Operating System

An operating system (OS) is a program that acts as an interface between the system hardware and the user. Moreover, it handles all the interactions between the software and the hardware. All the working of a computer system depends on the OS at the base level. Further, it performs all the functions like handling memory, processes, the interaction between hardware and software, etc. Now, let us look at the functions of the operating system.
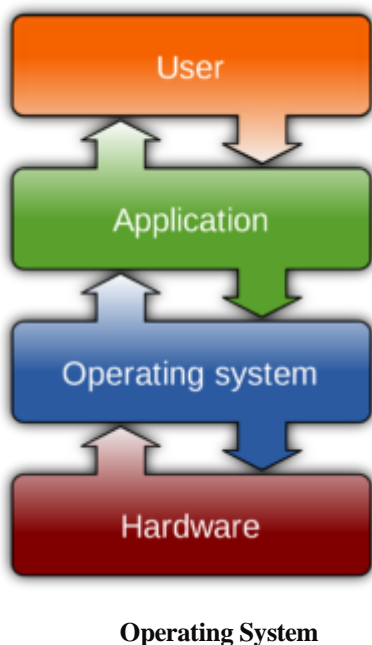
Operating System

Objectives of OS

The primary goals of an operating system are as follows:

- **Convenience** – An operating system improves the use of a machine. Operating systems enable users to get started on the things they wish to complete quickly without having to cope with the stress of first configuring the system.

- **Efficiency** – An operating system enables the efficient use of resources. This is due to less time spent configuring the system.

- **Ability to evolve** – An operating system should be designed in such a way that it allows for the effective development, testing, and introduction of new features without interfering with service.

- **Management of system resources** – It guarantees that resources are shared fairly among various processes and users.

Functions of Operating System

1. Memory Management

It is the management of the main or primary memory. Whatever program is executed, it has to be present in the main memory. Main memory is a quick storage area that may be accessed directly by the CPU. When the program is completed, the memory region is released and can be used by other programs. Therefore, there can be more than one program present at a time. Hence, it is required to manage the memory.

The operating system:

- Allocates and deallocates the memory.

- Keeps a record of which part of primary memory is used by whom and how much.

- Distributes the memory while multiprocessing.

- In multiprogramming, the operating system selects which processes acquire memory when and how much memory they get.

2. Processor Management/Scheduling

Every software that runs on a computer, whether in the background or in the frontend, is a process. Processor management is an execution unit in

which a program operates. The operating system determines the status of the processor and processes, selects a job and its processor, allocates the processor to the process, and de-allocates the processor after the process is completed.

When more than one process runs on the system the OS decides how and when a process will use the CPU. Hence, the name is also **CPU Scheduling**. The OS:

- Allocates and deallocates processor to the processes.

- Keeps record of CPU status.

3. Device Management

An operating system regulates device connection using drivers. The processes may require devices for their use. This management is done by the OS. The OS:

- Allocates and deallocates devices to different processes.

- Keeps records of the devices.

- Decides which process can use which device for how much time.

4. File Management

The operating system manages resource allocation and de-allocation. It specifies which process receives the file and for how long. It also keeps track of information, location, uses, status, and so on. These groupings of resources are referred to as file systems. The files on a system are stored in different directories. The OS:

- Keeps records of the status and locations of files.

- Allocates and deallocates resources.

- Decides who gets the resources.

5. Storage Management

Storage management is a procedure that allows users to maximize the utilization of storage devices while also protecting data integrity on whatever media on which it lives. Network virtualization, replication, mirroring, security, compression, deduplication, traffic analysis, process automation, storage provisioning, and memory management are some of the features that may be included. The operating system is in charge of storing and accessing files. The creation of files, the creation of directories, the reading and writing of data from files and directories, as well as the copying of the contents of files and directories from one location to another are all included in storage management.

The OS uses storage management for:

- Improving the performance of the data storage resources.

- It optimizes the use of various storage devices.

- Assists businesses in storing more data on existing hardware, speeding up the data retrieval process, preventing data loss, meeting data retention regulations, and lowering IT costs

6.Security – For security, modern operating systems employ a firewall. A firewall is a type of security system that monitors all computer activity and blocks it if it detects a threat.

7.Job Accounting – As the operating system keeps track of all the functions of a computer system. Hence, it makes a record of all the activities taking place on the system. It has an account of all the information about the memory, resources, errors, etc. Therefore, this information can be used as and when required.

8.Control over system performance – The operating system will collect consumption statistics for various resources and monitor performance indicators such as reaction time, which is the time between requesting a service and receiving a response from the system.

9.Error detecting aids – While a computer system is running, a variety of errors might occur. Error detection guarantees that data is delivered reliably across susceptible networks. The operating system continuously monitors the system to locate or recognize problems and protects the system from them.

10.Coordination between other software and users – The operating system (OS) allows hardware components to be coordinated and directs and allocates assemblers, interpreters, compilers, and other software to different users of the computer system.

11.Booting process – The process of starting or restarting a computer is referred to as Booting. Cold booting occurs when a computer is totally turned off and then turned back on. Warm booting occurs when the computer is restarted. The operating system (OS) is in charge of booting the computer.

Types of Operating System

The operating system can be of different types. They are as follows:

1. Batch OS

In this system, the OS does not forward the jobs/tasks directly to the CPU. It works by grouping together similar types of jobs under one category. Further, we name this group as a 'batch'. Hence, the name batch OS.

Examples are the payroll system, bank statement, etc.

2. Time-Shared OS

When more than one task takes place on the system it is called time-shared OS. As multiple tasks can run at the system at a time as per requirement. Hence, they all share the CPU time one by one. Therefore, we also name it **multitasking**. The time that each task gets is called **quantum**.

A fixed interval of time is decided for each task. When the first task executes for that period of time, the second task executes, and so on.

Examples are UNIX etc.

3. Distributed OS

In this system, there is more than one CPU present. The OS distributes the tasks among all the processors. The processors do not share any memory or clock time. OS handles all communication between them through various communication lines.

Examples are LOCUS etc.

4. Network OS

In these OS various systems are connected to a server. It allows the system to share resources such as files, printers, applications, etc. Moreover, it gives the capability to serve to manage these resources.

Examples are UNIX, LINUX, Microsoft Windows Server 2008, etc.

5. Real-Time OS (RTOS)

In these systems, the time interval for processing and responding to inputs is very small. Therefore, due to this quality, these are used in real-time situations. For example in missile systems, robots, etc.

They have two categories as follows:

a) Hard Real-Time Systems

In this, the time constraint is very short and strict. Even seconds of delay is not acceptable.

b) Soft Real-Time Systems

In this, the time constraint is not so short and strict.