

CHAPTER 1: COMPUTER HISTORY, FUNDAMENTALS, AND OPERATING SYSTEMS

Quick Summary

Computers are an integral part of daily life. Looking at the past clarifies the present and directs your future.

A little history - In the 1980s:

- Only the U.S. government and large universities were able to access the Internet—including e-mail.
- Cell phones were just coming into use.
- The World Wide Web would not become viable until 1993.

Today:

- Millions of people around the world use the Internet in both their professional and personal lives.
- Cell phones, laptop computers, and the need for instant connectivity are a vital component of daily mobile life.

In the Future:

- The more you understand and learn about computers, the less mysterious and confusing they will seem.
- This increased understanding will prepare you to make technology-related decisions.

A *computer* is a machine that performs four basic operations under a program's direction and control—also referred to as the *information–processing cycle*. The four basic operations include:

- **Input:** The action of entering data into the computer system.
- **Processing:** The manipulation of the input—data—by a sequence of instructions that converts the input into information. **Information** is data converted into a meaningful format.
- **Output:** The display of the information.
- **Storage:** The action of saving information for later use

A computer system, also referred to as a system, is a collection of related components that work together to accomplish a task. A computer system has two categories of components—**hardware** and **software**.

Hardware includes:

- **System unit:** The base unit of the computer made up of the plastic or metal enclosure.
- **Motherboard:** The circuit board located within the system unit to which all components are connected.
- **Central processing unit-** CPU or Processor: A chip that is anchored to the board and acts as the brain of computer system.
- **Random Access Memory-** also referred to as RAM: temporarily stores the programs and data with which the CPU is interacting.
- **Integrated Peripherals:** Components inside or outside the system unit that are connected physically or wirelessly to the system unit and motherboard. Inside components include power supply, cooling fans, memory, CD or DVD drive, and internal hard drive. Outside components include keyboards, mice, monitors, printers, external storage devices, etc.

Software is a set of instructions that tells the computer how to perform a certain task. There are two primary types of software:

- **Application Software:** Programs that direct the computer to carry out specific tasks; for example, word processing, playing a game, or computing numbers on a worksheet.
- **System software:** The programs that enable your computer's hardware to work with and run the application software. It provides the interface between you, other programs, and the computer's hardware. *System software has two major components:* (1) the **operating system** and (2) **system utilities**.

Additional Hardware includes:

- **Input devices:** Keyboard, mouse, microphones, scanners, digital cameras, and camcorders - devices that enable you to input data.
- **Output devices:** Monitor, printer, or speakers - devices that enable you to view, see, and hear the results of processing operations.
- **Storage devices:** Hard drives, USB flash drives, CDs, DVDs, and flash memory cards - devices that retain your programs and data even when power is disrupted or turned off.
- **Communication devices:** Modems, cables, ports, and devices like smartphones, tablets, and notebooks - these devices enable **communication** - the high-speed exchange of information within and between computers or other communication devices.

Recall system software has two major components: (1) the operating system and (2) system utilities, which perform various maintenance functions.

The ***operating system (OS)*** is essentially a set of programs designed to work with a specific type of hardware, such as a PC or a Macintosh. Its most important role is coordinating the various functions of the computer's hardware. The operating system also provides support for running application software. The operating system is most often found on a hard disk, although on some small handheld computers, you'll find the operating system on a memory chip.

Providing a necessary addition to an operating system, ***system utilities*** (also called ***utility programs***) are used to keep your computer system running smoothly. Sometimes these programs are included in the operating system; sometimes software vendors provide them for an additional cost.

The primary functions of an operating system are:

- Starting the computer and transferring files from the storage device to RAM memory.
- Managing applications that are active or running in the background.
- Managing random access memory (RAM) to optimize its use.
- Coordinating tasks including the communication between input and output devices and programs.
- Providing a user interface to allow for easy and seamless communication between you and your computer.

What happens when you boot, or turn on, your computer?

The *booting* of your computer, whether it is a *cold* or *warm boot*, is a step-by-step process.

1. **Activate** the basic input/output system – **BIOS**: BIOS refers to information that is permanently written in your computer's ROM - *read only memory*. It consists of descriptions of the equipment that your system contains, typically the CPU, hard disk, RAM, and video component—equipment you do not usually replace. The operating system then uses the BIOS data to control those devices.
2. Perform the **power-on self-test** – **POST**: A series of tests to make sure that the computer and associated peripherals are operating correctly
3. **Load the operating system into RAM**: After the power-on self-test is successfully completed, the BIOS initiates a search for the operating system. When BIOS locates the operating system, it loads the operating system's kernel into RAM memory. At that point, the operating system takes control of the computer from BIOS and begins loading system configuration information.
4. **Configure and customize settings**: After the operating system's kernel is loaded, it checks the system's configuration to determine which drivers and other utility programs are needed.
5. **Load needed system utilities**: After the operating system detects and configures all of the system's hardware, it loads system utilities such as speaker volume control, antivirus software, and power management options.

