Theoretical concepts of Operating System

🎯 Learning objectives

✓ To know the concept of Operating Systems and their types.
✓ To acquire the basic Knowledge of Operating Systems and its functions.

4.1 Introduction to Software

A software is set of instructions that perform specific task. It interacts basically with the hardware to generate the desired output.

4.1.1 Types of Software

Software is classified into two types:

1) Application Software
2) System Software

Application Software:

Application software is a set of programs to perform specific task. For example MS-word is an application software to create text document and VLC player is familiar application software to play audio, video files and many more.

System Software:

System software is a type of computer program that is designed to run the computer's hardware and application programs. Example Operating System and Language Processor

4.2 Introduction to Operating System (OS):

An Operating System (OS) is a system software which serves as an interface between a user and a computer.

This controls input, output and other peripheral devices such as disk drives, printers and electronic gadgets. The functions of an Operating System include file management, memory management, process management and device management and many more.
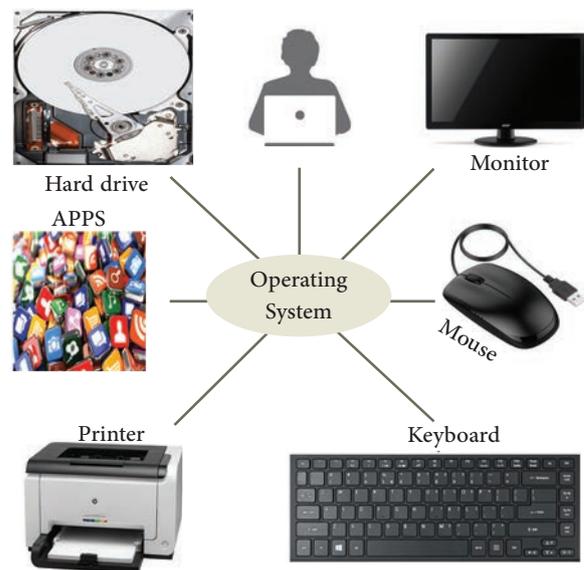

Figure: 4.1 Operating System

Without an Operating System, a computer cannot effectively manage all the resources. When a computer is switched on, the operating system is loaded in to the memory automatically.

Some of the popular Operating Systems used in personal computers and laptops are **Windows**, **UNIX** and **Linux**. The mobile devices mostly use Android and ioS as mobile **OS.**
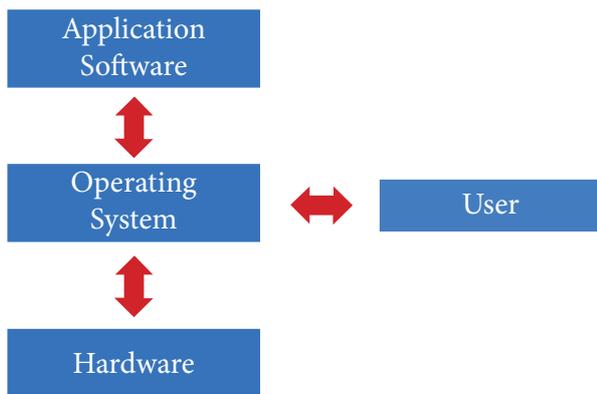
Figure: 4.2 Interaction of Operating system and user

Uses of Operating Systems

The following are few uses of Operating System

The main use of Operating System is

- ⌃ to ensure that a computer can be used to extract what the user wants it do.

- ⌃ Easy interaction between the users and computers.

- ⌃ Starting computer operation automatically when power is turned on (Booting).

- ⌃ Controlling Input and Output Devices

- ⌃ Manage the utilisation of main memory.

- ⌃ Providing security to user programs.

4.3 Types of Operating System

Operating System are classified into the following types depending on their processing capabilities.

4.3.1 Single User Operating Systems

An operating system allows only a single user to perform a task at a time. It is called as a Single user and single Task operating system.MS-DOS is an example for a single user and single task Operating System.

4.3.2 Multi-user Operating Systems

It is used in computers and laptops that allow same data and applications to be accessed by multiple users at the same time. The users can also communicate with each other. Windows, Linux and UNIX are examples for multi-user Operating System.

