Chapter 4: System Software
A few windows containing applications cannot be resized, for example, the calculator.

Grab the corner of most windows that are not maximized with the mouse to resize them.

Click the X to close a window.

Click this icon to maximize a window.

Click the – icon to minimize a window.
Objectives

• List the two major components of system software.
• List the four basic functions of an operating system.
• Explain why a computer needs an operating system.
• Explain what happens when you turn on a computer.
Objectives

• List the three major types of user interfaces.
• List the three categories of operating systems.
• Discuss the strengths and weaknesses of the most popular operating systems.
• List the system utilities that are considered essential.
Objectives

• Discuss data backup procedures.
• Understand troubleshooting techniques and determine probable solutions to any operating system problems you may encounter.
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:
    - The operating system
    - System utilities (utility programs)
The Operating System

• Four basic functions
  o Manages applications
  o Manages memory
  o Handles input and output device messages
  o Provides a user interface for communication
The Operating System

• **Operation system (OS)**
  - Set of programs that coordinates:
    - Interactions of hardware components to each other
    - Interaction between application software and computer hardware
• **Starting the computer**
  
  o **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

1. BIOS is loaded
2. Power-on self-test (POST) is completed
3. Operating system is loaded
4. System configuration is accomplished
5. System utilities are loaded
6. User is authenticated
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
    - Bios is encoded on ROM (read-only memory)
    - Does not control external devices
  - Adjustable energy settings
  - 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
The Operating System

• Step 2: Initiate the Power-On Self-Test
  o **Power-on self-test (POST)**—to confirm that both the computer and its peripheral devices are working properly
  o 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
  o BIOS
    • Looks for the operating system
    • Loads the **kernel** (the central part of the operating system) into memory
  o The operating system loads the system configuration information.
The Operating System

• Step 4: Configure the System
  - Operating system
    - Checks the registry
      - Database that stores information about software and peripherals choices, for configuration information
    - Checks the configuration for drivers
      - Utility programs containing instructions for the proper functioning of peripheral devices.
  - Automatically detects plug-and-play (PnP) devices
  - Checks for conflicts between devices
  - Installs and loads needed drivers
The Operating System

• **Step 5: Load System Utilities**
  
  o Antivirus software
  o Speaker volume control
  o Power management options
The Operating System

• Step 6: Authenticate a User
  
  o Verifies authorized users
    
    • Enter an authentication/login user name and password
  
  o Profile—a record of a specific user’s preferences for the desktop theme, icons, and menu styles
  
  o Account—for multiuser computer systems each user has an account
    
    • Consists of user name, password, and storage space
    
    • Created by server/computer administrator
• Managing applications
  o **Single-tasking operating systems**—run only one application at a time
  o **Multitasking operating systems**—permit more than one application to run at the same time
    • The **foreground application** is the active one.
    • **Background applications** appear inactive.
  o **Preemptive multitasking**—ensures all applications have fair access to the CPU
The Operating System

The Word document is active and in the foreground.

The Excel document is inactive and in the background.

An icon appears on the taskbar for each open application.
Managing memory

- **Buffer**
  - Area that holds data and instructions temporarily
  - Makes 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.
Managing memory (con’t.)

- Virtual memory (VM) — uses portion of hard disk to extend RAM
  - Pages — units of fixed size, contain program instructions and data
  - When RAM is full, copies of pages are temporarily stored in a swap file, a special hard disk file.
  - Transferring files between RAM and the hard disk — paging
  - Excessive paging — thrashing
Managing memory (con’t.)
  o Adding more RAM—best way to improve computer performance:
    • Paging slows computer.
    • Accessing data from hard disk is slower than accessing from RAM.
  o Windows Vista and Windows 7 come with Windows ReadyBoost
    • Uses removable memory devices (e.g. flash drives) for VM
    • Better performance than hard disk virtual memory—why?
The Operating System
The Operating System

