SYSTEM SOFTWARE: OPERATING SYSTEMS AND UTILITY PROGRAMS

Introduction to Information and Communication Technologies

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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 can 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 these programs perform.
7. Describe what the operating systems of the future might be like.

Overview

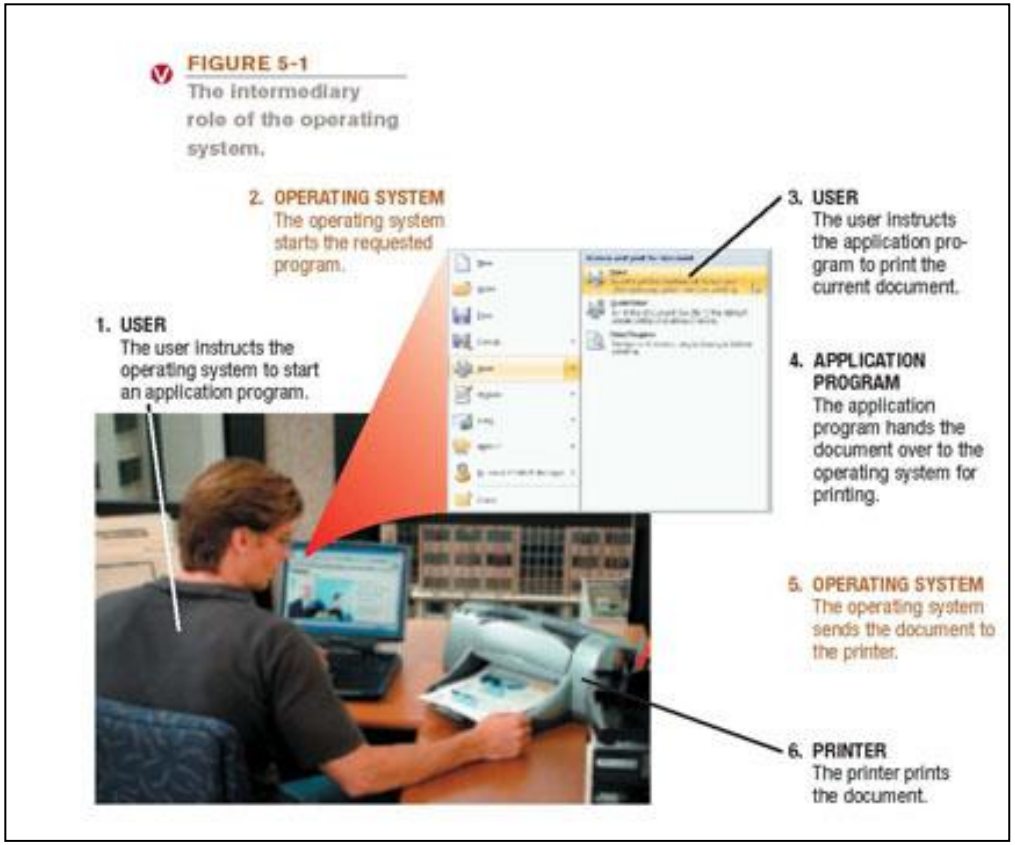
- This chapter covers:
  - Differences between system software and application software
  - Functions of and differences among operating systems
  - Various types of operating systems
  - Functions of and various types of utility programs
  - A look at the possible future of operating systems

System Software and 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 hard drive, and protects from unauthorized use
- Application software: Programs that allow a user to perform specific tasks on a computer
  - Word processing, playing a game, preparing taxes, browsing the Web, and so forth

The Operating System

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



Functions of an Operating System

- Interfacing with users (typically via a GUI)
- Booting the computer
  - Kernel is loaded into memory
  - Processes are started
  - *msconfig* used to control startup of processes
- Configuring devices
  - Device drivers are often needed; can be reinstalled if needed
  - Plug and Play devices are recognized automatically

FIGURE 5-3
Finding new hardware. Most operating systems are designed to detect new hardware and to try to configure it automatically.

Functions of an Operating System

- Managing resources and jobs
  - Makes resources available to devices
  - Monitors for problems
  - Scheduling routines
- File management
  - Keeps track of files stored on computer
  - Hierarchical format
- Security
  - Passwords
  - Biometric characteristics
  - Firewalls

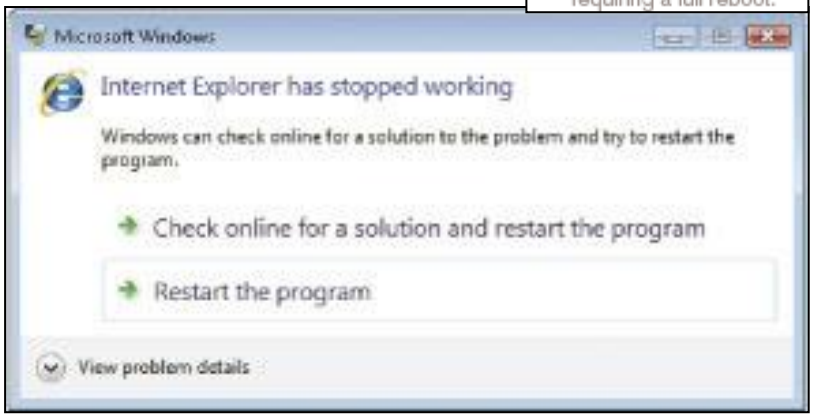


FIGURE 5-4
Program malfunctions. Most operating systems attempt to close only the program causing the problem, rather than requiring a full reboot.

