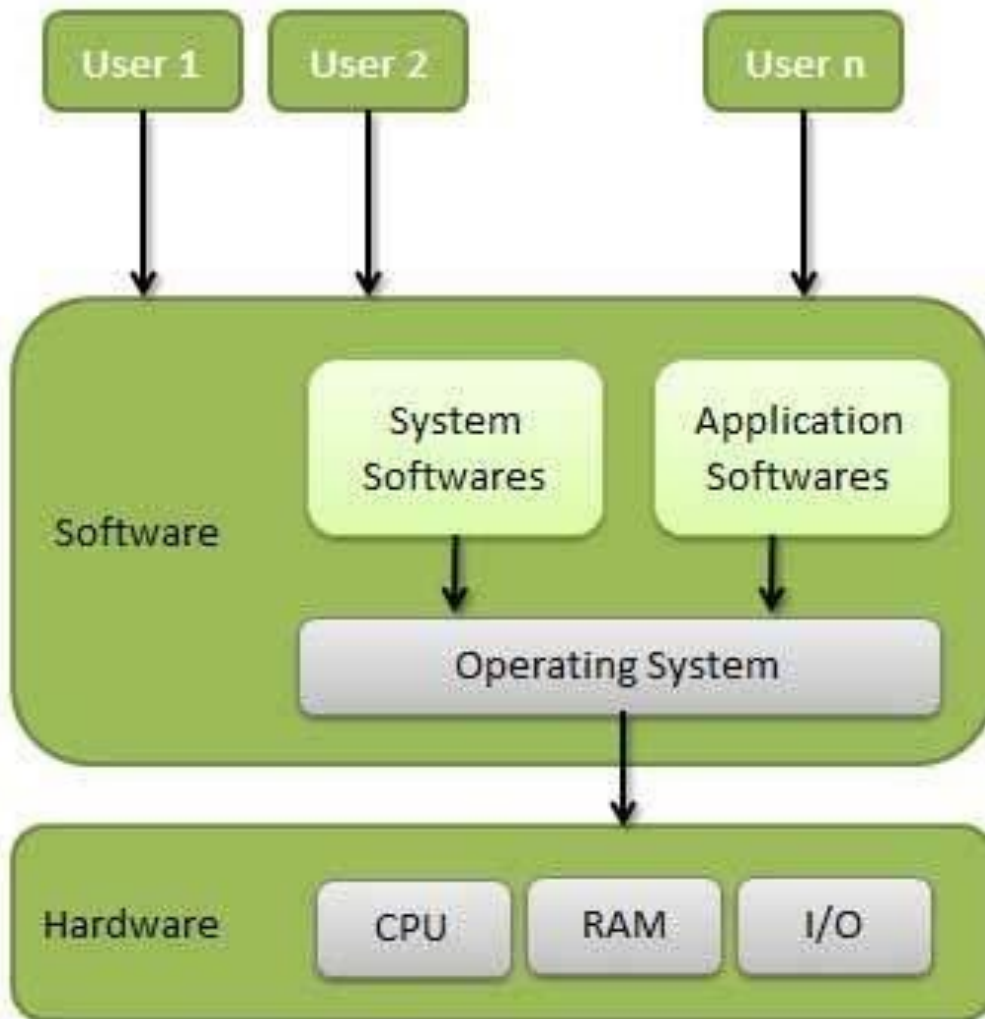


# Types of Operating Systems

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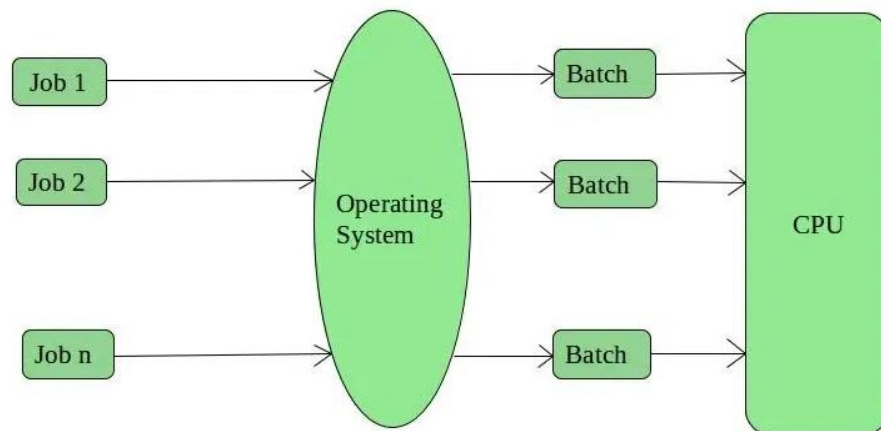
An **operating system** (OS) is software that manages computer hardware and software resources. It acts as a bridge between users and the computer, ensuring smooth operation. Different types of OS serve different needs some handle one task at a time, while others manage multiple users or real-time processes.



# Types of Operating Systems

## 1. Batch Operating System

A [Batch Operating System](#) is designed to handle large groups of similar jobs efficiently. It does not interact with the computer directly but instead processes jobs that are grouped by an operator. These jobs are queued and executed one after the other, without user interaction during the process.



### Advantages of Batch Operating System

- **Efficient Job Management:** Multiple users can efficiently share the system, making it cost-effective.
- **Minimal Idle Time:** The system minimizes idle time by processing jobs in a continuous sequence without human intervention.
