

**CO - I**

**Session : I**

**COURSE NAME : SYSTEM DESIGN AND INTRODUCTION TO CLOUD**  
**COURSE CODE : 23AD2103A**

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**TOPICS :** OPERATING SYSTEM FUNCTIONALITIES,  
TYPES OF OPERATING SYSTEMS

# SESSION DESCRIPTION

- What is an Operating System?
- Description of Computer System Structure related to OS.
- Components of a Computer System.
- What Operating Systems Do.
- Functions of an Operating System.
- Defining an Operating System.
- Types of an Operating System.

# WHAT IS AN OPERATING SYSTEM?

- An operating system is a type of software that acts as an interface between the user and the hardware.
- It is responsible for handling various critical functions of the computer and utilizing resources very efficiently so the operating system is also known as a resource manager.
- The operating system also acts like a government because just as the government has authority over everything, similarly the operating system has authority over all resources.

# GENERATION OF OPERATING SYSTEM

- Below are four generations of operating systems.
- The First Generation - The First Generation (1940 to early 1950s)
- The Second Generation - The Second Generation (1955 – 1965)
- The Third Generation - The Third Generation (1965 – 1980)
- The Fourth Generation - The Fourth Generation (1980 – Present Day)

# TYPES OF OPERATING SYSTEM

- Operating Systems have evolved in past years.
- It went through several changes before getting its original form.
- These changes in the operating system are known as the evolution of operating systems.
- OS improve itself with the invention of new technology.
- Basically , OS added the feature of new technology and making itself more powerful.

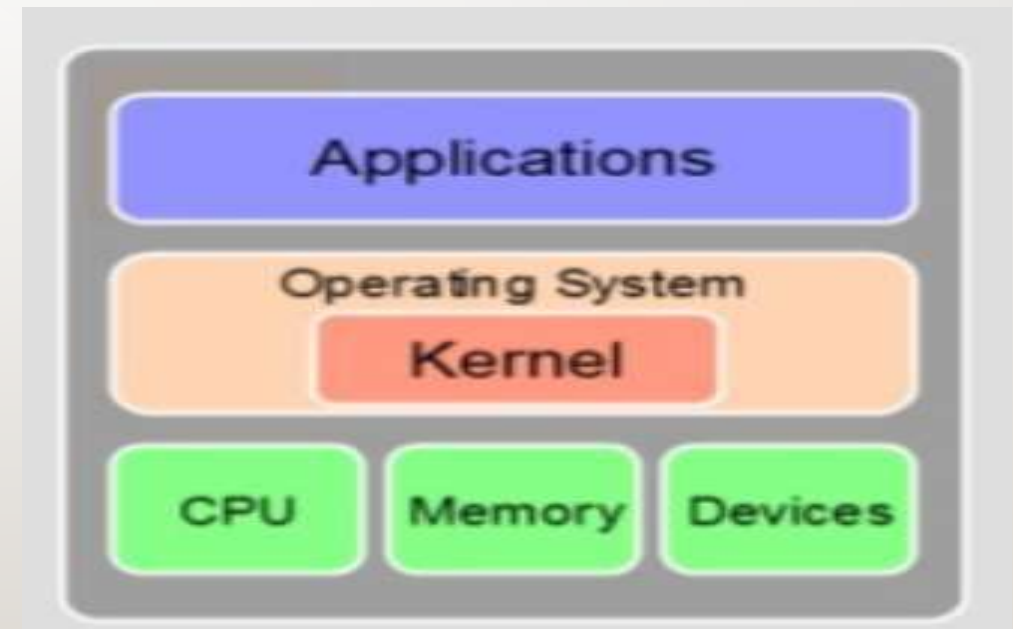
- No OS – (0s to 1940s)
- Batch Processing Systems -(1940s to 1950s)
- Multiprogramming Systems -(1950s to 1960s)
- Time-Sharing Systems -(1960s to 1970s)
- Introduction of GUI -(1970s to 1980s)
- Networked Systems – (1980s to 1990s)
- Mobile Operating Systems – (Late 1990s to Early 2000s)
- AI Integration – (2010s to ongoing)

# OPERATING SYSTEM GOALS:

## PURPOSE OF AN OPERATING SYSTEM:

- Execute user programs and make solving user problems easier.
- Make the computer system convenient to use.
- Efficiently use the computer hardware.
- The purpose of an operating system is to provide an environment in which a user can execute programs in a convenient and efficient manner.

- An operating system is software that manages the computer hardware.
- Another more common definition is that the operating system is the one program running at all times on the computer—Usually, it is usually called the kernel.
- The kernel is the core that provides essential services for all other parts of the OS.
- It is the primary layer between the OS and underlying computer hardware, and it helps with tasks such as process and memory management, file systems, device control, and networking.





- Manages directories, folders and files.
- Manages memory.
- Manages hardware and software.
- Provides computer networking functions.
- Example: Windows, DOS, Linux, Ubuntu.