File Management

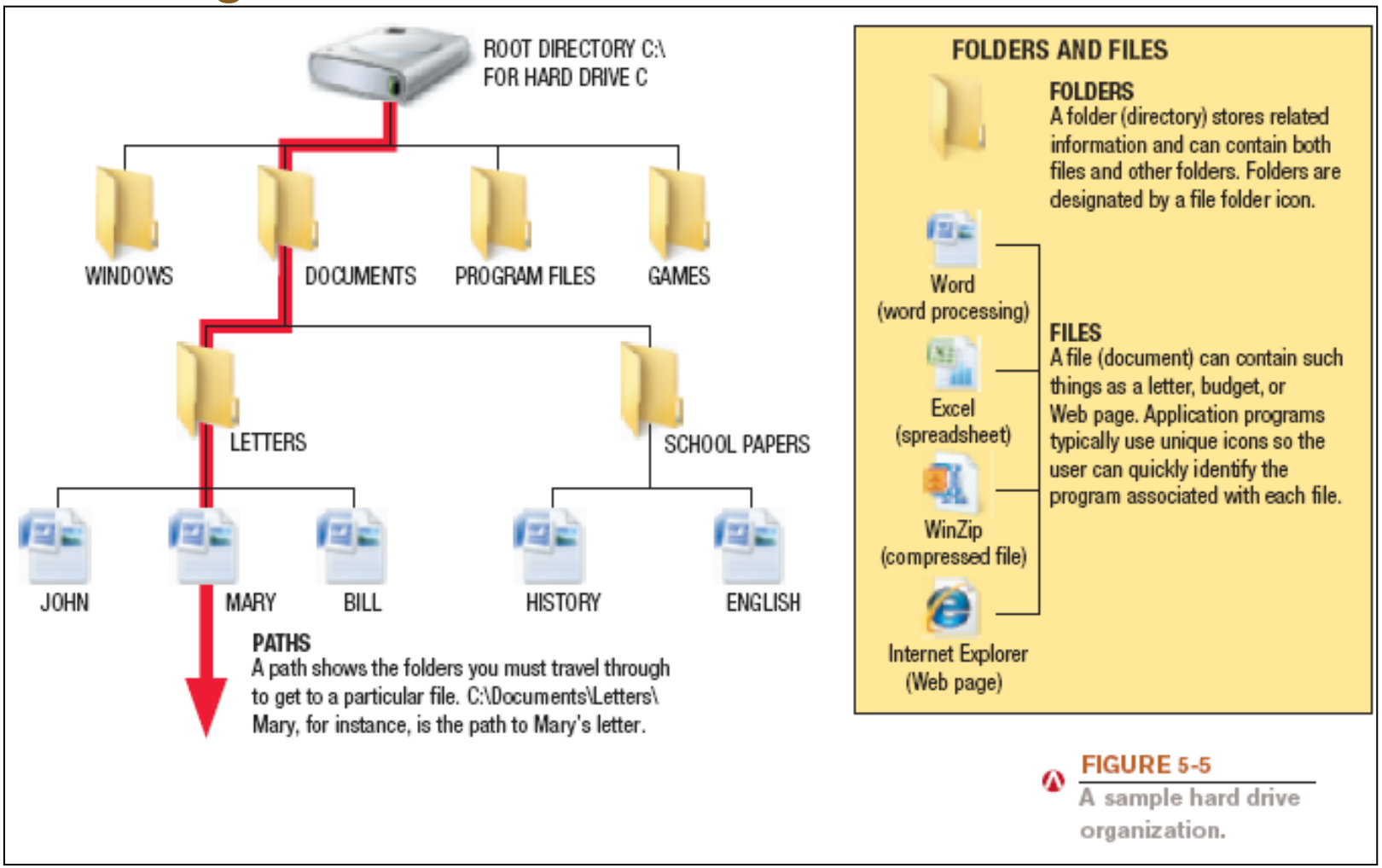


FIGURE 5-5
A sample hard drive organization.

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
- **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 threads

Processing Techniques for Increased Efficiency

- **Multiprocessing and parallel processing**: Multiple processors (or multiple cores) are used in one computer system to perform work more efficiently
  - Simultaneous processing: Performs tasks at the same time
  - Multiprocessing: Each CPU (or core) typically works on a different job
    - Used with personal computers with multi-core processors
  - Parallel processing: CPUs or cores typically work together to complete one job more quickly
    - Used with servers and mainframes

Processing Techniques for Increased Efficiency

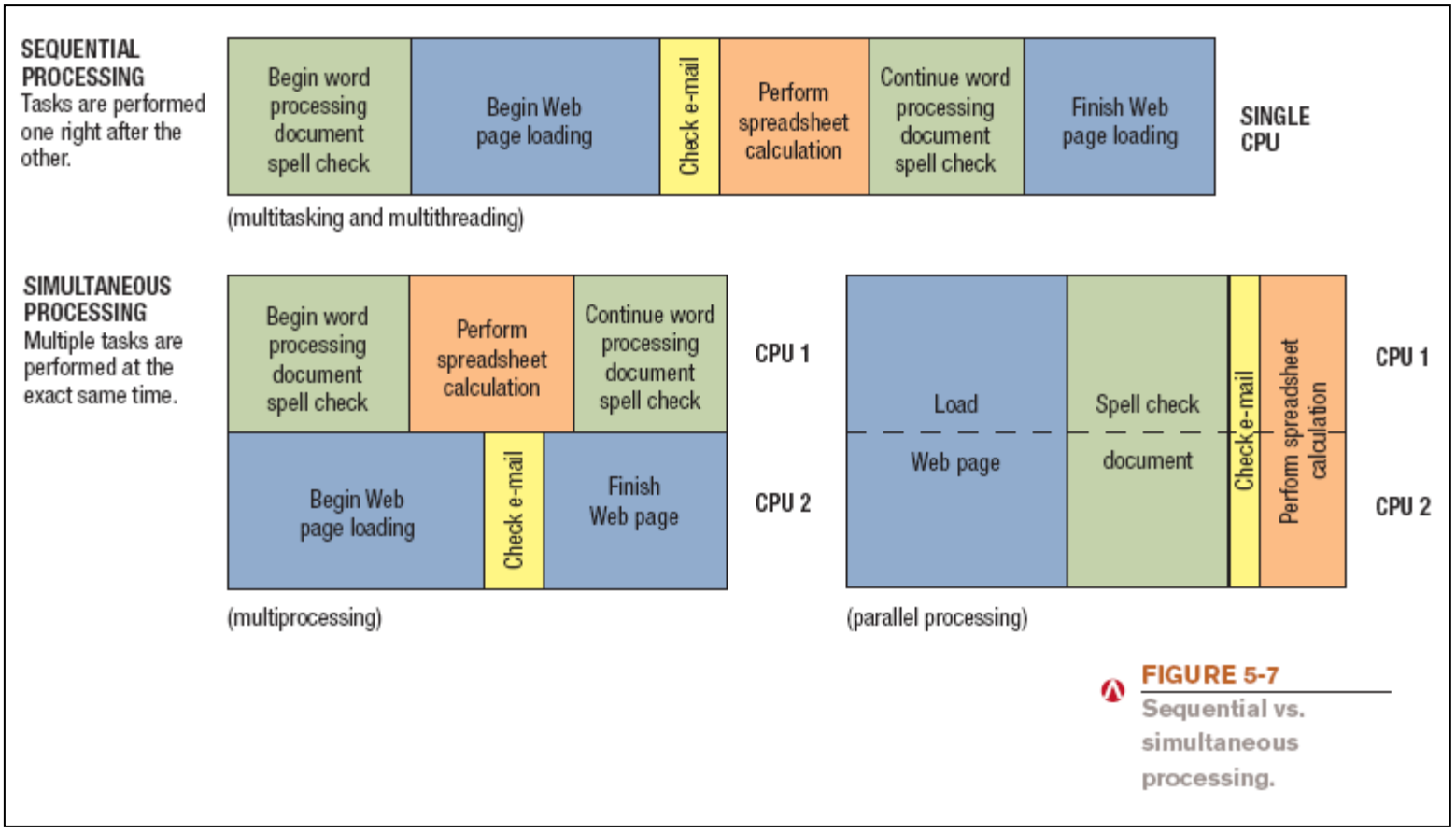


FIGURE 5-7
Sequential vs. simultaneous processing.