• Coordinating tasks
  o Device drivers— enable communication between computer and devices
  o **Interrupts**— signals created by input and output devices
    • Notify the OS when actions are taken
  o **Interrupt handlers** (also called **interrupt service routines**)—miniprograms that immediately respond when an interrupt occurs
  o **Interrupt vector table**— holds responses from multiple interrupts in RAM, where the OS processes them in highest to lowest priority order
  o **Interrupt request (IRQ)**— actual interrupting of an event by an interrupt signal
The Operating System

• Providing the user interface
  o Allows the user to:
    • Start application programs
    • Manage storage devices
    • Safely shut down the computer
The Operating System

Types of user interfaces

- Graphical user interface (GUI)
- Menu-driven user interface
- Command-line user interface
The Operating System

• Types of user interfaces (con’t.)
  o Graphical user interface (GUI)
    • Uses **icons**—small images that:
      o Represent computer resources used to initiate actions
      o 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

- Windows 7 is the most recent Microsoft OS
• **Types of user interfaces (con’t.)**
  
  o **Menu-driven user interface**
    - Provides text-based menus
    - Displays available user options
  
  o **Command-line user interface**
    - Requires the user to type commands to instruct the OS to perform the desired actions
    - Uses complicated rules of syntax
Three categories of operating systems

- Stand-alone operating systems—used by single users
- Server operating systems—used in client/server network environments
- Embedded operating systems—found on ROM chips in portable or dedicated devices
<table>
<thead>
<tr>
<th>Category</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand-alone</td>
<td>DOS—developed for original IBM PC</td>
</tr>
<tr>
<td></td>
<td>Professional, Windows ME, Windows XP, Windows Vista, Windows 7</td>
</tr>
<tr>
<td></td>
<td>MAC OS X</td>
</tr>
<tr>
<td></td>
<td>UNIX</td>
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<td></td>
<td>Linux</td>
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<tr>
<td></td>
<td>Linux</td>
</tr>
<tr>
<td></td>
<td>Novell Netware</td>
</tr>
<tr>
<td></td>
<td>Solaris</td>
</tr>
<tr>
<td></td>
<td>Red Hat Enterprise Server</td>
</tr>
<tr>
<td>Embedded</td>
<td>Windows CE (variations are Windows Mobile, Pocket PC)</td>
</tr>
<tr>
<td></td>
<td>iPhone OS</td>
</tr>
<tr>
<td></td>
<td>Palm OS</td>
</tr>
<tr>
<td></td>
<td>BlackBerry OS</td>
</tr>
<tr>
<td></td>
<td>Embedded Linux</td>
</tr>
<tr>
<td></td>
<td>Google Android</td>
</tr>
<tr>
<td></td>
<td>Symbian OS</td>
</tr>
</tbody>
</table>
Stand-Alone Operating Systems

- Windows Operating Systems Timeline

1983
Windows announced
November 10, 1983

1990
Windows 3.0 announced
May 22, cost $149.95

1992
Windows 3.1, released in
April, sold over 1 million
copies in the first 2
months

1993
Windows NT 3.1 released
July 27

1995
Windows 95, released
August 24, 1995, sold over 1
million copies in 4
days

1996
Windows CE 1.0 released
in November

1998
Windows 98 released in
June

2000
January 4th
Bill Gates announced
that the next version of
Windows CE would be called
Pocket PC
Windows 2000 released in
February

2001
Windows XP released
October 25

2003
Windows Server 2003
released
March 28

2005
Windows XP Professional
x64 edition released
April 24

2007
Windows Vista and
Office 2007 released
January 30

2009
Windows 7 released
October 22
### Edition | Features
--- | ---
Windows 7 Starter | Designed for small notebook computers, this edition was originally known as "the one that would not let you run more than three applications at a time." The decision on the limit of three was reversed, and the final version can run just about any Windows task. When multitasking, it is recommended that you avoid high-resource tasks like watching a DVD. This edition must be preinstalled on notebooks and is not available for individual purchase.

Windows 7 Home Basic | This is the other "nonpremium" edition available only in emerging markets (not in the United States, Canada, Europe, and other developed nations). It is more graphically interesting than Starter but lacks premium features like Windows Media Center.

Windows 7 Home Premium | This is the entry-level edition for most average consumers. It has the full Aero interface (translucent design, subtle animation, and additional colors) and Windows Media Center.