- **Handling Repetitive Tasks:** Ideal for managing large, repetitive tasks, such as payroll and billing, with minimal effort.
- **Improved Throughput:** Batch systems can handle high volumes of jobs at once, improving overall system throughput.

### Disadvantages of Batch Operating System

- **Inefficient CPU Utilization:** When a job is waiting for input/output (I/O), the CPU remains idle, leading to poor utilization of resources.
- **Unpredictable Job Completion:** If one job fails, others may be delayed indefinitely, making job completion time unpredictable.
- **Increased Response Time:** The time between job submission and output can be high as all jobs are processed sequentially.
- **Lack of Real-Time Feedback:** Users cannot interact with the system in real-time, making it less suitable for interactive tasks.

**Examples:**

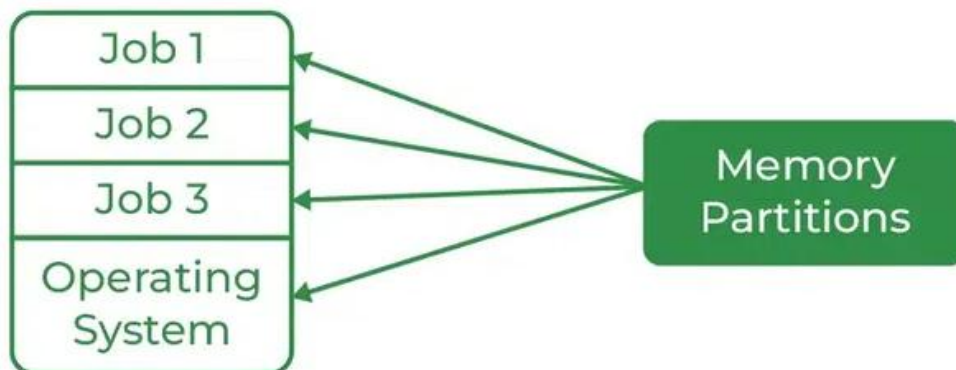
*Payroll Systems*

*Bank Statements*

## 2. Multi-Programming Operating System

In a [Multi-Programming Operating System](#), multiple programs run in memory at the same time. The CPU switches between programs, utilizing its resources more effectively and improving overall system performance.