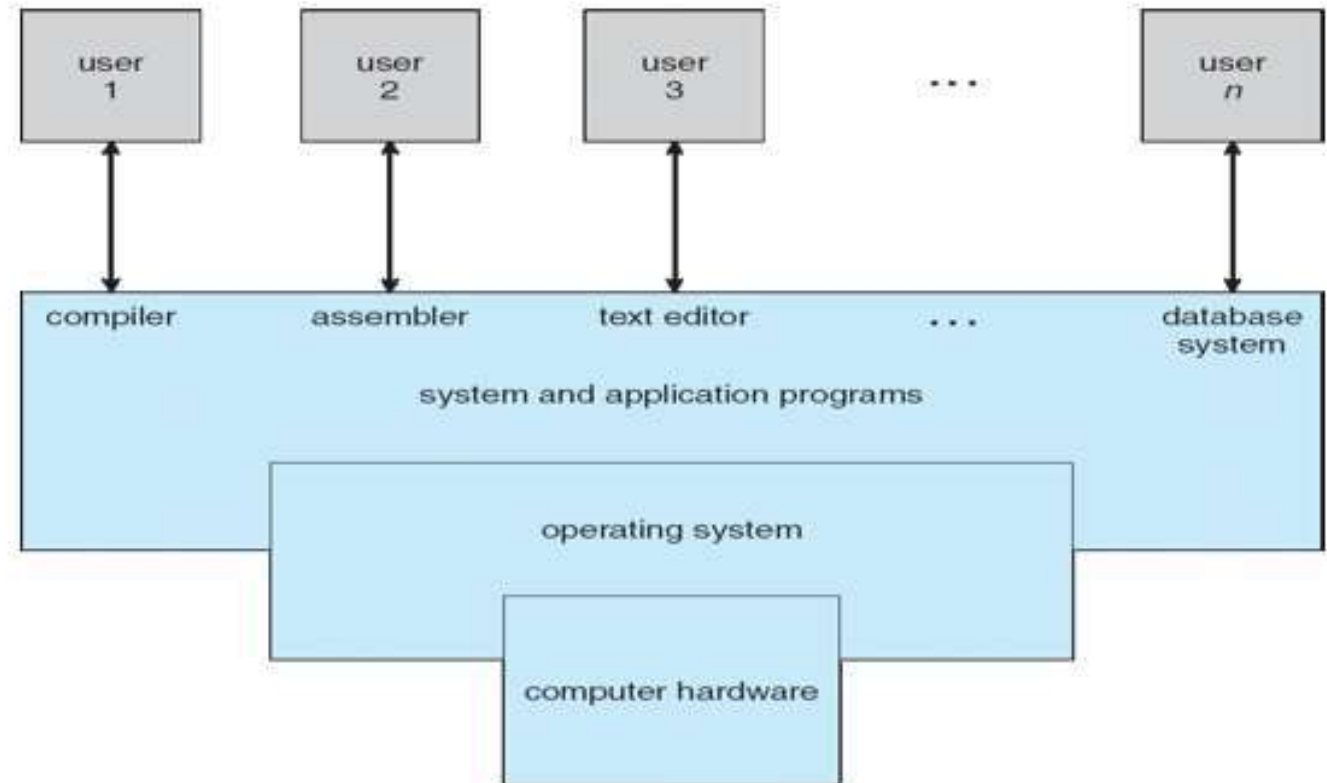
# WHY ARE OPERATING SYSTEMS USED?

- Operating System is used as a communication channel between the Computer hardware and the user. It works as an intermediate between System Hardware and End-User. Operating System handles the following responsibilities:
- It controls all the computer resources.
- It provides valuable services to user programs.
- It coordinates the execution of user programs.
- It provides resources for user programs.
- It provides an interface (virtual machine) to the user.
- It hides the complexity of software.
- It supports multiple execution modes.
- It monitors the execution of user programs to prevent errors.

# COMPONENTS OF COMPUTER SYSTEM

Abstract view  
of the  
components  
of a computer  
system

## Four Components of a Computer System



# COMPUTER SYSTEM STRUCTURE

- Computer System can be divided into **four** components
- **Hardware** - Provides basic computing resources

Ex: CPU, Memory, I/O devices

- **Operating System** - Controls and coordinates use of hardware among various applications and users
- **Software** - It is a set of programs, procedures and routines that instructs a computer system what to do. Two types of software's are **System Software** and **Application Software**.

# COMPUTER SYSTEM STRUCTURE

- **System Software** : It is a set of computer programs, which is designed to manage system resources usually written using low level language.

Ex : linkers, loaders, assemblers, kernel programs etc.

- **Application Software**: Define the ways in which the system resources are used to solve the computing problem of the users.

- Ex: Word Processors, compilers, web browsers, database systems, video games.

- **Users** - Who utilizes a computer

Ex : People, Machines, Other Computers.

# WHAT OPERATING SYSTEMS DO

- The operating system controls the h/w and coordinates its use among the various application programs for the various users.
- We can also view a computer system as consisting of h/w, s/w and data.
- The operating system provides the means for proper use of these resources in the operation of the computer system.
- To understand more fully the operating system's role, we explore operating systems from two view points:

The user.

The system.

