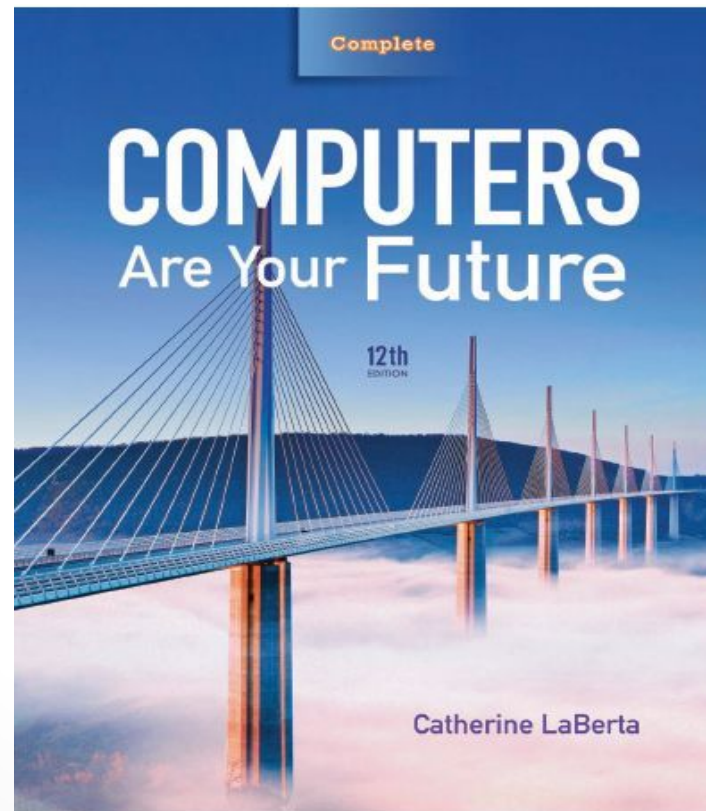


Computers Are Your Future

Twelfth Edition

Chapter 4: System Software



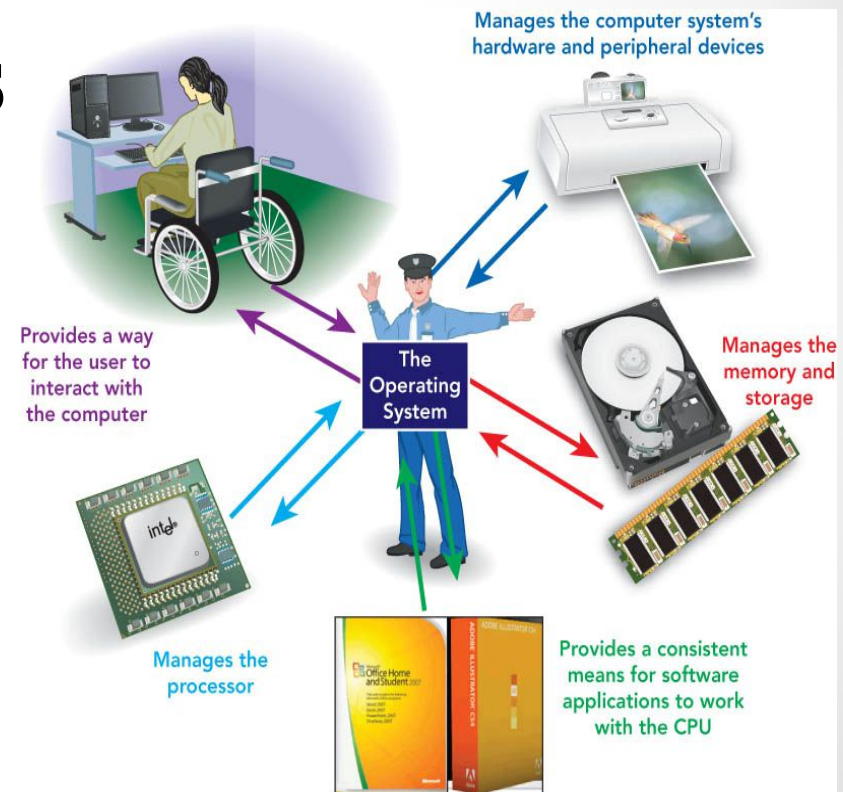
System Software

- **System software**
 - Consists of all the programs that enable the computer and its peripheral devices to function smoothly
 - Divided into two main categories:
 - Operating System (OS)
 - System utilities (utility programs)

The Operating System

- **Five basic functions**

1. Starts the computer
2. Manages applications
3. Manages memory
4. Handles input and output device messages
5. Provides a user interface for communication



The Operating System (OS)

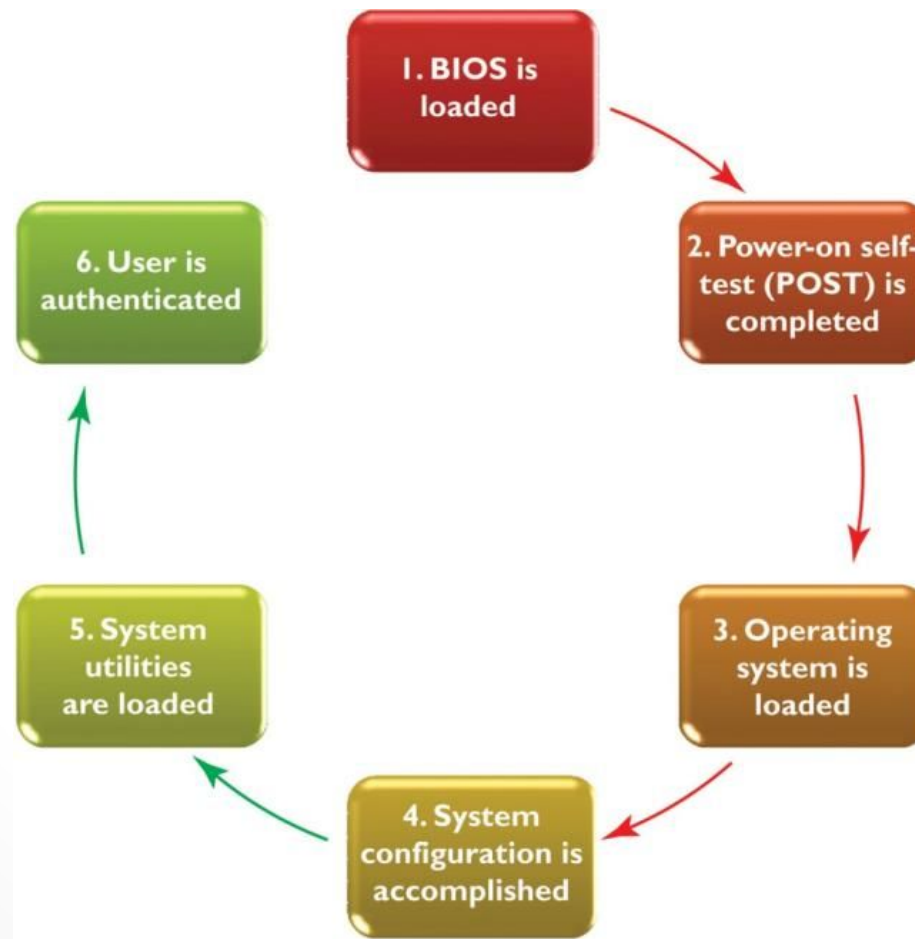
- OS coordinates:
 - Interactions of hardware components to each other
 - Interactions between application software and computer hardware
- The OS is most often located on a hard disk, although it can be stored and loaded from a USB drive, CD, or DVD.

