Understanding Computers

11th Edition

TODAY AND TOMORROW

CHAPTER 6

System Software: Operating Systems and Utility Programs

Learning Objectives

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

Learning Objectives, *Cont'd*

- State several devices other than desktop PCs and servers that require an operating system and list one possible operating system for each type of device.
- Discuss the role of utility programs and outline several duties these programs can perform.
- Describe what the operating systems of the future may 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 vs. Application Software

- **System software:** acts as a mediator between application programs and the computer system's hardware, as well as between the PC and the user

- **Application software:** programs that allow a user to perform specific tasks on a computer, such as 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

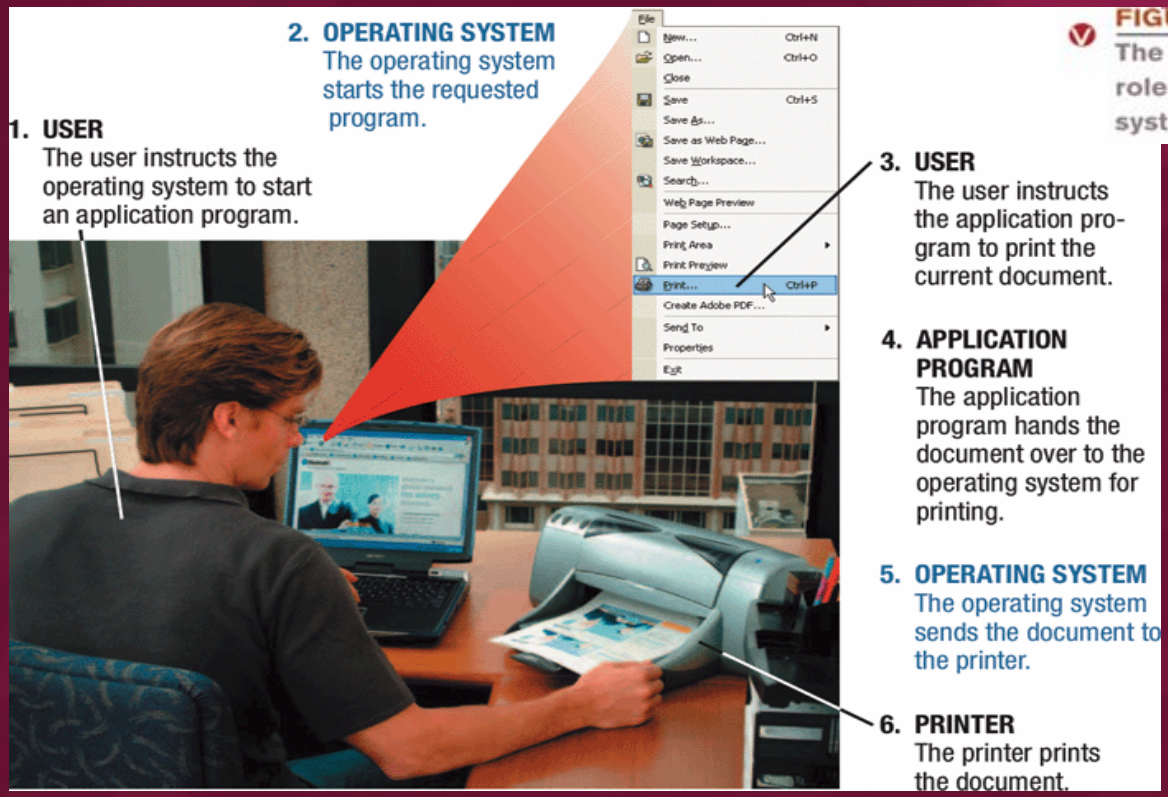


FIGURE 5-1
The intermediary role of the operating system.

Functions of an Operating System

- Interfacing with users (typically via a *GUI*)
- Booting the computer
- Configuring devices
  - **Device drivers** are often needed
  - *Plug and Play* devices are recognized automatically
- Managing and monitoring resources and jobs
- File management
- Security

Functions of an Operating System, *Cont'd*

- File management
  - Filename rules vary with each operating system
  - File extensions are often added automatically
- Security
  - Protect access to resources via *passwords* or other security procedures
  - Many operating systems include a *firewall*
  - Security capabilities are often upgraded via *security patches*

