gramm-Leach-Bliley) Act Extends the ability of banks, securities firms, and insurance companies to share consumers' non-public personal information, but requires them to notify consumers and give them the opportunity to opt out before disclosing any information.
1998	Child Online Protection Act (COPA) Prohibits online pornography and other content deemed harmful to minors; has been blocked by the Supreme Court.
1998	Children's Online Privacy Protection Act (COPPA) Regulates how Web sites can collect information from minors and communicate with them.
1998	Telephone Anti-Spamming Amendments Act Applies restrictions to unsolicited, bulk commercial e-mail.
1991	Telephone Consumer Protection Act Requires telemarketing companies to respect the rights of people who do not want to be called.
1988	Computer Matching and Privacy Protection Act Limits the use of government data in determining federal-benefit recipients.
1988	Video Privacy Protection Act Limits disclosure of customer information by video-rental companies.
1986	Electronic Communications Privacy Act Extends traditional privacy protections governing postal delivery and telephone services to include e-mail, mobile phones, and voice mail.
1984	Cable Communications Policy Act Limits disclosure of customer records by cable TV companies; extended in 1992 to include companies that sell wireless services.
1974	Education Privacy Act Stipulates that, in both public and private schools that receive any federal funding, individuals have the right to keep the schools from releasing information such as grades and evaluations of behavior.
1974	Privacy Act Stipulates that the collection of data by federal agencies must have a legitimate purpose.
1970	Fair Credit Reporting Act Prevents private organizations from unfairly denying credit and provides individuals the right to inspect their credit records.
1970	Freedom of Information Act Gives individuals the right to inspect data concerning them that is stored by the federal government.

FIGURE 15-31
Federal legislation related to computer security and privacy.



Quick Quiz

1. A document that discloses how your personal information will be used is called a(n) _____.
 - a. privacy policy
 - b. opt out
 - c. throw-away e-mail address
2. True or False: The problem of protecting personal privacy and keeping personal information private did not exist before computers and the Internet.
3. The ability of one computing device on a network to identify the status of another device on that network is known as _____.

Answers:

1) a; 2) False; 3) presence technology



Summary

- Why Be Concerned About Computer Security?
- Hardware Loss, Hardware Damage, and System Failure
- Software Piracy and Digital Counterfeiting
- Why Be Concerned About Information Privacy?
- Databases, Electronic Profiling, Spam, and Other Marketing Activities
- Electronic Surveillance and Monitoring
- Computer Security and Privacy Legislation

15th Edition

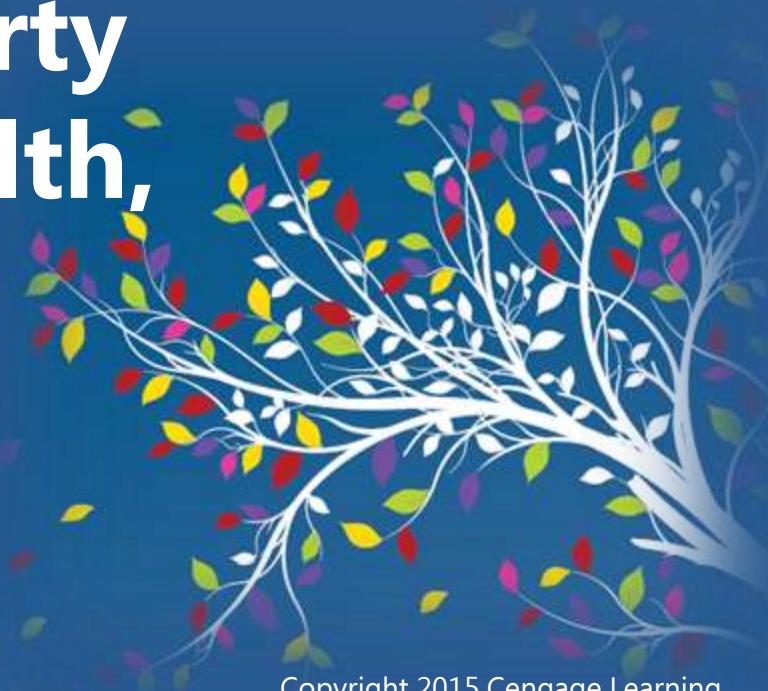
Understanding Computers

Today and Tomorrow
Comprehensive

Chapter 16:

Intellectual Property Rights, Ethics, Health, Access, and the Environment

Deborah Morley
Charles S. Parker



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Learning Objectives

1. Understand the different types of intellectual property rights and how they relate to computer use.
2. Explain what is meant by the term *ethics* and provide several examples of unethical behavior in computer-related matters.
3. Describe some possible physical and emotional health risks associated with the use of computers.
4. Discuss the impact that factors such as nationality, income, race, education, and physical disabilities may have on computer access and use.



Learning Objectives

4. Suggest some ways computer users can practice *green computing* and properly dispose of obsolete computer equipment.
5. Discuss the current status of legislation related to intellectual property rights, ethics, access, and the environment in relation to computers.



Overview

- This chapter covers:
 - Various types of intellectual property rights
 - A discussion of ethics, including ethical use of copyrighted material, ethical uses of resources and information, unethical use of digital manipulation, and ethical business practices and decision making
 - The impact of computers on our physical and emotional health
 - Issues related to equal access
 - The impact of computers on our environment
 - A look at legislation related to these issues



Intellectual Property Rights

- Intellectual Property Rights
 - Rights to which creators of original creative works are entitled
 - Indicate who has the right to use, perform, or display a creative work
 - Indicate how long the creator retains rights to the property
 - Examples of intellectual property
 - Music and movies; paintings, computer graphics, and other works of art; poetry, books, and other types of written works; symbols, names, and designs; inventions



Intellectual Property Rights

- Copyrights
 - Form of protection available to the creator of original artistic or literary works
 - Last until 70 years after creator's death
 - For corporate copyrights or anonymous works, last 95 years from date of publication or 120 years from date of creation, whichever is shorter
 - Can be registered with U.S. Copyright Office

FIGURE 16-1

Copyright statements. Are often included on books, Web sites, and other original copyrighted works.