### Multiprogramming



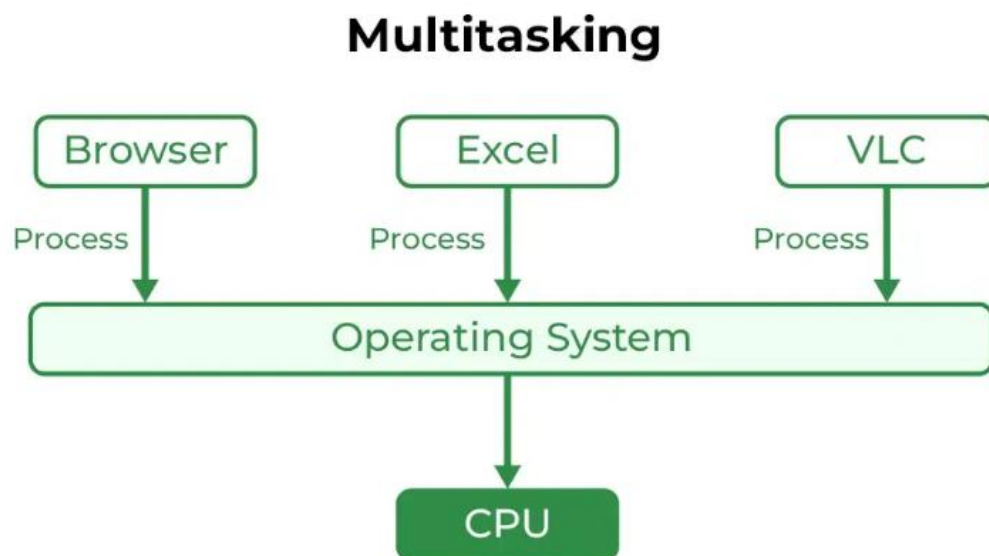
## Multi Programming

### Advantages of Multi-Programming Operating System

- CPU is better utilized and the overall performance of the system improves.
- It helps in reducing the response time.

### 3. Multi-tasking/Time-sharing Operating systems

Multitasking OS is a type of Multiprogramming system with every process running in round robin manner. Each task is given some time to execute so that all the tasks work smoothly. Each user gets the time of the CPU as they use a single system. These systems are also known as Multitasking Systems. The task can be from a single user or different users. The time that each task gets to execute is called quantum. After this time interval is over, the OS switches over to the next task.



### Advantages of Time-Sharing OS

- Each task gets an equal opportunity.
- Fewer chances of duplication of software.

- CPU idle time can be reduced.
- Resource Sharing: Time-sharing systems allow multiple users to share hardware resources such as the CPU, memory and peripherals, reducing the cost of hardware and increasing efficiency.
- Improved Productivity: Time-sharing allows users to work concurrently, thereby reducing the waiting time for their turn to use the computer. This increased productivity translates to more work getting done in less time.
- Improved User Experience: Time-sharing provides an interactive environment that allows users to communicate with the computer in real time, providing a better user experience than batch processing.

### **Disadvantages of Time-Sharing OS**

- Reliability problem.
- One must take care of the security and integrity of user programs and data.
- Data communication problem.
- High Overhead: Time-sharing systems have a higher overhead than other operating systems due to the need for scheduling, context switching and other overheads that come with supporting multiple users.
- Complexity: Time-sharing systems are complex and require advanced software to manage multiple users simultaneously. This complexity increases the chance of bugs and errors.
- Security Risks: With multiple users sharing resources, the risk of security breaches increases. Time-sharing systems require careful management of user access, authentication

and authorization to ensure the security of data and software.

