Computers Are Your Future
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Chapter 4

System Software
What You Will Learn . . .

- The two major components of operating system software
- Why a computer isn’t useful without an operating system
- The five basic functions of an operating system
- What happens when you turn on a computer
- The three major types of user interfaces
What You Will Learn . . .

✓ The strengths and weaknesses of the most popular operating systems
✓ The seven essential system utilities
✓ Data backup procedures
✓ Troubleshooting techniques
System software includes all of the programs needed to keep a computer and its peripheral devices running smoothly.

Two major categories of system software are:
- Operating systems (OS)
- System utilities
The Operating System (OS): The Computer’s Traffic Cop

✓ The operating system is a set of programs that perform certain basic functions with a specific type of hardware

✓ The functions of the operating system are:
  ➢ Starting the computer
  ➢ Managing programs
  ➢ Managing memory
  ➢ Handling messages from input and output devices
  ➢ Enabling user interaction with the computer
Starting the Computer

✓ **Booting** – The process of loading or reloading the operating system into the computer’s memory

✓ The booting processes are:
  - **Cold boot** – Loads the OS when the power is turned on
  - **Warm boot** – Reloads the OS when the computer is already on
Starting the Computer

☑ The computer copies the kernel from the hard drive into the computer’s memory

➢ The kernel:
  ▪ Is the central part of the operating system
  ▪ Starts all applications
  ▪ Manages devices and memory
  ▪ Resides in memory at all times
  ▪ Performs other essential functions
Starting the Computer

The step-by-step booting process (click for each step):

1. Power-on Self-test is completed
2. BIOS is loaded
3. Operating System is loaded
4. System configuration is accomplished
5. System Utilities are loaded
6. Users are authenticated
Step 1: The BIOS and Setup Program

- **ROM** (read only memory) – Permanent and unchanging memory
- **BIOS** (basic input/output system) – The part of the system software that includes the instructions that the computer uses to accept input and output
- **Load** – To transfer from a storage device to memory
- ROM loads BIOS into the computer’s memory
- **Setup program** – A special program containing settings that control the computer’s hardware
  - The program can be accessed while the BIOS information is visible
Step 2: The Power-On-Self-Test (POST)

POST (power-on-self-test) – A series of tests conducted on the computer’s main memory (random access memory or RAM), input/output devices, disk drives, and the hard disk.

- BIOS conducts a Power-On-Self-Test (POST) to check the input/output system for operability.

The computer will produce a beeping sound and an error message will appear on the monitor if any problems are encountered.
Step 3: The Operating System (OS) Loads

- BIOS searches for the OS
- Settings in the CMOS—complementary metal-oxide semiconductor—determine where to look for the OS
- The operating system’s kernel is loaded into the computer’s memory
- The OS takes control of the computer and begins loading system configuration information
Step 4: System Configuration

✓ **Registry** – A database that stores information about peripherals and software

✓ **Peripheral** – Device connected to a computer

✓ **Driver** – A utility program that makes peripheral devices function properly

✓ The system is configured from the operating system’s registry

✓ Drivers are loaded into memory
Step 5: System Utilities Loads

✓ System utilities are loaded into memory

- Volume control
- Antivirus software
- PC card unplugging utility
Step 6: Users Authentication

- Authentication or user login occurs
  - User name
  - Password

- The user interface starts, enabling user interaction with computer programs
Managing Applications

- **Single-tasking** operating systems run one application program at a time.

- **Multitasking** operating systems have the ability to run more than one application program at a time.

- Multitasking is accomplished by:
  - A foreground application – The active program or program in use
  - One or more background applications – Inactive program(s) or program(s) not in use
Example of Multitasking

Background application

Foreground application
Managing Programs

✓ **Preemptive multitasking** – Enables the operating system to regain control if an application stops working.
Managing Memory

✓ Computers use **memory** to make processing more fluid

✓ The operating system allocates memory areas for each running program; it keeps programs from interfering with each other

✓ The operating system uses **virtual memory** as an extension of random access memory (RAM)
Managing Virtual Memory

Virtual memory management involves transferring data or program instructions between the memory and the hard disk. The diagram shows the process of swapping in and swapping out pages. The most recently transferred data or program instructions are kept in memory, while the least recently used data or program instructions are swapped out to the swap file on the hard disk.
Handling Input and Output

- Input and output devices generate **interrupts**, or signals, that tell the operating system that something has happened.

- The OS provides **interrupt handlers** or mini-programs that begin when an interrupt occurs.

- **Interrupt request** (IRQ) lines handle the communications between input/output devices and the CPU.

- An **IRQ conflict** causes system instability when two devices try to use the same IRQ line.
Providing the User Interface

The **user interface** is that part of the operating system with which the user interacts with a computer.

