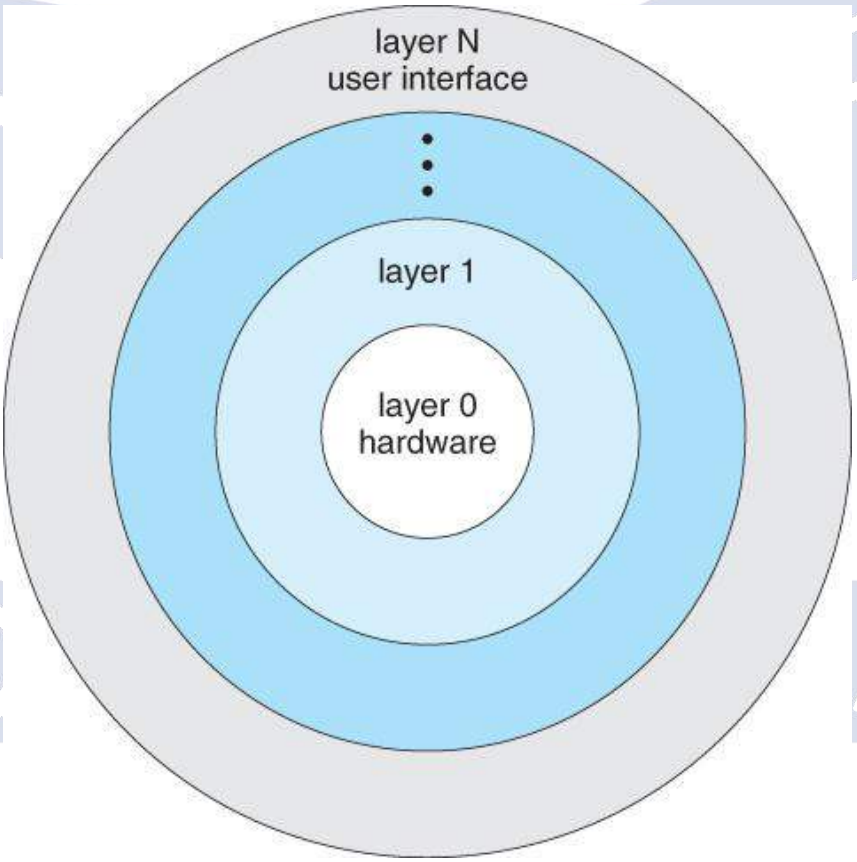
Operating System

An Operating System (OS) is a program that acts as an interface between a computer user and computer hardware. It performs all the basic tasks and controls the peripheral devices such as disk drives and printers.

Examples – Linux (Ubuntu), Windows (Windows XP, Windows 7, Windows 8, Windows 8.1, Windows 10), iOS, Chrome OS, DOS etc.

Apple's latest operating system, macOS Mojave, version 10.14.

Layered Structure of Operating System



Functions of Operating systems

The operating system is the manager of all system resources. The functions of operating systems are:

1. Memory Management
2. Process Management
3. Device Management
4. File Management
5. Storage Management
6. Security
7. Job Accounting
8. Controls system performance
9. Error detecting aids
10. Coordination between other software and users

1. **Memory Management**

   Memory management is the process of controlling and coordinating computer memory, conveying memory blocks to various running programs to enhance overall system performance.

2. **Process Management**

   Process Management allocates the processor (CPU) to a process and de- allocates the processor when a process is no longer essential. It can save the tracks of the processor and the status of the process.

3. **Device Management**

   Device Management keeps track of all devices. This is called the Input/output controller and it decides which process gets the device, when, and for how long.

4. **File Management**

   File Management allocates and de-allocates the resources. It keeps track of information, location, uses, status etc. The collective facilities are known as a file system.

5. **Storage Management**

   Storage Management provides secondary storage to backup main memory. It can store all data and program permanently. Disk scheduling, Storage allocation, Free space management are the activities in Storage Management.