The Operating System

- **Starting the computer**
 - **Booting**—loading the OS into RAM
 - **Cold boot:** Starting computer when it has not yet been turned on
 - **Warm boot:** Restarting a computer that is already on

The Operating System

The Six Steps of Booting a System

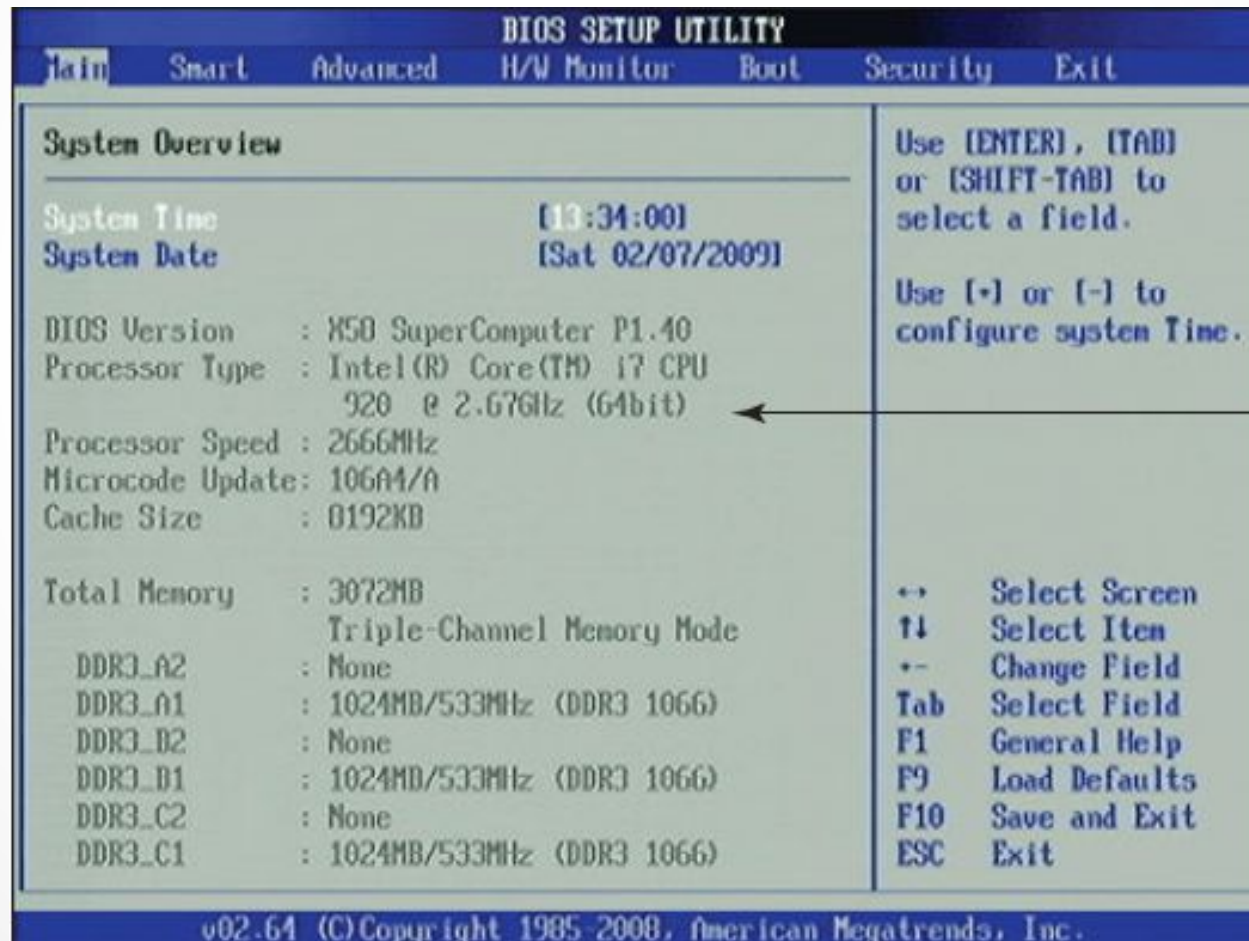


The Operating System

- **Step 1: Activate the BIOS and Setup Program**
 - **BIOS (Basic Input/Output System)** instructions provide the computer with descriptions of the internal equipment (typically the hard disk, RAM...)
 - BIOS is encoded on ROM (read-only memory)
 - Does not control external devices (jump drives and speakers)
 - Setup program
 - Includes settings that control computer hardware
 - Do not alter—making incorrect changes to a BIOS device will cause the system not to boot

BIOS Setup Utility

After the BIOS is located, you may briefly see the BIOS screen, a text-only screen that provides information about BIOS-controlled devices.



The Operating System

- **Step 2: Initiate the Power-On Self-Test**

- **Power-on self-test (POST)**—series of tests to confirm that both the computer and its peripheral devices are working properly
- If the POST fails:
 - A beep will sound.
 - An error message will appear on the monitor.
 - The computer will stop.

The Operating System

- **Step 3: Load the Operating System**

- BIOS initiates search for OS
 - Usually in HD then optical disk (search order)
 - Loads the **kernel** into memory—central part OS
- OS takes control of computer and loads the system configuration information

The Operating System

- **Step 4: Configure the System**

- Operating system

- Checks the **registry**- Database that stores configuration information about software and peripherals choices
 - Installs and loads needed **drivers**
Utility programs containing instructions for the proper functioning of peripheral devices
 - Automatically detects plug-and-play (PnP) devices
 - Checks for conflicts between devices

The Operating System

- **Step 5: Load System Utilities**

- Antivirus software
- Speaker volume control
- Power management options

- When the operating system finishes loading, you may see a request for a user name and password (authentication or login)

The Operating System

- **Step 6: Authenticate a User**

- Verifies authorized users

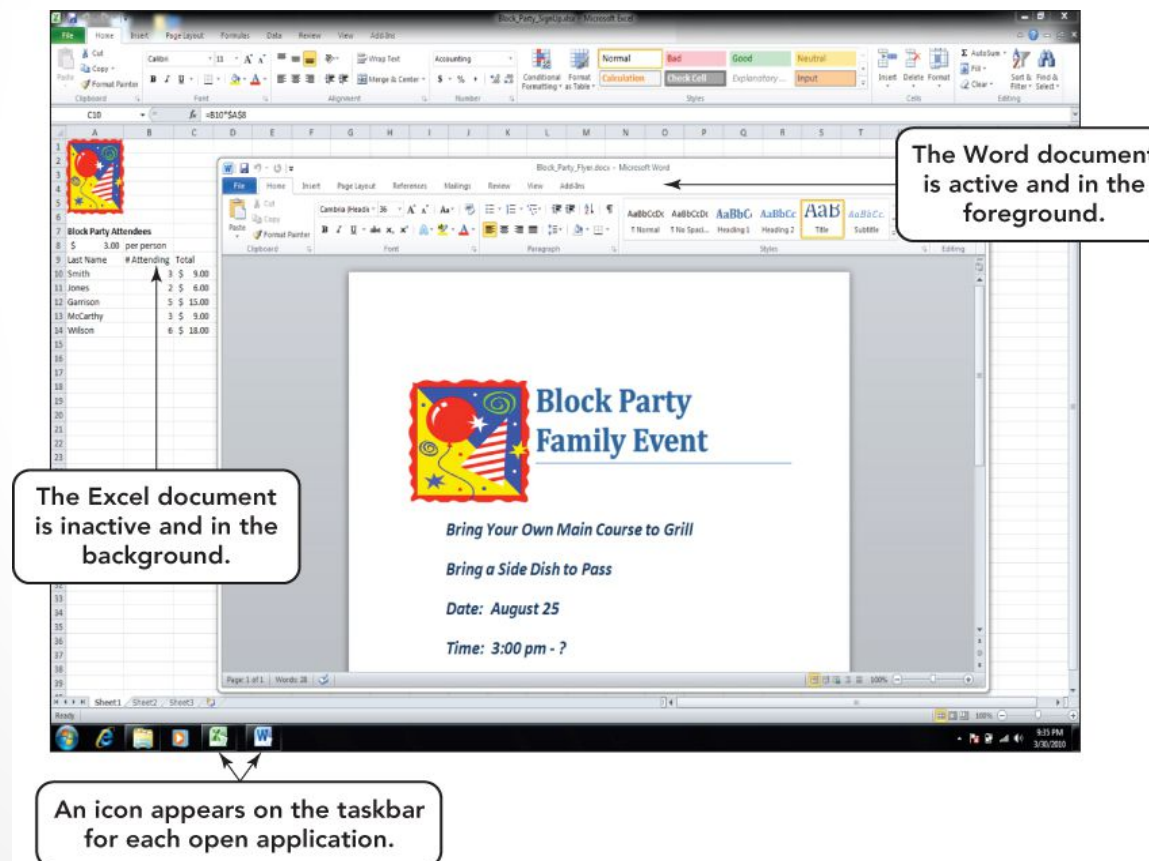
- Authentication/login** user name and password

