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SUBJECT:- OPERATING SYSTEM-I

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Chapter 1 :- Introduction to Operating Systems

• Operating Systems Overview- system Overview and Functions of operating systems:-

An Operating System (OS) is an interface between a computer user and computer hardware. An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

An operating system is software that enables applications to interact with a computer's hardware. The software that contains the core components of the operating system is called the **kernel**.

The primary purposes of an **Operating System** are to enable applications (spftwares) to interact with a computer's hardware and to manage a system's hardware and software resources.

Some popular Operating Systems include Linux Operating System, Windows Operating System, VMS, OS/400, AIX, z/OS, etc. Today, Operating systems is found almost in every device like mobile phones, personal computers, mainframe computers, automobiles, TV, Toys etc.

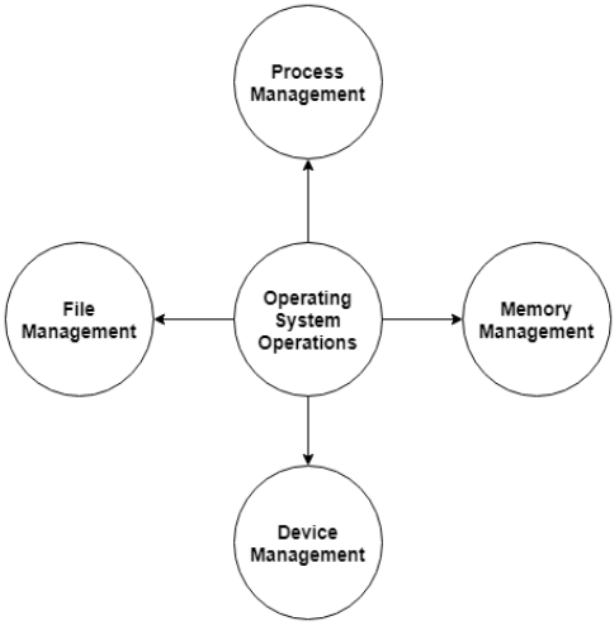
Definitions

An Operating System is the low-level software that supports a computer's basic functions, such as scheduling tasks and controlling peripherals.

• Operating system Operations:-

An **operating system** is a construct that allows the user application programs to interact with the system hardware. Operating system by itself does not provide any function but it provides an atmosphere in which different applications and programs can do useful work.

The major operations of the operating system are process management, memory management, device management and file management. These are given in detail as follows:



1. Process Management

The operating system is responsible for managing the processes i.e assigning the processor to a process at a time. This is known as process scheduling. The different algorithms used for process scheduling are FCFS (first come first served), SJF (shortest job first), priority scheduling, round robin scheduling etc.

There are many scheduling queues that are used to handle processes in process management. When the processes enter the system, they are put into the job queue. The processes that are ready to execute in the main memory are kept in the ready queue. The processes that are waiting for the I/O device are kept in the device queue.

2. Memory Management

Memory management plays an important part in operating system. It deals with memory and the moving of processes from disk to primary memory for execution and back again.

The activities performed by the operating system for memory management are −

- The operating system assigns memory to the processes as required. This can be done using best fit, first fit and worst fit algorithms.
- All the memory is tracked by the operating system i.e. it nodes what memory parts are in use by the processes and which are empty.
- The operating system deallocated memory from processes as required. This may happen when a process has been terminated or if it no longer needs the memory.

3. Device Management

There are many I/O devices handled by the operating system such as mouse, keyboard, disk drive etc. There are different device drivers that can be connected to the operating system to handle a specific device. The device controller is an interface between the device and the device driver. The user applications can access all the I/O devices using the device drivers, which are device specific codes.

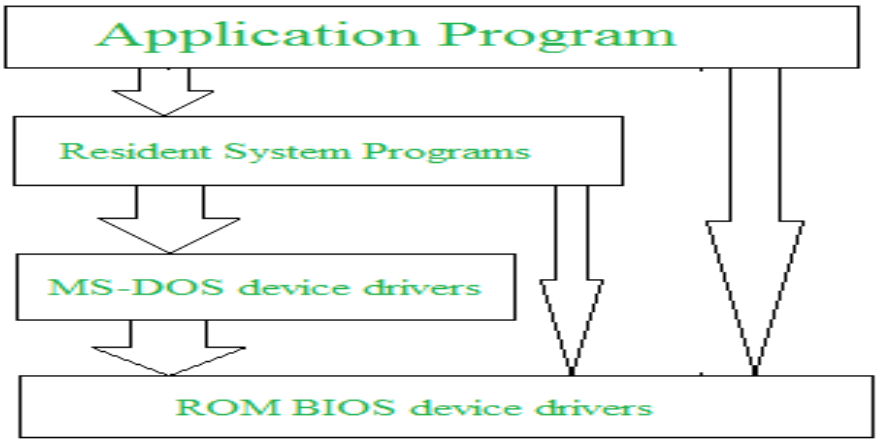
4. File Management

Files are used to provide a uniform view of data storage by the operating system. All the files are mapped onto physical devices that are usually non volatile so data is safe in the case of system failure.

The files can be accessed by the system in two ways i.e. sequential access and direct access −

- **Sequential Access**
  The information in a file is processed in order using sequential access. The files records are accessed on after another. Most of the file systems such as editors, compilers etc. use sequential access.
- **Direct Access**
  In direct access or relative access, the files can be accessed in random for read and write operations. The direct access model is based on the disk model of a file, since it allows random accesses.

• Operating system structure:-



The operating system can be implemented with the help of various structures. The structure of the OS depends mainly on how the various standard components of the operating system are interconnected and melded into the kernel.