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

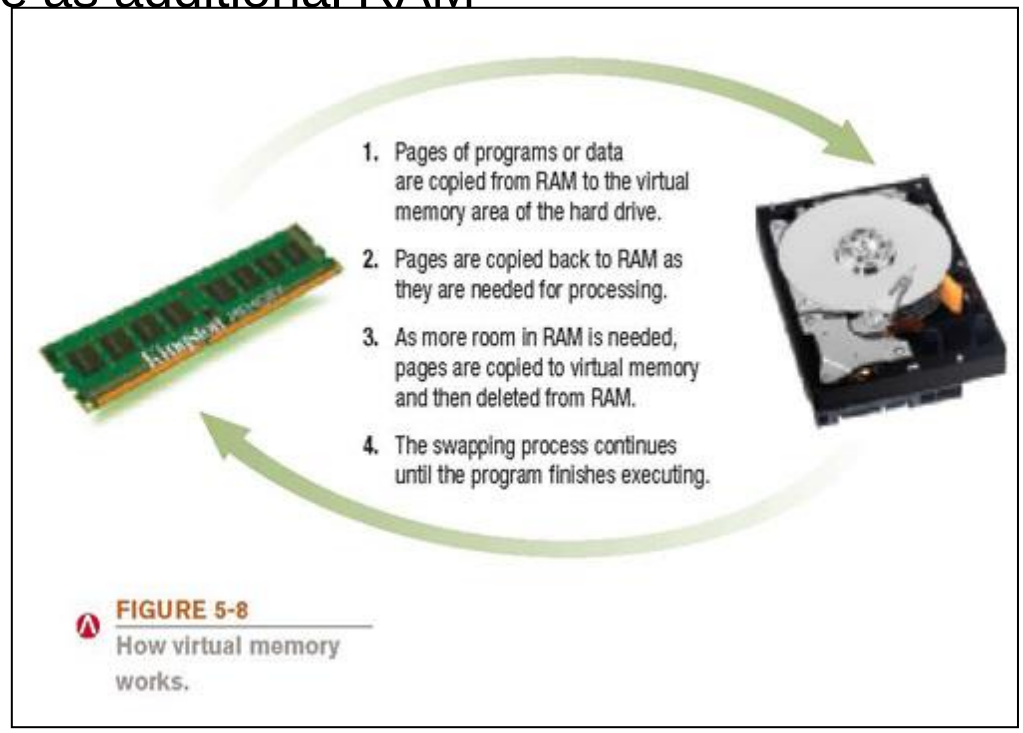


FIGURE 5-8
How virtual memory works.

Processing Techniques for Increased Efficiency

- Buffering and spooling: Used with printers and other peripheral devices
  - Buffer: area in RAM or on the hard drive designated to hold input and output on their way in or out of the system
  - Spooling: placing items in a buffer so they can be retrieved by the appropriate device when needed

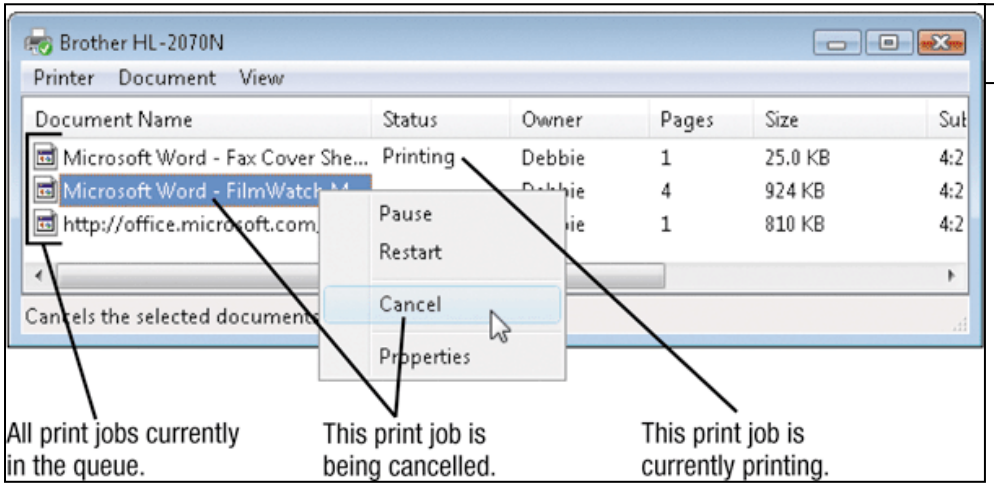


FIGURE 5-9
A print queue.

Quick Quiz

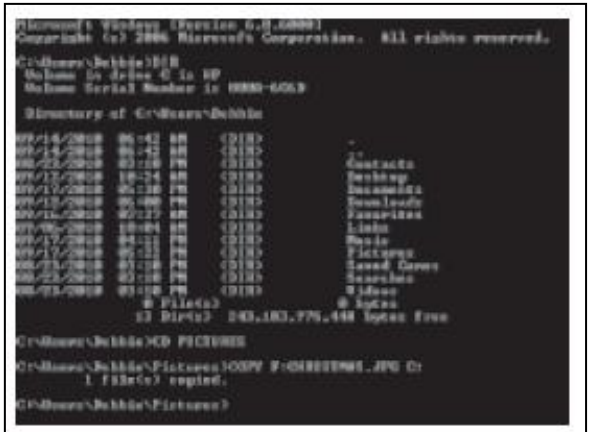
1. Which of the following processing techniques allows a computer to work with more than one program at a time?
   a. Parallel processing
   b. Virtual memory
   c. Multitasking
2. True or False: Most operating systems today use a command line interface.
3. _____ is the task included with operating systems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

Answers:

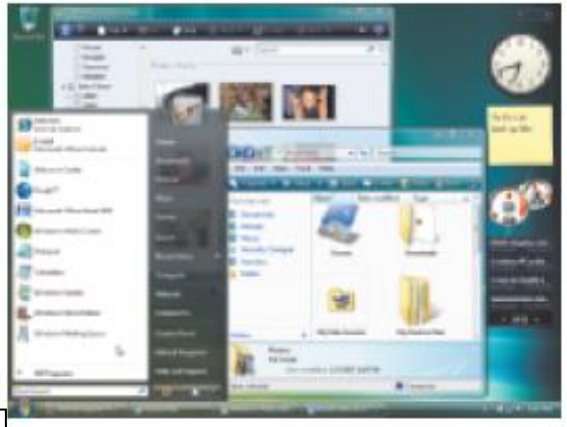
1) c; 2) False; 3) File management

Differences Among Operating Systems

- Command line vs. graphical user interface (GUI)
  - Most operating systems use GUI today



COMMAND LINE INTERFACE
Commands are entered using the keyboard.



GRAPHICAL USER INTERFACE
Icons, buttons, menus, and other objects are selected with the mouse to issue commands to the computer.

FIGURE 5-10
Command line vs. graphical user interfaces.

Differences Among Operating Systems

- Personal vs. server operating system
  - Personal operating system: designed to be installed on a single computer
  - Server operating system: designed to be installed on a network server
    - Client computers still use a personal operating system
    - Server operating system controls access to network resources
  - Many operating systems come in both versions
- Mobile and embedded operating systems also exist

