CHAPTER 6 OPERATING SYSTEM

Any computer system you use has an operating system. The user interacts with the machine via the operating system. A software on the machine interacts with the hardware via the operating system. Operating system intermediates between the hardware and the user. The purpose of this chapter is to introduce you to the Operating System.

6.1 INTRODUCTION

The computer system comprises of a functional set of hardware, software, user and data. Hardware consists of the components of computer like memory, processor, storage devices, and Input/Output devices. The software may be of different kinds—application software and system softwa re. A computer system may be a single stand-alone system or may consist of several interconnected systems. The user uses the application software to perform various tasks, for example, the user uses word processing software for document preparation. While using the application software, the user uses the storage of a computer—to store a document on the hard disk, to execute a command on the CPU, to retrieve a document from a peripheral device or to print document on printer. For using the hardware, there is a need for software that interacts with both the hardware and the application software. Operating system (OS) is the software that provides an interface between the computer hardware, and the application programs or users (Figure 6.1).

In this chapter, we discuss about the components of operating system, the different types of operating system and the functions of operating system. A brief description of some operating systems is also given.
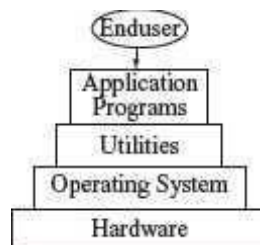

Figure 6.1 View of components of computer system

7.1 OBJECTIVES OF OPERATING SYSTEM

Operating system is system software that controls and coordinates the use of hardware among the different application software and users. OS intermediates between the user of computer and the computer hardware. The user gives a command and the OS translates the command into a form that the machine can understand and execute. OS has two main objectives—(1) to make the computer system convenient and easy to use, for the user, and—(2) to use the computer hardware in an efficient way, by handling the details of the operations of the hardware.

- OS hides the working of the hardware from the user and makes it convenient for the user to use the machine. The application program used by the user requires the use of the hardware during processing. Some examples are—display of application's user interface, loading a program into memory, using I/O devices, allocating CPU to different processes during

execution, and store or load data from hard disk. When using the machine, the user gives the command to perform the required actions to the OS and the OS handles all the operational steps. The user is not bothered about how these actions will be performed. This is the job of OS. OS provides an interface to the application programs to interact with the hardware. The user need not get into the details of this interaction.

- At the other end, the different resources of computer hardware have to be managed and controlled. This includes managing the communication between different devices, controlling the sequence and execution of processes, allocating space on hard disk, providing error handling procedures etc. OS supervises and manages the hardware of the computer.

Some of the commonly used operating systems are Microsoft Disk Operating System (MS- DOS), Windows 6, Windows XP, Linux, UNIX, and Mac OS X Snow Leopard.

6.2 TYPES OF OPERATING SYSTEMS

OS are classified into different types depending on their capability of processing—(1) Single user, (2) Multiuser, (3) Multitasking, (4) Multiprocessing, (5) Real time, and (6) Embedded.

- Single User and Single Task OS is for use by a single user for a standalone single computer for performing a single task (Figure 6.2). Operating system for Personal Computers (PC) are singleuser OS. For example, if the user is editing a document, then a document cannot be printed on the printer simultaneously. Single user OS are simple operating system designed to manage one task at a time. MS-DOS is an example of single user OS.

Figure 6.2 A single user performing a single task

- Single User and Multitasking OS allows execution of more than one task or process concurrently. For this, the processor time is divided amongst different tasks. This division of time is also called time sharing. The processor switches rapidly between processes. For example, the user can listen to music on the computer while writing an article using a word processor software. The user can switch between the applications and also transfer data between them (Figure 6.3). Windows 95 and all later versions of Windows are examples of multitasking OS.

Figure 6.3 A single user performing multitasking (issuing print command and making drawings)

- **Multiuser OS** is used in computer networks that allow same data and applications to be accessed by multiple users at the same time (Figure 6.4). The users can also communicate with each other. Linux, UNIX, and Windows 6 are examples of multiuser OS.
- **Multiprocessing OS** have two or more processors for a single running process. Processing takes place in parallel and is also called *parallel processing*. Each processor

works on different parts of the same task, or, on two or more different tasks. Since execution takes place in parallel, they are used for high speed execution, and to increase the power of computer. Linux, UNIX and Windows 6 are examples of multiprocessing OS.