User interface functions:
- Start application programs
- Manage disks and files
- Shut down the computer safely
Graphical User Interface (GUI):

- Uses graphics to create a desktop environment
- Icons (small pictures) represent computer resources
- Programs run within on-screen windows
Menu-driven User Interface

✓ Menu-driven:
  ➢ Text-based menus are used to show all of the options available to the user
✓ Command-line:

- The user is required to type keywords or commands in order to enter data or give instructions.
Exploring Popular Operating Systems

**WINDOWS XP**

**WINDOWS NT**

**WINDOWS CE**

**MAC OS X**
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Exploring Popular Operating Systems

LINUX  MS-DOS  UNIX
Microsoft Windows

Click to view each Windows version (1985-2001)
Windows XP

✓ Released in 2001 by Microsoft
✓ XP is short for “experience”
✓ Uses the same underlying code for all versions
✓ Replaces all previous versions of Windows
✓ Three versions:
  - Windows XP Home Edition
  - Windows XP Professional
  - Windows XP Server
Windows NT

- Released in 1993 by Microsoft
- Designed for client/server systems
- Two components:
  - Windows NT Workstation
  - Windows NT Server
- Oriented to business needs
- Offers security, remote administration, directory services, and a Web server
Windows CE

- Released in 1996 by Microsoft
- System used in PDAs or palmtops
- Runs simplified versions of Windows programs
- Data can be transferred to PCs
- Includes handwriting and voice recognition
MAC OS

✓ Created in 1984
✓ First OS to use graphical user interface
✓ Easiest operating system for beginners
✓ A new version, Mac OS X, was released in 2000
Linux

- Developed in 1991 by UNIX
- Open-source code – Available for all to see and use
- Competes with Windows and MAC-OS
- Powerful and free
- Growing acceptance
MS-DOS

- Developed for IBM PCs in 1981
- Uses command-line interface
- Use is diminishing
UNIX

✓ Developed by AT&T in 1970s
✓ Included first preemptive multitasking system
✓ Developed concepts of file management and path names
✓ Facilitates client/server networking
✓ Widely used by corporations
System Utilities: Tools for Housekeeping

✓ System utilities are programs that help the operating system manage the computer system’s resources

✓ Types of utilities:
  - Backup software
  - Antivirus software
  - Disk scanning
  - Disk defragmentation
  - File management
  - File-searching software
  - File compression
Backup software includes programs that enable the user to copy data from the hard disk to another storage medium.

Types of backups:
- Full backup
- Incremental backup
Antivirus software protects the computer from computer viruses
File Management Utilities

- Known as a file manager
- Enables the user to perform various tasks on storage devices using files, folders, and directories
- Tasks include:
  - Creating folders
  - Saving, deleting, copying, and moving files and folders
  - Examining the contents of files
  - Launching application programs
Search programs enable users to find files on storage devices.
File Compression Utility

✓ A file compression utility reduces the size of a file
Disk Scanning Programs

✅ **Disk-scanning utilities** are programs that detect and fix physical and logical problems on storage devices.

✅ **Disk cleanup utilities** are programs that remove files that are no longer needed.
Disk Defragmentation Programs

A disk defragmentation program moves data on a storage device to improve performance.
System Update

✓ Windows Update keeps the operating system up to date

⇒ windowsupdate.microsoft.com
Troubleshooting

✓ Computer startup failure:
  ➢ Use a boot disk (emergency disk) in the floppy drive

✓ Configuration problems after adding new peripherals:
  ➢ Start the computer in Windows’ safe mode
    ▪ Access safe mode by pressing the F8 key during the startup process
Troubleshooting

✓ System slowdown:
  ➢ Scan for viruses
  ➢ Check the CPU fan
  ➢ Check BIOS options
  ➢ Defragment the hard disk
Shutting Down Your System

✓ Click Start, then Turn Off Computer
  ➢ Standby - low power state
  ➢ Shut Down – turns computer off
  ➢ Restart – reboots computer
Chapter 4 Summary

- Two of the system software components are the operating system and system utilities.
- The operating system coordinates the functions of a computer’s hardware and provides support for application programs.
- An operating system manages programs, memory, and input/output devices, and it also provides a means of communicating with the user.
- The six steps to start a computer are loading the BIOS, power-on self-test, load operating system, configure system, load utilities, authenticate users.
Chapter 4 Summary (continued)

• Two major operating systems for the personal computer are Microsoft Windows and the Mac OS X
• The basic types of user interface are command-line, menu-driven, and graphical
• System utilities keep the computer running efficiently
• Backup procedures keep data safe
• Troubleshooting is helpful for discovering errors