6. ***Authenticate the user:*** The process of verifying that the person using the computer is authorized to use the computer.

How does an operating system manage applications that are active?

Most operating systems today are referred to as ***multitasking operating systems*** because they permit more than one application to run at the same time and are capable of managing these multiple applications as they run simultaneously. The operating system is able to switch between applications as needed. Modern operating systems use ***preemptive multitasking***—an environment in which programs do not run from start to finish but are interrupted or suspended in order to start or continue to run another task. Each task receives a recurring slice of time from the CPU. The time slice may or may not be the same for all programs.

How does an operating system manage random access memory (RAM)?

To ensure that programs run quickly, operating systems use the computer's RAM as a ***buffer***—an area that temporarily holds data and instructions. Because the computer's operating system is responsible for managing this memory area, it gives each running program, and some devices, a portion of RAM, and then keeps the programs from interfering with each other's use of memory.

How does an operating system coordinate tasks between devices?

Your operating system coordinates tasks involving input and output devices, and also enables communication with these devices and the programs in use. Most operating systems come with device drivers for popular input and output devices. **Device drivers** are programs containing specific instructions to allow a particular brand and model of input or output device to communicate and function properly with the operating system.

How many types of user interfaces are there?

There are three basic types of user interfaces: (1) command-line interface, (2) menu-driven interface, and (3) graphical user interface (GUI). GUIs are the easiest to use, but some experienced users prefer the speed of command-line interfaces.

- **Command-line user interface** requires the user to type commands using keywords that tell the operating system what to do (such as format or copy) one line at a time. The user must observe complicated rules of **syntax** that specify exactly what can be typed in a given place.
- **Menu-driven user interface** enables the user to avoid memorizing keywords and syntax. On-screen text-based menus show all the options available at a given point. With most systems, the user selects an option with the arrow keys and then presses Enter. Some systems enable the user to click the desired option with the mouse or to choose a letter with the keyboard.
- A **graphical user interface** (GUI, pronounced “goeey”) is a program interface that takes advantage of the computer’s graphics capabilities to make the program easier to use. GUIs are used to create the desktop environment, in which

computer resources (such as programs, data files, and network connections) are represented by icons. Although GUIs are easy to use, they make heavy demands on a computer's processing circuitry and can slow the computer down considerably.

The three categories for operating systems are (1) standalone operating systems, (2) server operating systems, and (3) embedded operating systems.

- ***Standalone operating systems*** work on a desktop computer, laptop, notebook, or any portable computing device. The term standalone indicates that it does not need to be connected to any other system or computer to run. (e.g. Windows and Linx)
- ***Server operating systems*** are used in client/server network environment. Normally, they are complete operating systems with a file and task manager. Additional features such as a Web server, directory services, and a messaging system may also be included. (e.g. Unix and Microsoft Windows Server)
- ***Embedded operating systems*** are found on ROM chips in the portable or dedicated devices we use today. PDAs, cell phones, point-of-sale devices, VCRs, industrial robot controls, and even modern toasters are examples of devices that contain embedded systems. (e.g. IOS for iPhones, Android)

Essential system utilities include backup software, antivirus software, searching for and managing files, scanning and defragmenting disks, file compression utilities, system updates, and troubleshooting.

- **Backup software** is an essential part of safe, efficient computer use. It copies data from the computer's hard disk to backup devices such as CDs and DVDs, an external hard drive, or an online storage location. Should the hard disk fail, the user can recover the data from the backup disk.
- **Antivirus software** protects a computer from computer viruses. This software works by examining all the files on a disk and looking for the telltale "signatures" of virus code. One limitation of such programs is that they can detect only those viruses whose signatures are in their databases. Most antivirus programs enable the user to download the signatures of new viruses from a Web site.
- Another important system utility is the ability to search for and manage files. The **file manager**, such as Windows Explorer, is a utility program that enables you to perform various operations on the files and folders held in your computer's storage devices. In order to locate a file you may have misplaced on your storage device, most operating systems also include a **search utility** – a program that searches an entire hard disk or peripheral storage device for the file you designate.
- A **disk scanning program**, or disk scanner, is an error checking program, can detect and resolve physical and logical problems that can occur when your computer stores files on a disk. A **disk cleanup utility** differs from a disk scanning program in that it does not correct any problems. Instead, it improves system performance and increases storage space by removing files that you no longer need. Another utility, a **disk defragmentation program**, is used to reorganize the data on the disk so that it is reassembled as

one chunk of disk space, which decreases disk search time when trying to re-open a file.

- ***File compression utilities*** can reduce the size of a file by as much as 80 percent without harming the data. Most file compression utilities work by searching the file for frequently repeated but lengthy data patterns and substituting short codes for these patterns. When the file is decompressed, the utility restores the lengthier pattern in which each code is encountered.
- ***Accessibility utilities*** make computing easier for individuals with special needs. Windows 7 includes a screen magnifier, on-screen keyboard, speech recognition utility, and a narrator feature – that reads out loud everything on the screen. These utilities are accessible from the Control Panel in the Ease of Access category