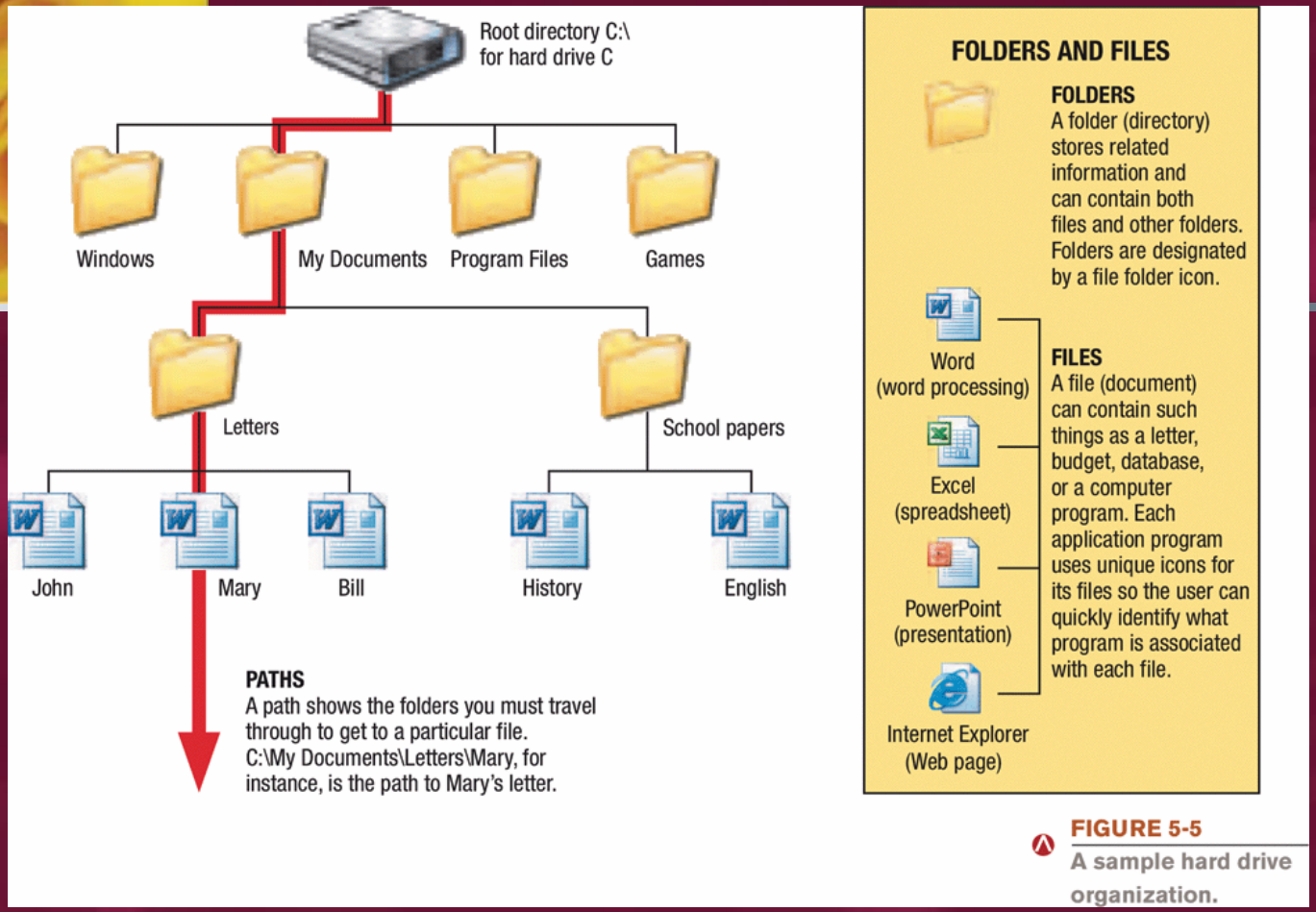


FIGURE 5-5
A sample hard drive organization.

FIGURE 5-6
Common file extensions.

WIDELY USED FILE EXTENSIONS
DOCUMENTS
.doc .txt .htm .html .mht .mhtml .xml .xls .mdb .ppt .rtf .pdf
PROGRAMS
.com .exe
GRAPHICS
.bmp .tif .jpg .eps .gif .png .pcx .svg
AUDIO
.wav .au .mp3 .snd .aiff .midi .aac .wma .ra
VIDEO
.mpg .mov .avi .mpeg .rm .wmv .asf
COMPRESSED FILES
.zip .sit .sitx .tar

Processing Techniques for Increased Efficiency

- **Multitasking:** the ability of an operating system to work with more than one program (*task*) at one time
  - CPU rotates between tasks (concurrent processing)
- **Multithreading:** the ability to run multiple *threads* for a program at one time so that processing is completed faster and more efficiently
  - ***Thread:*** sequence of instructions within a program that is independent of other threads
  - Concurrent processing

Processing Techniques for Increased Efficiency, *Cont'd*

- **Multiprocessing:** multiple processors are used in a single computer, usually to process multiple jobs at one time faster than with a single processor
  - Simultaneous processing
  - Used with servers and mainframes; used with desktop PCs now (dual-core processors)
- **Parallel processing:** multiple processors are used in a single computer, usually to process a single job faster (simultaneous processing)
- **Coprocessing:** utilizing special processors for specialized chores (e.g. *math* or *graphics coprocessor*)

