



# **SNS COLLEGE OF ENGINEERING**

**Kurumbapalayam(Po), Coimbatore – 641 107**

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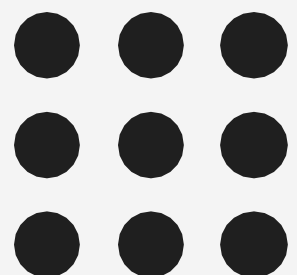
## **Department Of Artificial Intelligence and Data Science**

**Course Code / Name – 23ITB203 /**

**Principles of Operating Systems**

**II Year / IV Semester**

**Unit 1 - OPERATING SYSTEMS  
INTRODUCTION**



# OPERATING SYSTEMS



## Definition:

- A program that acts as an interface ( **intermediary**) **between** a user of a computer and the computer hardware

## Operating System Goals:

- The primary goal is to make computer system **convenient** to use
- **Efficient** use of computer system

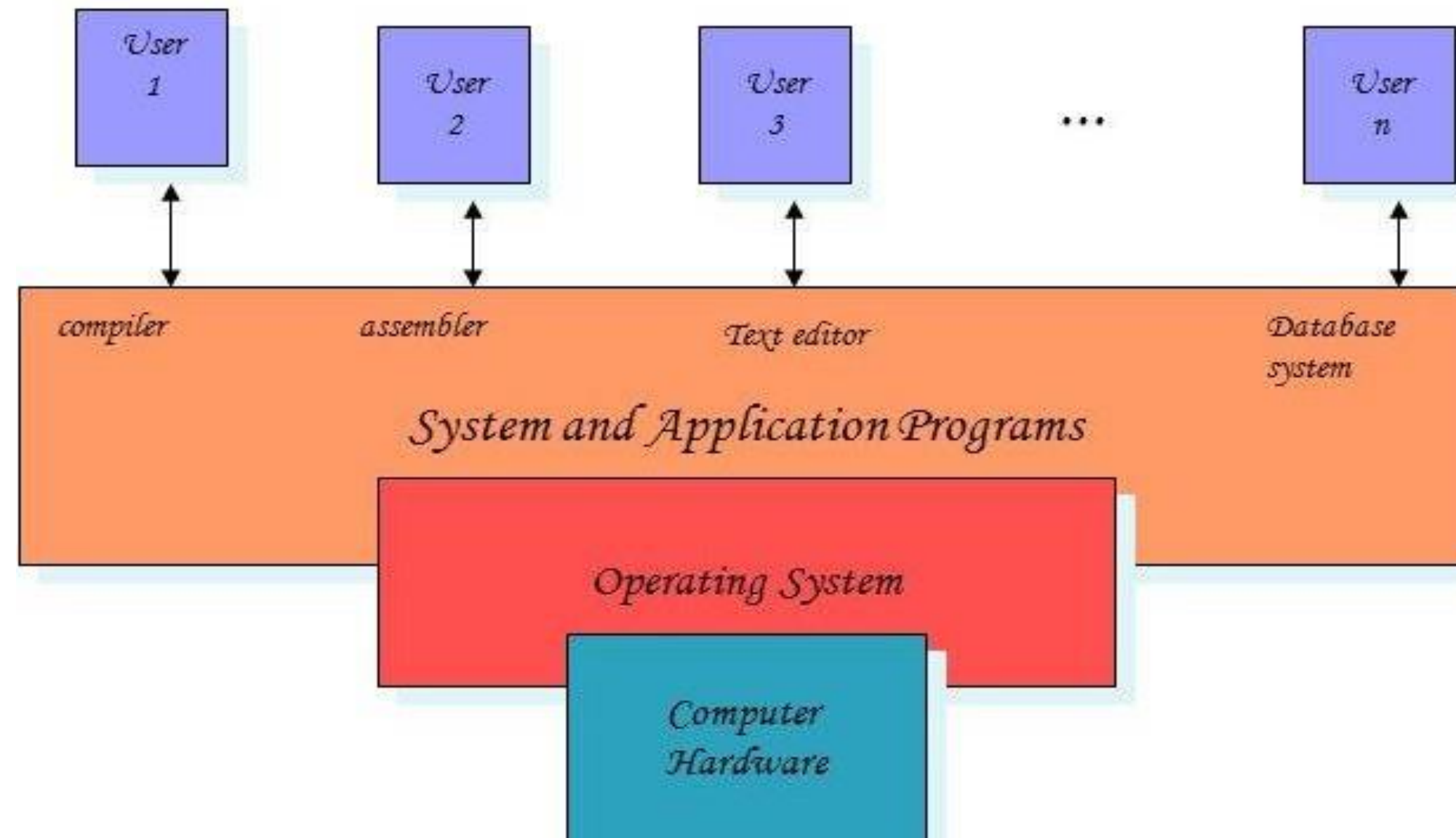


# Computer System

A computer system is divided into four components:

