

Operating System

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 (software's) 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

We can have a number of definitions of an Operating System. Let's go through few of them:

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

We can refine this definition as follows:

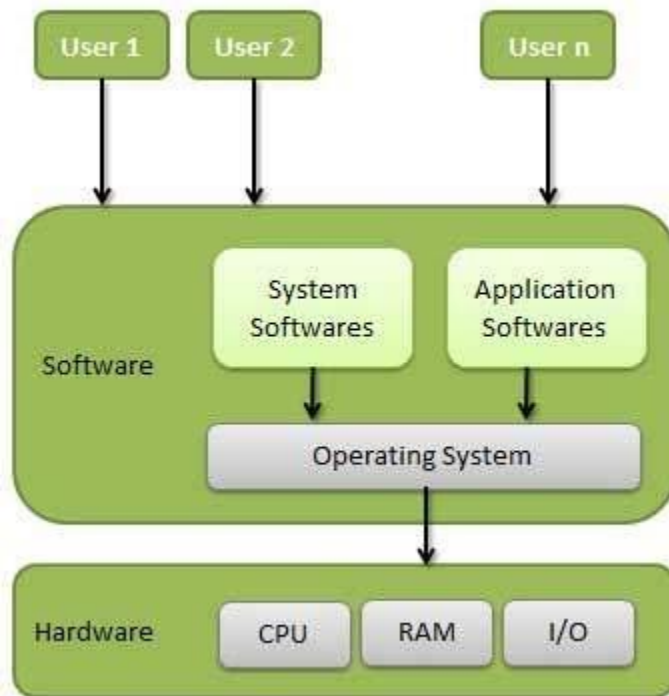
An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.

Following is another definition taken from Wikipedia:

An operating system (OS) is system software that manages computer hardware, software resources, and provides common services for computer programs.

Architecture

We can draw a generic architecture diagram of an Operating System which is as follows:



Operating System Generations

Operating systems have been evolving over the years. We can categories this evaluation based on different generations which is briefed below:

0th Generation

The term 0th generation is used to refer to the period of development of computing when Charles Babbage invented the Analytical Engine and later John Atanasoff created a computer in 1940. The hardware component technology of this period was electronic vacuum tubes. There was no Operating System available for this generation computer and computer programs were written in machine language. These computers in this generation were inefficient and dependent on the varying competencies of the individual programmer as operators.

First Generation (1951-1956)

The first generation marked the beginning of commercial computing including the introduction of Eckert and Mauchly's UNIVAC I in early 1951, and a bit later, the IBM 701.

System operation was performed with the help of expert operators and without the benefit of an operating system for a time though programs began to be written in higher level, procedure-oriented languages, and thus the operator's routine expanded. Later mono-programmed operating system was developed, which eliminated some of the human intervention in running job and provided programmers with a number of desirable functions. These systems still continued to operate under the control of a human operator who used to follow a number of steps to execute a program. Programming language like FORTRAN was developed by John W. Backus in 1956.

Second Generation (1956-1964)

The second generation of computer hardware was most notably characterized by transistors replacing vacuum tubes as the hardware component technology. The first operating system GMOS was developed by the IBM computer. GMOS was based on single stream batch processing system, because it collects all similar jobs in groups or batches and then submits the jobs to the operating system using a punch card to complete all jobs in a machine. Operating system is cleaned after completing one job and then continues to read and initiates the next job in punch card.

Researchers began to experiment with multiprogramming and multiprocessing in their computing services called the time-sharing system. A noteworthy example is the Compatible Time Sharing System (CTSS), developed at MIT during the early 1960s.

Third Generation (1964-1979)

The third generation officially began in April 1964 with IBM's announcement of its System/360 family of computers. Hardware technology began to use integrated circuits (ICs) which yielded significant advantages in both speed and economy.

Operating system development continued with the introduction and widespread adoption of multiprogramming. The idea of taking fuller advantage of the computer's data channel I/O capabilities continued to develop.

Another progress which leads to developing of personal computers in fourth generation is a new development of minicomputers with DEC PDP-1. The third generation was an exciting time, indeed, for the development of both computer hardware and the accompanying operating system.

Fourth Generation (1979 – Present)

The fourth generation is characterised by the appearance of the personal computer and the workstation. The component technology of the third generation, was replaced by very large scale integration (VLSI). Many Operating Systems which we are using today like Windows, Linux, MacOS etc developed in the fourth generation.

Following are some of important functions of an operating System.

- Memory Management
- Processor Management
- Device Management
- File Management
- Network Management
- Security
- Control over system performance
- Job accounting
- Error detecting aids
- Coordination between other software and users

Memory Management

Memory management refers to management of Primary Memory or Main Memory. Main memory is a large array of words or bytes where each word or byte has its own address.

Main memory provides a fast storage that can be accessed directly by the CPU. For a program to be executed, it must in the main memory. An Operating System does the following activities for memory management –

- Keeps tracks of primary memory, i.e., what part of it are in use by whom, what parts are not in use.
- In multiprogramming, the OS decides which process will get memory when and how much.
- Allocates the memory when a process requests it to do so.
- De-allocates the memory when a process no longer needs it or has been terminated.

Processor Management

In multiprogramming environment, the OS decides which process gets the processor when and for how much time. This function is called **process scheduling**. An Operating System does the following activities for processor management –

- Keeps tracks of processor and status of process. The program responsible for this task is known as **traffic controller**.
- Allocates the processor (CPU) to a process.
- De-allocates processor when a process is no longer required.

Device Management

An Operating System manages device communication via their respective drivers. It does the following activities for device management –

- Keeps tracks of all devices. Program responsible for this task is known as the **I/O controller**.
- Decides which process gets the device when and for how much time.
- Allocates the device in the efficient way.
- De-allocates devices.

File Management

A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions.

An Operating System does the following activities for file management –

- Keeps track of information, location, uses, status etc. The collective facilities are often known as **file system**.
- Decides who gets the resources.
- Allocates the resources.
- De-allocates the resources.

Other Important Activities

Following are some of the important activities that an Operating System performs –

- **Security** – By means of password and similar other techniques, it prevents unauthorized access to programs and data.
- **Control over system performance** – Recording delays between request for a service and response from the system.
- **Job accounting** – Keeping track of time and resources used by various jobs and users.
- **Error detecting aids** – Production of dumps, traces, error messages, and other debugging and error detecting aids.
- **Coordination between other software and users** – Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.