Figure 6.4 Multiple users working on connected computers

Real Time OS are designed to respond to an event within a predetermined time. These operating systems are used to control processes. Processing is done within a time constraint. OS monitors the events that affect the execution of process and respond accordingly. They are used to respond to queries in areas like medical imaging system, industrial control systems etc. LynxOS is an example of real time OS.

Embedded OS is embedded in a device in the ROM. They are specific to a device and are less resource intensive. They are used in appliances like microwaves, washing machines, traffic control systems etc.

6.3 FUNCTIONS OF OPERSATING SYSTEM

Operating system is a large and complex software consisting of several components. Each component of the operating system has its own set of defined inputs and outputs. Different components of OS perform specific tasks to provide the overall functionality of the operating system (Figure 6.5). Main functions of the operating system are as follows:

Figure 6.5 Functions of OS

- **Process Management**—The process management activities handled by the OS are—(1) control access to shared resources like file, memory, I/O and CPU, (2) control execution of applications, (3) create, execute and delete a process (system process or user process),
  - □ cancel or resume a process (5) schedule a process, and (6) synchronization, communication and deadlock handling for processes.
- **Memory Management**—The activities of memory management handled by OS are—(1) allocate memory, (2) free memory, (3) re-allocate memory to a program when a used block is freed, and (4) keep track of memory usage.
- **File Management**—The file management tasks include—(1) create and delete both files and directories, (2) provide access to files, (3) allocate space for files, (4) keep back-up of files, and (5) secure files.
- **Device Management**—The device management tasks handled by OS are—(1) open, close and write device drivers, and (2) communicate, control and monitor the device driver.
- **Protection and Security**—OS protects the resources of system. User authentication, file attributes like read, write, encryption, and back-up of data are used by OS to provide basic protection.
- **User Interface or Command Interpreter**—Operating system provides an interface between the computer user and the computer hardware. The user interface is a set of commands or a graphical user interface via which the user interacts with the applications and the hardware.

6.4 EXAMPLES OF OPERATING SYSTEMS

MS-DOS, Windows family of operating systems, Unix OS, Linux OS, and Mac OS X are some of examples of commonly used OSs. Each operating system has specific characteristics. Here, we will discuss the features of the MS-DOS, Windows family of operating systems and Linux operating system.

MS-DOS

- MS-DOS was the first widely-installed operating system for PCs in 1980s.
- MS-DOS is easy to load and install. It neither requires much memory for the operating system, nor a very powerful computer to run on.
- MS-DOS is a command line user interface operating system. This means that the user has to type single line commands through the command interface. So, user has to remember the different commands and their syntax.
- It is a single-user and single-tasking operating system for the PC. Only one user can use it and only one task can be executed, at a given point of time. Also, it does not have a built-in support for networking.
- MS-DOS is a 16-bit OS, meaning thereby that it can send or receive 16 bits of data at a time and can process 16 bits of data. It is not able to take the advantage of 32-bit processors.
- To use MS-DOS, user must know where the programs and data are stored and how to interact with it. In the MS-DOS command mode, *command.com* routine interprets the typed in command from the keyboard.

To get the window of the command prompt [C:_] in the Windows environment

- <Start> <Run> Type "*cmd*" <Enter>, or
- <Start> <All programs> <Accessories> <Command Prompt>

cmd.exe or command prompt is the command line interpreter on the current Windows-based OS. It is similar to command.com in MS-DOS. cmd.exe is a Windows program that acts as a DOS-like command line interpreter.