4.4 Key features of the Operating System

The various key features are given below
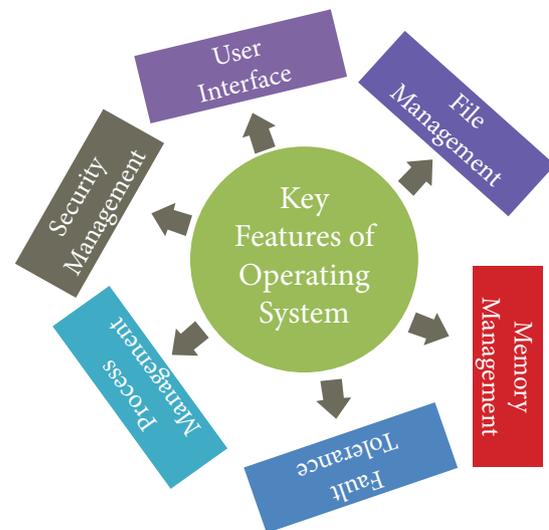
Figure: 4.3 Key Features of the Operating System

4.4.1 User Interface (UI)

User interface is one of the significant feature in Operating System. The only way that user can make interaction with a computer. This is a main reason for key success of GUI (Graphical User Interface) based Operating System. The GUI is a window based system with a pointing device to direct I/O, choose from menus, make selections and a keyboard to enter text.Its vibrant colours attract the user very easily.

Now Linux distribution is also available as GUI based Operating System. The following points are considered when User Interface is designed for an application.

1. The user interface should enable the user to retain this expertise for a longer time.
2. The user interface should also satisfy the customer based on their needs.
3. The user interface should save user's precious time.
4. The ultimate aim of any product is to satisfy the customer. The User Interface is also to satisfy the customer.
5. The user interface should reduce number of errors committed by the user

4.4.2 Memory Management

Memory Management is the process of controlling and coordinating computer's main memory and assigning memory block (space) to various running programs to optimize overall computer performance. The Memory management involves the allocation of specific memory blocks to individual programs based on user demands.

The objective of Memory Management process is to improve both the utilization of the CPU and the speed of the computer's response to its users via main memory. For these reasons the computers must keep several programs in main memory that associates with many different Memory Management schemes.

The Operating System is responsible for the following activities in connection with memory management:

- Keeping track of which portion of memory are currently being used and who is using them.

- Determining which processes (or parts of processes) and data to move in and out of memory.

- Allocation and de-allocation of memory blocks as needed by the program in main memory. (Garbage Collection)

4.4.3 Process management

Process management is function that includes creating and deleting processes(program) and providing mechanisms for processes to communicate and synchronize with each other.

. A system task, such as sending output to a printer or screen, can also be called as a Process.

A computer consists of a collection of processes, they are classified as two categories:

- Operating System processes which is executed by system code

- User Processes which is execute by user code

All these processes can potentially execute concurrently on a single CPU.

The following algorithms are mainly used to allocate the job (process) to the processor.

1. FIFO   2. SJF   3. Round Robin

4. Based on Priority

FIFO (First In First Out)Scheduling:

This algorithm is based on queuing technique. Assume that a student is

standing in a queue (Row) to get grade sheet from his/her teacher. The other student who stands first in the queue gets his/her grade sheet first and leaves from the queue (Row). Followed by the next student in the queue gets it corrected and so on. This is the basic logic of the FIFO algorithm.

Technically, the process that enters the queue first is executed first by the CPU, followed by the next and so on. The processes are executed in the order of the queue (row).

SJF (Shortest Job First)Scheduling:

This algorithm works based on the size of the job being executed by the CPU.

Consider two jobs A and B.

1) A = 6 kilo bytes   2) B = 9 kilo bytes

First the job "A" will be assigned and then job "B" gets its turn.

Round RobinScheduling

The Round Robin (RR) scheduling algorithm is designed especially for time sharing systems. Jobs (processes) are assigned and processor time in a circular method. For example take three jobs A, B, C. First the job A is assigned to CPU then job B and job C and then again A, B and C and so on.

Based On Priority

The given job (process) is assigned based on a Priority. The job which has higher priority is more important than other jobs. Take two jobs A and B. Let the priority of A be 5 and priority B be 7.

Job B is assigned to the processor before job A.

4.4.4 Security Management

The major challenge in computer and software industry is to protect user's legitimate data from hackers. The Operating System provides three levels of securities to the user end. They are

(1) File access level

(2) System level

(3) Network level

In order to access the files created by other people, you should have the access permission. Permissions can either be granted by the creator of the file or bythe administrator of the system.

System level security is offered by the password in a multi-user environment.

Both windows and Linux offer the password facility.

Network security is an indefinable one. So people from all over the world try to provide such a security.

All the above levels of security features are provided only by the Operating System.

4.4.5 Fault Tolerance

The Operating Systems should be robust. When there is a fault, the Operating System should not crash, instead the Operating System have fault tolerance capabilities and retain the existing state of system.

4.4.6 File Management

File management is an important function of OS which handles the data storage techniques. The operating System manages the files, folders and directory systems on a computer. The FAT(File Allocation Table) stores general information about files like filename, type (text or binary), size, starting address and access mode. The file manager of the operating system helps to create, edit, copy, allocate memory to the files and also updates the FAT. There are few other file management techniques available like Next Generation File System (NTFS) and ext2(Linux).