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BOOK COPYRIGHT NOTICES

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WEB SITE COPYRIGHT NOTICES



Intellectual Property Rights

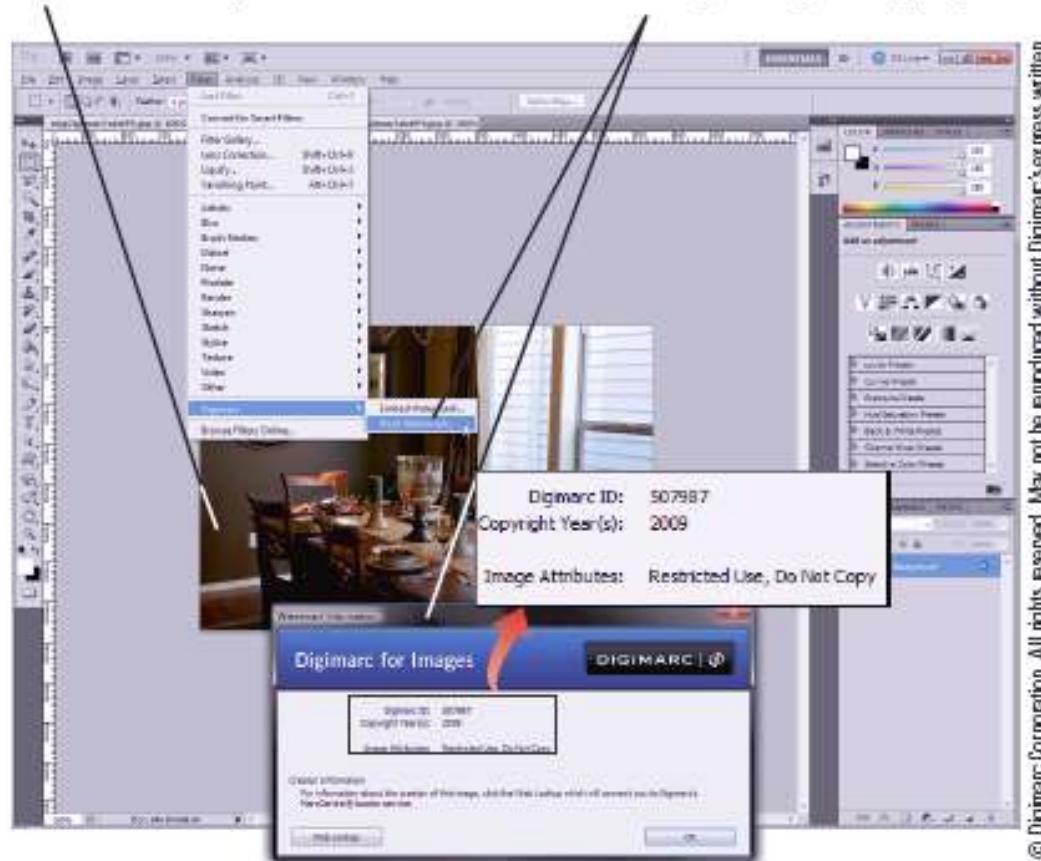
- Recent issue: Termination rights granted to musicians and songwriters
 - Can request rights back after 35 years
- Digital Watermarks
 - Subtle alteration of digital content that is not noticeable but can identify the copyright holder
 - Can be used with images, music, movies, etc.
- Digital Rights Management (DRM) Software
 - Used to protect and manage the rights of creators of digital content such as art, music, photographs, movies
 - Can control use of downloaded content (number of devices a file can be copied to, expiration of video-on-demand movie, etc.)



Intellectual Property Rights

The invisible watermark is embedded into the photo.

The information contained in the watermark can be viewed using an image editing program.



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FIGURE 16-2
Digital watermarks.



Inside the Industry Box

New Applications for Digital Watermarking

- Digimarc Discover is one example
- Enables mobile devices to recognize media in your immediate surroundings to provide related online content
 - Product ads
 - Songs
 - Magazine articles
- Can be implemented without taking up valuable space on resource like is required with a QR code





Intellectual Property Rights

- Trademarks
 - A word, phrase, symbol, or design that identifies goods or services
 - Trademark used to identify a service is called a service mark; service marks claimed but not registered may use the sm mark
 - Trademarks claimed but not registered may use the [™] mark; registered trademarks use the [®] mark
 - Includes protection for domain names
 - Domain name disputes can be brought to the World Intellectual Property Organization (WIPO)



Intellectual Property Rights

FIGURE 16-3

Examples of
trademarked logos.

Courtesy McDonald's Corporation; Courtesy SONIC.
These materials have been reproduced with the
permission of eBay Inc. © 2011 EBAY INC. All
RIGHTS RESERVED; Courtesy Logitech



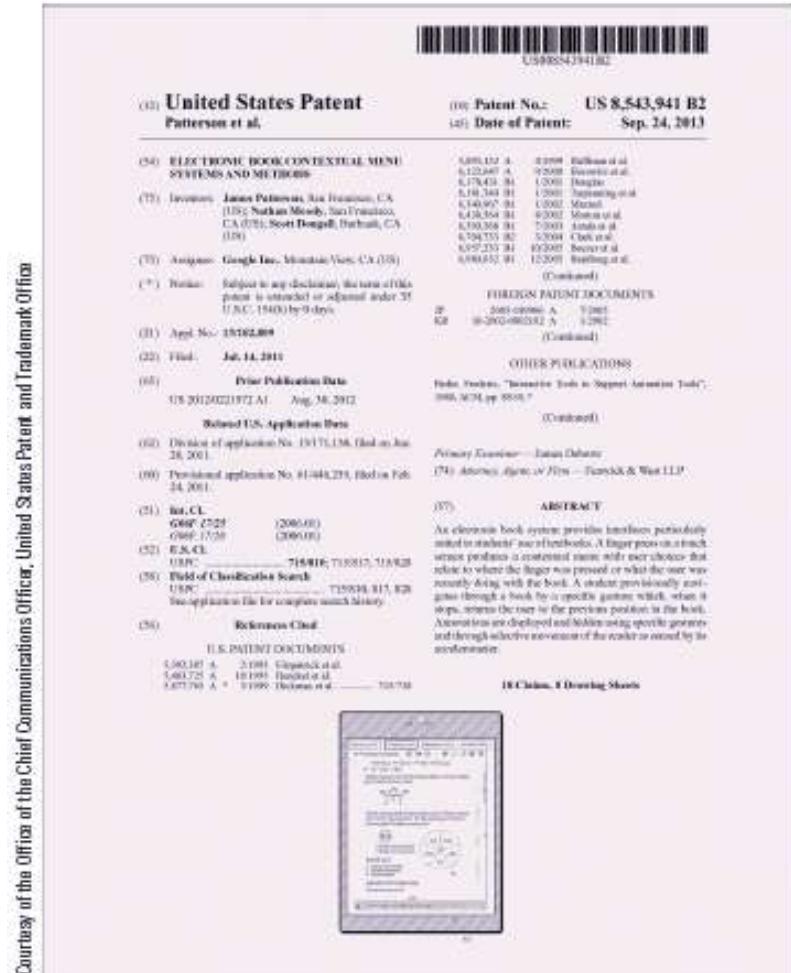


Intellectual Property Rights

- Patents
 - Protect inventions
 - Last for 20 years
 - Can also protect a practice or procedure
 - Google's for “pay-for-gaze” advertising
 - Amazon.com's one-click purchase procedure
 - Expensive and difficult to obtain but can be very lucrative

FIGURE 16-4

Patents. The patent shown here is for a new e-book menu system.





Quick Quiz

1. Copyrights are valid for _____.
 - a. 70 years after the creation of the work
 - b. 70 years after the publication of the work
 - c. 70 years after the death of the creator
2. True or False: Logos cannot be trademarked, just the names of companies or products.
3. _____ are used to protect inventions.

Answers:

- 1) c; 2) *False*; 3) *Patents*



Ethics

- Ethics
 - Overall standards of moral conduct
 - Can vary with individual and religious beliefs, country, race, or culture
 - Personal Ethics
 - Guide an individual's personal behavior
 - Business Ethics
 - Guide an individual's workplace behavior
 - Computer Ethics
 - Concern moral conduct related to computer use
 - Individuals and businesses need to make ethical decisions every day



Technology and You Box

Virtual Currency—Real or Not?