Server Operating Systems

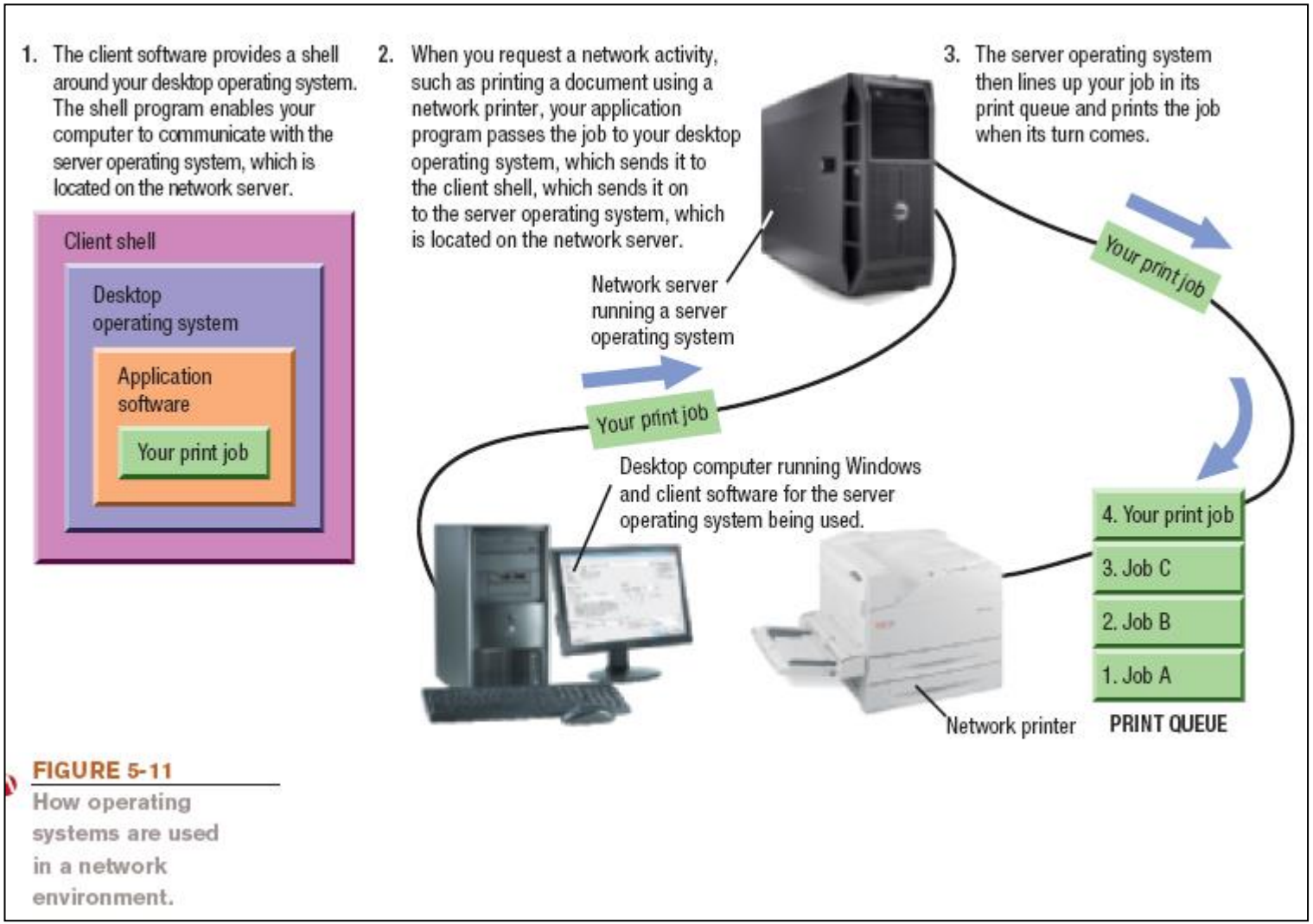


FIGURE 5-11
How operating systems are used in a network environment.

Differences Among Operating Systems

- Types of processors supported
  - Desktop, mobile, server, etc.
- Number of processors
- 32-bit or 64-bit CPUs
- Support for other technologies
  - New types of buses
  - Virtualization
  - Power-saving features
  - Touch and gesture input

Operating Systems for Personal Computers and Servers

- DOS: Disk Operating System
  - PC-DOS: Created originally for IBM microcomputers
  - MS-DOS: used with IBM-compatible computers
  - DOS traditionally used a command-line interface
  - Can enter DOS commands in Windows

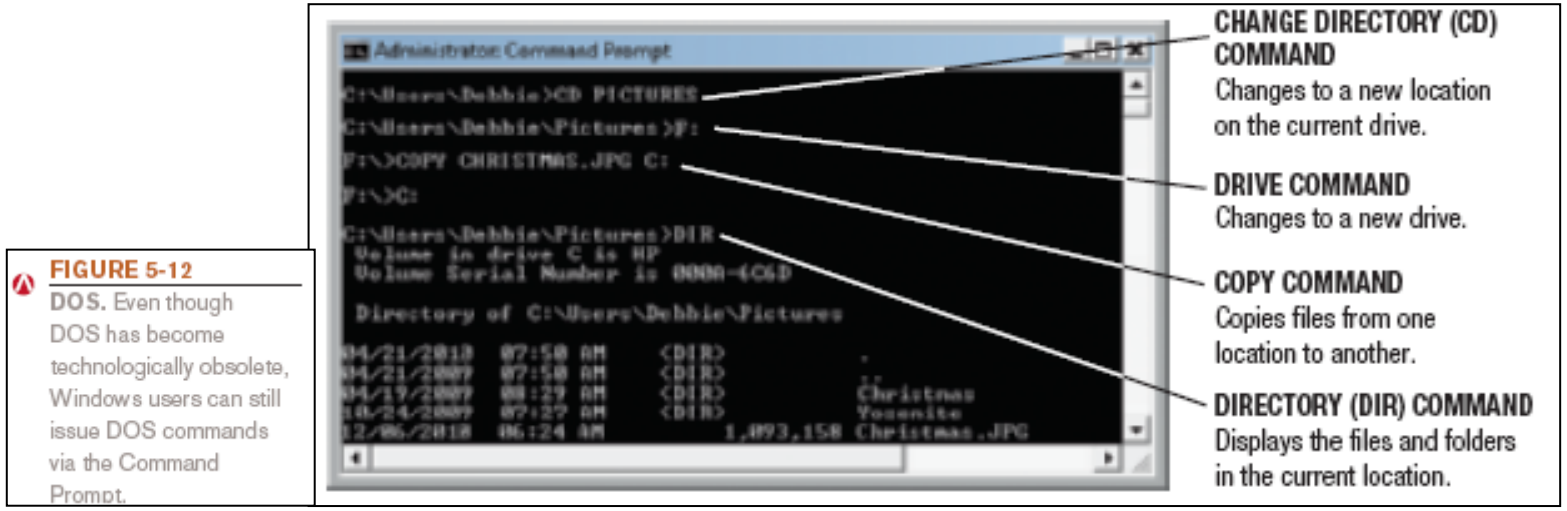


FIGURE 5-12
DOS. Even though DOS has become technologically obsolete, Windows users can still issue DOS commands via the Command Prompt.

Windows

- Windows: The predominate personal operating system developed by Microsoft Corporation
  - Windows 1.0 through Windows 3.x: Operating environments for DOS
  - Windows 95 and Windows 98: Used a similar GUI to the one used with Windows 3.x
  - Windows NT (New Technology): first 32-bit version of Windows designed for high-end workstations and servers
  - Windows Me (Millennium Edition): designed for home computers, improved home networking and a shared Internet connection

Windows

- Windows 2000: replaced Windows NT; was geared towards high-end business workstations and servers, support for wireless devices
- Windows XP: Replaced both Windows 2000 and Windows Me
  - Improved photo, video, and music editing and sharing
  - Improved networking capabilities
  - Support for handwriting and voice input
  - Large user base, MS will support until 2014

Windows

- Windows Vista: Replaced Windows XP
  - Features the Aero visual interface
    - Transparency and animations
    - Live Thumbnails
  - Additional features
    - Sidebar, Instant Search, etc.
  - The Vista Start menu is more streamlined
  - Improved networking and multimedia
  - Built-in security features
  - Hardware requirements for Vista have increased over earlier versions of Windows