- The User's view of the computer varies according to the interface being used.
- **Single User Computers (e.g., PC, Workstations)** : Such systems are designed for one user to monopolize its resources. the goal is to maximize the work(or play) that the user is performing. the operating system is designed mostly for ease of use and good performance.
- **Muti User Computers (e.g., Mainframes, Computing servers):** These users share resources and may exchange information. the operating system in such cases is designed to maximize resources utilization - to assure that all available CPU time, memory and I/O are used efficiently and that no individual users take more than their air share.
- **Handheld Computers (e.g., Smartphones and tablets):** The user interface for mobile computers generally features a touch screen. The systems are resource poor, optimized for usability and battery life.
- **Embedded Computers (e.g., Computers in home devices and automobiles):** The user interface may have numeric keypads and may turn indicator lights on or off to show status. The operating systems are designed primarily to run without user intervention.



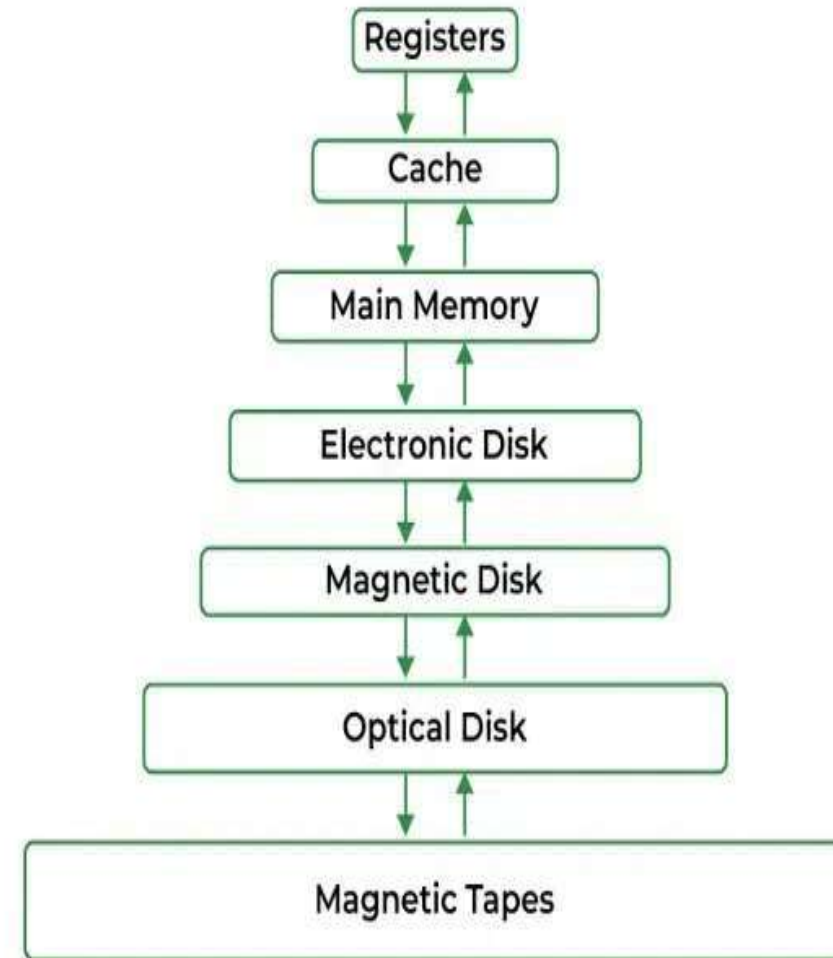
# FUNCTIONS OF OPERATING SYSTEM





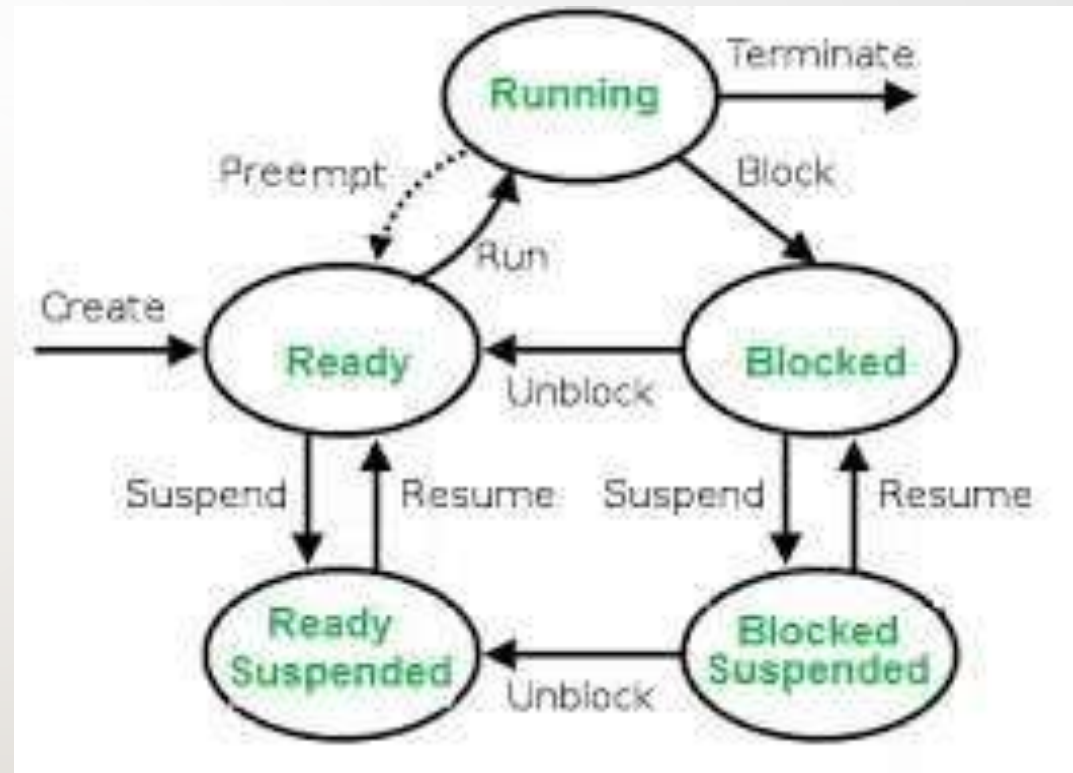
# MEMORY MANAGEMENT

- The operating system manages the Primary Memory or Main Memory.
- Main memory is made up of a large array of bytes or words where each byte or word is assigned a certain address.
- Main memory is fast storage and it can be accessed directly by the CPU.