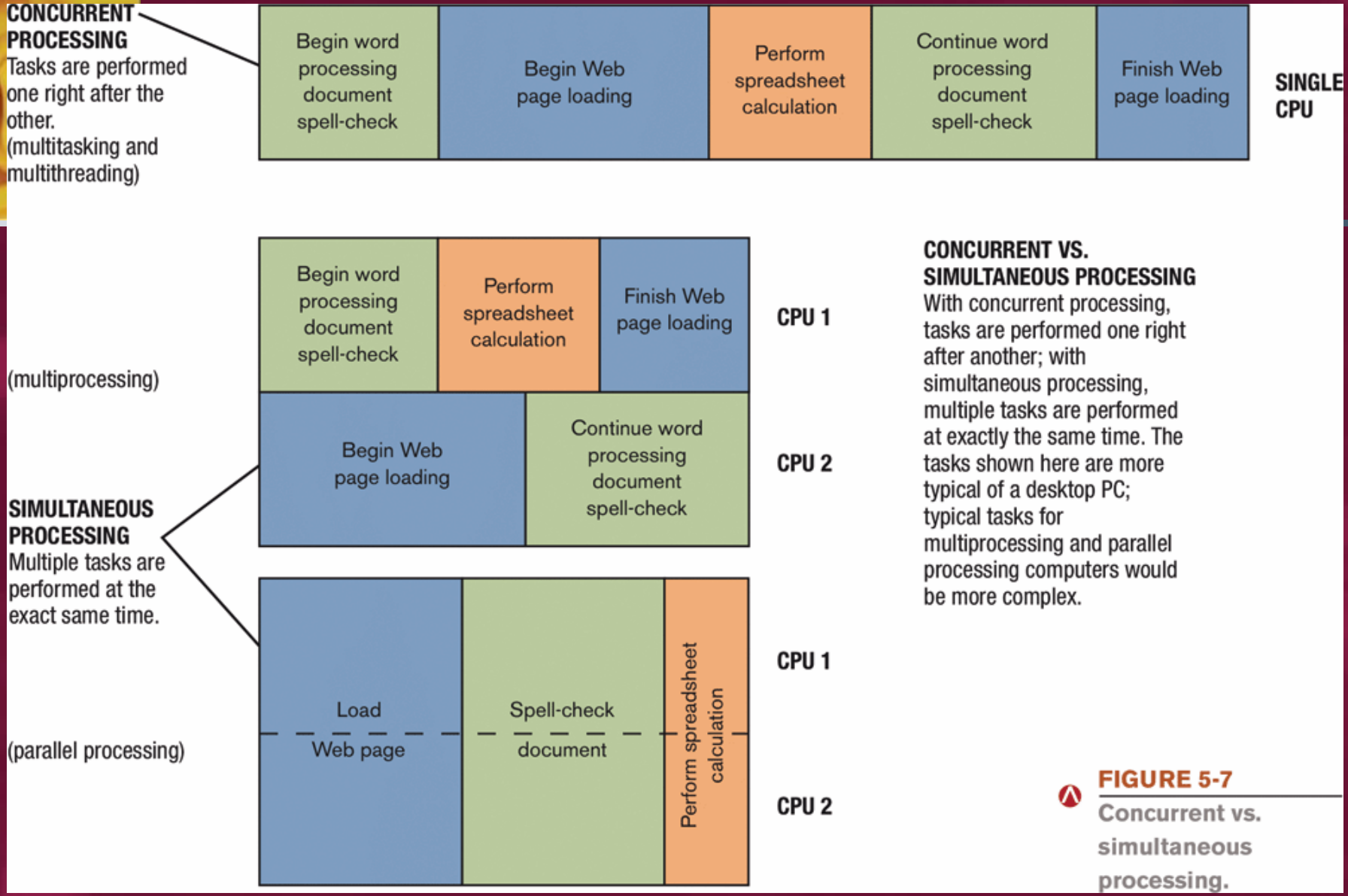


FIGURE 5-7
Concurrent vs. simultaneous processing.

Processing Techniques for Increased Efficiency, *Cont'd*

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

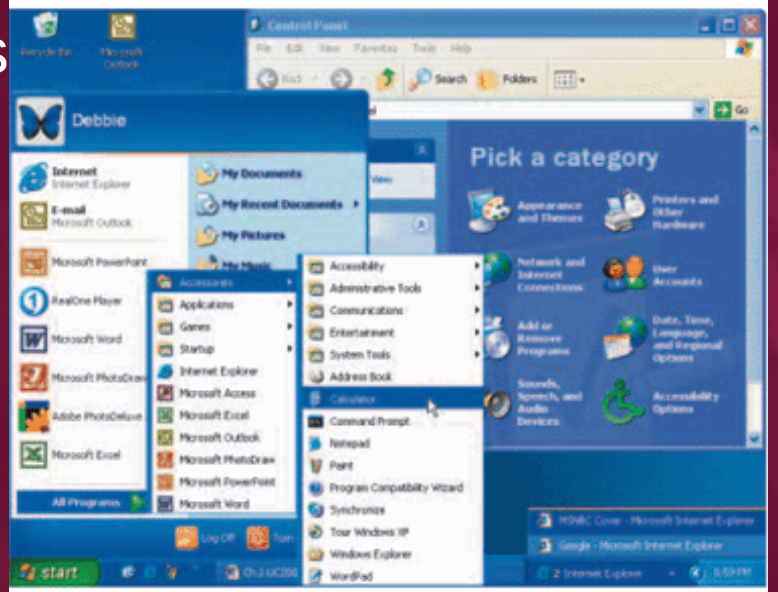
Differences Among Operating Systems

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

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

```
C:\WINDOWS>cd..

C:\>cd mydocu~1

C:\My Documents>dir

 Volume in drive C has no label
 Volume Serial Number is 1338-14DC
 Directory of C:\My Documents

.              <DIR>          07-19-01  1:34p .
..             <DIR>          07-19-01  1:34p ..
MYPICT~1       <DIR>          07-19-01  1:38p My Pictures
MYWEBS~1       <DIR>          07-26-01  8:59p My Webs
FAXTEM~1 DOC         20,480   08-21-01  7:37a Fax template.doc
COMPAN~1 JPG         12,009   08-27-01  6:46a Company logo.jpg
DIGITA~1 BMP         90,038   03-01-01 12:11p Digital signature Morley.bmp
MYMUSI~1       <DIR>          10-11-01  7:57a My Music
MYEBOO~1       <DIR>          10-24-01  1:46p My eBooks
HOMEWORK       <DIR>          10-24-01  3:54p Homework
        3 file(s)        122,527 bytes
        7 dir(s)      33,944.47 MB free

C:\My Documents>
```

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 PC.

Differences Among Operating Systems, *Cont'd*

- Personal vs. server operating system
  - **Personal operating system:** designed to be installed on a single PC
  - **Server operating system:** designed to be installed on a network server
    - **Client PCs still use a personal operating system**
    - **Server operating system controls access to network resources**
  - Many operating systems come in both versions