Windows Vista

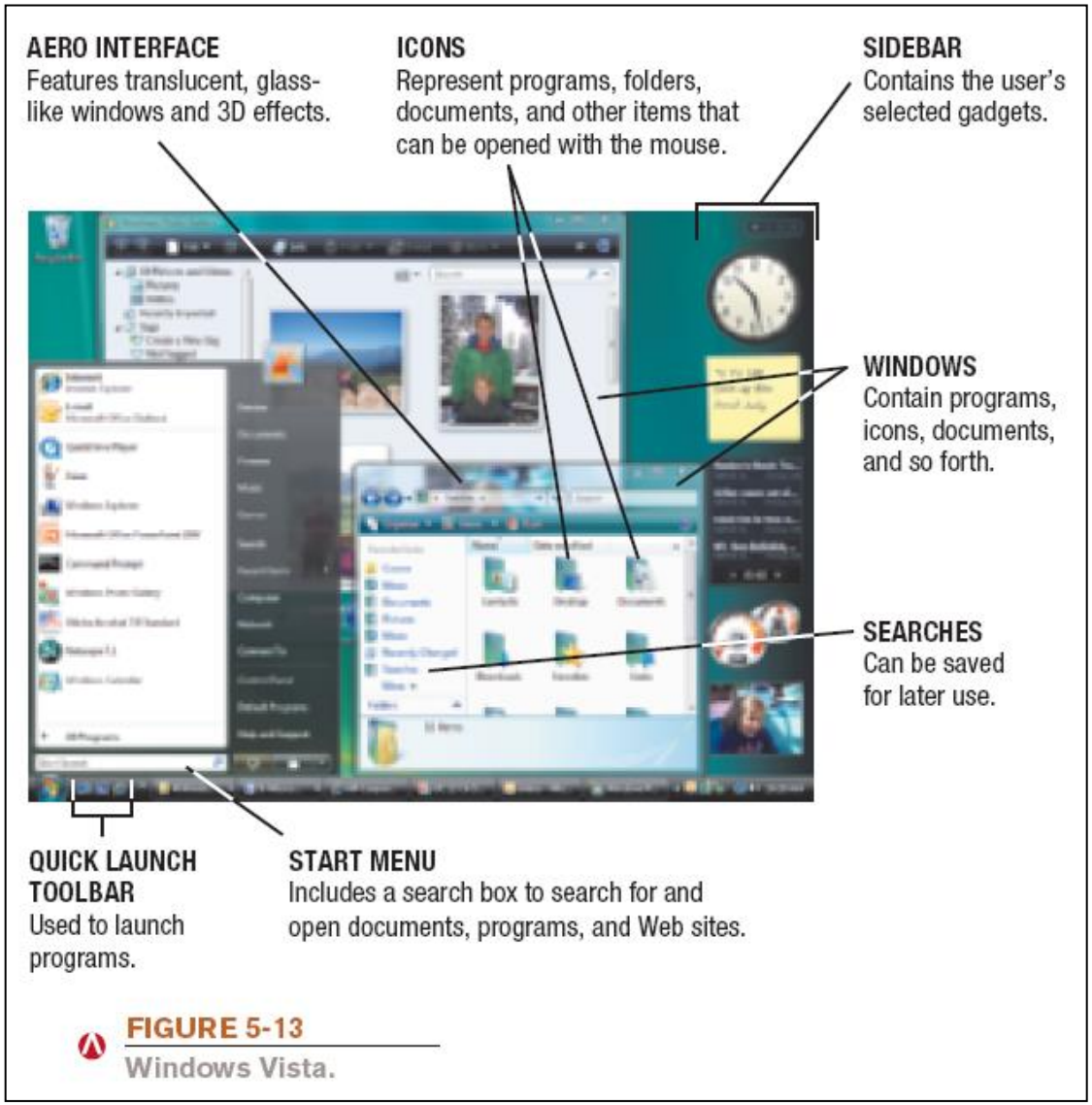
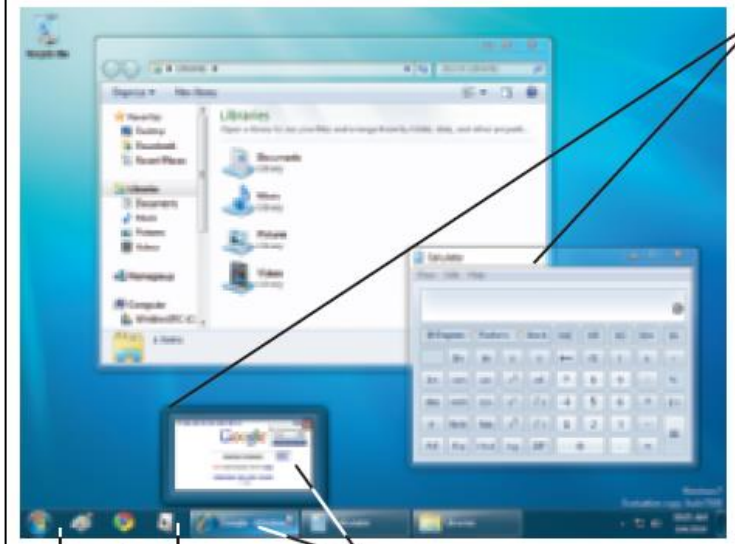


FIGURE 5-13
Windows Vista.

Windows

- Windows 7: Newest version of Windows released Oct. 2009
  - 32-bit and 64-bit versions in four editions
    - Home Premium (primary version for home users)
    - Professional (primary version for businesses)
  - Starts up and responds faster than Vista
  - Will run well on netbooks, unlike Vista
  - Device Stage for all connected devices
  - Improved home networking (HomeGroup, etc.)
  - Jump lists, gadgets, etc.

Windows 7

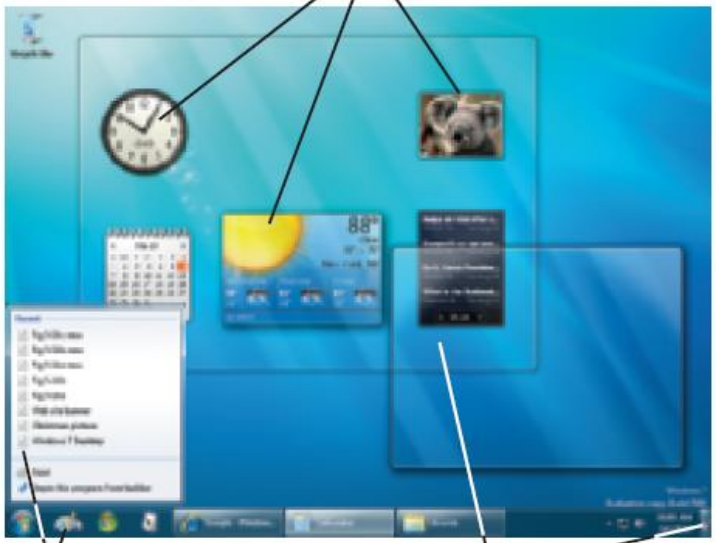


AERO INTERFACE
Windows are still transparent and 3D options (such as Live Thumbnails) are active.

PROGRAM ICONS
Can be pinned to the taskbar.

TASKBAR BUTTONS
Can be rearranged by the user; pointing to a button displays a Live Thumbnail.

DESKTOP GADGETS
Gadgets are now located on the desktop.



JUMP LISTS
Right-click an icon to display the most recent documents for that program.

SHOW DESKTOP
Point to the Show Desktop button to make all windows temporarily transparent.