- Linden dollars, World of Warcraft gold, Facebook Credits, Nintendo Points, Amazon Coins, Bitcoins, etc.
- Issue: Is it real currency?
- Recent decision: Bitcoins are a form of money, in the same way gold and silver are recognized as money
- Taxability of virtual profits is another issue
 - Some countries tax it



Courtesy: Cassius

These physical Bitcoins each have a unique code that can be used to retrieve virtual Bitcoins online.



Ethics

- Ethical Use of Copyrighted Material
 - Books and Web-Based Articles
 - Need to properly credit sources to avoid plagiarism
 - Plagiarism is a violation of copyright law and an unethical act
 - Strict consequences for plagiarism at school and work
 - Online tests for plagiarism are available and widely used by schools



Ethics

PLAGIARISM

A student including a few sentences or a few paragraphs written by another author in his essay without crediting the original author.

A newspaper reporter changing a few words in a sentence or paragraph written by another author and including the revised text in an article without crediting the original author.

A student copying and pasting information from various online documents to create her research paper without crediting the original authors.

A teacher sharing a poem with a class, leading the class to believe the poem was his original work.

NOT PLAGIARISM

A student including a few sentences or a few paragraphs written by another author in his essay, either indenting the quotation or placing it inside quotation marks, and crediting the original author with a citation in the text or with a footnote or endnote.

A newspaper reporter paraphrasing a few sentences or paragraphs written by another author without changing the meaning of the text, including the revised text in an article, and crediting the original author with a proper citation.

A student copying and pasting information from various online documents and using those quotes in her research paper either indented or enclosed in quotation marks with the proper citations for each author.

A teacher sharing a poem with a class, clearly identifying the poet.

FIGURE 16-5
Examples of what is and what is not normally considered plagiarism.



Ethics

- Music
 - Debate began with Napster
 - Concerns still exist about P2P file sharing sites
 - Downloading a music file from a P2P site without compensating the artist and record label is violation of the copyright law and an unethical act
 - Copying purchased songs for personal, non-commercial use usually considered within the fair use concept
 - DRM controls can impact downloaded files, purchased CDs, etc.
 - Many downloads today are DRM-free MP3 formats
 - RIAA suing individuals for illegal downloads



Ethics

- Once music is obtained legally, transferring those songs to other devices is typically viewed as fair use
 - Many apps available to legally listen to music on demand
- E-Books
- In 2011, sales of e-books at Amazon.com exceeded print books
 - Piracy of e-books is growing quickly



FIGURE 16-7

Music apps. Allow you to legally listen to music on demand on your devices.



Ethics

- Movies
 - Movie piracy is rampant
 - New issues such as sharing VOD movies or recorded TV show
 - Distributing bootleg copies of movies is illegal and unethical
 - Often happens via the Internet
 - Many legal online alternatives are available
 - Often contain DRM tools to prevent unauthorized use



Ethics

- FBI Anti-Piracy Seal is used with movie DVDs, music CDs, and other intellectual properties commonly pirated



Courtesy: Amazon

FIGURE 16-8
Amazon Instant Video. Allows you to legally download (buy) or stream (rent) movies and TV shows to your TV, computer, or mobile device.

FBI Anti-Piracy Warning:
Unauthorized copying is punishable under federal law.



Federal Bureau of Investigation.
Used with permission.

FIGURE 16-9
The FBI Anti-Piracy Warning Seal.



How It Works Box

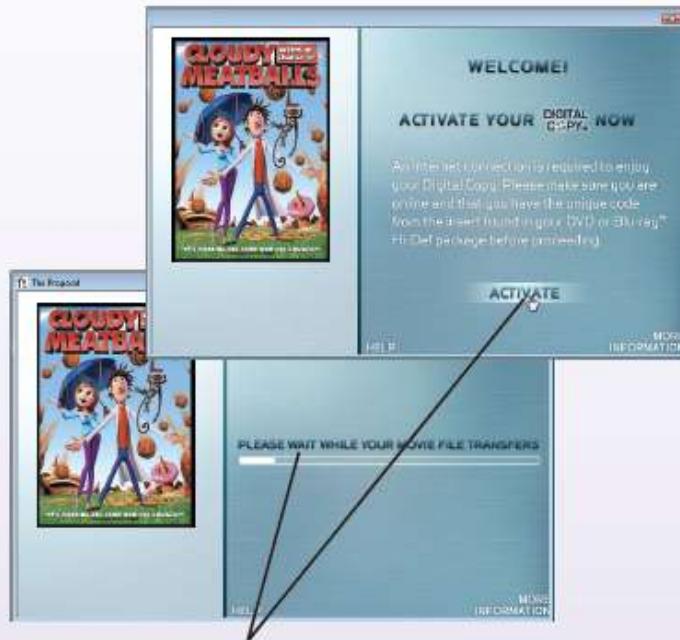
Digital Copy Movies

- Allow you to install a copy of a purchased movie on a mobile device

Cloudy With a Chance of Meatballs is available on Blu-ray Disc™
from Sony Pictures Home Entertainment



1. The movie includes a Digital Copy—insert the disc into your computer.



2. Follow the on-screen instructions to activate your Digital Copy and transfer the movie to your computer and mobile device.



3. The movie can be played on your mobile device, as well as on your computer.

© Chardhaniv/Shutterstock.com



Ethics

- Ethical Use of Resources and Information
 - Ethical Use of School or Company Resources
 - Code of Conduct
 - Policy that specifies allowable use of resources by students or employees
 - Students and employees should be familiar with what is considered acceptable
 - Code of Ethics
 - Policy, typically for an industry or organization, that specifies overall moral guidelines adopted by that industry or organization
 - Whistleblowers have some protection under the law



Ethics

- Ethical Use of Employee and Customer Information
 - Businesses need to decide what is ethical use of employee and customer information
 - Most business schools are incorporating business ethics courses into the curriculum
- Cheating and Falsifying Information
 - Cheating at all levels of school is rampant
 - Includes texting answers during exams, storing notes on smartphones, etc.
 - Can be reduced by academic honor codes



Ethics

- Résumé padding is considered unethical by most companies
 - Many companies will terminate employees who were hired based on falsified résumés or applications
 - Other possible consequences include blacklisting from an industry or being sued for breach of contract
- Also exists in IT certification tests
- For personal situations (online profiles, chat rooms, etc.) there are differing opinions about how ethical providing inaccurate information is



Ethics

- Computer Hoaxes and Digital Manipulation
 - Computer Hoax
 - An inaccurate statement or story spread through the use of computers
 - Often sent via e-mail or social media
 - Often related to viruses, health issues, impending terrorist attacks, etc.
 - Consider researching before passing on to others

FIGURE 16-12

Hoax-Slayer. This is one site that can be used to research possible computer hoaxes.





Ethics

- Digital Manipulation
 - Digitally altering text, images, photographs, music, and other digital content
 - Copyright concern
 - Can be used to misquote people, repeat comments out of context, or create false or misleading photographs
 - Some beneficial ethical uses (aging photos of runaways and missing children, altering photos of wanted criminals, etc.)
 - Use by media is controversial



Ethics



DIGITALLY ALTERED PHOTO



ORIGINAL PHOTO

FIGURE 16-13
Digital manipulation.
The digitally manipulated photo (bottom) added sleeves and a higher neckline to the real photo (top) of Michelle Obama.