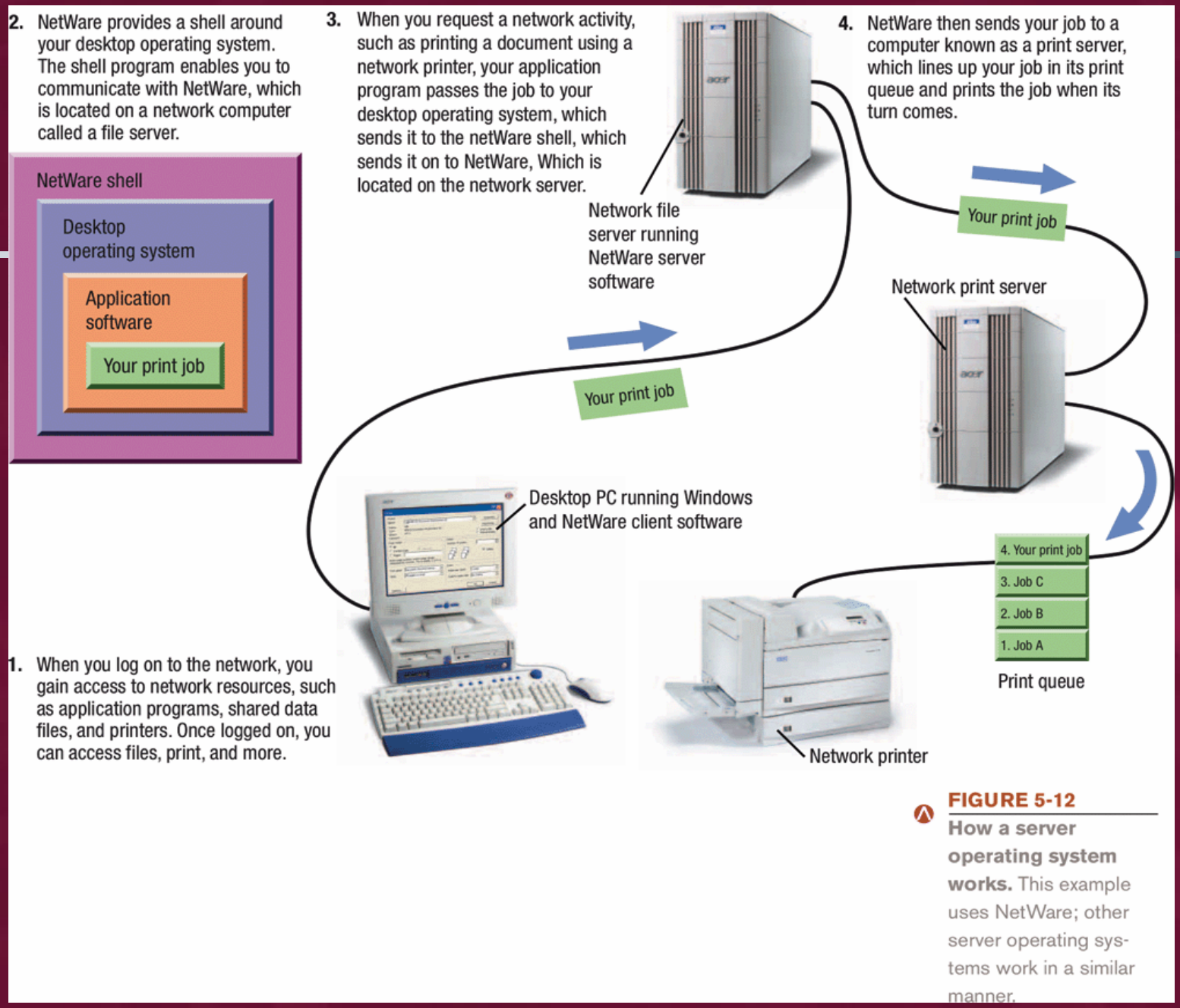


FIGURE 5-12
How a server operating system works. This example uses NetWare; other server operating systems work in a similar manner.

Differences Among Operating Systems, *Cont'd*

- There are also *mobile* and *embedded operating systems*
- Most operating systems are designed for a specific type of processors (desktop CPUs or server CPUs, for instance)
- Also usually designed for either 32-bit or 64-bit PCs

Operating Systems for Desktop PCs and Servers

- Operating systems are usually designed for use on either:
  - Desktop PCs (personal operating systems)
  - Network servers (network operating systems)
- Many operating systems are available in both personal and server versions
- Older operating system is *DOS*; most PCs today run *Windows, Mac OS,* or *Linux*

DOS

- The operating system designed for and widely used on early IBM and IBM-compatible PCs
- There were two primary forms of DOS:
  - *PC-DOS:* created originally for IBM microcomputers
  - *MS-DOS:* used with IBM-compatible PCs
- DOS traditionally used a command-line interface
- Not widely used today

```
C:\WINDOWS>cd..

C:\>cd mydocu~1

C:\My Documents>dir

 Volume in drive C has no label
 Volume Serial Number is 1338-14DC
 Directory of C:\My Documents

.              <DIR>          07-19-01   1:34p .
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MYMUSI~1       <DIR>          10-11-01   7:57a My Music
MYEBOO~1       <DIR>          10-24-01   1:46p My eBooks
HOMEWORK       <DIR>          10-24-01   3:54p Homework
         3 file(s)        122,527 bytes
         7 dir(s)      33,944.47 MB free

C:\My Documents>
```

FIGURE 5-13

DOS. Even though DOS has become technologically obsolete, some PCs still use it. This table lists some of the most commonly used DOS commands, and the screen shows DOS in action.

COMMAND	DESCRIPTION	EXAMPLE	EXPLANATION
COPY	Copies individual files	**COPY BOSS A:WORKER**	Makes a copy of the file BOSS located in the current directory on the current disk and stores it on the disk in the A drive using the filename WORKER.
DIR	Displays the names of files on a disk	**DIR A:**	Displays names of files stored on the disk in the A drive.
DEL	Deletes individual files	**DEL A:DOLLAR**	Deletes the file DOLLAR from the disk in the A drive.
REN	Renames individual files	**REN SAM BILL**	Changes the name of the file SAM located in the current directory on the current disk to BILL.
CD	Changes to a new directory	**CD HOMEWORK**	Changes the current directory to HOMEWORK, located one level down from the current location on the current disk.
FORMAT	Prepares a disk for use, erasing what was there before	**FORMAT A:**	Formats the disk in the A drive.