6. **Security**

   Security controls the unauthorized access of programs, processes and data resources by means of passwords etc. It can be used to ensure that the files, memory segment, and other resources can be operated only by authorized users.

7. **Job Accounting**

   It keeps track of time and resources used by various users and processes.

8. **Control System Performance**

   Control System records delays between the request for a service and from the system.

9. **Error Detecting Aids**

   Error detecting Aids ensure the consistent delivery of data across the network. Production of dumps, traces, error messages and other debugging etc are techniques that enable reliable delivery of digital data over unreliable communication channels.

10. **Coordination between other software and users**

Operating System Coordinates and assigns compilers, interpreters, assemblers and other software to the various users of the computer systems.

Types of Operating Systems

1. Batch Operating System
2. Multi-Programming Operating System
3. Timesharing/Multitasking Operating System
4. Distributed Operating System
5. Real-Time Operating System
6. Single-user operating System

1. Batch Operating System

The users of the batch operating system do not interact with the computer directly. Each user prepares his job on an off-line device like punch cards and submits it to the computer operator.

Disadvantages

- Lack of interaction between the user and the job
- The speed of the process is slow. Hence Output is time taking
- The CPU is in idle condition

2. Multiprogramming Operating System

The users of multiprogramming operating system can execute several programs simultaneously. The CPU keeps on processing. The processes which are running exist in main memory at a time.

Disadvantages

- The waiting time for the job is high
- Complicated schedule handling

3. Timesharing / Multitasking Operating System

Time-sharing or multitasking is a logical extension of multiprogramming. It is a technique which enables many people, located at various terminals, to use a computer system at the same time. The CPU executes multiple programs by switching among the programs. Unix is an example of timesharing OS.

Disadvantages

- Less Reliability
- Problem of Data Communication

4. **Distributed Operating System** – Distributed Operating System allows multiple users on different computers or terminals to access a single system with one Operating System on it. The processors communicate with one another through various communication lines. These are referred to as loosely coupled systems.

Advantages

- Potential Operation
- Better service to the customers.
- The load on the host computer is reduced
- Delays in data processing are reduced

5. Single User Operating System

This type of operating system supports a single user at any given time. Single keyboard and Single monitor are used for interaction. Several programs can also run by a single user in this operating system.

Example – Windows 95, Windows XP etc

6. Real-Time Operating System

It is a data processing system in which the time interval required to process and respond to inputs is small. It is always online whereas online system need not be real time. They are used in scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, air traffic control systems, etc.

Examples – VRTX, RT Linux, Lynx etc

There are two types of real-time operating systems.

7. Hard real-time systems

In this system, the critical tasks complete on time. Secondary storage is limited, and the data is stored in ROM. Virtual memory is almost never found.

Examples – Industrial control applications, Robots, etc

8. Soft real-time systems

In this system, the time constraint is less strict. A critical real-time task gets priority and retains the priority until it completes. It has limited utility.

Examples – Multimedia, Virtual reality, Advanced Scientific Projects like undersea exploration and planetary rovers, etc.

Advantages

- It can be used in an embedded system
- Error-free
- Better memory allocation

Disadvantages

- Algorithm is complex

Android - Android is the name of the operating system used on many smartphones and tablets. It is owned and maintained by Google. The recent version of Android is Android 11.

Other Terms related to Operating System

- **Booting -** When the computer starts, the operating system is first loaded (as it is essential for running all other programs), this process is known as booting.
- **Cold Boot –** Turn ON the computer from an OFF position is called Cold Booting.
- **Warm Boot** - A computer system starts up/reset from a complete powerless state is called Warm Booting.
- **Firmware** - Firmware is a software program that is written to a hardware device. It allows the hardware to be updated. The contents are saved when a hardware device is turned off or loses its externalpower source.
- **Middleware** - Middleware is a software layer situated between applications and operating systems.It enables communication and data management for distributed applications.