- The **hardware** - provides the basic computing resources
  - CPU , memory and I / O devices
- The **application programs** - define the ways in which the resources are used to solve the computing problems of the user
  - word processors , spreadsheets , compilers ,
- The **operating systems** – controls and coordinates the use of the hardware among various applications and users
- **Users**

# Abstract View of the components of computer system





# Operating System Definition

To understand the OS role, we explore OS from 2 view points.:

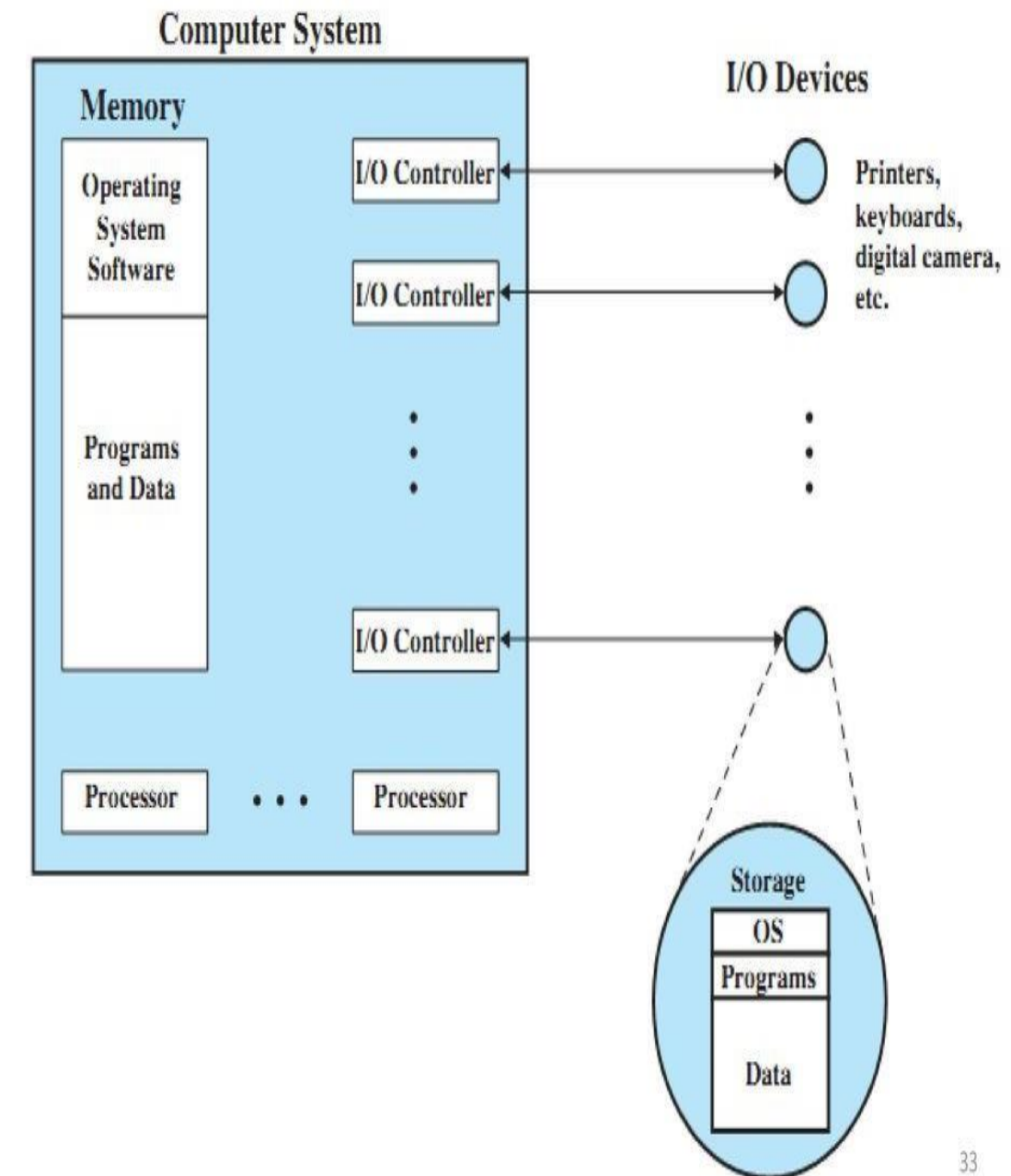
1. **User view:** The user's view of the computer varies according to the mode being used.