Windows

- **Windows**: the primary PC operating system developed by Microsoft Corporation
- *Windows 1.0* through *Windows 3.x*: *operating environments* for DOS, not full-fledged operating systems
- *Windows 95* and *Windows 98:* both used a similar GUI to the one used with Windows 3.x
- *Windows 98 Second Edition* (*SE*): update to Windows 98, released in 1999; still an installed base of older PCs running Windows 98 SE

Windows, *Cont'd*

- *Windows NT (New Technology):* first 32-bit version of Windows designed for high-end workstations and servers
- *Windows Me (Millennium Edition):* designed for home PCs, improved home networking and a shared Internet connection
- *Windows 2000:* replaced Windows NT; was geared towards high-end business workstations and servers, support for wireless devices

Windows, *Cont'd*

- **Windows XP:** latest personal version of Windows; designed to replace both Windows Me and Windows 2000
  - Based on Windows NT technology
  - More stable and powerful than earlier versions of Windows; built on the Windows 9x kernel
  - Newest features are related to multimedia and communications
  - Available in five versions plus *Starter Editions* in other languages

FIGURE 5-14

Windows XP. Most versions of Windows XP look like the Professional edition (left); Windows XP Media Center (right), however, has a different appearance.

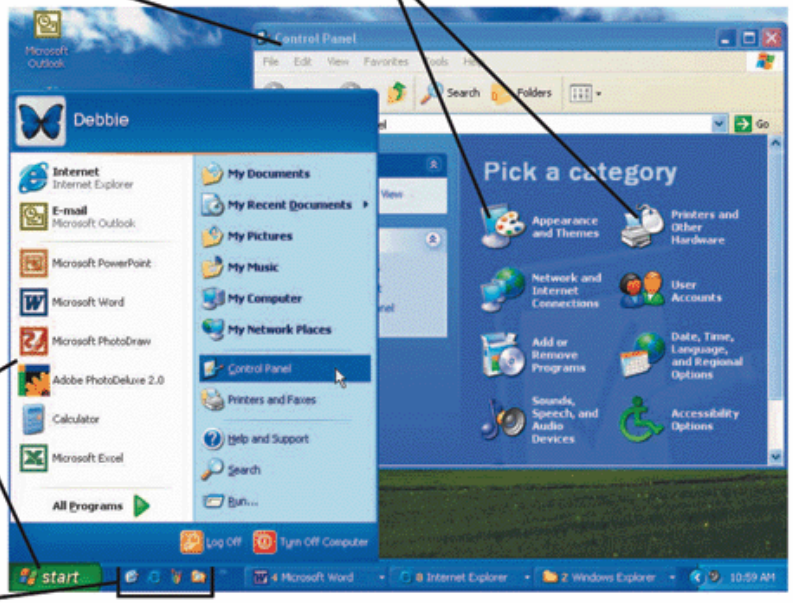
WINDOWS
Contain programs, icons, documents, and so forth.

ICONS
Represent programs, folders, documents, and other items that can be opened with the mouse.

START MENU
Used to launch programs.

START BUTTON AND START MENU
Used to launch programs.

TASKBAR TOOLBAR
Used to launch programs.



WINDOWS XP PROFESSIONAL

WINDOWS XP MEDIA CENTER EDITION

Windows, *Cont'd*

- **Windows Server 2003:** most recent version of Windows designed for server use
  - Builds on the server version of Windows 2000 but is designed to be easier to deploy, manage, and use
  - Incorporates Microsoft .NET technology for connecting information, people, systems, and devices
- **Windows Vista:** upcoming version of Windows (known before as Longhorn) to replace Windows XP

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:** most recent version of the operating system used on Apple computers; latest personal and server versions are version 10.4, known as *Tiger*

Mac OS, *Cont'd*

MENU BAR
Allows you to select options from pull-down menus.

WINDOWS
Contain programs, icons, documents, and so forth.

ICONS
Represent programs, folders, documents, or other items that can be opened with the mouse.

SPOTLIGHT
Used to continually search for documents that meet specified criteria.

DOCK
Contains commonly used icons.

FIGURE 5-17
Mac OS X Tiger.