**Examples:**

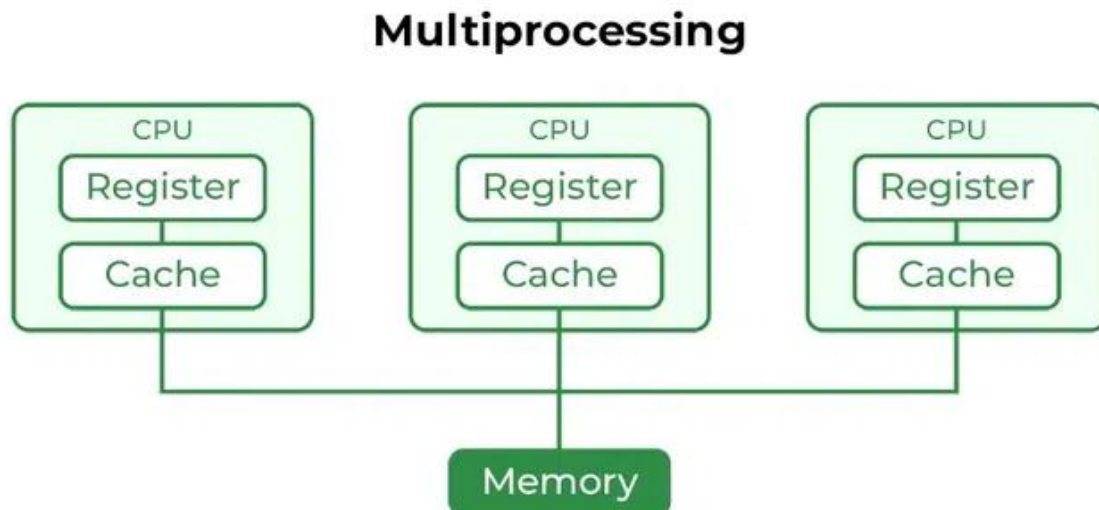
*IBM VM/CMS*

*TSO (Time Sharing Option*

*Windows Terminal Services*

#### **4. Multi-Processing Operating System**

[A Multi-Processing Operating System](#) is a type of Operating System in which more than one CPU is used for the execution of resources. It betters the throughput of the System.



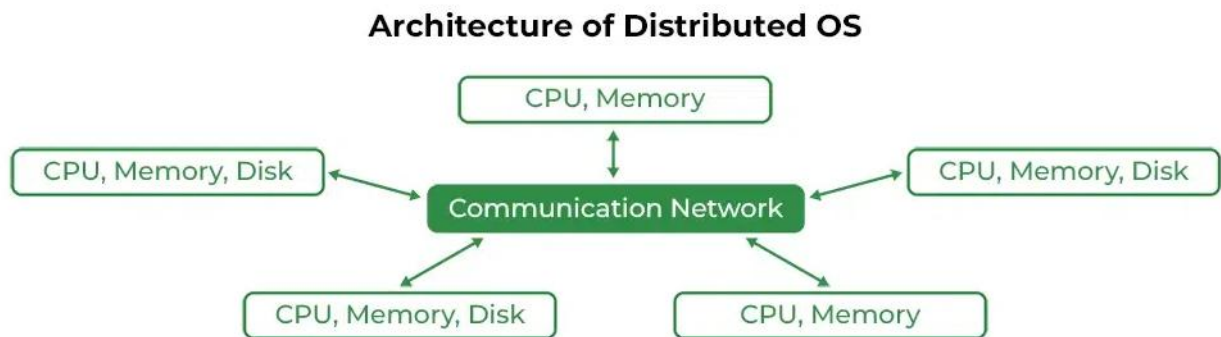
#### **Advantages of a Multi-Processing Operating System**

- It increases the throughput of the system as processes can be parallelized.
- As it has several processors, so, if one processor fails, we can proceed with another processor.

#### **5. Distributed Operating System**

[Distributed operating systems](#) are a recent advancement in the world of computer technology and are being widely accepted all over the world and, that too, at a great pace. Various

autonomous interconnected computers communicate with each other using a shared communication network. Independent systems possess their own memory unit and CPU. [Systems](#). These systems' processors differ in size and function. The major benefit of working with these types of operating systems is that it is always possible that one user can access the files or software which are not present on his system but on some other system connected within this network, i.e., remote access is enabled within the devices connected to that network.



