



OPERATING SYSTEMS

In the previous lesson you have learnt about computer software. An operating system is system software that runs on a computer. Every computer must have an operating system to run other programs and applications. An operating system (OS) is a program that acts as an interface between the user and the computer hardware. Without an operating system, a computer and software programs would be useless. Operating system performs basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers. In this lesson, you will learn about functions of operating system and types of operating system.



OBJECTIVES

After reading this lesson, you will be able to:

- define operating system;
- list the functions of operating system;
- classify operating system.

4.1 OPERATING SYSTEM

A computer is a machine which needs to be instructed for every single step. The operating system is the most important software that runs on a computer. The OS performs the following functions.

- It provides a convenient and an efficient environment for users to execute programs.
- It is a software which manages hardware.

- An operating system controls the allocation of resources like memory, processors, devices, and information.
- It makes sure that different programs and multi-users do not interfere with each other.

Computer system cannot operate without an operating system. Some of the most common operating systems are Windows operating systems (by Microsoft), Macintosh operating systems (by Apple) and UNIX family of operating systems. There are many operating systems which are available for special-purpose applications, including specializations for mainframes, robotics, real-time control systems and so on.

There are certain standard services which are required by every application program (like music player, word processor, games, etc.). A few examples of services which are provided by the operating system are:

1. While listening to music on the media player, it works to retrieve the music from its source. The operating system sends the information from the music player to the speakers so that we can hear the music.
2. The OS sends the signals to the printer when the word processing program prints the output on the paper.
3. On a network, where more than one computer shares a printer or other resource, the OS will coordinate those activities.
4. Managing memory when multiple programs are running. For example, listening to music and writing your notes in the word processor are two different applications which are allocated memory by the OS.

Thus, for users, it does the basic management of hardware and software resources and sets the system to look and perform the way they want it.

OS, is a collection of software that manages computer hardware resources and provides common services for computer programs. It deals with management and coordination of its activities. The operating system is a vital component of the system software in a computer system.

4.2 FUNCTIONS OF OPERATING SYSTEM

The operating system manages computer resources, especially the allocation or assignment of the resources among other programs. Management tasks include scheduling the resources to avoid conflicts and interference between programs.

The various functions of operating system are shown in Fig. 4.1.



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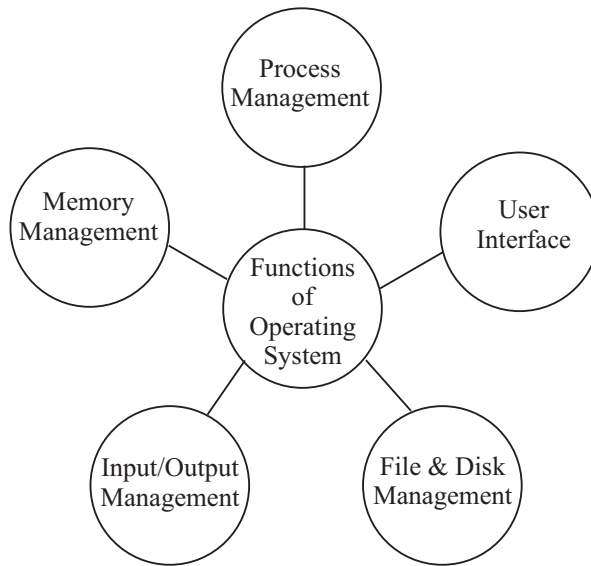
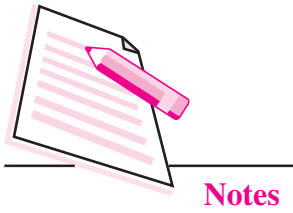


Fig. 4.1: Functions of Operating System

Let us now discuss each function in detail.

4.2.1 Process Management

We know that a program is a set of logical instructions given to the computer. A program that is in an execution state is called a **process**. For example, a word processing program like MS-Word being run by a user on a personal computer is a process. A system task, such as sending output to a printer, can also be a process.

A process needs certain resources-such as CPU time, memory, files and I/O devices to accomplish its tasks. These resources are allocated to the process either when they are created or while they are executing. The operating system helps in the allocation of resources to each process. The most critical task for an operating system is allocation of the CPU time. Each process is allowed to use the CPU for a limited time, which may be a fraction of a second. It must then give up control and thus becomes suspended until its next turn. Thus, to maximize CPU utilization and allow multiple processes to run, process scheduling is performed by the OS. The operating system is responsible for creation, deletion, and scheduling of various processes that are being executed at any point of time.

4.2.2 Memory Management

A computer program remains in main (RAM) memory during its execution. To improve CPU usage several processes are being executed simultaneously in the memory. The OS keeps track of every memory location, that is either assigned to some process or is free. It also checks how much memory should be assigned to each process.