FIGURE 5-14
Windows 7.

Windows

- Windows Server: Server version of Windows
  - Windows Server 2008: Most recent version
  - Includes a variety of services
    - Web platform
    - Support for virtualization
    - New security tools
    - Streamlined management tools
- Windows Home Server: New operating system based on Windows Server
  - Provides services for a home network
  - Can back up all devices on the network automatically

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 Snow Leopard: Most recent personal version
  - Includes:
    - Safari Web browser
    - New features like Time Machine, Stacks, Quick Look, Boot Camp, etc.
    - More responsive than previous versions

Mac OS

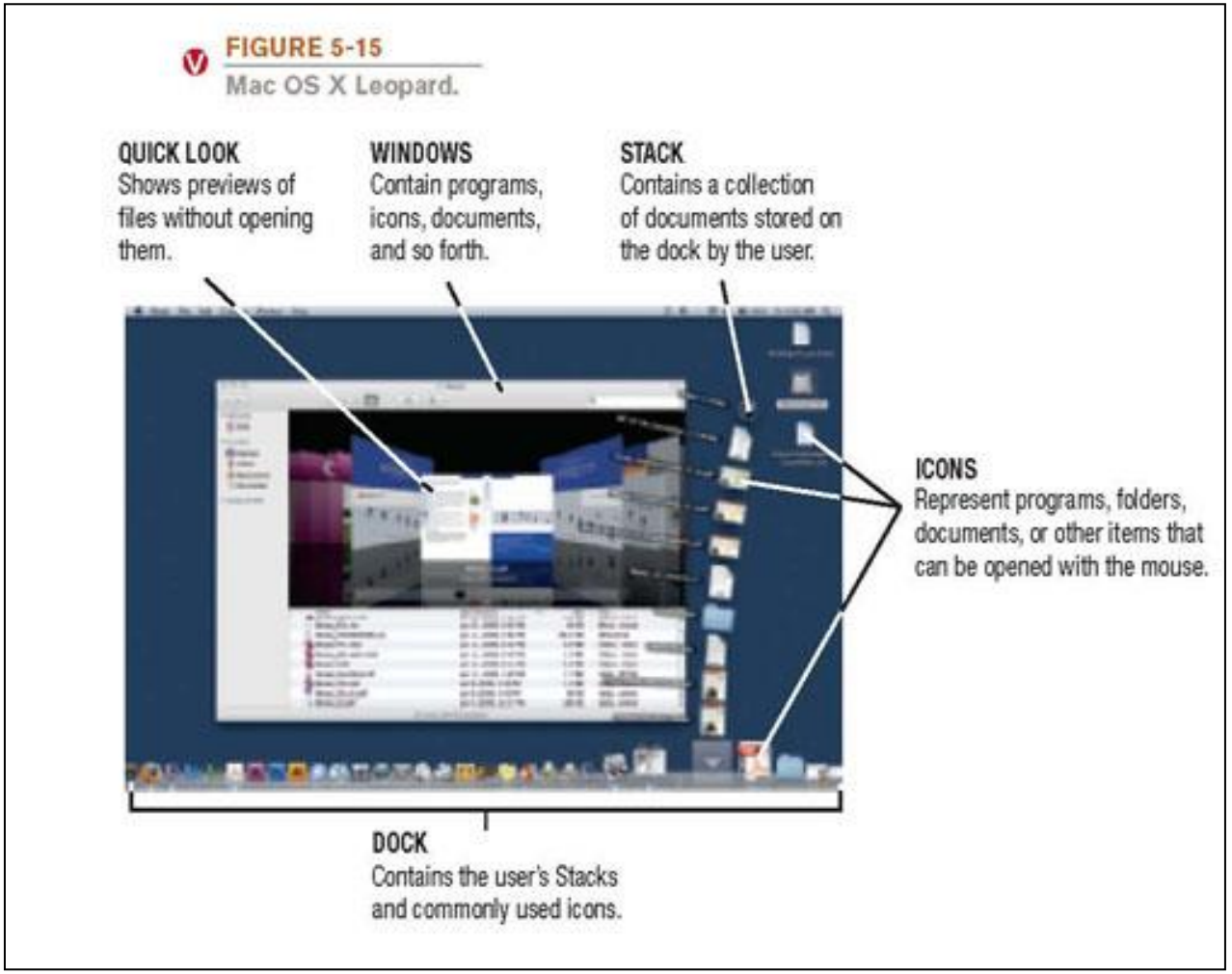


FIGURE 5-15
Mac OS X Leopard.
QUICK LOOK
Shows previews of files without opening them.
WINDOWS
Contain programs, icons, documents, and so forth.
STACK
Contains a collection of documents stored on the dock by the user.
ICONS
Represent programs, folders, documents, or other items that can be opened with the mouse.
DOCK
Contains the user's Stacks and commonly used icons.

UNIX

- UNIX: Operating system developed in the late 1960s for midrange servers
  - Multiuser, multitasking operating system
  - More expensive, requires a higher level of technical knowledge; tends to be 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: Version (flavor) of UNIX available without charge over the Internet
  - Increasingly being used with personal computers, servers, mainframes, and supercomputers
  - 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 Sun, IBM, HP, and Novell
  - Much less expensive than Windows or Mac OS

Linux

FIGURE 5-16

Linux. This version of Linux includes a 3D graphical interface to increase the user's workspace.

Quick Quiz

1. Which of the following is the most recent personal version of Windows?
   a. Windows 7
   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

Operating Systems for Mobile Phones and Other Devices

- Windows Mobile: Designed for mobile phones
  - Look and feel of desktop versions
  - Current version 6.1, next version to be called Microsoft Phone.
- Windows Embedded: Designed for consumer and industrial devices that are not perosonal computers
  - Cash register, GPS devices, ATMs, medical devices and robots.
  - Windows Automotive and Microsoft Auto for cars
    - Ford Sync
- Android: Linux based OS developed by Open Handset Alliance (including Google)

Operating Systems for Mobile Phones and Other Devices

- iPhone OS: Designed for Apple Mobile phones and mobile devices.
- BlackBerry Operating System: Designed for BlackBerry devices
- Palm OS and Palm webOS: Designed for Palm devices
- Symbian OS: Designed for use with smart phones
- Embedded Linux: Used with mobile phones, GPS devices, and other mobile devices

Operating Systems for Mobile Phones and Other Devices

WINDOWS MOBILE ANDROID

IPHONE OS BLACKBERRY OS

FIGURE 5-17
Examples of mobile operating systems.

Operating Systems for Larger Computers

- Larger computers sometimes use operating systems designed solely for that type of system
- IBM's z/OS and i/5OS operating systems are designed for their servers and mainframes
- Windows, UNIX, and Linux are also used with both mainframes and supercomputers
- Often a group of Linux computers are linked together to form what is referred to as a Linux supercomputing cluster

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

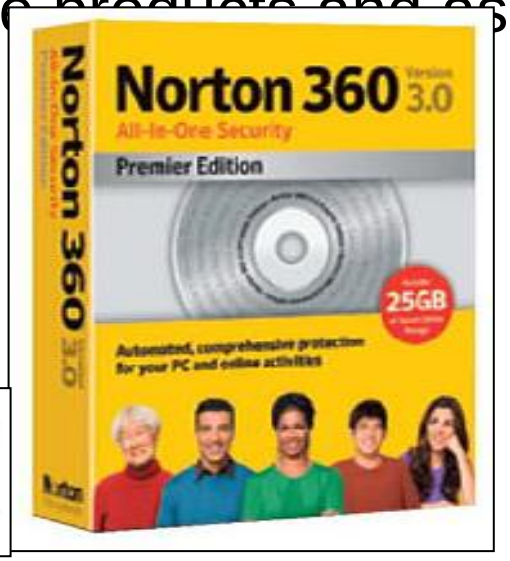


FIGURE 5-18
Utility suites. Utility suites contain a number of related utility programs.