- **Profile**—a record of a specific user's preferences for the desktop theme, icons, and menu styles

- **Account**—for multiuser computer systems, each user has an account

- Consists of user name, password, and storage space
 - Created by server/computer administrator

Now OS is loaded and running ready to manage applications



The Operating System

- **Managing applications**

- **Single-tasking OSs**

- run only one application at a time

- **Multitasking OSs (current)**

- permit more than one application to run at same time

- **Foreground application** is the active one

- **Background applications** appear inactive

- **Preemptive multitasking**—ensures all applications have fair access to the CPU

The Operating System

- **Managing memory**

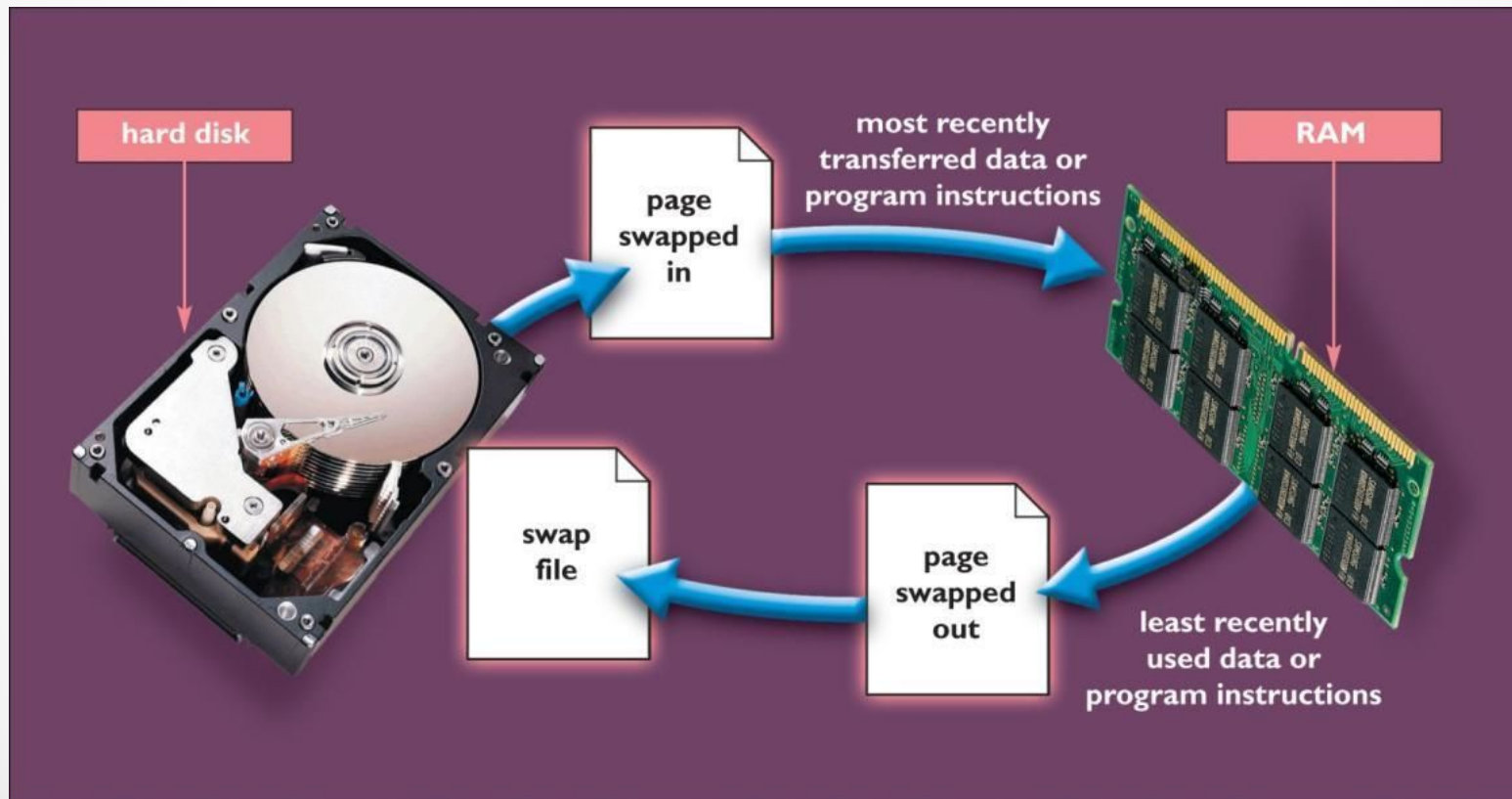
- If OS had to constantly access program instructions from their storage location on your computer's HD, programs would run very slowly
- **Buffer**
 - Area that holds data and instructions temporarily to make programs run faster
- **RAM** memory functions as the buffer
- OS gives each program a portion of RAM memory and keeps them from interfering with each other

The Operating System

- **Managing memory (cont.)**

- Today's OSs can make the computer's RAM seem larger than it really is
- **Virtual memory**—uses portion of HD to extend RAM
 - When RAM is full, OS temporarily stores copies of pages in a **swap file**, a special hard disk file
 - When the pages are needed, they are copied back into RAM
 - Transferring files between RAM and the hard disk—**paging**
 - **Pages**—units of fixed size, contain program instructions and data
 - Excessive paging—**thrashing** it slows down the system

The Operating System



The Operating System

- **Managing memory (cont.)**
 - Adding more RAM is the best way to improve computer performance:
 - Paging slows computer
 - Accessing data from hard disk is slower than accessing from RAM
 - With sufficient RAM, the OS makes minimal use of virtual memory

The Operating System

- Instead of using the hard drive for virtual memory, Windows Vista and Windows 7 come with Windows **ReadyBoost**, a feature that allows for the allocation of space on **removable memory devices** that can be used to increase the size of RAM memory.
- ReadyBoost performance is better than hard disk virtual memory because accessing files on flash memory (USB flash drives) is quicker than accessing information on a hard drive.