4.2.3 Input/Output Management

Humans interact with machines by providing information through input output devices. Management of input/output (I/O) devices is one of the most important functions of an operating system. A few examples of the variety of input/output devices on a modern computer are- mouse, keyboards, disk drives, USB devices, I/O, printers, special devices for the physically challenged, etc. Operating system provides a generic, consistent, convenient and reliable way to access I/O devices.

OS responds to the user keystrokes, mouse clicks and other input formats. It then interprets the I/O requests so that requested input/output functions can be performed. For this the operating system requires device driver software to interact with a particular hardware device.

4.2.4 File and Disk Management

Computer systems have secondary storage devices like magnetic disk, magnetic tape, optical media, flash drives, etc. for permanent storage of programs and data. The programs and the user data are stored in files. In general, a file is a sequence of bits, bytes, lines or records. The operating system is responsible for allocating space for files on secondary storage media. A file, especially a large file, may or may not be stored in a contiguous location on a physical disk drive. If the file is of large size, it is fragmented into smaller pieces. The OS then keeps track of the memory location allocated to each piece of the file on the storage disk.

The operating system is thus responsible for the organisation of the file system. It guarantees that the read and write operations performed on the secondary storage device are secure and reliable. The operating system must be able to read, write and search each file whenever it is required, keeping the access time to the minimum. Operating systems like DOS, Windows, Macintosh and Unix follow the hierarchical structure to store files and folders, e.g. in case of windows, a file is placed in the desired folder or a subfolder.

4.2.5 User Interface

A User Interface (UI) is the part of an operating system, program or device that the user uses to input and receive data. A **Text User Interface** (TUI) or **Command Line Interface** (CLI) allows users to interact with an operating system by typing commands in a terminal or console window. The users type a command or series of commands for each task they want to perform on a visual prompt. Examples of command line based operating systems are DOS (Disk Operating System), and UNIX etc.



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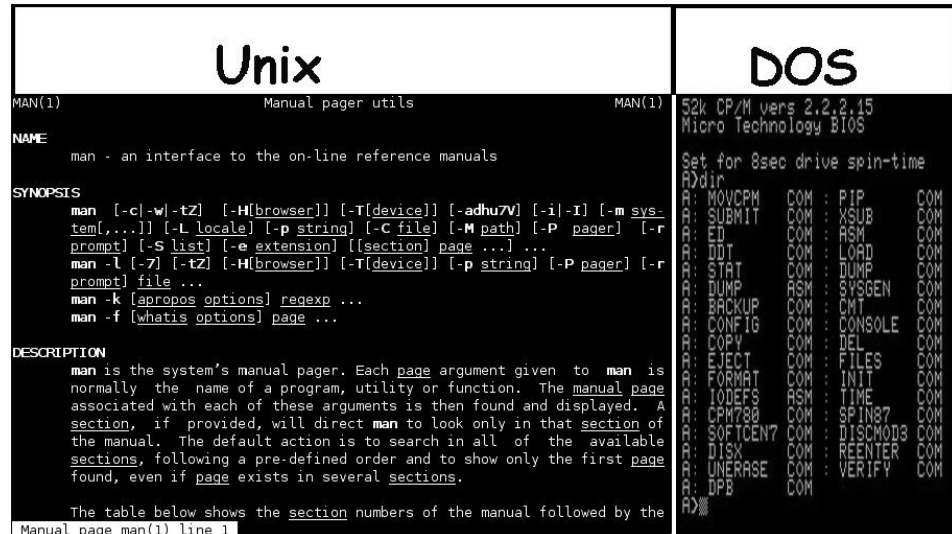


Fig. 4.2: Screenshot of UNIX and DOS window

Graphical User Interface (GUI) is an easy to use interface. It uses graphics, along with a keyboard and a mouse, to provide an easy-to-use interface to a program. A GUI makes interaction for the user easy with the operating system or applications because it provides you with features like pull-down menus, buttons, scrollbars, iconic images, wizards and other icons. Examples of GUI operating systems are Windows, Linux, and Solaris.



Fig. 4.3: GUI Operating Systems

Difference between GUI and CLI

| Basis | GUI | CLI |
|-------|--|--|
| Ease | GUI is very easy to interact with the computer. For example, application programs, commands, disk drives, files etc., are presented in the form of icons. You can click using mouse on these icons. GUI also provides menus, buttons and other graphical objects to the user to perform different tasks. | The new users find it difficult to use the command line interface since, it requires memorization of commands. |

| | | |
|-----------------|--|---|
| Control | GUI provides a lot of control over the file system and the operating system but still to perform some advanced level tasks command line is required. | Some advanced level tasks can be performed only through commands. Users using command line interface get much more control over the operating system and the file system. For example, a single line command may be used to copy a file from one location to the other. |
| Resource | In the case of GUI, a lot of system resources are required, because each component such as drivers for video, mouse and other devices also needs to be loaded. | Very few computer resources are needed when the system is running. |
| Example | Windows, Macintosh, Linux | UNIX,MS-DOS |