File Management Programs

- 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 is Windows Explorer

Using Windows Explorer

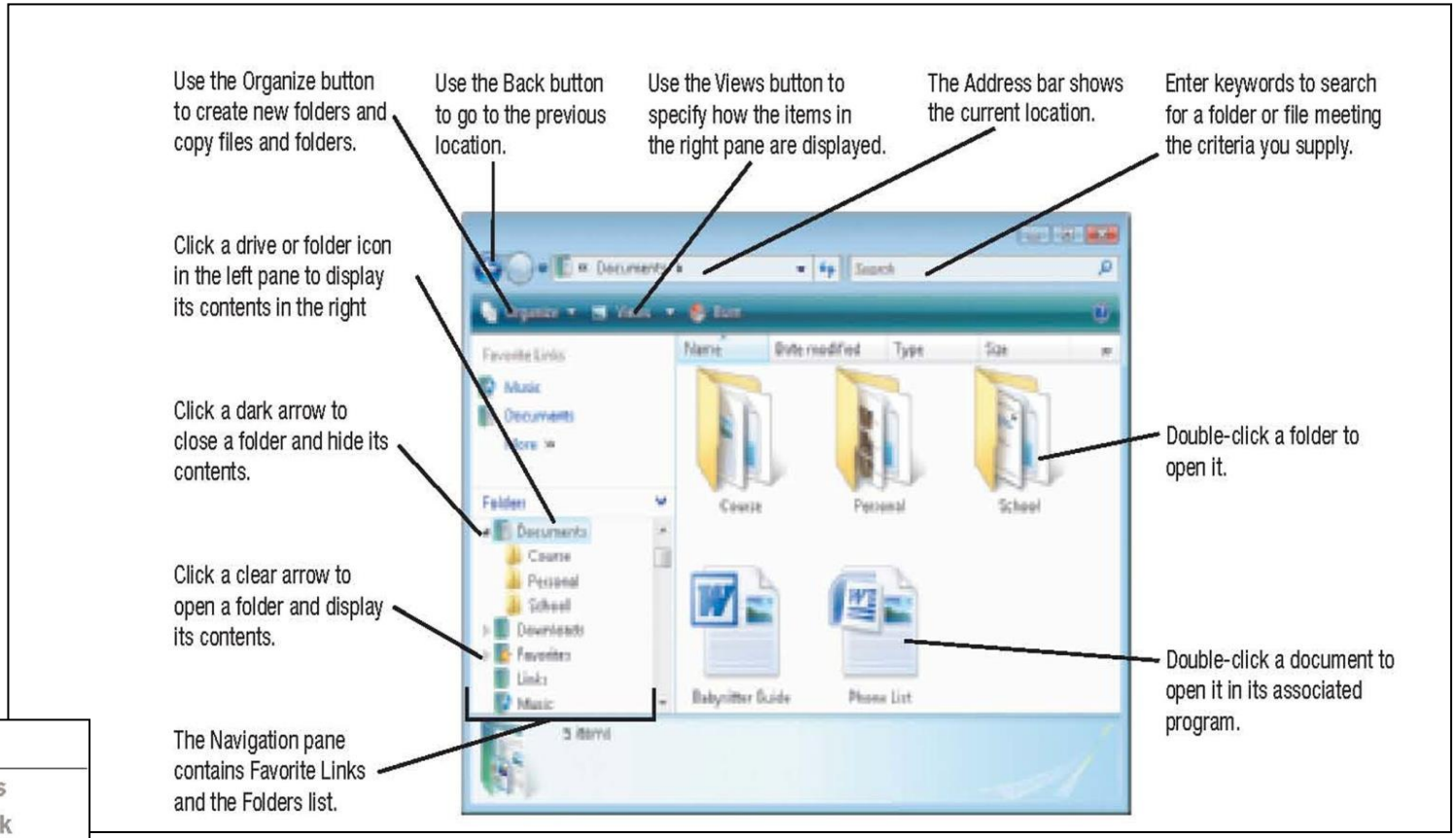


FIGURE 5-19
Using Windows Explorer to look at the contents of a computer.

Using Windows Explorer

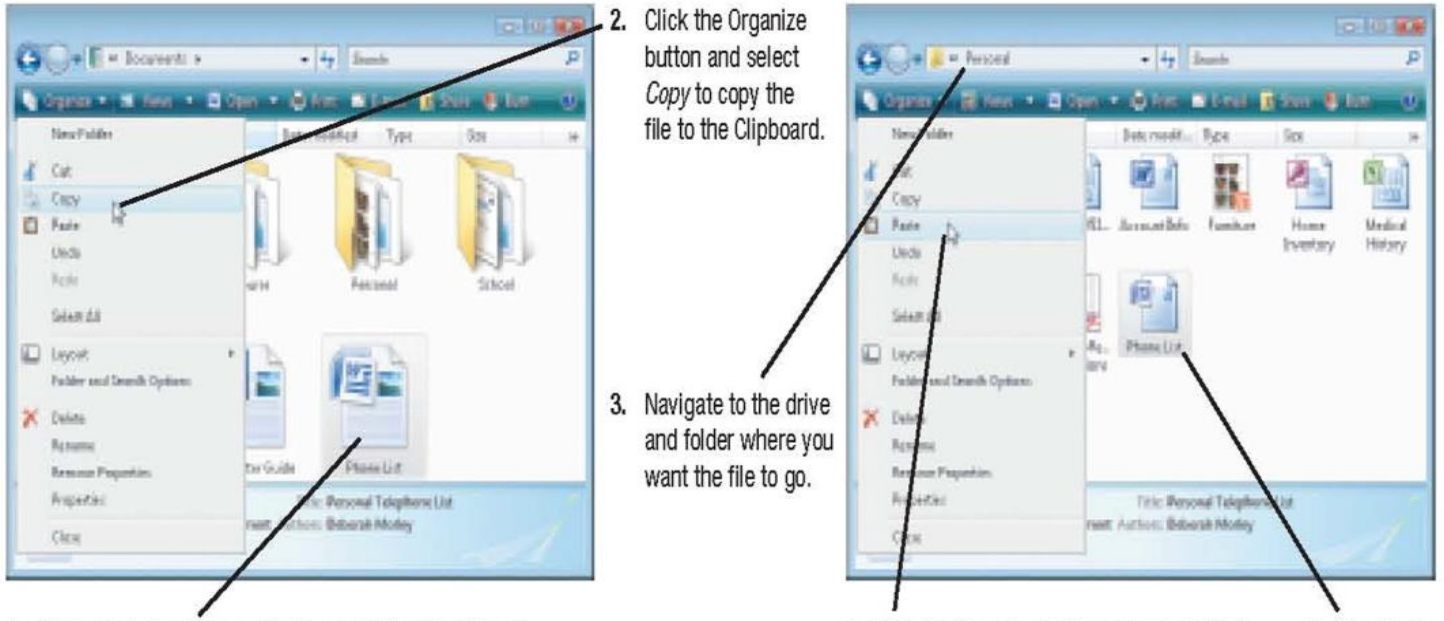


FIGURE 5-20
Using Windows Explorer to copy files.