The Operating System

- **Coordinating Tasks**

- **Device drivers**—enable communication between computer and devices
- **Interrupts**—signals created by input and output devices that notify the OS when actions are taken
- Examples: the user pressing a key, the mouse moving to a new position, or notice that a document is waiting to print
- **Interrupt request (IRQ)**—actual interrupting of an event by an interrupt signal
- **Interrupt handlers**—mini-programs that immediately respond when an interrupt occurs
- **Interrupt vector table**—in case of multiple interrupts, it holds responses from multiple interrupts in RAM, where the OS processes them in highest to lowest priority order

The Operating System

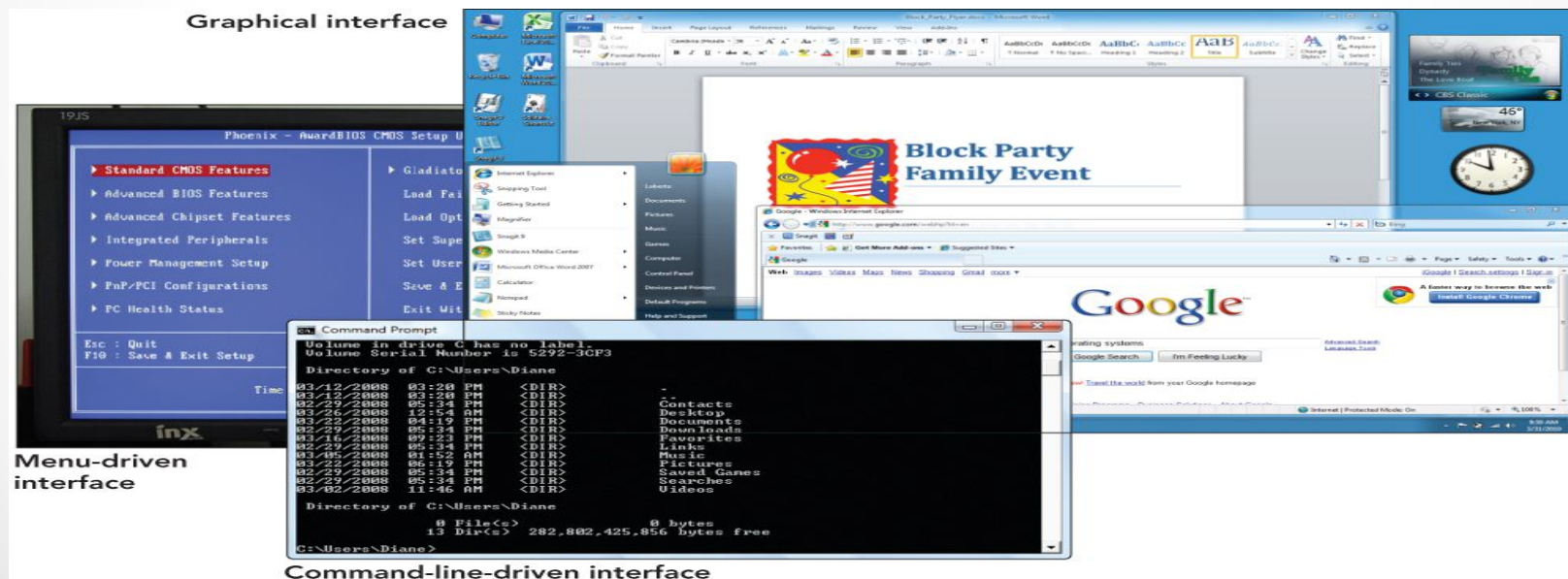
- **Providing the user interface**

- Allows the user to:
 - Start application programs
 - Manage storage devices
 - Safely shut down the computer

The Operating System

- **Types of user interfaces**

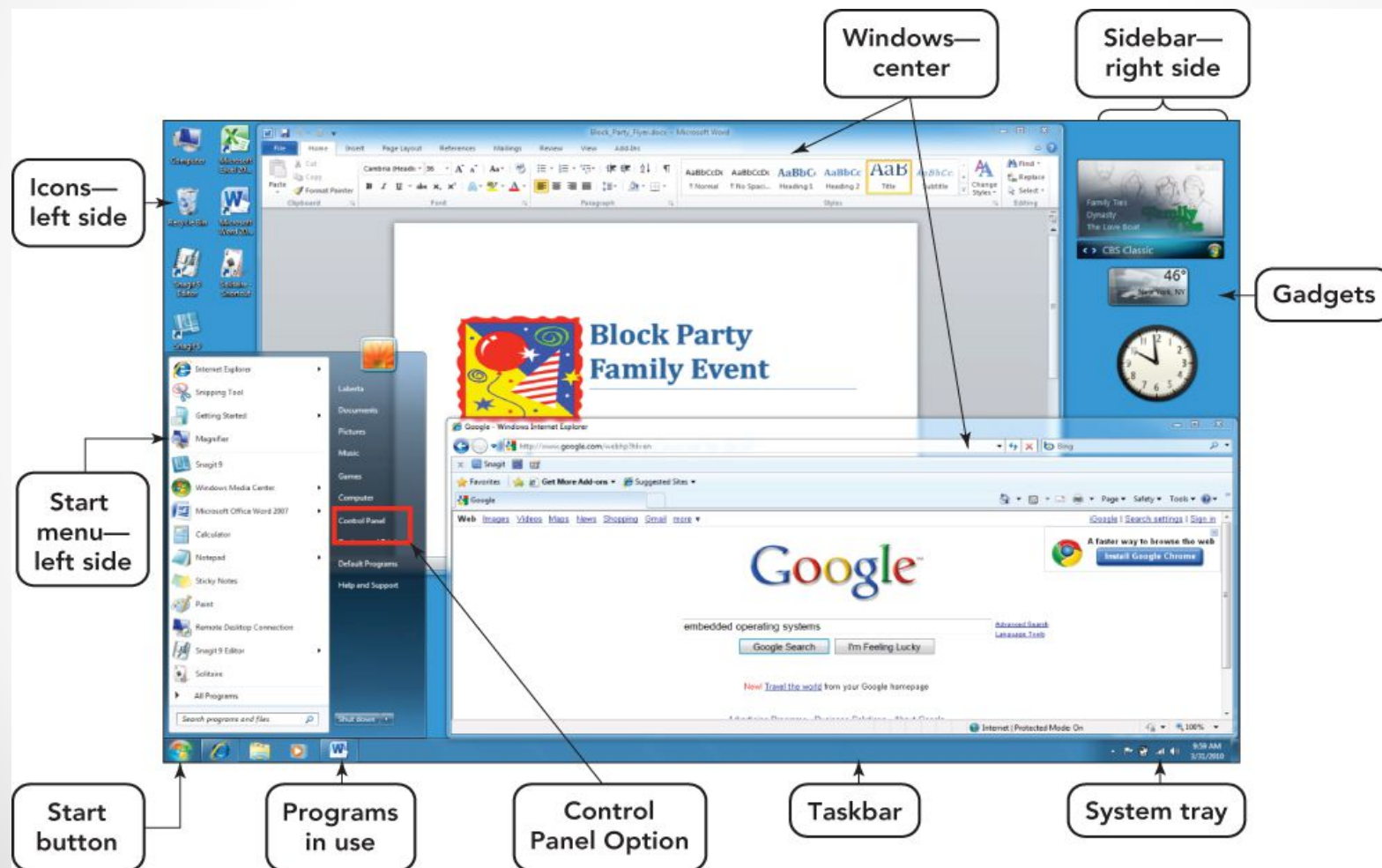
1. Graphical user interface (GUI)
2. Menu-driven user interface
3. Command-line user interface



The Operating System

- **Types of user interfaces**
 - **Graphical user interface (GUI)**
 - Uses **icons**—small images that represent computer resources used to initiate actions
Appear on the **desktop**- Work area created after the OS loads into memory
 - **Sidebar**—invisible 1-inch vertical strip on the right side of the desktop, holds user designated gadgets
 - Programs you open will appear in the center of the desktop.