Notes



INTEXT QUESTIONS 4.1

- I. Choose the appropriate answer.
 1. What is an Operating system?
 - (a) Collection of programs that manages hardware resources
 - (b) System service provider to the application programs
 - (c) Link to interface the hardware and application programs
 - d) All of the above
 2. Process is
 - (a) Program in high-level language kept on disk.
 - (b) A program in execution.
 - (c) Contents of main memory.
 - (d) A job in secondary memory.
 - (e) None of the above.
 3. An is an intermediary between users and computer hardware.
 - (a) Operating environment
 - (b) Operating System
 - (c) System Software
 - (d) None



Notes

II. Fill in the blanks.

1. and are two types of user interfaces.
2.,,, are all the resources managed by operating system.
3. is an example of GUI based OS.

4.3 TYPES OF OPERATING SYSTEM

There are many different operating systems that have been developed for different purposes. The most typical OS in ordinary desktop computers and laptops are Microsoft Windows, Linux, UNIX, etc.

4.3.1 Microsoft Windows

Windows is an operating system designed by Microsoft. It is the most popular OS for home PCs. There have been many versions of Windows, but the most recent ones include Windows 10 (released in 2015), Windows 8 (2012), Windows 7 (2009), Windows Vista (2007).



Fig. 4.4: Windows 10 Operating system

Features of Microsoft Windows Operating System

- (a) It is GUI based operating system, i.e., interaction with the computer is done by clicking with mouse on the icons. GUI also provides menus, buttons

and other graphical objects to the user to perform different tasks. GUI is very easy to interact with the computer. Thus, Windows eliminate the need to memorize commands for the command line (MS-DOS).

- (b) Several programs can be opened at the same time, i.e., it supports multiprogramming and multitasking.

4.3.2 Linux

Linux is an open-source operating system. The term open source refers to program code which is freely available and its source code is available to developers or users for modification. Linux typically provides two GUIs: KDE and Gnome. The various distributions of Linux come from different companies like Red Hat, SuSE, Ubuntu, Xandros etc.



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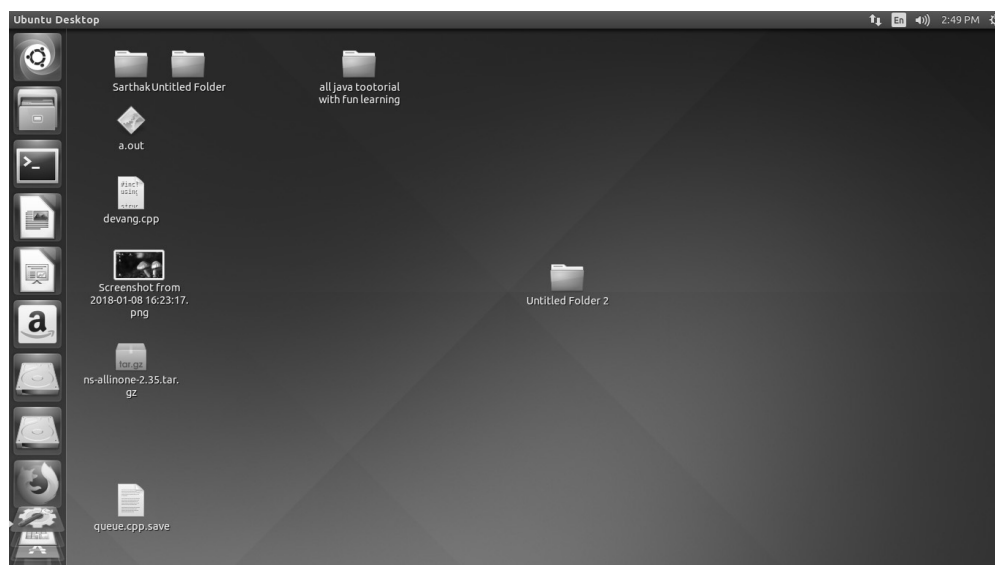


Fig. 4.5: Linux operating system

Linux operating system has three main components.

- (i) *Kernel - Core part of Linux. It is responsible for major activities of operating system.*
- (ii) *System library - It has special functions using which application programs access Kernel's features.*
- (iii) *System utility - It is responsible to do specialized, individual level tasks.*

**Notes****Features of Linux Operating System**

- (a) It is an open source OS. Open source refers to any program whose source code is made available for use or modification. Open source software is usually developed as a public collaboration and made freely available.
- (b) It is a multi-user system operating system that supports multiple users at once or different times.

Linux is customizable in a way that Windows is not. The user interface, while similar in concept, varies in detail from distribution to distribution.