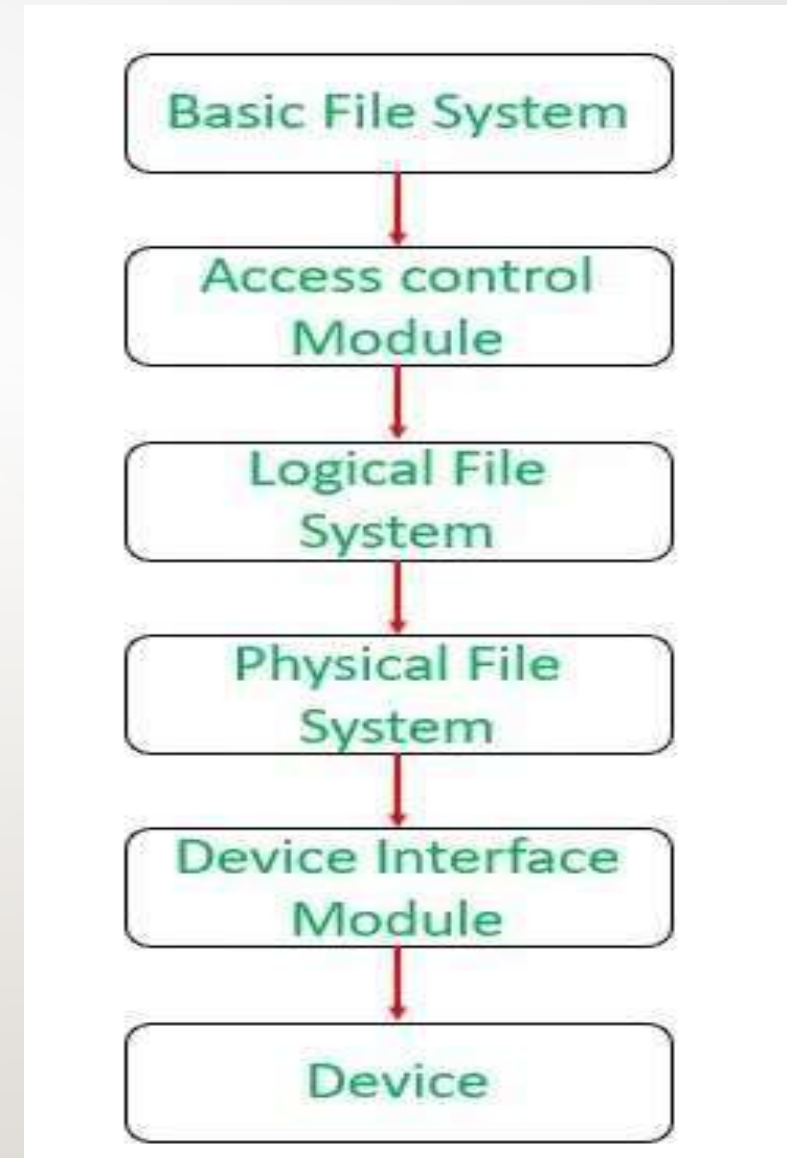
# PROCESSOR MANAGEMENT

- In a multi-programming environment, the OS decides the order in which processes have access to the processor, and how much processing time each process has. This function of OS is called Process Scheduling.
- An operating system manages the processor's work by allocating various jobs to it and ensuring that each process receives enough time from the processor to function properly.
- Keeps track of the status of processes. The program which performs this task is known as a traffic controller. Allocates the CPU that is a processor to a process. De-allocates processor when a process is no longer required.



## Device Management

- An OS manages device communication via its respective drivers. It performs the following activities for device management. Keeps track of all devices connected to the system. Designates a program responsible for every device known as the Input/Output controller.
- Decide which process gets access to a certain device and for how long. Allocates devices effectively and efficiently. Deallocates devices when they are no longer required.
- **File Management**
- A file system is organized into directories for efficient or easy navigation and usage. These directories may contain other directories and other files. An Operating System carries out the following file management activities. It keeps track of where information is stored, user access settings, the status of every file, and more. These facilities are collectively known as the file system.