## Advantages of Distributed Operating System

- Failure of one will not affect the other network communication, as all systems are independent of each other.
- Electronic mail increases the data exchange speed.
- Since resources are being shared, computation is highly fast and durable.
- Load on host computer reduces.
- These systems are easily scalable as many systems can be easily added to the network.
- Delay in data processing reduces.

## **Disadvantages of Distributed Operating System**

- Failure of the main network will stop the entire communication.
- To establish distributed systems, the language is not yet well-defined.
- These types of systems are not readily available as they are very expensive. Not only that the underlying software is highly complex and not understood well yet.

## **Issues With Distributed Operating System**

- Networking causes delays in the transfer of data between nodes of a distributed system. Such delays may lead to an inconsistent view of data located in different nodes and make it difficult to know the chronological order in which events occurred in the system.
- Control functions like scheduling, resource allocation and deadlock detection have to be performed in several nodes to achieve computation speedup and provide reliable operation when computers or networking components fail.
- Messages exchanged by processes present in different nodes may travel over public networks and pass through computer systems that are not controlled by the distributed operating system. An intruder may exploit this feature to tamper with messages or create fake messages to fool the authentication procedure and masquerade as a user of the system.

### **Examples:**

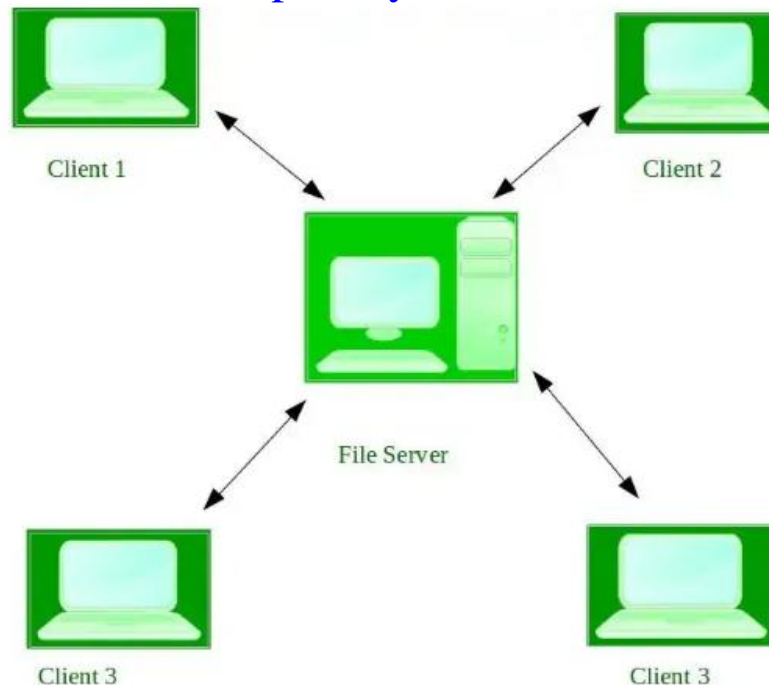
*LOCUS*

*MICROS*

*Amoeba*

## 6. Network Operating System

These systems run on a server and provide the capability to manage data, users, groups, security, applications and other networking functions. These types of operating systems allow shared access to files, printers, security, applications and other networking functions over a small private network. One more important aspect of Network Operating Systems is that all the users are well aware of the underlying configuration, of all other users within the network, their connections, etc. and that's why these computers are popularly known a [tightly coupled systems](#).



## Network Operating System

### Advantages of Network Operating System

- Highly stable, centralized servers.
- Security concerns are handled through servers.
- New technologies and hardware upgrades are easily integrated into the system.

- Server access is possible remotely from different locations and types of systems.

## **Disadvantages of Network Operating System**

- Servers are costly.
- The user has to depend on a central location for most operations.
- Maintenance and updates are required regularly.