- **PC** Users needs ease of use, convenience and performance but none paid on resource utilization
- **Mainframe or minicomputer** users (share resources and exchange information )needs maximized resource utilization to assure that all available CPU time, memory, and I/O are used efficiently .
- Workstation users - os is designed between individual usability and resource utilization
- Handheld devices are designed for individual usability and performance of battery life as well
- Some computers have little or no user view. For example, embedded computers in home devices and automobiles are designed primarily to run without user intervention.

## OS as a Resource Manager

### 2. System view :

- Operating system as a **resource allocator**
  - manages all resources to operate computer system efficiently and fairly
- A **control program**
  - manages execution of user programs to prevent errors and improper use of the computer





**Who controls the execution of programs to prevent errors and improper use of computer?**

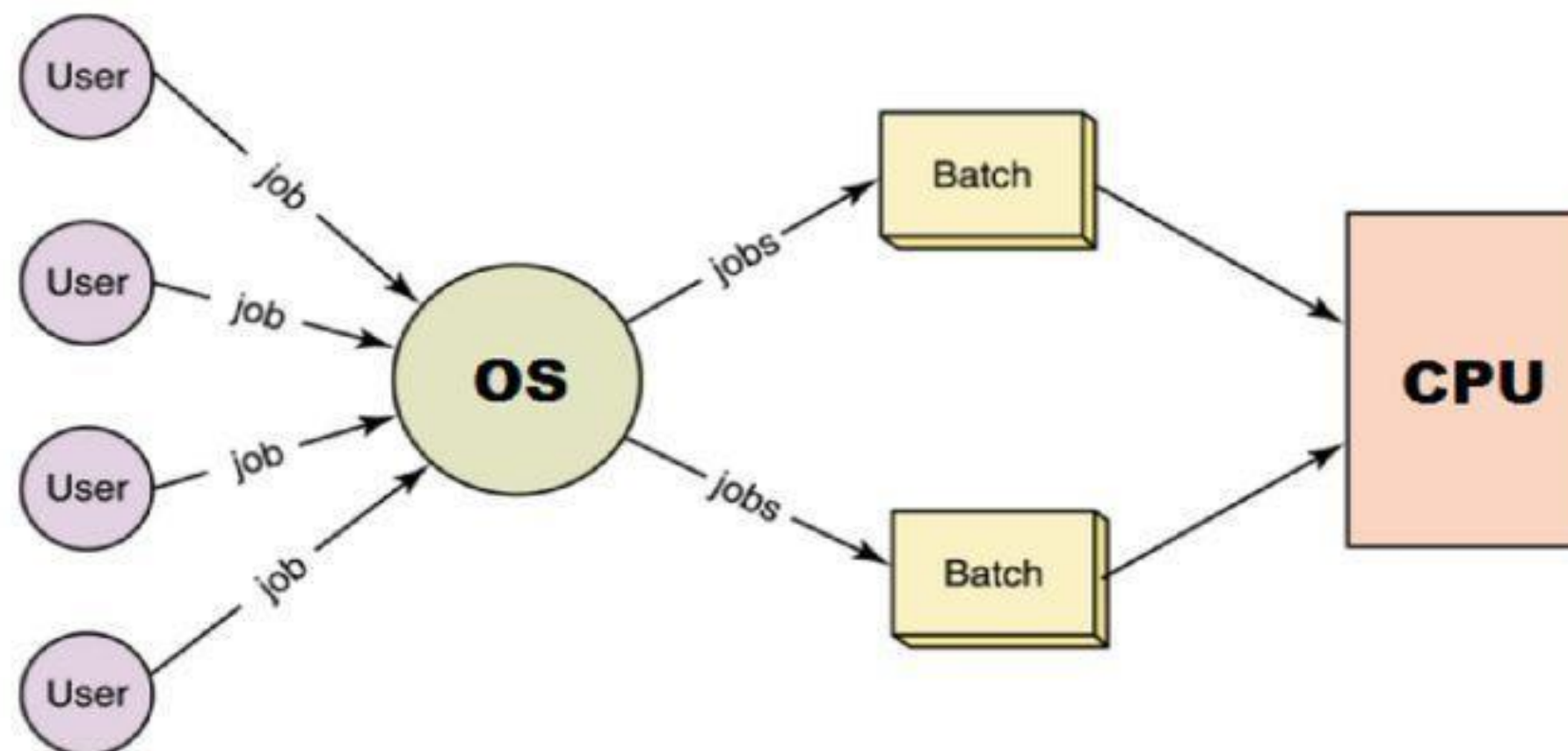
- a) Resource allocator
- b) Control Program
- c) Hardware
- d) None of the above



# Types of Mainframe systems

## Batch systems:

- The users of a 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
- To speed up processing, jobs with similar needs are batched together and run as a group





- The user has to submit a job (written on cards or tape) to a computer operator.
- Then computer operator places a batch of several jobs on an input device.
- Jobs are batched together by type of languages and requirement.
- Then a special program, the monitor, manages the execution of each program in the batch.
- The monitor is always in the main memory and available for execution.
- Following are some disadvantages of this type of system :

Zero interaction between user and computer.