- **User Interface or Command Interpreter**
- The user interacts with the computer system through the operating system. Hence OS acts as an interface between the user and the computer hardware. This user interface is offered through a set of commands or a graphical user interface (GUI). Through this interface, the user makes interacts with the applications and the machine hardware.



# SECURITY

- The operating system uses password protection to protect user data and similar other techniques. it also prevents unauthorized access to programs and user data. The operating system provides various techniques which assure the integrity and confidentiality of user data. The following security measures are used to protect user data:
- Protection against unauthorized access through login.
- Protection against intrusion by keeping the firewall active.
- Protecting the system memory against malicious access.
- Displaying messages related to system vulnerabilities.

- **Job Accounting**

- The operating system Keeps track of time and resources used by various tasks and users, this information can be used to track resource usage for a particular user or group of users.

- **Error-Detecting Aids**

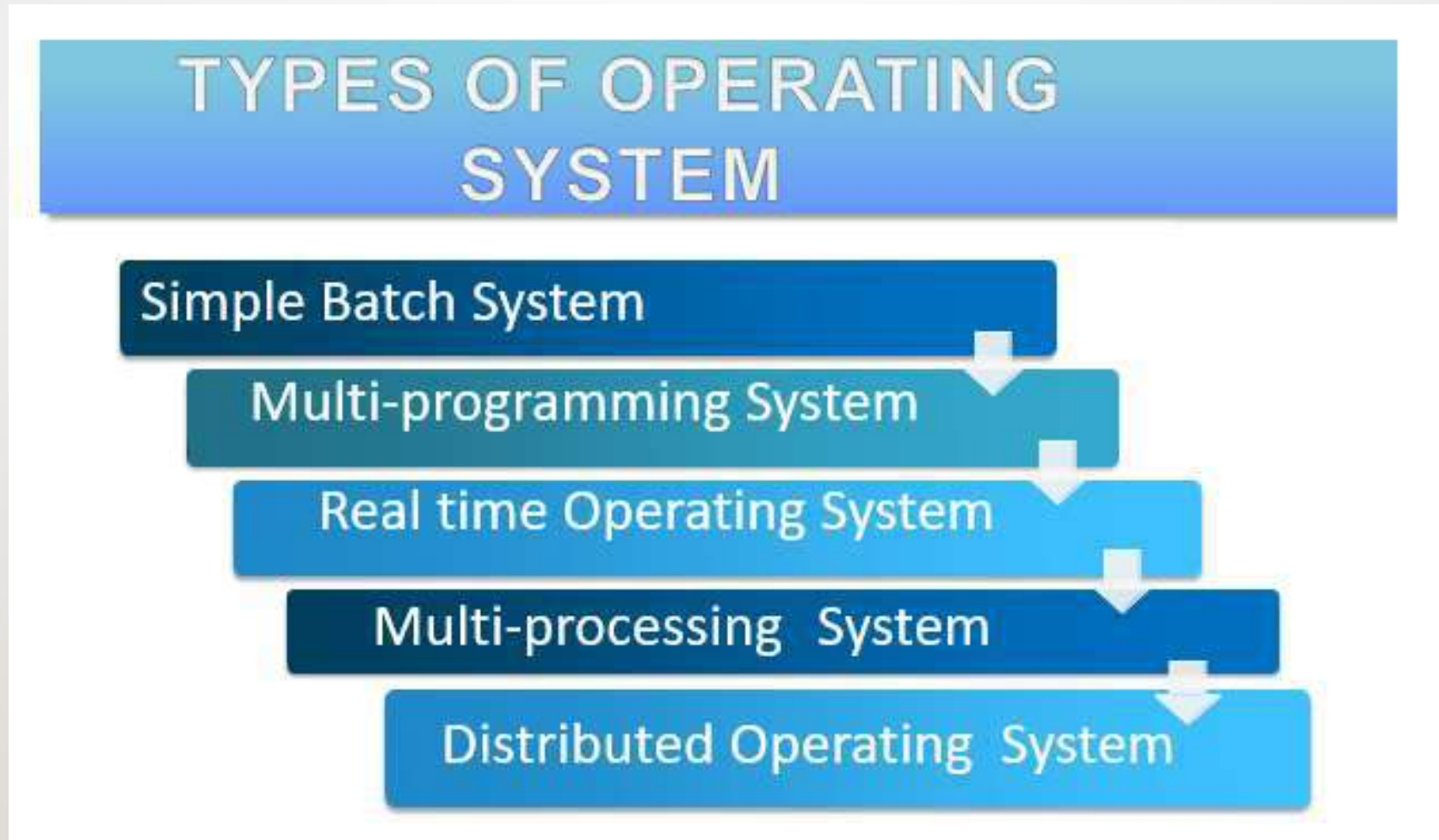
- The operating system constantly monitors the system to detect errors and avoid malfunctioning computer systems. From time to time, the operating system checks the system for any external threat or malicious software activity. It also checks the hardware for any type of damage.