The Operating System



The Operating System

- **Types of user interfaces (cont.)**
 - **Menu-driven user interface**

Provides text-based menus to display available user options
 - **Command-line user interface**
 - Requires the user to type commands to instruct the OS to perform the desired actions
 - Uses complicated rules of syntax

Exploring Popular Operating Systems

- **Three categories of OS**
 1. **Stand-alone OSs**—used by single users
 2. **Server OSs**—used in client/server network environments
 3. **Embedded OSs**—found on ROM chips in portable or dedicated devices

Exploring Popular Operating Systems

Category	Name
Stand-alone	DOS—developed for original IBM PC Windows 3.X, Windows 95, Windows 98, Windows 2000 Professional, Windows ME, Windows XP, Windows Vista, Windows 7 MAC OS X UNIX Linux
Server	Windows NT Server, Windows 2000 Server, Windows Server 2003, Windows Server 2008 UNIX Linux Novell Netware Solaris Red Hat Enterprise Server
Embedded	Windows CE (variations are Windows Mobile, Pocket PC) iPhone OS Palm OS BlackBerry OS Embedded Linux Google Android Symbian OS

Stand-Alone Operating Systems

- **UNIX**

- Free OS installed primarily on workstations
- Features preemptive multitasking
- Has many versions that are not compatible
- Hard to use—defaults to a command-line user interface. A number of GUI interfaces have been developed for UNIX, improving its usability
- Mac OS X is based on UNIX

Stand-Alone Operating Systems

- **Linux**

- **Open source software**—source code is available to users
- Powerful and free
- Features such as
 - Multitasking
 - Virtual memory
 - Internet support
 - GUI
- Disadvantages
 - Lack of technical support prevents adoption in corporate environments
 - Difficult to run Microsoft Office applications

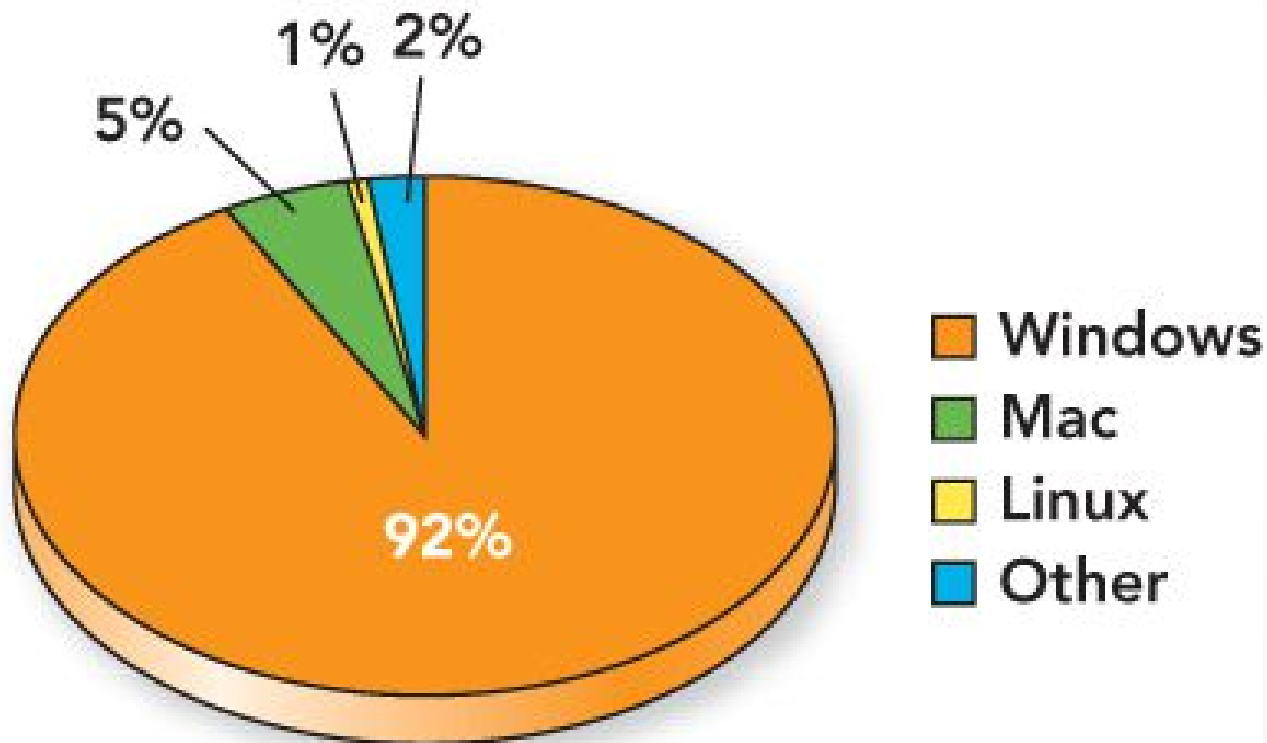
Stand-Alone Operating Systems

- **PC vs Mac vs Linux**

- **Platform**—determined by combination of microprocessor chip & OS by specific type of computer
- PCs
 - Dominate marketplace
 - Windows OS
 - Intel or AMD chip
 - More software available
- Macs
 - Mac OS
 - Motorola or IBM chip, then switched to Intel chip
 - Most current OS can run Windows software
 - Creative fields are almost exclusive to Mac
- Linux
 - Can be installed on PC or Mac
 - More secure—fewer viruses

Stand-Alone Operating Systems

Operating System Usage



Server Operating Systems

- Server operating systems are designed for network use.
- Normally, they are complete OSs with a file and task manager.
- Additional features like a Web server, directory services, and a messaging system may also be included.

Embedded Operating Systems

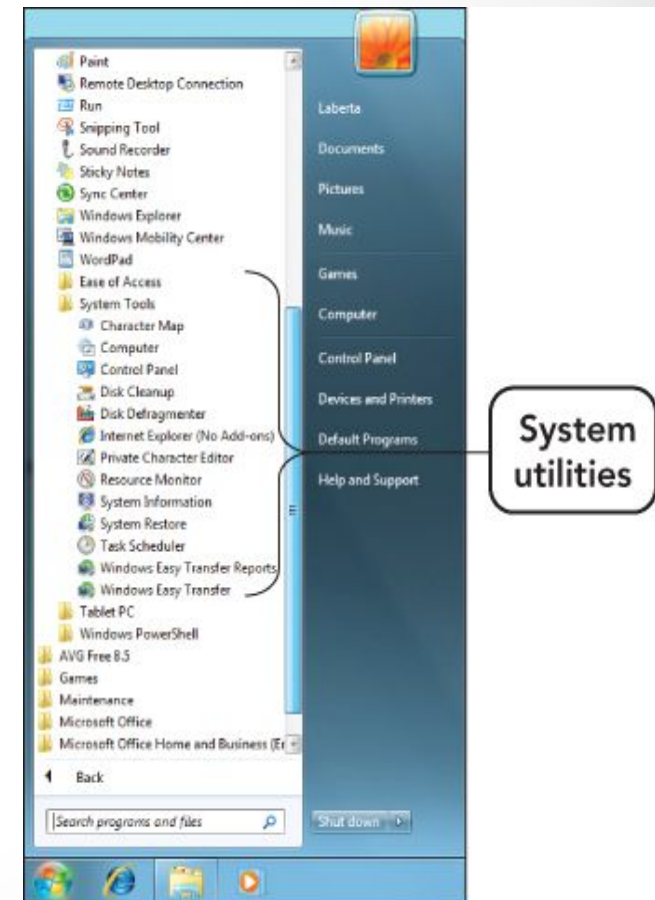
- Designed for specific applications
- Compact and efficient
- Eliminate many unneeded features of OSs
- Used in PDAs, cell phones, kitchen appliances, point-of-sale devices, industrial robots, etc.