A design known as an operating system enables user application programs to communicate with the machine's hardware. Given its complex design and need to be easy to use and modify, the operating system should be constructed with the utmost care. A straightforward way to do this is to supernaturally develop the operating system. These parts must each have unique inputs, outputs, and functionalities.

This article discusses a variety of operating system implementation structures, including those listed below, as well as how and why they function. Additionally, the operating system structure is defined.

• Protection and security:-

Protection and security requires that computer resources such as **CPU**, **softwares**, **memory** etc. are protected. This extends to the operating system as well as the data in the system. This can be done by ensuring integrity, confidentiality and availability in the operating system. The system must be protect against unauthorized access, viruses, worms etc.

Computing environments refer to the technology infrastructure and software platforms that are used to develop, test, deploy, and run software **applications. There are several types of computing environments, including:**

1. Mainframe: A large and powerful computer system used for critical applications and large-scale data processing.
2. Client-Server: A computing environment in which client devices access resources and services from a central server.
3. Cloud Computing: A computing environment in which resources and services are provided over the Internet and accessed through a web browser or client software.
4. Mobile Computing: A computing environment in which users access information and applications using handheld devices such as smartphones and tablets.

5.Grid Computing: A computing environment in which resources and services are shared across multiple computers to perform large-scale computations.

6.Embedded Systems: A computing environment in which software is integrated into devices and products, often with limited processing power and memory.

Booting:-

Booting happens when you start the computer. This happens when we turned ON the power or the computer restarts. The system BIOS (Basic Input/Output System) makes the peripheral devices active. Further, it requires that the boot device loads the operating system into the main memory.

Services of Operating System

1. Program execution
2. Input Output Operations
3. Communication between Process
4. File Management
5. Memory Management
6. Process Management
7. Security and Privacy
8. Resource Management

9. User Interface
10. Networking
11. Error handling
12. Time Management

Program Execution

It is the Operating System that manages how a program is going to be executed. It loads the program into the memory after which it is executed. The order in which they are executed depends on the CPU Scheduling Algorithms. A few are FCFS, SJF, etc. When the program is in execution, the Operating System also handles deadlock i.e. no two processes come for execution at the same time. The Operating System is responsible for the smooth execution of both user and system programs. The Operating System utilizes various resources available for the efficient running of all types of functionalities.

Input Output Operations

Operating System manages the input-output operations and establishes communication between the user and device drivers. Device drivers are software that is associated with hardware that is being managed by the OS so that the sync between the devices works properly. It also provides access to input-output devices to a program when needed.

Communication between Processes

The Operating system manages the communication between processes. Communication between processes includes data transfer among them. If the processes are not on the same computer but connected through a computer network, then also their communication is managed by the Operating System itself.

File Management

The operating system helps in managing files also. If a program needs access to a file, it is the operating system that grants access. These permissions include read-only, read-write, etc. It also provides a platform for the user to create, and delete files. The Operating System is responsible for making decisions regarding the storage of all types of data or files, i.e, floppy disk/hard disk/pen drive, etc. The Operating System decides how the data should be manipulated and stored.

Memory Management

Let's understand memory management by OS in simple way. Imagine a cricket team with limited number of player . The team manager (OS) decide whether the upcoming player will be in playing 11 ,playing 15 or will not be included in team , based on his performance . In the same way, OS first check whether the upcoming program fulfil all requirement to get memory space or not ,if all things good, it checks how much memory space will be sufficient for program and then load the program into memory at certain location. And thus , it prevents program from using unnecessary memory.

Process Management

Let's understand the process management in unique way. Imagine, our kitchen stove as the (CPU) where all cooking(execution) is really happen and chef as the (OS) who uses kitchen-stove(CPU) to cook different dishes(program). The chef(OS) has to cook different dishes(programs) so he ensure that any particular dish(program) does not take long time(unnecessary time) and all dishes(programs) gets a chance to cooked(execution) .The chef(OS) basically scheduled time for all dishes(programs) to run kitchen(all the system) smoothly and thus cooked(execute) all the different dishes(programs) efficiently.

Security and Privacy

- **Security :** OS keep our computer safe from an unauthorized user by adding security layer to it. Basically, Security is nothing but just a layer of protection which protect computer from bad guys like viruses and hackers. OS provide us defenses like firewalls and anti-virus software and ensure good safety of computer and personal information.
- **Privacy :** OS give us facility to keep our essential information hidden like having a lock on our door, where only you can enter and other are not allowed . Basically , it respect our secrets and provide us facility to keep it safe.
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Resource Management

System resources are shared between various processes. It is the Operating system that manages resource sharing. It also manages the CPU time among processes using CPU Scheduling Algorithms. It also helps in the memory management of the system. It also controls input-output devices. The OS also ensures the proper use of all the resources available by deciding which resource to be used by whom

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User Interface

User interface is essential and all operating systems provide it. Users either interface with the operating system through the command-line interface or graphical user interface or GUI. The command interpreter executes the next user-specified command.
A GUI offers the user a mouse-based window and menu system as an interface.

Networking

This service enables communication between devices on a network, such as connecting to the internet, sending and receiving data packets, and managing network connections.

Error Handling

The Operating System also handles the error occurring in the CPU, in Input-Output devices, etc. It also ensures that an error does not occur frequently and fixes the errors. It also prevents the process from coming to a deadlock. It also looks for any type of error or bugs that can occur while any task. The well-secured OS sometimes also acts as a countermeasure for preventing any sort of breach of the Computer System from any external source and probably handling them.

Time Management

Imagine traffic light as (OS), which indicates all the cars(programs) whether it should be stop(red)=>(simple queue) , start(yellow)=>(ready queue),move(green)=>(under execution) and this light (control) changes after a certain interval of time at each side of the road(computer system) so that the cars(program) from all side of road move smoothly without traffic