Ethics

- Ethical Business Practices and Decision Making
 - Fraudulent Reporting and Other Scandalous Activities
 - Sarbanes-Oxley Act of 2002
 - Includes provisions to improve the quality of financial reporting, independent audits, and accounting services for public companies
 - Ethically Questionable Business Decisions
 - Whether or not to implement a business process or decision that is ethically questionable
 - Customer privacy decisions
 - Plastic surgery photos posted online, etc.



Ethics

- Ethically Questionable Products or Services
 - Decisions regarding selling products or services some individuals find objectionable
 - How, if at all, should businesses that allow users to upload content to their Web sites monitor the content posted
 - Age Verification
 - Proof of age requirements for selling liquor, tobacco, and other adult products via Internet
 - Online age- and identity-verification is an emerging option



Ethics

- Workplace Monitoring
 - Inform employees of the types of monitoring that may occur
 - Especially in countries other than the United States (the EU has limits on the types of monitoring that can be done without employee notification)
 - Social media scrutiny
 - Often done during hiring process
 - Requiring full access to social media is considered by many to cross the ethical line



Ethics

- Cultural Considerations
 - Ethics vary within a country as well as from country to country
 - Some acts may be socially acceptable or ethical in one country but not another
 - Individuals and businesses need to consider both legal and ethical issues in global transactions
 - Some business schools and corporations are including diversity and cross-cultural training

FIGURE 16-15

Cultural considerations.
In some countries,
bootleg copies of
music CDs and movie
DVDs are sold openly.



Image © China via AP Images



Quick Quiz

1. An inaccurate statement or story spread through the use of computers is referred to as _____.
 - a. digital manipulation
 - b. code of ethics
 - c. computer hoax
2. True or False: Most legal experts agree that it's okay for someone who has legally obtained an audio CD to transfer those songs to a CD-R disc or portable media player for personal use.
3. A(n) _____ is an inaccurate statement or story spread through the use of computers.

Answers:

1) c; 2) True; 3) computer hoax



Computers and Health

- Physical Health
 - Computer use can cause physical injuries
 - Eyestrain
 - Blurred vision
 - Fatigue
 - Headaches
 - Wrist and finger pain
 - Repetitive stress injury (RSI)
 - Carpal tunnel syndrome (CTS) (keyboard use)
 - DeQuervain's tendonitis (associated with tiny keyboards)



Computers and Health

- Computer vision syndrome (CVS)
- Backaches
- iPad shoulder from looking down at tablets
- Gorilla arm from touch screens
- Other physical concerns
 - Heat from laptops
 - Hearing loss from headphones
 - 60/60 rule
 - Noise reduction headphones



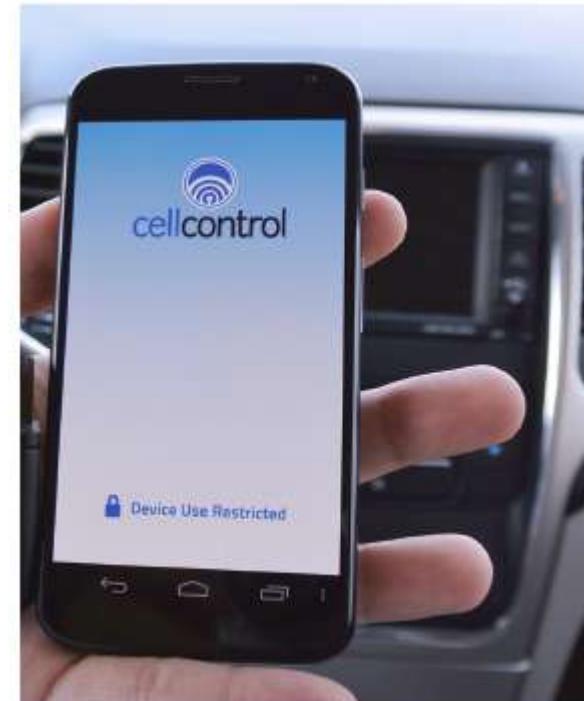
Computers and Health

- Texting or otherwise using phone while driving
 - Illegal in most states
 - Apps and other controls can be used to prevent use of phone while the car is in motion
- Possible radiation risks from wireless devices

FIGURE 16-16

Safe driving apps.

Restrict mobile phone use when the car is in motion.



Courtesy Caliocontrol



Computers and Health

- What Is Ergonomics?
 - The science of fitting a work environment to the people who work there
- Workspace Design
 - The design of a safe and an effective computer workspace

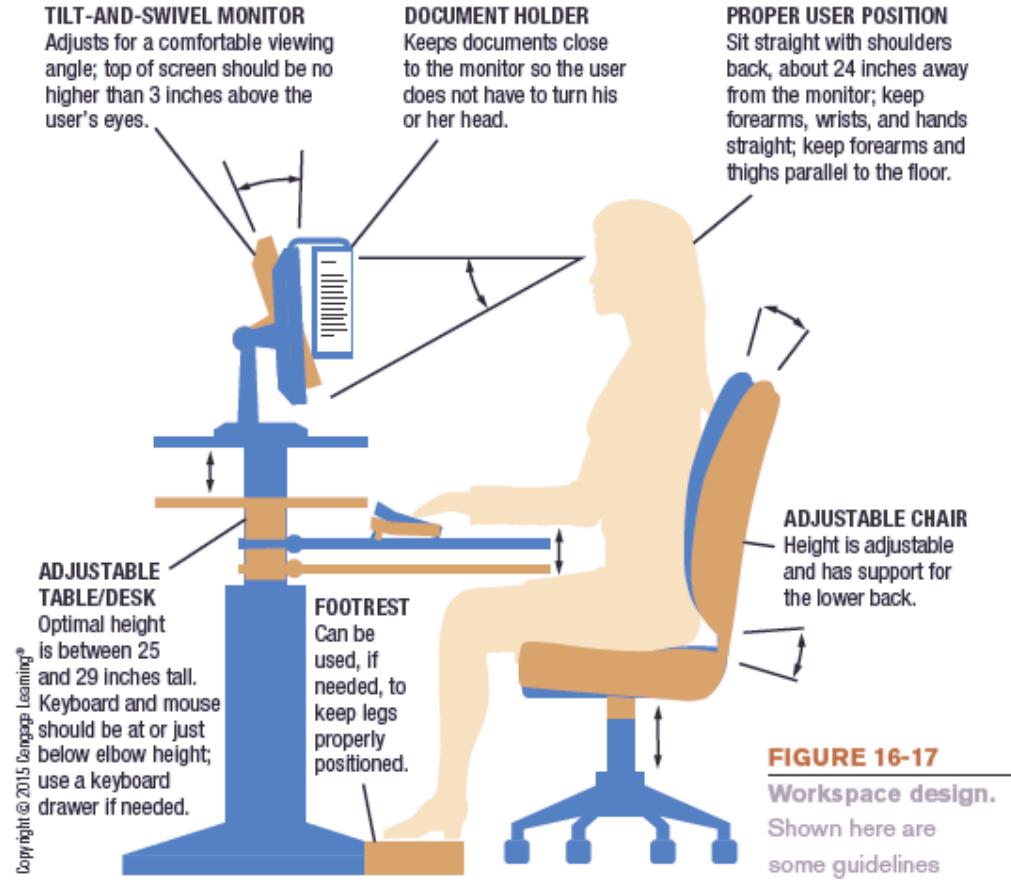


FIGURE 16-17
Workspace design.
Shown here are some guidelines for designing an ergonomic workspace.



