Computers Are Your Future

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4 Software Basics

The Ghost in the Machine

A Fast, Stupid Machine

Computers:
- Have limited capabilities
- Can only do basic mathematics and logical comparisons
- Must be instructed with programs what to do

Processing with Programs

Software programs are:
- stored in memory
- a set of instructions that tell a computer what to do
- designed to solve problems

The Language of Computers

✓ Programmers begin with an algorithm, which is:
- A set of step-by-step instructions (written in a natural language, e.g., English)
- Algorithms are translated into the vocabulary of a programming language

Programming Languages

Bridge the gap

Human language
Numeric code

COBOL, BASIC, Visual BASIC, C++, Java are a few of hundreds of programming languages
A compiler is software that translates the high level language to the machine language.

FOR Counter = 1 to 10
    Print Counter
NEXT counter

APPLICATIONS SOFTWARE
- programs employed by end-users to perform specific tasks
  - e.g., word processors, spreadsheets, etc.

SYSTEMS SOFTWARE
- programs and utilities that help manage the operation of the computer system
  - e.g., operating system

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 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

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 – Reloading the OS when the computer is already on

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):

- **BIOS is loaded**
- **Power-on self-test is completed**
- **Operating System is loaded**
- **System configuration is accomplished**
- **System Utilities are loaded**
- **Users are authenticated**

**Firmware stored in ROM BIOS chip**

**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

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
  - Hard disk
  - swap file
  - Page swapper
  - Least recently used data or program instructions
  - Next recently used data or program instructions

Parts of an Operating System

- **MEMORY MANAGER** – allocates memory segments for system and user processes
- **Virtual Memory**
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

The User Interface

Text-based Command Line Interpreters (CLIs)

- **Intense, powerful, steeper learning curves, unforgiving**

```plaintext
copy a:\mywork\excel\loan.xls c:\current

cd public_html/csci107
```

Graphical User Interfaces (GUIs)

- **Graphical user interface (GUI):**
  - Uses graphics to create a desktop environment
  - Icons (small pictures) represent computer resources
  - Programs run within on-screen windows

- **WIMP** – windows, icons, menus, pointing devices

Menu-driven User Interface

- **Menu-driven:**
  - Text-based menus are used to show all of the options available to the user

Command-Line Interface

- **Command-line:**
  - The user is required to type keywords or commands in order to enter data or give instructions
MS-DOS
- Developed for IBM PCs in 1981
- Uses command-line interface
- Use is diminishing

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

Windows 98 (1998)

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

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

- 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

- 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
Parts of an Operating System

- **FILE MANAGER** - creates and manages the file system for storing user’s data
  - logical files vs. disks and data blocks
  - hierarchical file system

Search

- **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
Utilities

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/Spyware
  - 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
• 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