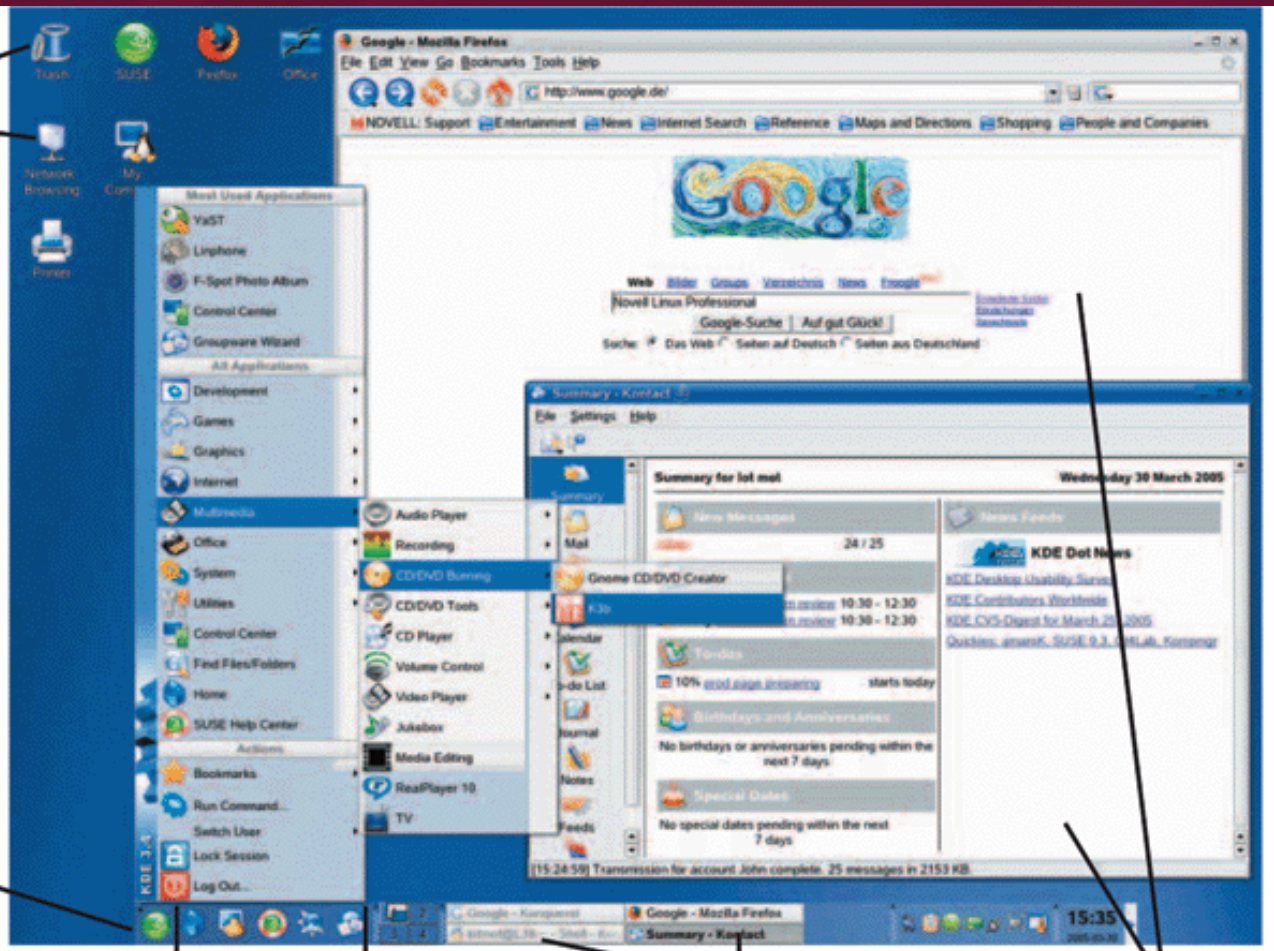
UNIX

- **Unix**: operating system developed in the 1970s for midrange servers and mainframes; many variations of this operating system are in use today
  - Multiuser, multitasking
  - More expensive, requires a higher level of PC knowledge, and tends to be harder to install, maintain, and upgrade than most other operating systems
  - “UNIX” initially referred to the original UNIX operating system, now refers to a group of similar operating systems based on UNIX

Linux

- **Linux:** version (flavor) of UNIX available without charge over the Internet
  - Increasingly being used with PCs, 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
  - Used on PCs, mainframes, and consumer appliances

ICONS
Represent programs, folders, documents, or other items that can be opened with the mouse.



MENU BUTTON
Opens the main menu used to start programs.

TOOLBAR
Contains icons that can be used to start programs.

MULTITASKING
Buttons can be used to switch between open windows.

WINDOWS
Contain programs, icons, documents, and so forth.

FIGURE 5-18
Linux.

NetWare

- **NetWare**: widely used operating system for PC-based networks
  - Developed by Novell
  - Competes directly with the server versions of Windows and Mac OS
  - Provides a shell around the users' local desktop operating systems so they can interact with network resources

Solaris

- *Solaris:* UNIX-based operating system developed by Sun Microsystems for Sun computers
  - Can run on desktop systems and servers, as well as on some supercomputers
  - Latest version—*Solaris 10*—is designed to run across a variety of platforms in a safe, efficient, and stable manner

Operating Systems for Handheld PCs and Mobile Devices

- Embedded and mobile versions of Windows
  - **Windows Embedded:** family of operating systems based on Windows, designed for nonpersonal computer devices, such as cash registers and consumer electronic devices
  - **Windows Mobile:** family of operating systems based on Windows and designed for handheld PCs, smart phones, and other mobile devices
- **Palm OS:** designed for Palm handheld PCs
- **Embedded Linux:** designed for handheld PCs and mobile devices
- **Symbian OS:** designed for use with smart phones

HANDHELD PC

PORTABLE MEDIA PLAYER

FIGURE 5-19
Windows Mobile.

A HANDHELD PC RUNNING PALM OS

A WI-FI INTERNET TABLET RUNNING EMBEDDED LINUX

A SMART PHONE RUNNING SYMBIAN OS

FIGURE 5-20
Palm OS, embedded Linux, and Symbian OS.

Operating Systems for Larger Computers

- Larger computers sometimes use operating systems designed solely for that type of system
- IBM's z/*OS*, *OS/390*, and *MVS* operating systems are designed for their various mainframes
- Windows, UNIX, and Linux, are also used with both mainframes and supercomputers
- Often a group of Linux PCs are linked together to form what is referred to as a *Linux supercluster* supercomputer

Utility Programs

- **Utility program:** a type of 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