### **Examples:**

*Microsoft Windows Server 2003*

*Microsoft Windows Server 2008*

*UNIX, Linux*

*Mac OS X*

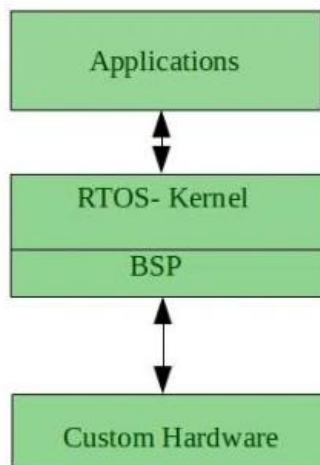
*Novell NetWare*

## **7. Real-Time Operating System**

These types of OSs serve real-time systems. The time interval required to process and respond to inputs is very small. This time interval is called **response time**. **Real-time systems** are used when there are time requirements that are very strict like missile systems, air traffic control systems, robots, etc.

### **Types of Real-Time Operating Systems**

- **Hard Real-Time Systems:** Hard Real-Time OSs are meant for applications where time constraints are very strict and even the shortest possible delay is not acceptable. These systems are built for saving lives like automatic parachutes or airbags which are required to be readily available in case of an accident. Virtual memory is rarely found in these systems.
- **Soft Real-Time Systems:** These OSs are for applications where time is less strict.



## Advantages of RTOS

- **Maximum Consumption:** Maximum utilization of devices and systems, thus more output from all the resources.
- **Task Shifting:** The time assigned for shifting tasks in these systems is very less. For example, in older systems, it takes about 10 microseconds to shift from one task to another and in the latest systems, it takes 3 microseconds.
- **Focus on Application:** Focus on running applications and give less importance to applications that are in the queue.
- **Real-time operating system in the embedded system:** Since the size of programs is small, RTOS can also be used in embedded systems like in transport and others.
- **Error-Free,:** These types of systems are error-free.
- **Memory Allocation:** Memory allocation is best managed in these types of systems.

## Disadvantages of RTOS

- **Limited Tasks:** Very few tasks run at the same time and their concentration is very less on a few applications to avoid errors.
- **Use heavy system resources:** Sometimes the system resources are not so good and they are expensive as well.
- **Complex Algorithms:** The algorithms are very complex and difficult for the designer to write.
- **Device driver and interrupt signals:** It needs specific device drivers and interrupt signals to respond earliest to interrupts.
- **Thread Priority:** It is not good to set thread priority, as these systems are much less prone to switching tasks.

### **Examples:**

*Scientific experiments*

*Medical imaging systems*

*Industrial control systems*

*Weapon systems*

*Robots*

*Air traffic control systems*

## **8. Mobile Operating Systems**

Mobile operating systems are designed specifically for mobile devices such as smartphones and tablets. Examples of such operating systems are Android and iOS. These operating systems manage the hardware and software resources of the device, providing a platform for running applications and ensuring a seamless user experience.

### **Advantages of Mobile Operating Systems**

- **User-Friendly Interfaces:** Mobile operating systems are designed to be intuitive and easy to use, making them accessible to a wide range of users.

- **Extensive App Ecosystems:** The availability of a vast number of applications allows users to customize their devices to meet their specific needs.
- **Connectivity Options:** Mobile operating systems support multiple connectivity options, enabling users to stay connected wherever they go.
- **Regular Updates:** Mobile operating systems receive regular updates, including new features, security patches and performance improvements.

### **Disadvantages Mobile Operating Systems**

- **Battery Life Constraints:** Despite advancements in power management, battery life remains a challenge for mobile devices, especially with heavy usage.
- **Security Risks:** Mobile devices are susceptible to various security threats, such as malware and phishing attacks, which can compromise user data.
- **Fragmentation:** In the case of Android, the wide range of devices and customizations can lead to fragmentation, making it difficult for developers to ensure compatibility across all devices.
- **Limited Hardware Resources:** Mobile devices have limited processing power, memory and storage compared to desktop computers, which can affect the performance of resource-intensive applications.