Utility Programs

- Search tools: Designed to search for files on the user's hard drive
  - Windows includes search tools
- 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
- Uninstall utilities: Remove programs from your hard drive without leaving bits and pieces behind
  - Important to properly uninstall programs, not just delete them

Utility Programs

- Clean up utilities: Delete temporary files
- File compression programs: Reduce the size of files so they take up less storage space on a storage medium or can be transmitted faster over the Internet
  - Both zip and unzip files
  - WinZip (Windows users) and Stuffit (Mac users)

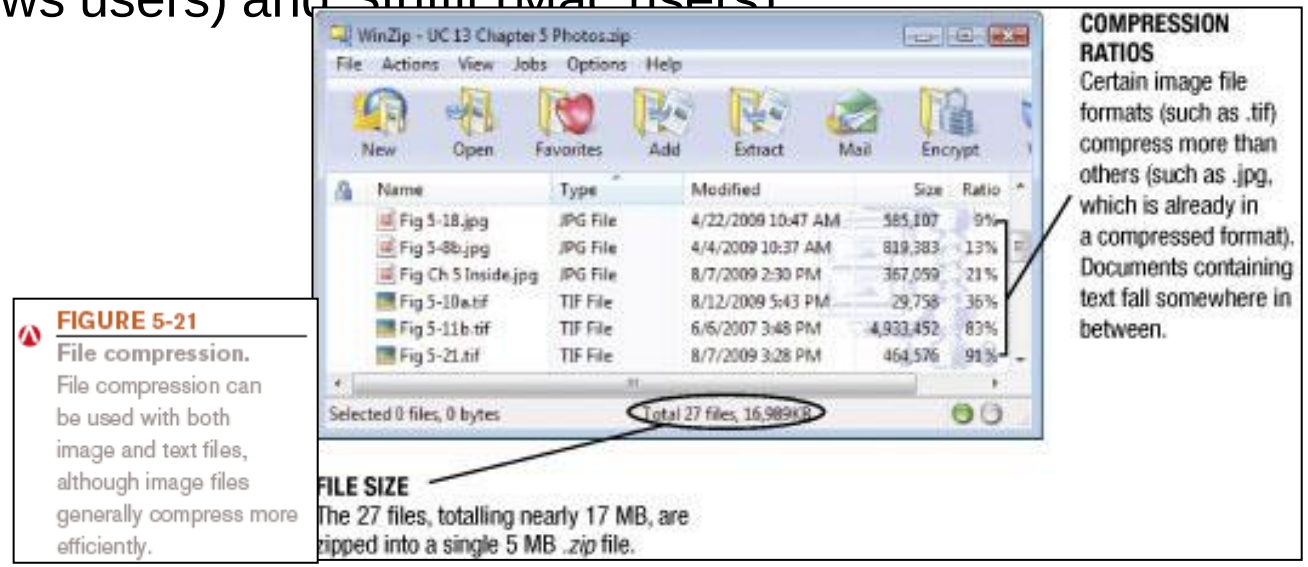
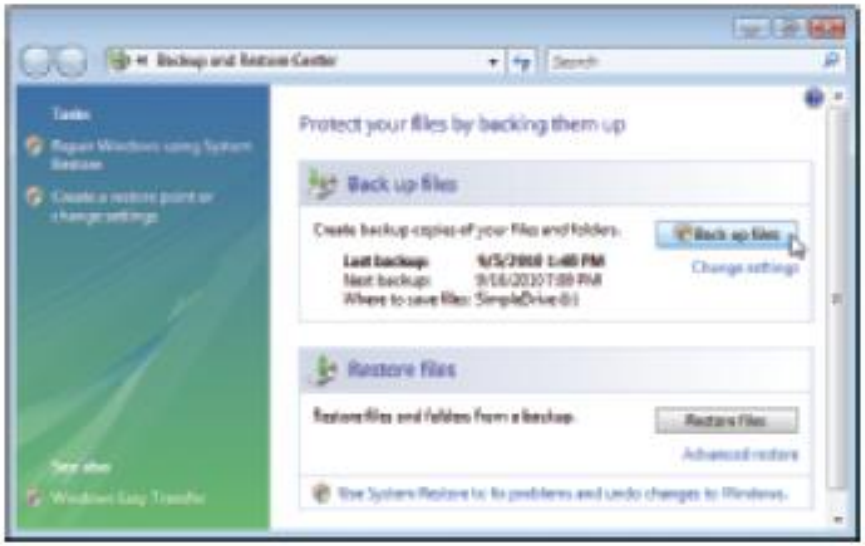


FIGURE 5-21
File compression. File compression can be used with both image and text files, although image files generally compress more efficiently.

Utility Programs

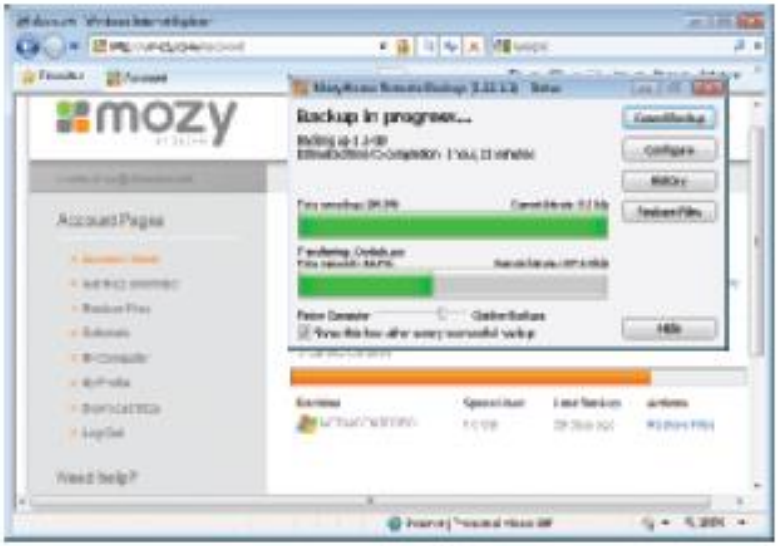
- Backup and recovery utilities: Make the backup and restoration process easier
  - Backup: Duplicate copy of data or other computer content
  - Good backup procedures are critical for businesses
  - Individuals should back up important documents, e-mail, photos, home video, etc.
  - Store backup data on a CD or DVD, second hard drive, flash memory drive, or upload to the Internet
  - Back up your entire computer once all programs have been installed, so your system can be restored to that configuration.

Backup Programs



WINDOWS BACKUP PROGRAM

Allows you to back up files to the desired backup medium manually or on a regular basis automatically.



WEB-BASED BACKUP SERVICE

Allows you to back up files to a secure Web site.

FIGURE 5-22

Backup utilities.

Utility Programs

- Security programs: Protect computers and users
  - Antivirus programs
  - Antispyware programs
  - Firewalls
  - Many are included in Windows and other operating systems
  - Discussed in detail in Chapter 9

The Future of Operating Systems

- Will continue to become more user-friendly
- Will eventually be driven primarily by a voice interface
- Likely to continue to become more stable and self-healing
- Will likely continue to include improved security features and to support multiple processors and other technological improvements
- 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