Embedded Operating Systems



System Utilities: Housekeeping Tools

- **System utilities (utility programs)**
 - Software programs—essential to effective management of the computer system
 - Perform tasks such as:
 - Backing up files
 - Providing antivirus protection
 - Searching for and managing files
 - Compressing files
 - Providing accessibility utilities to individuals with special needs



System Utilities: Housekeeping Tools

- **Backup software**—copies data found on the hard disk to a backup device such as flash drives, DVDs, external HD, or online storage location
 - **Full backups**—include all files and data
 - **Incremental backups**—include only those files changed or added since the previous backup
- **Drive imaging software**—creates a mirror image of the entire hard drive including the OS and applications, as well as all files and data

System Utilities: Housekeeping Tools

- **Antivirus software**—protects the computer from viruses
 - Popular antivirus programs:
 - BitDefender Antivirus
 - Kaspersky Anti-virus
 - Webroot AntiVirus wit SpySweeper
 - Norton AntiVirus
 - ESET Nod32 Antivirus

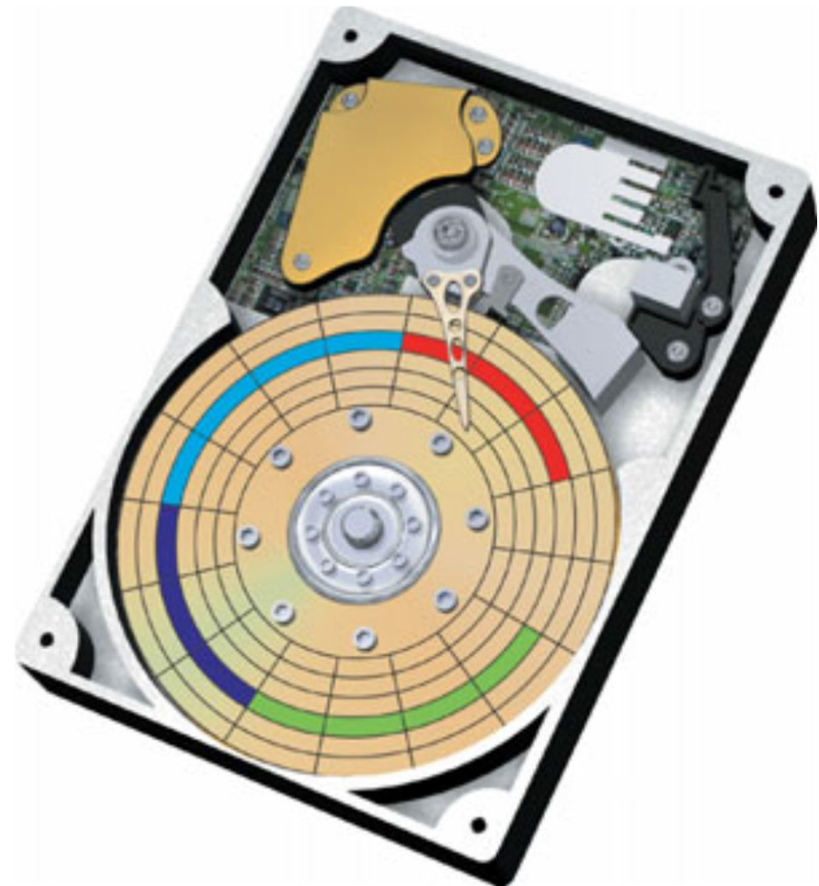
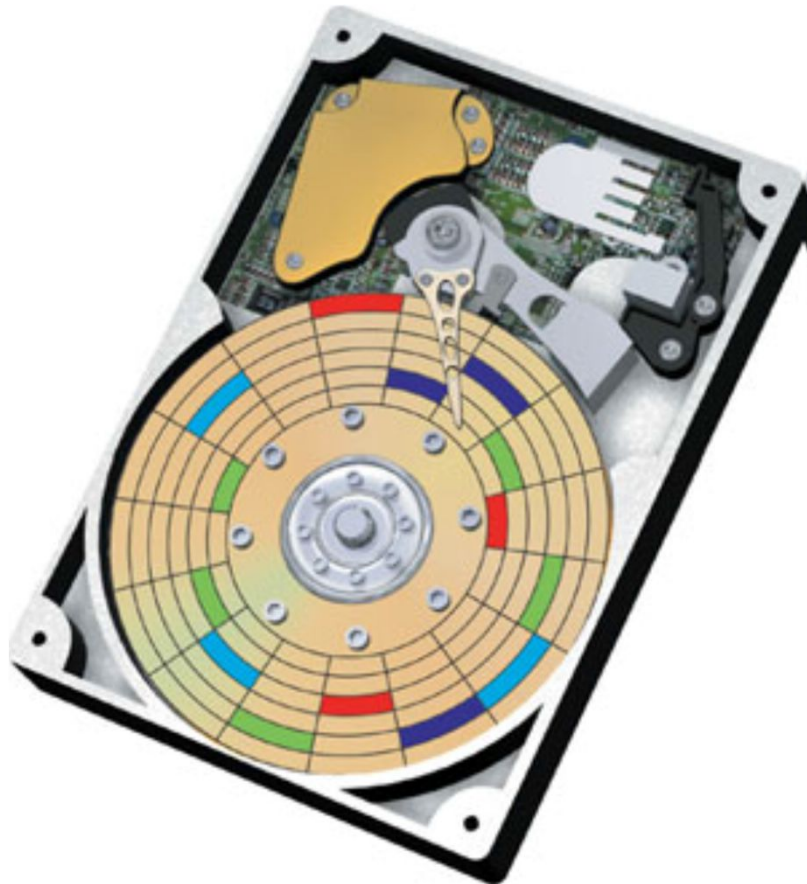
System Utilities: Housekeeping Tools

- **Searching for and managing files**
 - **File manager**—utility software that organizes and manages data files
 - Copy files
 - Determine how and where files are stored
 - Delete files
 - **Search utility**—enables you to locate files