Windows Family of OS

- Windows is a personal computer operating system from Microsoft.
- The Windows family of OS which is currently in use includes the Windows 9x family (Windows 95, Windows 98 and Windows 2000), Windows XP, Windows Vista, and Windows 6 operating systems.
- Windows family of OS is GUI-based operating system. Since GUI interfaces are easy to use and are user-friendly, these have become very popular.
- Windows support multi-tasking. It means Windows OS allows simultaneous execution of multiple tasks (Figure 6.19).
- Windows contains built-in networking, which allows users to share files and applications with each other, if their PCs are connected to a network.
- Windows 6 comes in six different editions, Starter, Home Basic, Home Premium, Professional, Enterprise and Ultimate.
- With each new version of the Windows OS, the user interface undergoes some changes and the user has to learn to use the new interface. This becomes troublesome for the user.
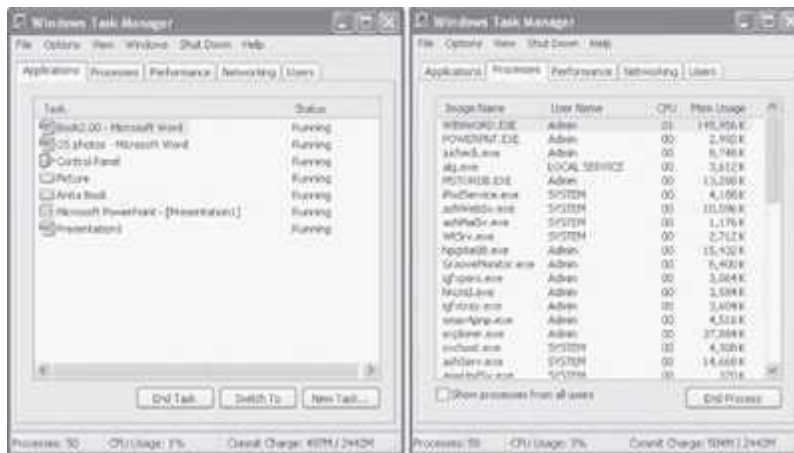

Figure 6.19 Windows task manager

Brief History of Windows OS

The Windows OS has evolved from the Windows 1.0 in the 1985 to the Windows 6 in 2009. In this span of 24 years, several versions of the Windows OS have been released. Table 6.1 gives an overview of the history of the Windows OS, along with their significance.

Year Windows OS Comments Released

Year	Windows OS	Comments Released
1985	Windows 1.0	It was not successful
1990	Windows 3.0	The first commercially successful version of Windows. It is an upgrade to the interface over Windows 1 and 2
1993	Windows NT 3.1	The first Microsoft OS not based in DOS. Separate versions of NT with their DOS counterparts are released
1995	Windows 95	The first native 32 bit OS. Microsoft plans to merge the NT and DOS platforms but are unsuccessful due to backward compatibility issues and lack of hardware support of NT.
1998	Windows 98	Microsoft integrates its web browser in the GUI and file manager. Hackers can use the Internet to infiltrate a computer or network.
2000	Windows 2000	As with Windows 95, Microsoft planned Windows 2000 to merge the NT and DOS based OS's but was unsuccessful
2001	Windows XP	Windows XP successfully merges the compatibility found in Windows 98 with the stability found in Windows NT/2000. It provides enhanced stability over Windows 98.
2005	Windows XP Professional x64 Edition	OS was slow to take off due to the dearth of 64-bit software and drivers
2008	Windows Vista	First 3D operating system
2009	Windows 6	Some of the new features included in Windows 6 are advancements in touch, speech, and handwriting recognition, support for virtual hard disks, support for additional file formats, improved performance on multi-core processors, improved boot performance, and kernel improvements.

Table 6.1 Windows OS overview

Linux OS

- Linux is a Unix-like OS. Unix OS has a user interface called *shell*. The kernel provides interface for the programs to interact with the hardware, and provides services like process management and memory management. The shell interacts with the kernel through the system calls.
- Linux was developed by *Linus Torvalds* in 1992. Linux is copyright under the GNU Public License. Linux is a "free" operating system that is easily available. Since Linux follows the open development model, it is being constantly upgraded by programmers across the globe.
- Some organizations offer Linux with add-on features and capabilities. Red Hat, Mandrake, Debian and Novell are the popular vendors of Linux OS.
- Tux, the Linux penguin is the official mascot of Linux.
- Linux is a command line user interface OS. Linux has GUI interfaces called desktop environments like GNOME and K Desktop Environment (KDE). The GUI interface is convenient for the user to use.
- Linux is a 32-bit, multi-tasking OS. It supports multiple users and multiple processors.
- Linux is a reliable and secure OS, and is available almost for free. So, Linux is fast becoming very popular and powerful OS.
- Linux OS is easily available, such as Redhat Linux ver. 9, and, Debian·s— Ubuntu, Kubuntu, and Edubuntu