No mechanism to prioritize processes.



## Multiprogrammed OS

- Needed for efficiency
- Single user cannot keep CPU and I/O devices busy at all times
- Multiprogramming organizes jobs (code and data) so CPU always has one to execute
- A subset of total jobs in system is kept in memory
- One job selected and run via job scheduling
- When it has to wait (for I/O for example), OS switches to another job
- Once this job needs an I/O operation operating system switches to another job (CPU and OS always busy).
- Jobs in the memory are always less than the number of jobs on disk(Job Pool).



- If several jobs are ready to run at the same time, then system chooses which one to run (CPU Scheduling).
- In Non-multiprogrammed system, there are moments when CPU sits idle and does not do any work.
- In Multiprogramming system, CPU will never be idle and keeps on processing.

**Time-Sharing Systems** are very similar to Multiprogramming batch systems. In fact time sharing systems are an extension of multiprogramming systems. In time sharing systems the prime focus is on minimizing the response time, while in multiprogramming the prime focus is to maximize the CPU usage.



- Time-Sharing is the logical extension of multiprogramming.
- In this time-sharing Operating system, many processes are allocated with computer resources in respective time slots.
- In this, the processor's time is shared with multiple users.
- That's why it is called a time-sharing operating system.
- It has a fixed time slice for the different processes.
- Its main purpose is interactive response time. The CPU executes multiple jobs by switching between them, but the switches occur so frequently.





## **Difference between Multiprogramming and Time-Sharing System**

In multi-programming, more than one process can reside in the main memory at a time.

Thus, when one process goes for I/O operation, the CPU is not waiting and allocated to another process. This keeps the CPU busy at all times.

# Multiprocessor operating systems

- They are also known as parallel OS or tightly coupled OS.
- Multiprocessor systems have three main advantages:

Increased throughput – Number of tasks per unit time

Economy of scale

Increased reliability

- The ability to continue providing service proportional to the level of surviving hardware is called graceful degradation.
- Systems designed for graceful degradation are called fault tolerant.



The multiprocessor operating systems are classified into two categories:

1. Symmetric multiprocessing system

2. Asymmetric multiprocessing system

- In symmetric multiprocessing system, each processor runs an identical copy of the operating system, and these copies communicate with one another as needed.
- In asymmetric multiprocessing system, a processor is called master processor that controls other processors called slave processor. Thus, it establishes master-slave relationship. The master processor schedules the jobs and manages the memory for entire system.



# Distributed Operating Systems

- In distributed system, the different machines are connected in a network and each machine has its own processor and own local memory. It manages a group of different computers and makes appear to be a single computer
- In this system, the operating systems on all the machines work together to manage the collective network resource.
- It can be classified into two categories:
  1. Client-Server systems
  2. Peer-to-Peer systems

## Real-Time Operating Systems (RTOS)

- A real-time operating system (RTOS) is a multitasking operating system intended for applications with fixed deadlines (real-time computing).
- Such applications include some small embedded systems, automobile engine controllers, industrial robots, spacecraft, industrial control, and some large-scale computing systems.
- The real time operating system can be classified into two categories:
  1. hard real time system and
  2. soft real time system.





A **hard real time system** guarantees that the critical tasks to be completed on time.

This goal requires that all delays in the system be bounded from the retrieval of stored data to time that it takes the OS to finish the request.

A **soft real time system** is a less restrictive one where a critical real time task gets priority over other tasks & retains the property until it completes. Soft real time system is achievable goal that can be mixed with other type of systems. They have limited utility than hard real time systems.

Soft real time systems are used in area of multimedia, virtual reality & advanced scientific projects. It cannot be used in robotics or industrial controls due to lack of deadline support.



# Desktop Systems

- The PC operating system is designed for maximizing user convenience and responsiveness. This system is neither multi-user nor multitasking. These systems include PCs running Microsoft Windows and the Apple Macintosh.
- The MS-DOS operating system from Microsoft has been superseded by multiple flavors of Microsoft Windows and IBM has upgraded MS-DOS to the OS/2 multitasking system.
- The Apple Macintosh operating system has been ported to more advanced hardware, and now includes new features such as virtual memory and multitasking.