System Utilities: Housekeeping Tools

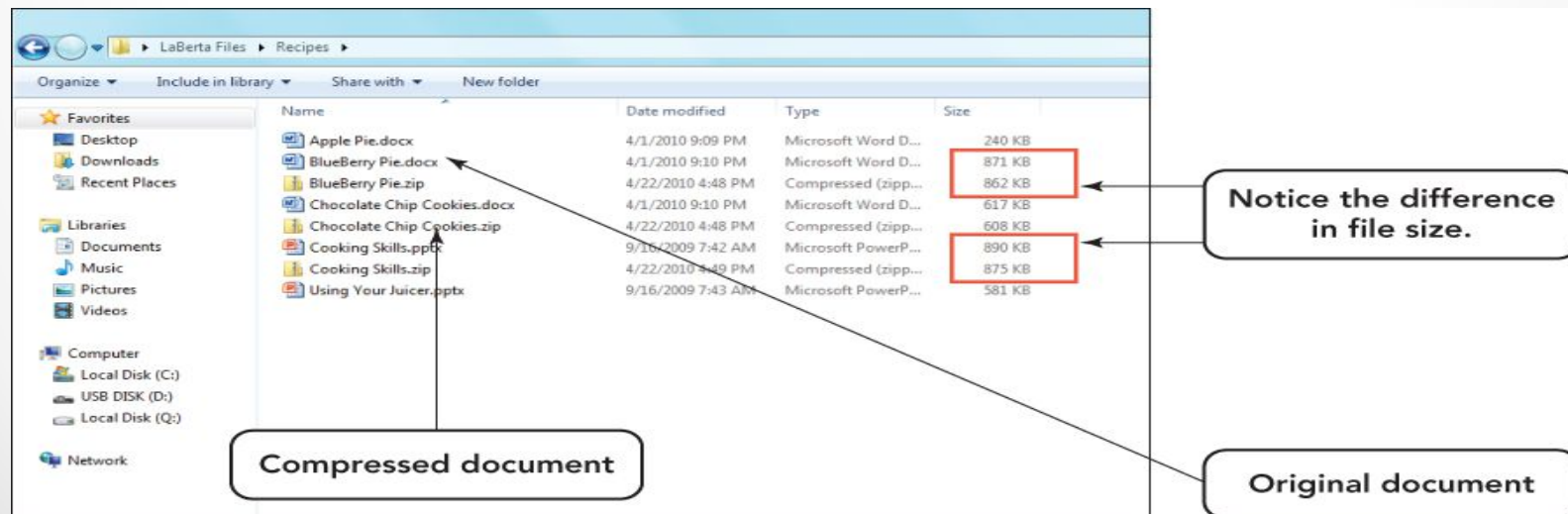
- **Scanning and defragmenting disks**
 - **Disk scanning programs**—find and resolve disk file storage problems such as bad sectors
 - **Disk cleanup utilities**—improves system performance and increases storage space by removing files that you no longer need
 - **Fragmented disk**—results from computer creating and erasing files on hard disk
 - Causes disk access to slow while system looks in several locations to find all file segments
 - **Disk defragmentation programs**—reorganize stored data in a more efficient manner

Fragmented vs Defragmented Files



System Utilities: Housekeeping Tools

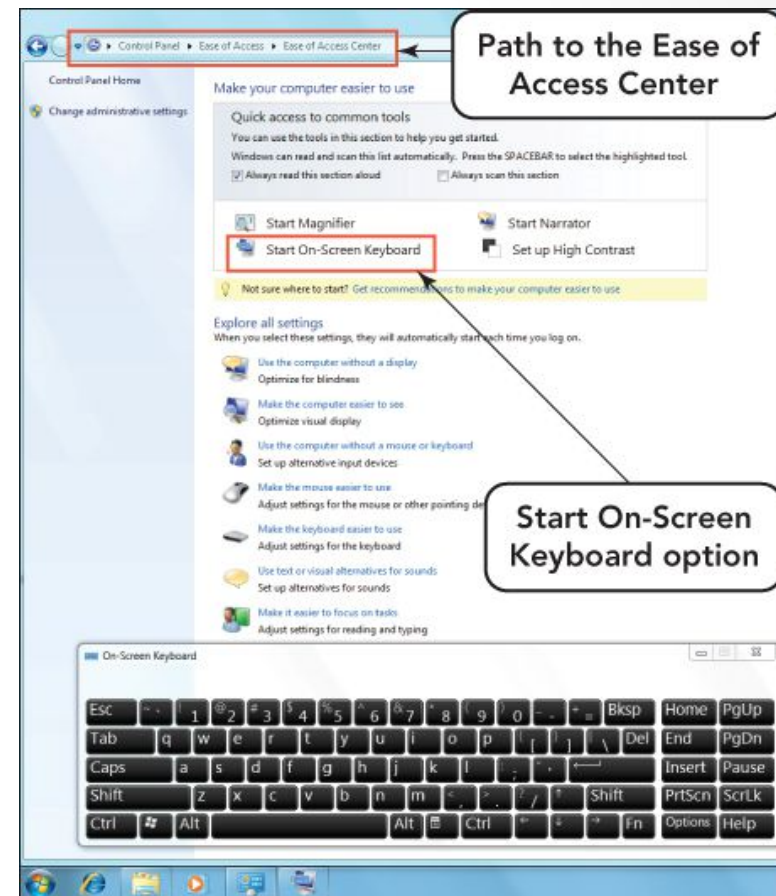
- **File compression utilities**
 - **Decrease size** of files, resulting in faster downloads
 - Create **archives** by storing files in a **special format**



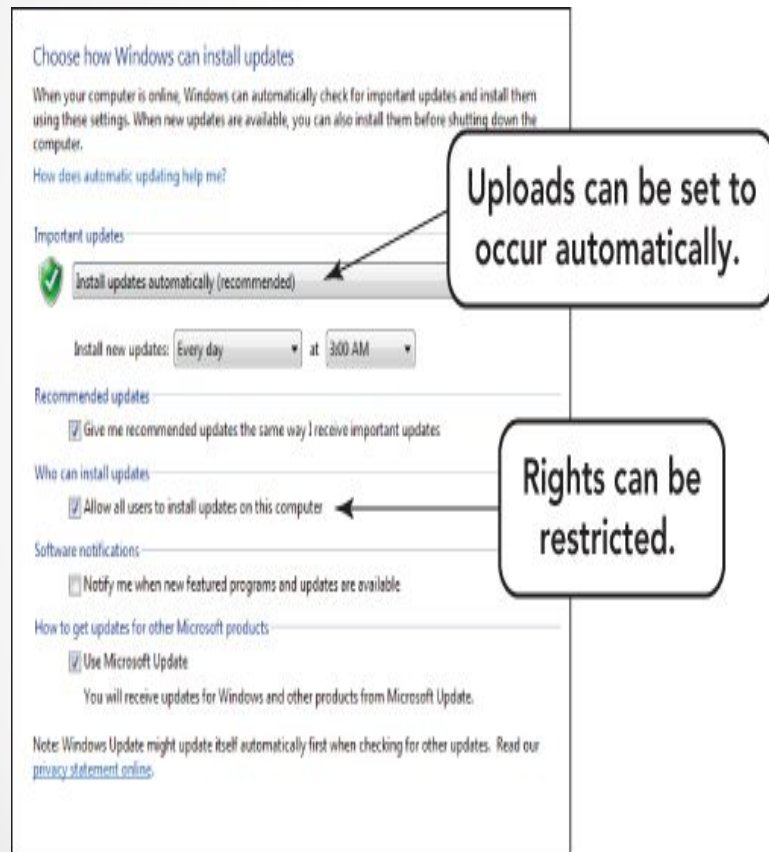
System Utilities: Housekeeping Tools

- **Accessibility utilities**

- Designed to make computing easier for individuals with special needs
 - Magnifier
 - On-screen keyboard
 - Speech recognition
 - Narrator



System Utilities: Housekeeping Tools



- **System update**

- **Windows Update** for Windows 7 and Vista automatically downloads and installs updates
- Includes service packs, version upgrades, and security updates