- **Coordination Between Other Software and Users**

- Operating systems also coordinate and assign interpreters, compilers, assemblers, and other software to the various users of the computer systems. In simpler terms, think of the operating system as the traffic cop of your computer.



# TYPES OF OPERATING SYSTEM



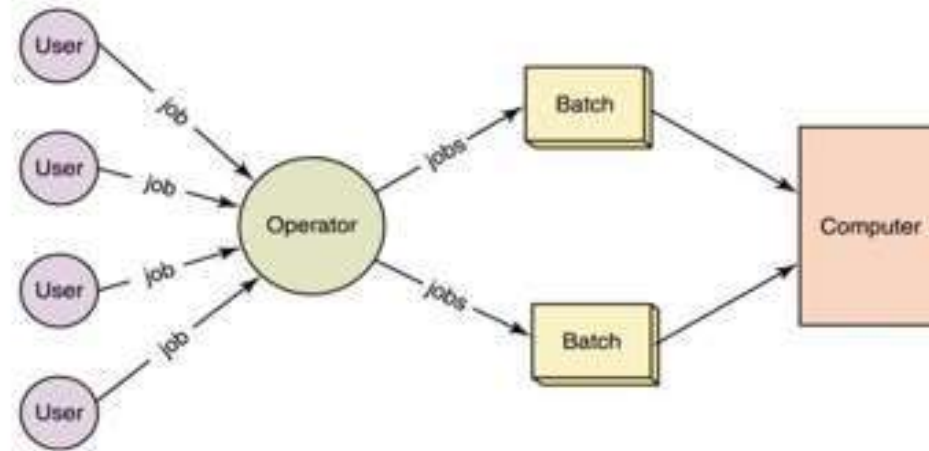
# TYPES OF OPERATING SYSTEMS

- There are several types of Operating Systems which are mentioned below.
- Batch Operating System
- Multi-Programming System
- Multi-Processing System
- Multi-Tasking Operating System
- Time-Sharing Operating System
- Distributed Operating System
- Network Operating System
- Real-Time Operating System



## SIMPLE BATCH SYSTEM

- ✓ In Batch processing same type of jobs batch (BATCH- a set of jobs with similar needs) together and execute at a time.
- ✓ The OS was always resident in memory.





## ADVANTAGES

- ✓ A data center's staff can schedule batch processing during times when the computers are otherwise idle, such as overnight.
- ✓ The computer operators can delay or prioritize different batches easily, depending on circumstances.

## DISADVANTAGES

- ✓ Zero interaction between user and computer.
- ✓ No mechanism to prioritize processes.
- ✓ CPU is often idle, because the speeds of the mechanical I/O devices is slower than CPU.

## Examples

- ✓ Payroll run for company.
- ✓ Gas and electricity bills produced by batch system.

# MULTI-PROGRAMMING SYSTEM



- ✓ In this the operating system, picks and begins to execute one job from memory.
- ✓ Multiprogramming system, CPU will never be idle and keeps on processing.



## ADVANTAGES

- ✓ It increases CPU utilization.
- ✓ It maximizes the total job throughput of a computer.
- ✓ Better Reliability-if one processor breakdown then other takes its workload

## DISADVANTAGES

- ✓ It must keep track of all kinds of jobs.
- ✓ Each system requires large chunks of hard drive space which cannot be allocated to programs.
- ✓ Poor CPU usage when only one program is present in memory.

## Example

Consider that Three jobs are submitted. Almost no contention for resources . All three can run in minimum time in a multitasking environment (assuming JOB2/3 have enough CPU time to keep their I/O operations active)



# REAL-TIME OPERATING SYSTEM



Real time system is defined as a data processing system in which the time interval required to process and respond to inputs is so small that it controls the environment.