4.4.7 Multi-Processing

This is a one of the features of Operating System. It has two or more processors for a single running process (job). Processing takes place in parallel is known as parallel processing. Since the execution takes place in parallel, this feature is used for high speed execution which increases the power of computing.

4.4.8 Time-sharing

This is a one of the features of Operating Systems. It allows execution of multiple tasks or processes concurrently. For each task a fixed time is allocated. This division of time is called Time- sharing. The processor switches rapidly between various processes after a time is elapsed or the process is completed.

For example assume that there are three processes called P1, P2, P3 and time allocated for each process 30, 40, 50 minutes respectively. If the process P1 completes within 20 minutes then processor takes the next process P2 for the execution. If the process P2 could not complete within 40 minutes, then the current process P2 will be paused and switch over to the next process P3.

4.4.9 Distributed Operating Systems

The Distributed Operating System is used to access shared data and files that reside in any machine around the world using internet/intranet. The users can access as if it is available on their own computer.

The advantages of distributed Operating System are as follows:

- A user at one location can make use of all the resources available at another location over the network.

- Many computer resources can be added easily in the network

- Improves the interaction with the customers and clients.

- Reduces the load on the host computer.
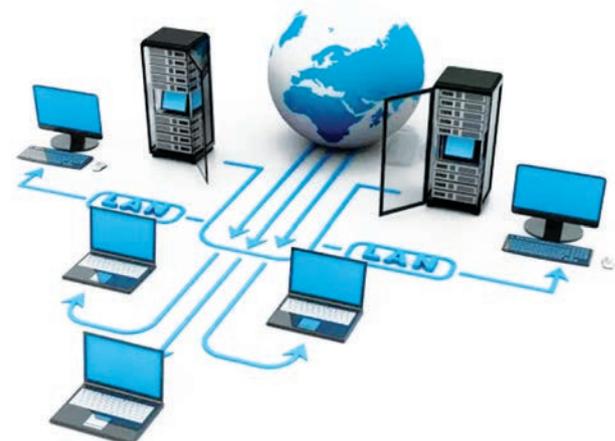
Figure: 4.4 Distributed Operating Systems

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4.5 Prominent Operating Systems

Prominent OS are as follows:

- UNIX
- Microsoft Windows
- Linux
- iOS
- Android

Modern operating systems use a Graphical User Interface(GUI). A GUI lets use to your mouse to click icons, buttons, menus and everything, is clearly displayed on the screen using a combination of graphics and text elements.

Student Activity

Activity 1: Draw a line between the operating system logo and the correct description.

A command-line operating system is an example of Open Source software development and Free Operating System	
A popular Operating System for mobile phone technology which is not linked with Apple products.	
Used with Apple computers and works well with cloud computing.	
Designed to be used for the Apple iPhone	
Is an Operating System that is very popular in universities, companies, big enterprises etc	
The most popular GUI Operating System for personal computers.	

Evaluation

Part I

1) Operating system is a

   A) Application Software
   B) Hardware
   C) System Software
   D) Component

2) Identify the usage of Operating Systems

   A) Easy interaction between the human and computer
   B) Controlling input & output Devices
   C) Managing use of main memory
   D) All the above

3) Which of the following is not a function of an Operating System?

   A) Process Management
   B) Memory Management
   C) Security management
   D) Complier Environment

4) Which of the following OS is a Commercially licensed Operating system?

   A) Windows   B) UBUNTU
   C) FEDORA   D) REDHAT

5) Which of the following Operating systems support Mobile Devices?

   A) Windows 7   B) Linux
   C) BOSS   D) iOS

6) File Management manages

   A) Files
   B) Folders
   C) Directory systems
   D) All the Above

7) Interactive Operating System provides

   A) Graphics User Interface (GUI)

   B) Data Distribution

   C) Security Management

   D) Real Time Processing

8) An example for single task operating system is

   A) Linux

   B) Windows

   C) MS-DOS

   D) Unix

9) The File management system used by Linux is

   A) ext2

   B) NTFS

   C) FAT

   D) NFTS

Part II

1) List out any two uses of Operating System?

2) What is multi-user Operating system?

3) What is a GUI?

4) What are the security management features available in Operating System ?

5) What is multi-processing?

6) What are the different Operating Systems used in computer?

Part III

8) What are the advantages and disadvantages of Time-sharing features?

9) List out the key features of Operating system

10) Write a note on Multiprocessing

Part IV

11) Explain the concept of a Distributed Operating System along with its advantages.

12) List out the points to be noted while creating a user interface for an Operating system.

13) Explain the process manangement algorithms in Operating System.

📖 References

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