Computers and Health

- More difficult with portable computers and mobile devices, but possible to improve work environment
- Travel mice and travel keyboards can help while on the go
- Standing desks are an emerging trend
- Docking station
 - Designed to connect a portable computer to peripheral devices more easily
- Notebook or tablet stand
 - Elevates a notebook/media tablet to the proper height
- Smartphone docks



Computers and Health

Courtesy ASUSTeK Computer Inc.



DOCKING STATIONS

Courtesy Belkin International, Inc.



TABLET STANDS

Courtesy BlueLounge



SMARTPHONE DOCKS

FIGURE 16-19

Docking stations and device stands can help create a more comfortable working environment.



Computers and Health

OCCASIONAL USERS

Sit with the device on a table and position it for comfortable wrist posture, using a stand for tablets whenever possible. If no table or stand is available, use a laptop desk to protect your legs.

Adjust the screen to a comfortable position so you can see the screen as straight on as possible. If you will be doing extensive touch screen work, tilt the device so it is not in a vertical position.

Bring a travel keyboard and mouse to use with the device, whenever practical.

When purchasing a new device, pay close attention to the total weight of the system if you will be using it primarily while traveling.

FULL-TIME USERS

Sit with the device on a desk or table (use a notebook or tablet stand to attain the proper display screen height); use a separate keyboard and mouse.

Elevate the device so the screen is at the proper height and distance, or connect the device to a stand-alone monitor; in either case, adjust the screen to the proper viewing angle and distance.

Use a separate keyboard and mouse, either attached directly to the device or to a docking station or notebook stand.

When purchasing a new device, pay close attention to the size and clarity of the display screen, as well as the ease of connecting the device to a docking station or stand and additional hardware.

FIGURE 16-20
Ergonomic tips for portable computer and media tablet users.



Computers and Health

- Ergonomic Hardware
 - Can help avoid physical problems or alleviate discomfort of existing problems
 - Ergonomic keyboards
 - Trackballs
 - Tablet arms
 - Document holders
 - Antiglare screens
 - Keyboard drawers/trays
 - Computer gloves



Computers and Health

Courtesy Kinesis Corporation; Used with permission from Microsoft Corporation
Courtesy Ergonomics, Inc.; Courtesy of Bi-Town Medical Industries, Inc.



DESKTOP ERGONOMIC KEYBOARDS



MOBILE ERGONOMIC KEYBOARDS



ERGONOMIC MICE



TABLET ARMS



KEYBOARD DRAWERS/TRAYS



COMPUTER GLOVES

FIGURE 16-21

Ergonomic
hardware.



Computers and Health

– Good User Habits and Precautions

CONDITION	PREVENTION
Wrist/arm/ hand soreness and injury	<ul style="list-style-type: none">➤ Use a light touch on a keyboard and touch screen.➤ Rest and gently stretch your fingers and arms every 15 minutes or so.➤ Keep your wrists and arms relaxed and parallel to the floor when using a keyboard.➤ When using a touch screen for extended periods of time, place the device more horizontally than vertically.➤ When using a device with a small keyboard, type short messages, take frequent breaks, and use a separate keyboard whenever possible.➤ Use an ergonomic keyboard, ergonomic mouse, computer gloves, and other ergonomic devices if you begin to notice wrist or hand soreness.
Eyestrain	<ul style="list-style-type: none">➤ Cover windows or adjust lighting to eliminate glare.➤ Rest your eyes every 15 minutes or so by focusing on an object in the distance (at least 20 feet away) for one minute and then closing your eyes for an additional minute.➤ Make sure your display's brightness and contrast settings are at an appropriate level and the display is placed at an appropriate distance from your eyes.➤ Use a larger text size or lower screen resolution, if needed. You should be able to read your display screen from three times the distance at which you normally sit.
Sore or stiff neck	<ul style="list-style-type: none">➤ Use good posture; never hunch over a keyboard or device.➤ Place your display and any documents you need to refer to while using your device directly in front of you.➤ Adjust your display to a comfortable viewing angle with the top of the screen no higher than 3 inches above your eyes.➤ Use a headset if you spend a significant amount of time on the phone; never prop a phone between your face and shoulders.

FIGURE 16-22
Good user habits.
These preventative measures can help avoid discomfort while working on a computer or mobile device.



Computers and Health

Backache; general fatigue	<ul style="list-style-type: none">➤ Use good posture and adjust your chair to support your lower back; use an ergonomic chair, if needed.➤ Use a footrest, if needed, to keep your feet flat on the floor.➤ Walk around or stretch briefly at least once every hour.➤ Alternate activities frequently.➤ When traveling, bring lightweight devices and carry only the essentials with you.
Ringing in the ears; hearing loss	<ul style="list-style-type: none">➤ Turn down the volume when using headphones (you should be able to hear other people's voices).➤ Wear over-the-ear-headphones instead of earbuds.➤ Limit the amount of time you use headphones or earbuds.➤ Use external speakers instead of headphones when possible.
Leg discomfort or burns	<ul style="list-style-type: none">➤ Use a laptop desk, cooling stand, or other barrier between a portable computer and your legs when using a computer on your lap.

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FIGURE 16-22

Good user habits.

These preventative measures can help avoid discomfort while working on a computer or mobile device.



Computers and Health

- Emotional Health
 - Increased use of computers and mobile devices in the home and office has raised concerns about emotional health
 - Stress and corresponding health issues
 - Stress of Ever-Changing Technology
 - Knowledge of and ability to use technology is becoming a necessity in many jobs
 - Technology changes at a rapid pace
 - Workers must regularly learn new skills which can create stress for many individuals



Computers and Health

© iStockphoto.com/facetimeaphans



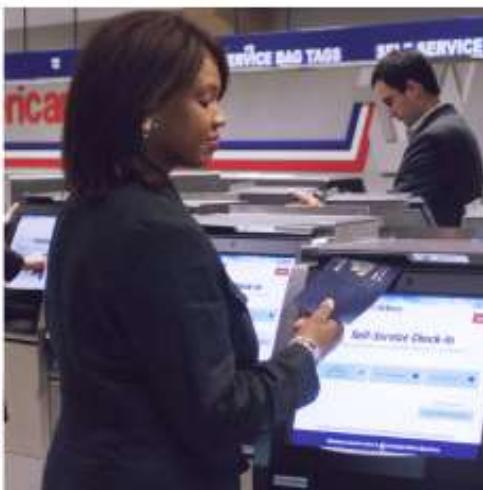
POLICE OFFICERS

Courtesy of DE SANTOS



RESTAURANT SERVERS

Courtesy American Airlines



AIRLINE PASSENGERS

© iStockphoto.com/Armanit



FIELD WORKERS

FIGURE 16-23

Ever-growing computer use. Many jobs and tasks that did not require computer use in the past require it today.