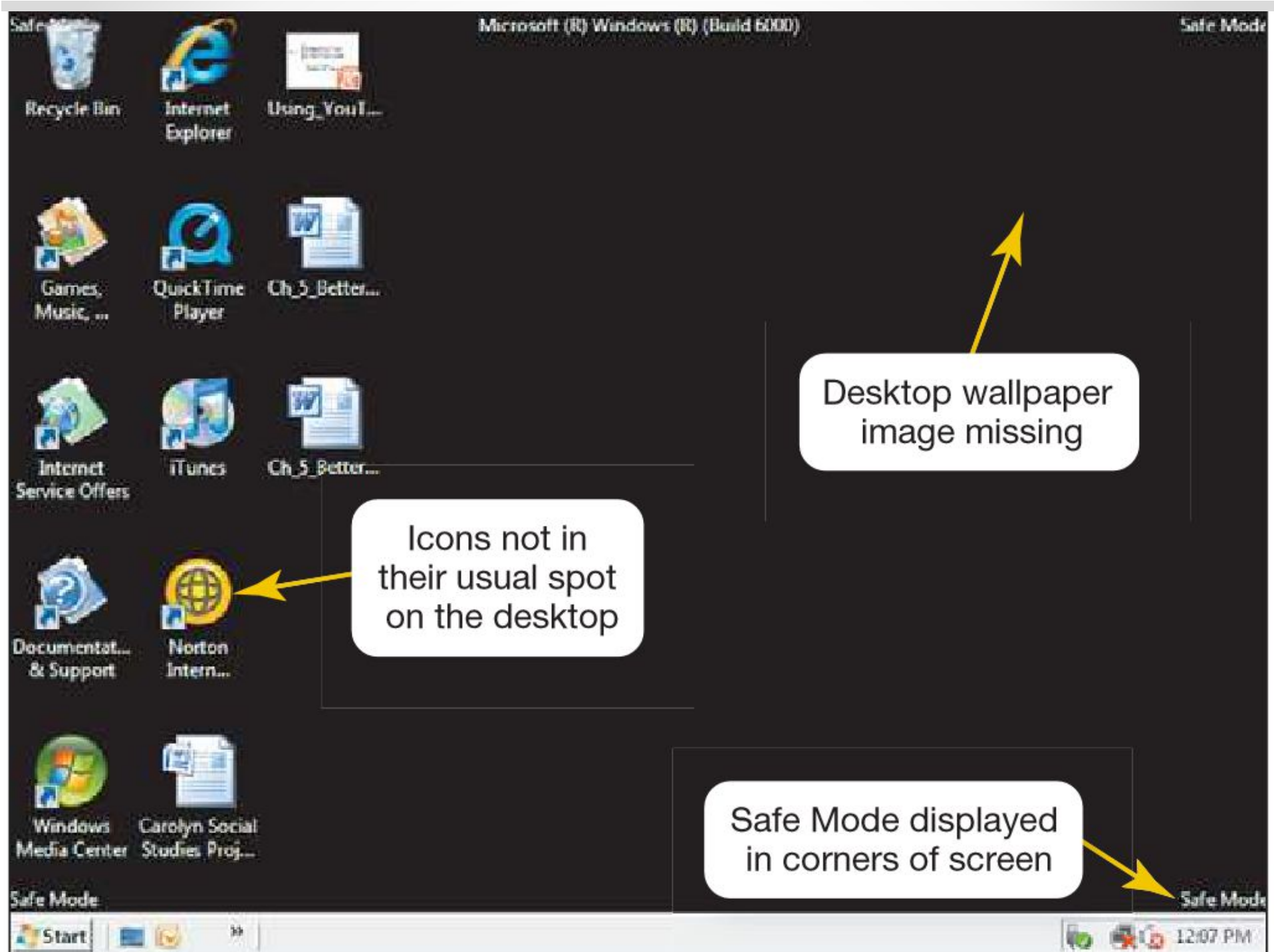
System Utilities: Housekeeping Tools

- **Troubleshooting**

- Keep a **boot disk (emergency disk)**—to load a reduced version of the OS that can be used for troubleshooting purposes
- Use the Windows Help and Support utility
- Shut down the system properly, use the correct procedure; don't just turn the power off.

System Utilities: Housekeeping Tools

- Adding a new peripheral device such as an external hard drive or new printer may cause conflicts that could interfere in the boot cycle
- **Safe Mode**
 - Windows loads a minimal set of drivers known to function correctly
 - Use Control Panel to discover devices that are causing the problem



System Utilities: Housekeeping Tools

- **Reliability and Performance Monitor**
 - Helps determine when system's performance began to degrade
 - Gives details about events that may have caused the problem
- **Help and Support**
 - Available from Start menu
 - Includes several ways to manage and maintain the computer

Power Modes

- **Sleep mode** transfers the current state of your computer to RAM, turn off all unneeded functions, and place the system in a low-power state.
- **Hibernate mode** saves battery power. Used primarily in notebooks, this mode puts your open documents and programs on your hard disk and then actually turns off your computer. When you restart your system, it is returned to the state prior to hibernation. Returning from Sleep mode is faster than returning from Hibernate due to the state of the computer being held in memory in the sleep mode.
- **Hybrid sleep** is a combination of sleep and Hibernate mode and puts open documents and programs in both RAM and on your hard disk, and then places the system in a low power state so you can quickly resume your work. If power is suddenly terminated, the Hibernate portion of this mode guarantees that your work can be restored.

Exercises

Exercise: Match

Answer	Column A		Column B	
E	1.	System utilities	A.	Database that stores information about software and peripherals choices, for configuration information
G	2.	Kernel	B.	Confirm that both the computer and its peripheral devices are working properly
F	3.	Embedded OS	C.	An emergency disk to load the operating system for emergencies
A	4.	Registry	D.	A backup that includes only those files changed or added since the previous backup
C	5.	Boot disk	E.	Software programs responsible for backing up & compressing files and providing antivirus protection
B	6.	Power-on self-test	F.	Found on ROM chips in portable or dedicated devices
D	7.	Incremental backup	G.	Central part of OS

Exercise: True/False

1. Compression utilities create archives by storing files in a special format. ✓
2. BIOS is encoded on RAM. ✗
3. A bad sector represents an irregularity on the disk's surface which causes a portion of the disk to unreliably store data. ✓
4. An interrupt handler holds responses from multiple interrupts in RAM, where the OS processes them in highest to lowest priority order. ✗
5. RAM memory functions as the buffer. ✓
6. Preemptive multitasking ensures all applications have fair access to the hard disk. ✗
7. Server OS eliminates many unneeded features of OSs used in client/server environments. ✗

Exercise: List

- Categories of OS
- Types of user interfaces
- Examples on system utilities
- Power modes

Exercise: Complete

1. ----- are units of fixed size which contain program instructions and data.
2. ----- are signals created by input and output devices to notify the OS when actions are taken.
3. ----- is a compact and efficient OS used in PDA and cell phones.
4. ----- copies data found on the hard disk to another device.
5. Accessing data from hard disk is ----- than accessing from RAM.
6. When RAM is full, copies of pages are temporarily stored in a -----, a special hard disk file.

Exercise: Differentiate between

1. Cold and warm boot
2. Full and incremental backup
3. Disk cleanup and defragmentation
4. User profile and account
5. Interrupt handler and vector table
6. Operating system and system utilities
7. Backup and troubleshooting utilities
8. Single and multi-tasking OSs
9. Sleep and safe modes

Exercise: Sort

- When you start or restart a computer, it reloads OS into the computer's memory. A computer goes through six steps at start-up. Sort them.
 - A. loading the OS
 - B. loading the BIOS
 - C. loading system utilities
 - D. performing the power-on self-test
 - E. configuring the system
 - F. authenticating users

Thank You