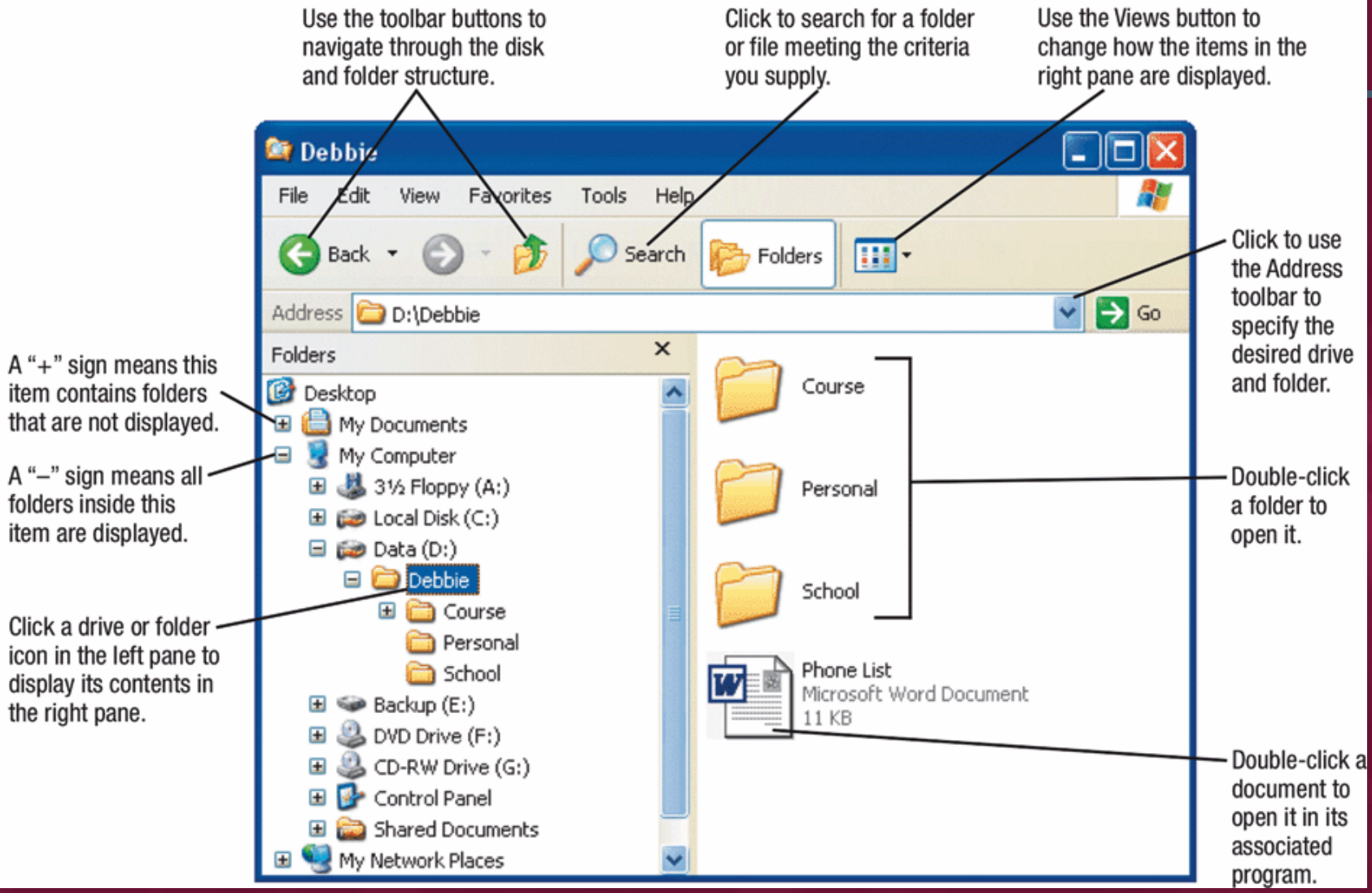
FIGURE 5-21
Utility suites. Utility suites contain a number of related utility programs.

File Management Programs

- **File management programs:** utility programs that enable the user to perform file management tasks, such as:
  - Looking at the contents of a PC or storage medium
  - Creating folders
  - Copying, moving, and renaming files and folders
  - Deleting files and folders

FIGURE 5-22

Using Windows Explorer to look at the contents of a PC.