Computers and Health

- Impact of our 24/7 Society
 - Ability to be in touch constantly can be a source of great stress for some people
 - “On call 24/7” and can never get away
 - Hard to relax when on vacation and available 24/7
 - Many employees are expected to be available while on vacation
 - Concerns of using bright screens in bed



FIGURE 16-24

Our 24/7 society.

With smartphones, media tablets, and portable computers, many individuals are available 24/7.

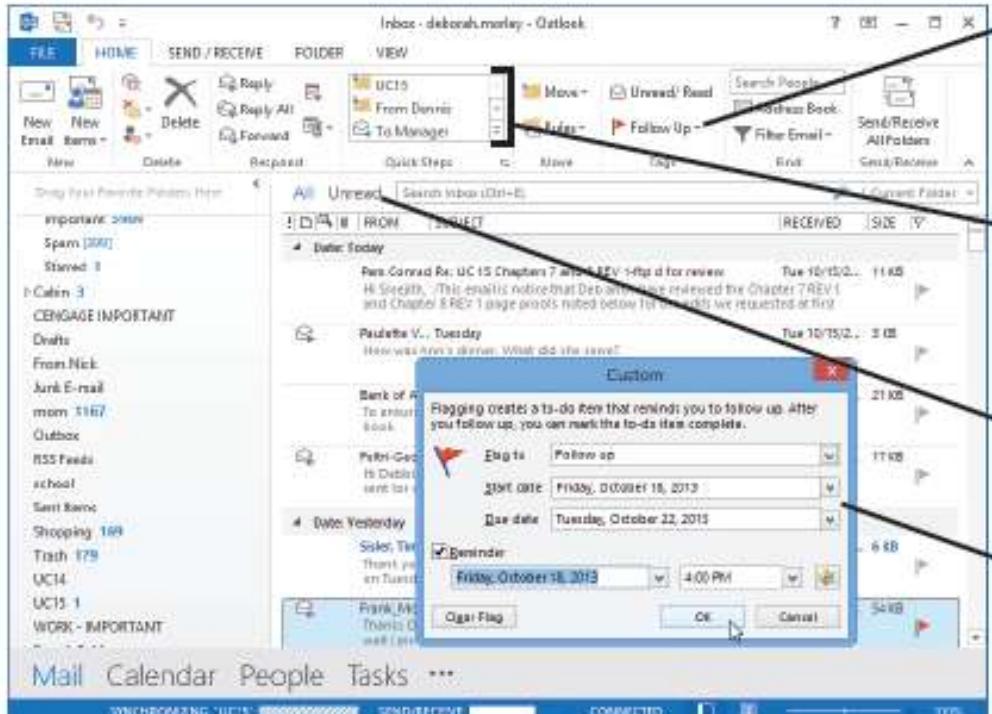


Computers and Health

- Information Overload
 - Good searching techniques are essential
 - Do not try to read everything written on a subject
 - Effectively manage your e-mail
 - Use e-mail filters, flags, and other tools
 - Check messages and updates only periodically
 - Turn off phone notifications as well



Computers and Health



Click to flag an e-mail message.

Use these options to file a message into a Quick Steps folder or start an e-mail to a Quick Steps contact.

Click to view all unread messages.

Press Ctrl+Shift+G to open this dialog box in order to set a custom flag or reminder.

Used with permission from Microsoft Corporation

FIGURE 16-25

E-mail reminder flags can help you organize your Inbox.



Computers and Health

- Burnout
 - A state of fatigue or frustration brought on by overwork
 - Early Signs
 - Feelings of emotional and physical exhaustion
 - No longer caring about a project that was once exciting
 - Irritability or feelings of resentment about amount of work to be done
 - Suggested Solutions
 - Reevaluate schedule, priorities, and lifestyle
 - Take a break or get away for a day
 - Say no to additional commitments
 - Develop healthy food and exercise routines



Computers and Health

- Internet and Technology Addiction
 - Problem of overusing, or being unable to stop using, the Internet
 - Can affect anyone
 - Can involve e-mailing, texting, online shopping, online gambling, social media, online gaming, cybersex, etc.
 - May have significant consequences, such as relationship problems, job loss, academic failure
 - Increasingly being tied to crime and even death
 - Can be treated, similar to other addictions



Computers and Health

Courtesy of Dr. Kimberly Young, Director of the Center for Internet Addiction Recovery

Do you feel preoccupied with the Internet (think about the previous online activity or anticipate the next online session)?

Do you feel the need to use the Internet with increasing amounts of time in order to achieve satisfaction?

Have you repeatedly made unsuccessful efforts to control, cut back, or stop Internet use?

Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use?

Do you stay online longer than originally intended?

Have you jeopardized or risked the loss of a significant relationship, job, educational, or career opportunity because of the Internet?

Have you lied to family members, a therapist, or others to conceal the extent of involvement with the Internet?

Do you use the Internet as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)?

FIGURE 16-26

Signs of Internet addiction. You may be addicted to the Internet if you answer "yes" to at least five of these questions.



Access to Technology

- The Digital Divide
 - The gap between those who have access to technology and those who don't
 - Can have digital divide within a country, as well as between countries
 - U.S. Digital Divide
 - Shrinking, but individuals with a higher level of income or a higher level of education are still more likely to go online
 - Younger people using technology more
 - Some people choose not to use technology



Access to Technology

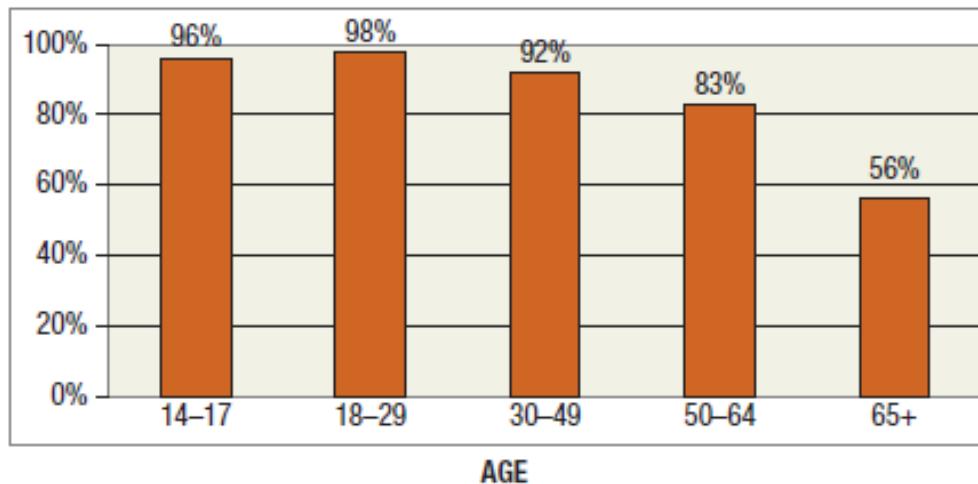
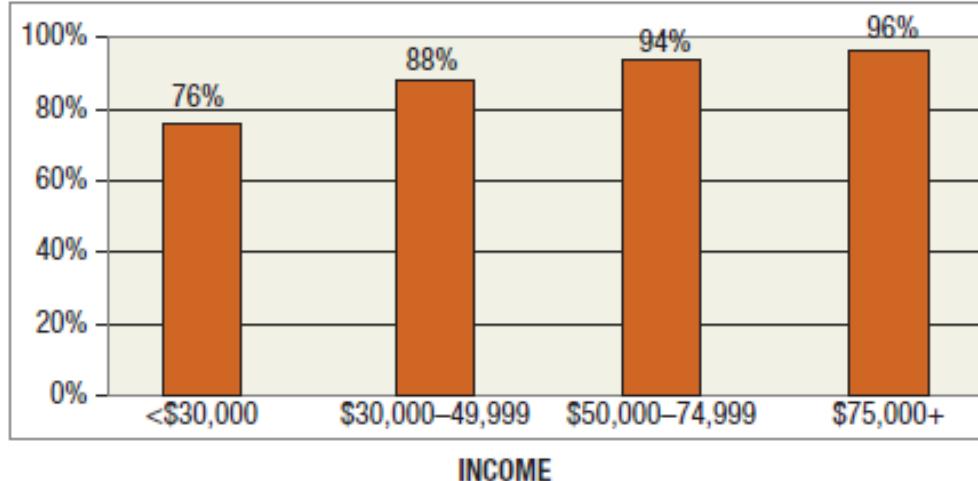