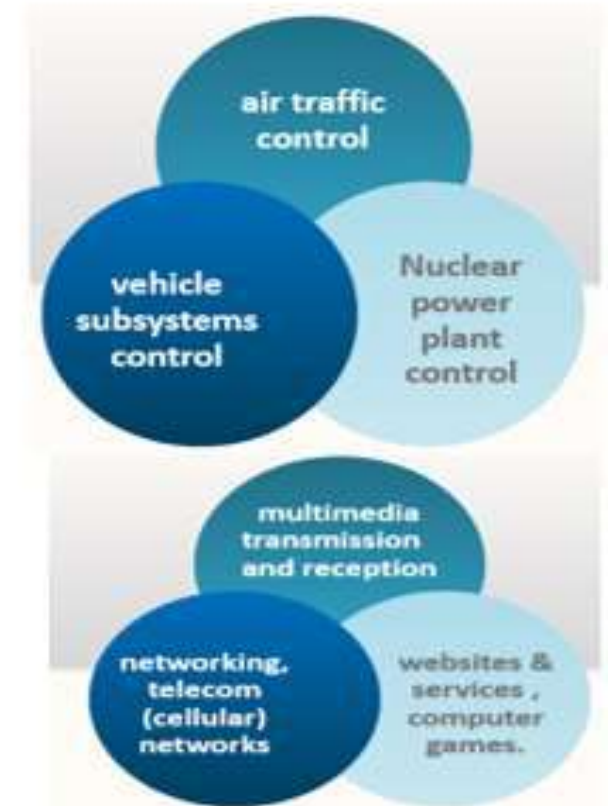
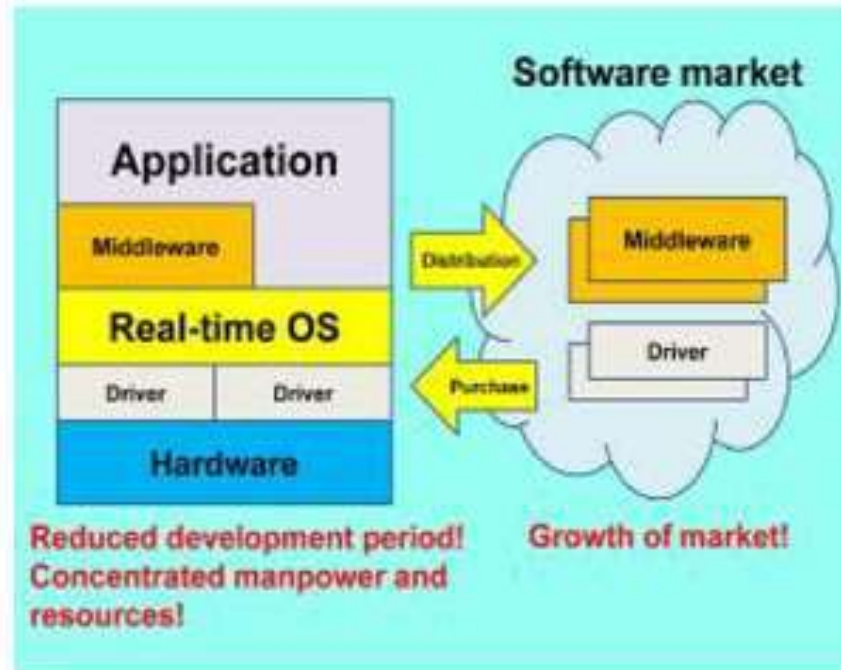
Types:

## 1. Hard real-time systems

Hard real-time systems-guarantee that critical tasks complete on time. In hard real-time systems secondary storage is limited or missing with data stored in ROM

## 2. Soft real-time systems

Soft real-time operating systems-that can only guarantee a maximum of the time are referred to as soft real-time.



## ADVANTAGES

- ✓ RTOS give maximum consumption of the system and gives us more output.
- ✓ Due to small size of programs RTOS can also be used in embedded systems like in transport and others.
- ✓ RTOS is error free that mean it has no chances of error in performing tasks.

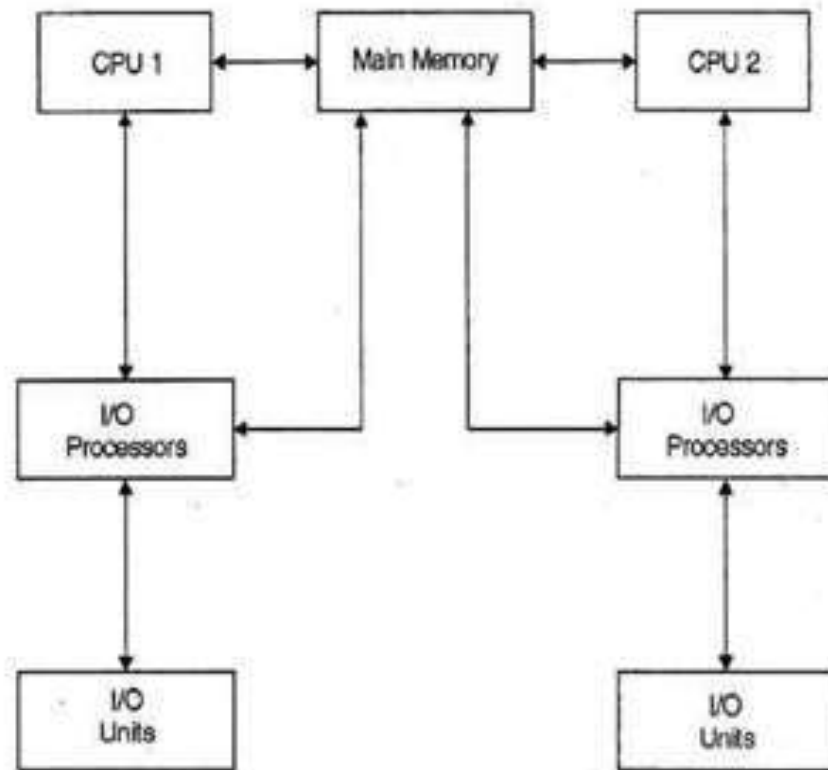
## DISADVANTAGES

- ✓ There are only limited tasks run at the same time and other task have to wait.
- ✓ RTOS used lot of system resources which is not as good and is also expensive.
- ✓ Multi tasking is done few of times and this is the main disadvantage of RTOS.

# MULTIPROCESSOR SYSTEM



A multiprocessor system consists of several processors that share a common physical memory. Multiprocessor system provides higher computing power and speed.



## ADVANTAGES

- ✓ Enhanced performance.
- ✓ Execution of several tasks by different processors concurrently, increases the system's throughput.