File Management Programs, *Cont'd*

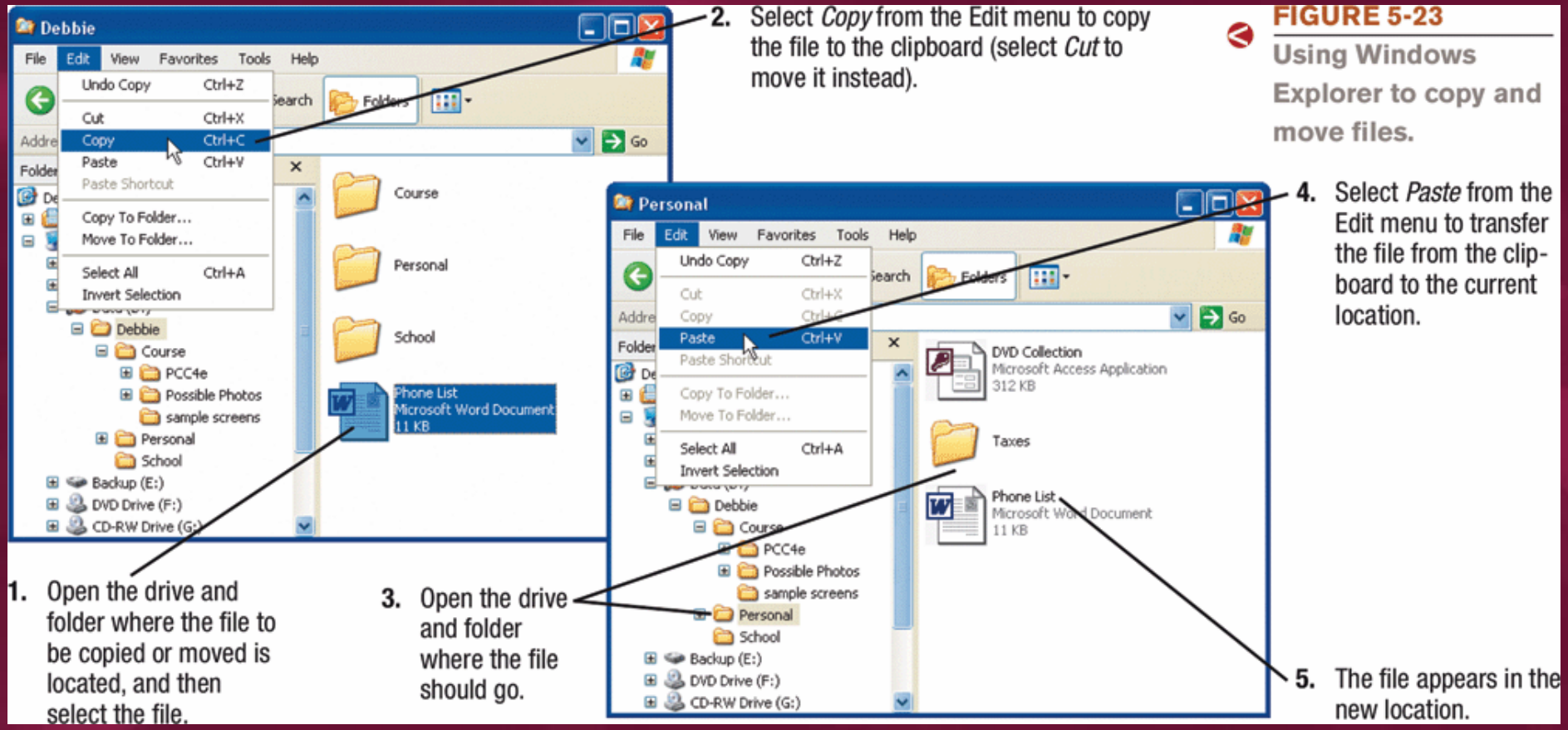


FIGURE 5-23
Using Windows Explorer to copy and move files.

Utility Programs, *Cont'd*

- **Search tools:** utility programs designed to search for files on the user's hard drive
- *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, *Cont'd*

- *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
  - Required to both compress (*zip*) and decompress (*unzip*) files
  - Common programs are *WinZip* (Windows users) and *Stuffit* (Mac users)

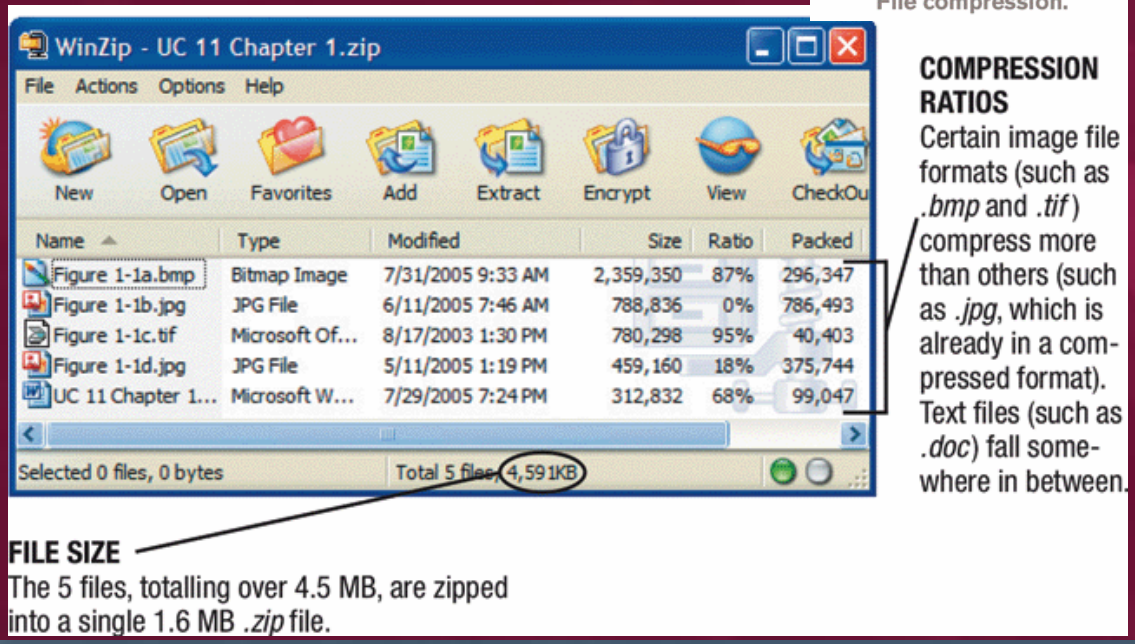


FIGURE 5-24
File compression.

Utility Programs, *Cont'd*

- *Uninstall utilities:* remove programs from your hard drive without leaving bits and pieces behind
  - Uninstall capabilities are built into most operating systems
  - Uninstall utility programs are also available as stand-alone programs
  - Sometimes an uninstall option is included in a program's folder when that program is originally installed
  - Important to properly uninstall programs, not just delete them

Utility Programs, *Cont'd*

- Backup and recovery utilities: programs to make the backup and restoration process easier
  - **Backup:** a duplicate copy of data or other computer content
  - Good backup procedures are critical for businesses and individuals
  - Backup data can be stored on a CD or DVD, second hard drive, flash memory drive, or uploaded to the Internet
  - It is a good idea to backup your entire PC once all programs have been installed, so your system can be restored to that configuration. The Windows *System Restore* program exists for that purpose

Utility Programs, *Cont'd*

- Security programs
  - *Antivirus* programs can protect against getting a virus in the first place, as well as detect and remove viruses
  - *Antispyware programs* can detect and remove spyware programs installed on your PC
  - *Firewalls* can protect against someone accessing your PC via the Internet

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

Summary

- System Software vs. Application Software
- The Operating System
- Operating Systems for Desktop PCs and Servers
- Operating Systems for Handheld PCs and Mobile Devices
- Operating Systems for Larger Computers
- Utility Programs
- The Future of Operating Systems