FIGURE 16-27

Key U.S. Internet use statistics. Shows the percent of individuals in each category who use the Internet.



Access to Technology

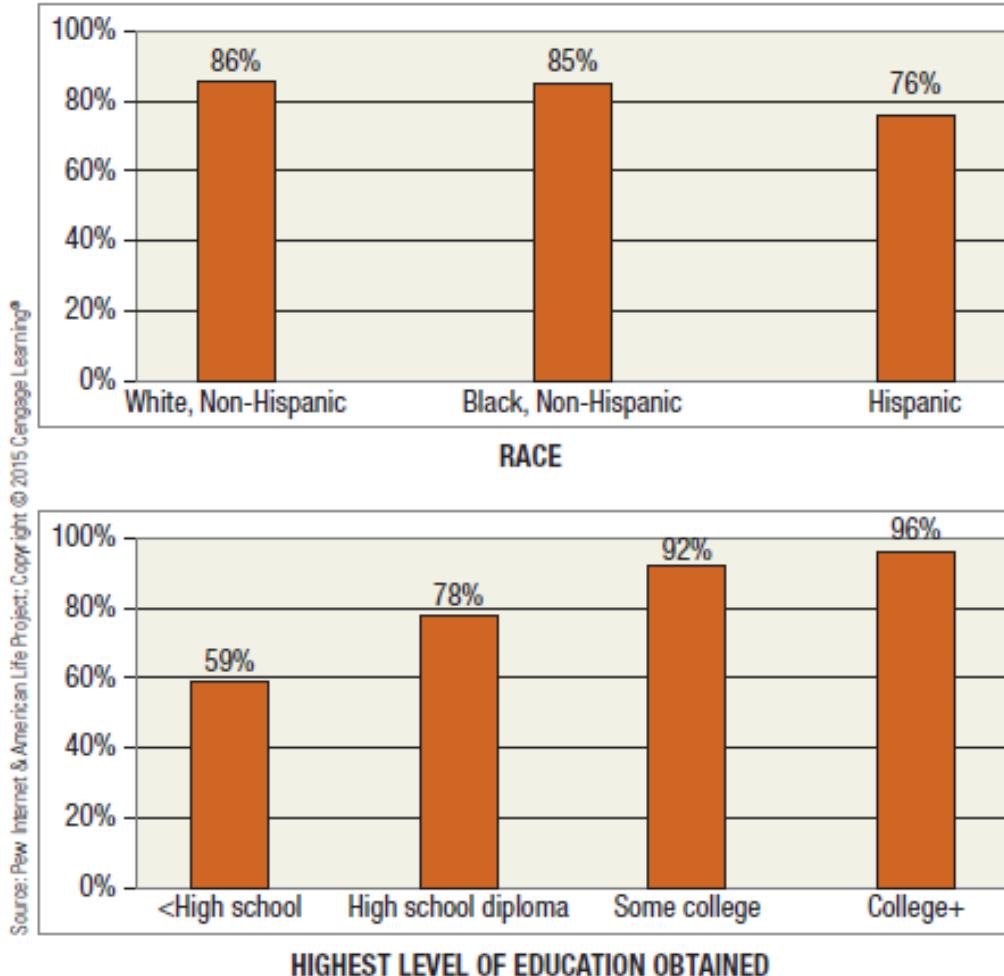


FIGURE 16-27

Key U.S. Internet use statistics. Shows the percent of individuals in each category who use the Internet.



Access to Technology

- The Global Digital Divide
 - Some countries have access to technology and others do not have the same level of access
 - Perhaps more dramatic than the U.S. digital divide
 - More than 2.4 billion people world-wide are online (34% of the world's population)
 - 78% of the North American population is online
 - 15.6% of Africa's population is online
 - Technology can provide telemedicine and education to remote areas



Access to Technology

- New projects are emerging that may help to reduce the global digital divide
 - One Laptop Per Child (OLPC) project
 - Goal is to provide every child in the world with access to a personal connected laptop
 - XO laptop
 - XO tablet available to the general public

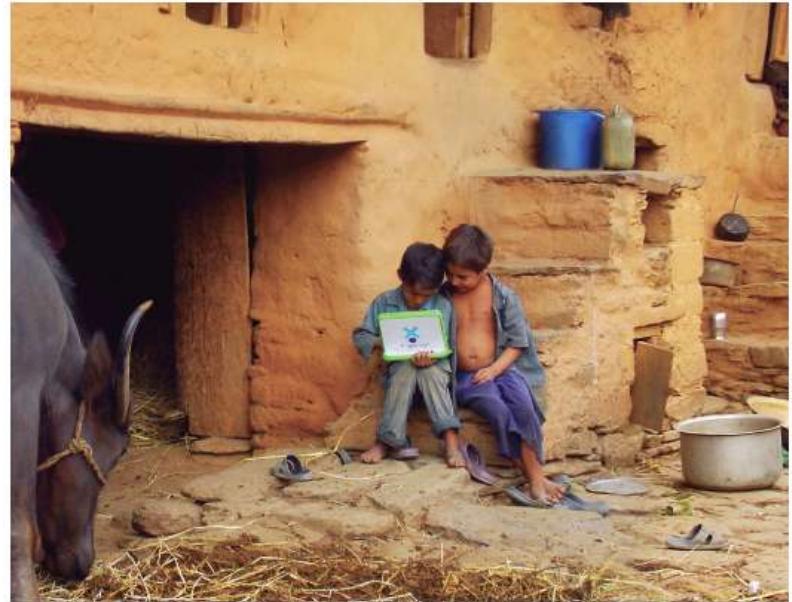


FIGURE 16-28
The OLPC XO laptop.