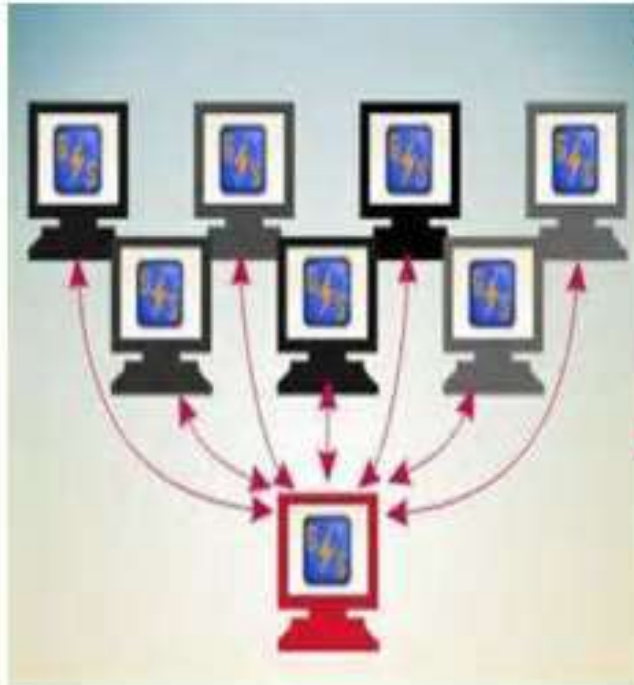
## DISADVANTAGES

- ✓ It's more complex than other operating systems.
- ✓ It requires context switching which slightly impacts performance.



# DISTRIBUTED OPERATING SYSTEM

- The motivation behind developing distributed operating systems is the availability of powerful and inexpensive microprocessors and advances in communication technology.



## ADVANTAGES

- ✓ If one machine crashes, the system as a whole can still survive.
- ✓ A distributed system may have more total computing power than a mainframe.
- ✓ Since it is an open system it is always ready to communicate with other systems.

## DISADVANTAGES

- ✓ Distributed systems will have an inherent security issue.
- ✓ If the network gets saturated then problems with transmission will surface.
- ✓ There is currently very little less software support for Distributed system.

## The Operating System provides various types of services

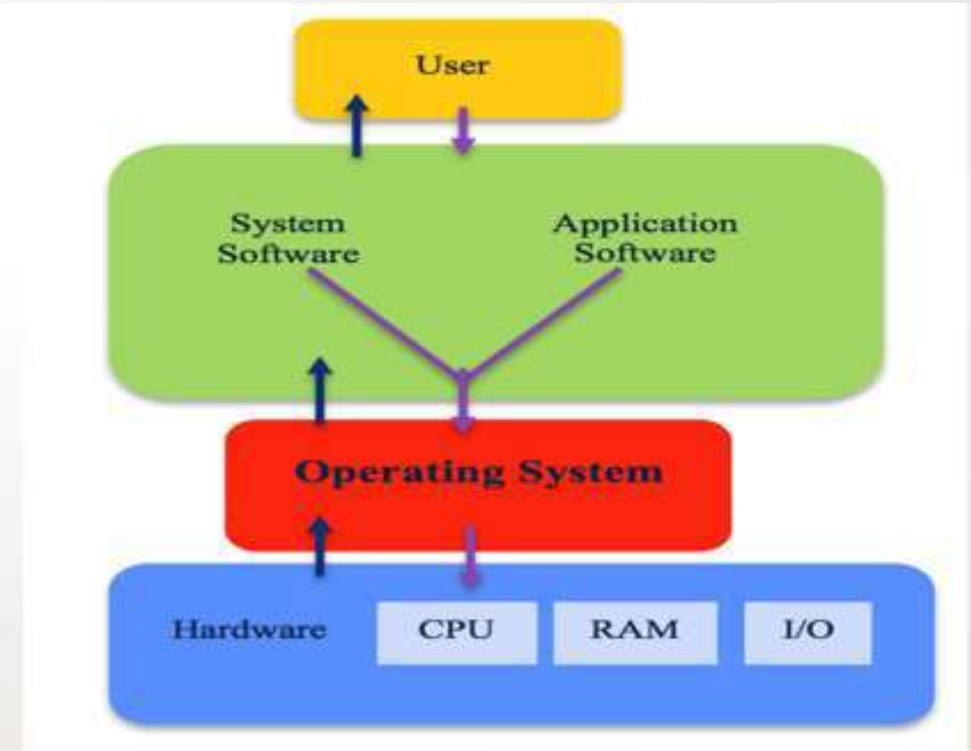
1. I/O operation
2. Program execution
3. File system manipulation
4. Communication
5. Error Handling
6. Resource allocation
7. Accounting
8. Protection

### Operating System Components

1. Process Management
2. File Management
3. Network Management
4. Main Memory Management
5. Secondary Storage Management
6. I/O Device Management
7. Security Management
8. Command Interpreter System

### Needs of operating system

1. Managing Input-Output Unit
2. The Operating system as a platform for application programs
3. Multitasking
4. Consistent user interface





# THANK YOU



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