Windows 7 Professional | This is the preferred edition for businesses and advanced home users. It builds on Home Premium and runs a remote desktop server, encrypts files, and makes network folders available offline.

Windows 7 Enterprise | Enterprise and Ultimate editions have most of the same features, but the Enterprise edition is geared to enterprise users and is available through volume licensing.

Windows 7 Ultimate | The Ultimate edition is for the high-end user, gamer, and multimedia professionals. It includes BitLocker disk encryption, which now works on USB flash drives.
<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jump list</td>
<td>A list activated by right-clicking an icon on the taskbar or the Start menu. The options in the list are specific to the icon clicked. By selecting an option in the jump list, the user instantly gets the result.</td>
</tr>
<tr>
<td>Pin</td>
<td>A method of attaching your favorite program anywhere on the taskbar by dragging it from the desktop to the taskbar. Removing it from the taskbar is done by dragging it off the taskbar.</td>
</tr>
<tr>
<td>Snap</td>
<td>A quick (and fun) new way to resize open windows by dragging them to the edges of your screen.</td>
</tr>
<tr>
<td>Windows Search</td>
<td>A feature activated by simply typing a description of what you want to locate in the search box located at the bottom of the Start menu. The results will be a list of relevant documents, pictures, music, and e-mail that match your entered description. Because most users store data on several devices, Windows 7 is designed to search external hard drives, networked PCs, and libraries (a Windows 7 feature that groups related files together regardless of their storage location).</td>
</tr>
</tbody>
</table>
Stand-Alone Operating Systems

• **Microsoft Windows 7**
  - Six versions
    - Starter
    - Home Basic
    - Home Premium
    - Professional
    - Enterprise
    - Ultimate
  - More efficient than previous versions
  - Compatibility issues resolved
  - New features
    - Jump list
    - Pin
    - Snap
    - Windows Search
Stand-Alone Operating Systems

• **Microsoft Windows Vista**
  - Five versions
    - Basic
    - Home Premium
    - Business
    - Ultimate
    - Enterprise
  - Replaced Windows XP
  - Supports tablet PCs and other mobile devices
  - New and improved features, such as:
    - Search
    - Networking tools
    - Integrated speech recognition
    - **Gadgets**—applications that appear as icons
Stand-Alone Operating Systems

- **Mac OS**
  - Used on Macintosh personal computers
  - Stable, simple to use
  - Latest version is **Mac OS X Snow Leopard**
The menu bar contains commands and tasks for the current application.

The System Preferences panel is similar to the Windows Control Panel.

The Dock, similar to the Windows taskbar, provides access to frequently used applications and those currently in use.

The dashboard icon is used to access widgets, similar to the gadgets stored on the sidebar in Windows 7.
Stand-Alone Operating Systems

• **UNIX**
  - Features preemptive multitasking
  - Has many versions that are not compatible
  - Hard to use—defaults to a command-line user interface
  - Mac OS X is based on UNIX
Stand-Alone Operating Systems

• **Linux**
  - Developed by Linus Torvalds in 1991
  - **Open source software**—source code is available to users
  - Powerful, free
  - Features such as
    - Multitasking
    - Virtual memory
    - Internet support
    - GUI
  - Gaining acceptance for Web servers
  - Disadvantages
    - Lack of technical support prevents adoption in corporate environments
    - Difficult to run Microsoft Office applications
• **PC Versus Mac Versus Linux**
  
  o **Platform**—determined by combination of microprocessor chip & OS
  
  o **PCs**
    - Dominate marketplace
    - Windows OS
    - Intel or AMD chip
    - More software available
  
  o **Macs**
    - Mac OS
    - Motorola or IBM chip
    - Most current OS can run Windows software
    - Creative fields are almost exclusive to Mac
  
  o **Linux**
    - Can be installed on PC or Mac
    - More secure—fewer viruses
Stand-Alone Operating Systems