Access to Technology

- Assistive Technology
 - Hardware and software designed for use by individuals with physical disabilities
 - Much improvement in assistive technology has occurred in recent years
 - Demand from disabled individuals and disability organizations
 - American with Disabilities Act
 - Requires companies with 15 or more employees to make reasonable accommodations for known physical or mental limitations of otherwise qualified individuals, unless doing so results in undue hardship for the company



Access to Technology

- Apps and devices to assist with day-to-day tasks
 - AAC systems
- Assistive Input Systems
 - Braille keyboards
 - Keyguards
 - One-handed keyboards
 - Switches
 - Foot-controlled mice
 - Head pointing systems
 - Eye tracking systems



FIGURE 16-30

AAC systems help individuals with speech disabilities communicate with others.



Access to Technology

Courtesy of Hooton Corporation



Courtesy of Matias Corporation

BRAILLE KEYBOARDS

The keys on this keyboard contain Braille overlays.

ONE-HANDED KEYBOARDS

Each key on this half keyboard contains two letters (one set for the keys on the right half of the keyboard and one set for the left half) so all keys can be reached with one hand.



Courtesy Tobii Technology AB

EYE TRACKING SYSTEMS

Cameras track the user's eye movements, which are used to select icons and other objects on the screen.

FIGURE 16-31

Assistive input devices.



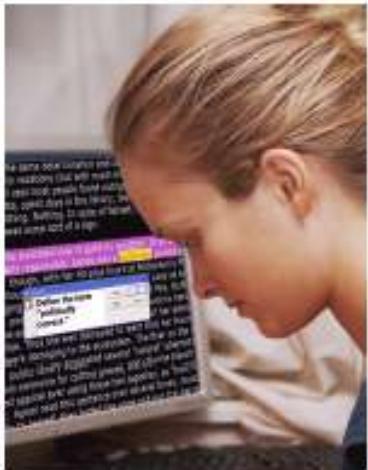
Access to Technology

- Assistive Output Systems
 - Screen readers
 - Braille displays
 - Braille printers
 - Windows and Mac OS include a screen reader, on-screen keyboard, speech recognition capabilities, and settings that can magnify the screen, change text size and color, and convert audio cues into written text



Access to Technology

Courtesy of Fraadom Scientific



SCREEN READER SOFTWARE



BRAILLE DISPLAYS



BRAILLE PRINTERS

FIGURE 16-32

Assistive output
devices.



Quick Quiz

1. Which of the following is NOT an assistive input device?
 - a. Braille display
 - b. Head-pointing system
 - c. One-handed keyboard
2. True or False: Internet addiction affects only teenagers.
3. A device designed to connect a portable computer to conventional hardware such as a keyboard, mouse, and printer is called a(n) _____.

Answers:

1) a; 2) False; 3) docking station



Environmental Concerns

- Green Computing
 - The use of computers in an environmentally friendly manner
 - Energy and paper consumption are key concerns today
 - ENERGY STAR Program
 - Developed to encourage the development of energy-saving devices
 - Eco-labels also used in other countries

U.S. Environmental Protection Agency, ENERGY STAR program; Courtesy of the European Commission; General COURTESY OF ABNT - ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS; Courtesy Good Environmental Choice Australia



UNITED STATES



EUROPEAN UNION



KOREA



BRAZIL



AUSTRALIA

FIGURE 16-33
Eco-labels.



Environmental Concerns

- Energy Consumption and Conservation
 - Power consumption and heat generation by computers are key concerns for businesses
 - More powerful computers use more energy and run hotter, increasing cooling costs
 - Servers are especially power-hungry
 - Some energy-saving features
 - Low-power sleep mode when not in use
 - Energy-efficient flat-panel displays
 - Liquid cooling systems
 - CPUs that power up and down on demand



Environmental Concerns

- Solar power and other alternatives
 - Solar panels convert sunlight into direct current (DC) electricity, which is then stored in a battery
 - Available for a number of applications
 - Solar panels are built into the covers of some computer and tablet cases
 - Portable solar panels can be attached to backpacks and other items
 - Hand-powered chargers can be used with portable computers, smartphones, and other mobile devices



Environmental Concerns

Courtesy Voltaic Systems, Inc.



SOLAR COMPUTER AND TABLET BAGS

Courtesy Voltaic Systems, Inc.



SOLAR-POWERED CHARGERS



HAND-POWERED CHARGERS

FIGURE 16-35

Alternate power.

Solar and hand power can be used to power smartphones, portable digital media players, GPS devices, portable computers, and other devices.



Environmental Concerns

- Green Components
 - Computers run quieter and cooler
 - More recyclable hardware and packaging being used
 - Amount of toxic chemicals in personal computers being reduced
 - Recycled plastics being used in some mobile phones
 - Built-in solar panels can charge devices



Trend Box

Power To Go

- Portable power devices can power your portable computers and mobile devices
- PowerCup inverter
 - Runs off car's battery
- PowerTrekk charger
 - Uses fuel cell technology
 - Water and fuel pucks





Environmental Concerns

- Recycling and Disposal of Computing Equipment
 - Paper-based trash
 - Paperless office basically a myth
 - Almost one-half billion pieces of paper a year generated by printers worldwide
 - Utilities designed to reduce paper consumption
 - GreenPrint, PrintWhatYouLike.com
 - » Eliminate images, blank pages, non-critical content in order to print on the least amount of paper as possible



Environmental Concerns

- E-waste (e-trash)
 - Discarded computer components
 - Current hardware contain a variety of toxic and hazardous materials
 - Global concern is where it all eventually ends up



Copyright Basal Action Network [2013]

FIGURE 16-36

E-waste. E-waste is often exported to developing countries.



Environmental Concerns

- Proper recycling is essential
 - Some recycling centers will accept computer equipment
- Many computer manufacturers have voluntary take-back programs
- Expired toner and ink cartridges can sometimes be returned to manufacturer or exchanged when purchasing new cartridges
- Using recharged printer cartridges saves consumers' money and helps reduce e-waste in landfills



Environmental Concerns

- Can donate obsolete equipment to schools and other organizations
- For security and privacy reasons, all data should be completely removed before disposal or donation

Courtesy Operation Homelink



FIGURE 16-37

Operation Homelink. The family of this soldier about to be deployed to Afghanistan will use this refurbished laptop to communicate with him while he is overseas.



Related Legislation

- There is legislation to protect intellectual property rights, such as:
 - Family Entertainment and Copyright Act of 2005
 - U.S. Anticybersquatting Consumer Protection Act of 1999
 - Digital Millennium Copyright Act (DMCA)
- Ethical legislation is more difficult to pass
 - The 1998 amendment to Section 508 of the Rehabilitation Act requires federal agency information be accessible to persons with disabilities



Related Legislation

- Currently, no federal computer recycling laws are in effect in the U.S.
 - Federal agencies are required to purchase energy-efficient electronic products
- The Sarbanes-Oxley Act and HIPAA established privacy and data protection standards



Quick Quiz

1. Which of the following is NOT a form of alternate power?
 - a. Solar power
 - b. Fuel cell technology
 - c. Eco-label
2. True or False: E-waste is no longer a concern today since modern computers contain very few toxic materials.
3. The _____ makes it illegal to circumvent antipiracy measures built into digital media and devices.

Answers:

- 1) c; 2) *False*; 3) *Digital Millennium Copyright Act (DMCA)*



Summary

- Intellectual Property Rights
- Ethics
- Computers and Health
- Access to Technology
- Environmental Concerns
- Related Legislation