4.3.3 UNIX

UNIX is an operating system developed in the 1960s. It is a stable, multi-user, multi-tasking system for servers, desktops, and laptops. There are many different versions of UNIX, although they share common similarities. The most popular versions of UNIX are Sun Solaris and MacOS X.

Features of UNIX Operating System

- (a) UNIX is a flexible operating system. It can be installed on many different types of machines like main-frame computers, supercomputers, and micro-computers.
- (b) UNIX has better built-in security and permissions features than Windows.

4.3.4 Smartphone Operating Systems

Smartphones are using operating systems too. This development has brought many advanced functions on mobile which were already available on our computer. Mobile phones or smartphones are not just a device to make phone calls or send some texts, but they are close to handheld computers that enable us to send email, play games, watch news, do video calls and much more. It is also a platform where developers can create applications or ‘app’ (software programs developed for smartphones that can perform specific functions). There are thousands of apps available, and they are constantly evolving - each with its distinct purpose. For example, you can download weather app that tells you the current temperature or possibility of rain in your city.

Let us learn about some of the smartphone operating systems in detail.

(a) iOS

Apple iOS is a multi-touch, multi-tasking operating system that runs on Apple iPhone, iPad, and iPod. It gives the response on the user’s touch. It allows them

to tap on the screen to open a program, enlarge an image, or swipe a finger on the screen to change the pages. Apple iOS can only be used by products made by Apple. It comes with the Safari web browser for internet access, iTunes application for playing music, and Mail app for accessing mail. You can download millions of apps like recipe books, guitar tutorials, games or any other app of your interest available on the App Store on any Apple device running iOS.



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Fig. 4.6: iOS Home Screens Evolution

(b) Android

Android is an open source mobile operating system owned by Google. You can find a wide range of devices from smartphones, to Android TV'S, tablets etc. which use Android as OS. The source code of the open software is available i.e., the source code can be viewed, altered and shared. Open source operating systems are fully customizable. It provides unlimited access to anyone who wants to develop apps for the phone and puts less restriction on its licensing, so users benefit from the free content. Android smartphone has a wide range of customers now. The Android market has millions of apps, most of which are totally free.



Fig. 4.7: Android based smart phones



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(c) Windows Phone

Microsoft released its Windows platform for mobile phones in late 2010. The Windows phone home screen resembles a Windows Desktop start menu. Windows phone is recognizable from its tile-based interface. The Home screen is fully customizable to add or remove tiles (square / rectangular shaped selectable icons), resize tiles and move them around on the screen to reorganize. The content like photos, music, etc. from various applications are automatically grouped together by the aggregator feature called hubs. Aforementioned enables easy access to similar content in one place for the user without opening individual applications. For example, all the photos from the mobile camera, downloaded from apps like Facebook, etc. are shown in a single location. Windows OS comes with Internet Explorer for web access and Microsoft Exchange for secure corporate emails access. These applications have been optimised for mobiles.



Fig. 4.8: Windows Phone



INTEXT QUESTIONS 4.2

Fill in the blanks.

1.,, are some of the smartphone operating systems.
2. operating system is developed by Microsoft.
3. Linux is an operating system.

4. and are widely used as server operating system.
5. is the latest version of Windows.
6. Software programs developed for smartphones that can carryout specific functions are called as
7. is an open source mobile OS and is developed by



Notes



WHAT YOU HAVE LEARNT

- An Operating System (OS) is an interface between users and computer hardware. It provides users an environment in which a user can execute programs conveniently and efficiently.
- An operating system controls the allocation of resources and services such as memory, processors, devices and information.
- A file is a collection of related information that is recorded on secondary storage device.
- Multiprogramming is the ability of an operating system to execute more than one program on a single processor machine. More than one task/program/job/process can reside into the main memory at one point of time.
- A multiuser operating system is a computer operating system (OS) that allows multiple users on different computers or terminals to access a single system with one OS on it.
- Multitasking is the ability of an operating system to execute more than one task simultaneously on a single processor machine. Though we say so but in reality no two tasks on a single processor machine can be executed at the same time. Actually CPU switches from one task to the next task so quickly that appears as if all the tasks are executing at the same time.



TERMINAL EXERCISE

1. State all the important functions of operating system. Explain with the help of diagrams.
2. Explain all the functions of operating system.
3. What are the advantages and disadvantages of GUI based operating system?
4. Explain different types of smartphone operating systems.



Notes

5. What do you understand by open source software? Give some examples.
6. What is the difference between Windows and Linux operating systems?

**ANSWERS TO INTEXT QUESTIONS****4.1****I.**

1. d) All of the above
2. b) A program in execution
3. b) Operating System

II.

1. GUI and CUI
2. Memory, file, input/output, process
3. Windows

4.2

1. Android, iOS, Windows
2. Windows
3. Open Source
4. Linux and Unix
5. Windows 10
6. Apps(application)
7. Android, Google