Operating System Usage

- Windows: 92%
- Mac: 5%
- Linux: 1%
- Other: 2%
Stand-Alone Operating Systems

- **Server operating systems**
  - **Microsoft Windows Server 2008**
    - Used in corporate environments to support client/server systems
    - Benefits include:
      - Security
      - Web server
      - Administration
      - Virtualization
  - **Other server operating systems**
    - Unix
    - Linux
    - Netware by Novell
    - Solaris
    - Mac OS X Server
Stand-Alone Operating Systems

- **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.
Stand-Alone Operating Systems

• Microsoft Windows Mobile
  - Designed for smartphones and PDAs
  - Includes simplified versions of Windows programs
  - Supports handwriting recognition and voice recording
  - Supports synchronizing with corresponding programs on desktop computers
Stand-Alone Operating Systems

• More embedded operating systems
  o Window CE
    • Used in devices such as hand-held PCs, video game players, digital cameras, and industrial products such as barcode readers
  o Palm OS
    • Developed for PDAs—currently used in smartphones such as Palm Pixi
  o Symbian OS
    • Open industry standard operating system for data-enabled mobile phones with many add-on devices
Stand-Alone Operating Systems
Stand-Alone Operating Systems

- More embedded operating systems
  - Android
    - Supports CDMA (Code Division Multiple Access) and more screen resolutions
  - iPhone OS
    - Features
      - Genius Mixes
      - Genius Recommendations
      - Saving video from mail and MMS into Camera Roll
      - Save a New Clip option
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
  - **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
System Utilities: Housekeeping Tools

Location of Backup and Restore utility

Storage medium for the backup

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**System Utilities: Housekeeping Tools**

- **Antivirus software**—protects the computer from viruses
  - Popular antivirus programs:
    - BitDefender Antivirus
    - Kaspersky Anti-virus
    - Webroot AntiVirus with SpySweeper
    - Norton AntiVirus
    - ESET Nod32 Antivirus
    - McAfee
System Utilities: Housekeeping Tools

• Searching for and managing files
  o File manager (Windows Explorer)—utility software that organizes and manages data
    • Copy files
    • Determine how and where files are stored
    • Delete files
  o Search utility—enables you to locate files
System Utilities: Housekeeping Tools

- Content of the current folder appears on the right side of the screen.
- Breadcrumbs in the Address bar show the path to your current location.
- Content can be sorted or filtered by using the column headings.
- The Navigation pane, on the left side of the window, displays folders and drives.
- The Details pane displays specifics on the selected file.
Enter the description of your search into the Search box located at the bottom of the Start menu.

The Save Search tool can save frequently used searches.

Search results begin to appear as soon as you start to type.

In the Search Results window, your search string appears in the upper right corner.
System Utilities: Housekeeping Tools

- Scanning and defragmenting disks
  - Disk scanning programs—find and resolve disk file storage problems
    - Bad sector—irregularity on the disk’s surface that renders a portion of the disk unable to store data reliably
  - Disk cleanup utilities—remove unnecessary files to save space
  - Fragmented disk (actually files)—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
System Utilities: Housekeeping Tools

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

Notice the difference in file size.

Compressed document

Original document
System Utilities: Housekeeping Tools

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

Path to the Ease of Access Center

Start On-Screen Keyboard option
System Utilities: Housekeeping Tools

• Systems update
  o Windows Update for Windows 7 and Vista automatically downloads and installs updates.
  o Includes service packs, version upgrades, and security updates
System Utilities: Housekeeping Tools

• Troubleshooting
  o Keep a **boot disk (system recovery disk)**—to load the operating system for emergencies
  o Use the Windows Help and Support utility
  o Shut down the system properly.
    • Use correct procedure; don’t just turn the power off.
    • Put in **sleep** mode, a low-power state, as an alternative.
System Utilities: Housekeeping Tools

- **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
  o Helps determine when system’s performance began to degrade
  o Gives details about events that may have caused the problem

• Help and Support
  o Available from Start menu
  o Includes several ways to manage and maintain the computer
Summary

• List the two major components of system software.
• List the five basic functions of an operating system.
• Explain why a computer needs an operating system.
• Explain what happens when you turn on a computer.
Summary

• List the three major types of user interfaces.
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