

## 1) Introduction To Operating System

Software are broadly classified into three types:

- ① System software
- ② Application software
- ③ Programming Languages

An operating system falls in the category of System software. Every computer requires an operating system.

Operating system is a system software that manages computer resources and provides users with an interface used to access those resources. Operating system is also called as platform for that machine. If the user would like to use any applications and tools on it, an Operating System must be present on the machine. There are many important functions performed by operating system like User Interface, Process Management, IO Management, Memory management, communication, Error Detection, Resource Allocation, Accounting, Protection and security etc.

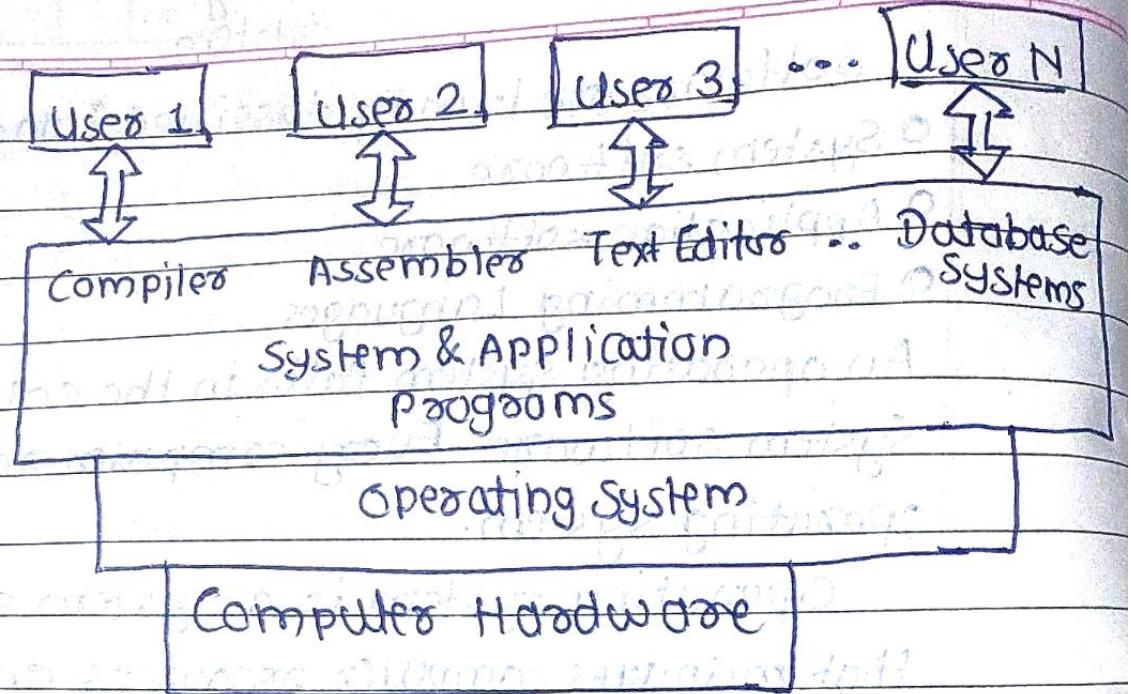
Ex:- MS-DOS, Microsoft Windows, UNIX, Linux, etc.



Parts/Components of computer system:

Computer System can be divided into 4 components:

- ① Hardware
- ② Operating System
- ③ System and Application programs
- ④ User



**X** **Hardware** :- These are used to take the physical parts of a machine which provides basic computing resources. The major classification of hardware devices are Input devices, Output devices, CPU, Storage devices, Networking Devices and other devices.

**X** **Operating System** :- Operating System is the system software that manages computer resources and provides user with an interface to access those resources. Ex:- MS-DOS, Windows, UNIX, etc. There are many important functions provided by OS like User Interface, Process Management, IO Management, Memory management, Communication, Error detection, Resource allocation, accounting, Protection and security etc.



## System and Application programs:-

**System programs :-** It is a set of programs which are used to manage the computer hardware and application programs used by the users.

Ex :- OS, drivers, etc.

**Application programs :-** It helps user to perform any defined task. They utilize hardware and software resources to fulfill user's computing requirement. Ex:- MS-Word, games, Web browsers, etc.



**Users :-** Users are human beings known as live-wire who operates the computer system.



## Generations / Evolution of Operating Systems :-

History of operating system is strongly linked with the development and history of different generations of computer system. During development changes in computer system, it had changed drastically in size, capacity, type, speed and cost.



**Zeroth Generation (Before 1945) :-** The first zeroth generation computer was made up of Analytical engine and was designed by Charles Babbage.

**Technology :-** Mechanical design

**Advantage :-** Simple design

**Disadvantages :-** Slow speed, unreliable, could perform only some basic calculations, No operating system used



## First generation (1945 - 1955) :-

Technology :- Vacuum Tube, Electrical design

Advantages :- High speed as compared to mechanical design.

Programs were written in machine

language.

Disadvantages :- Vacuum tubes have heating problem, so the components may get burn.

Vacuum tubes require large space.

Unreliable & high cost

No operating system used.



## Second generation (1955 - 1965) :- Assembly language was second generation language.

In this generations, vacuum tubes were replaced by transistors.

Technology :- Transistors, Batch system

Advantages :- Higher speed as compared to electrical design.

Required less space and size.

Cost reduced dramatically.

Problem of heating solved.

Increased reliability.

Operation system was used.

Disadvantages :- Current leakage problem of transistors.

Could run just one job at a time.

Relatively slow.

XX Third generation (1965 - 1980) :- Transistors were replaced by silicon chips known as Integrated Circuits (IC).

Technology :- Integrated Circuit (IC)

Advantages :- Good speed and increased performance

Required less space and size.

Cost gets reduced

Increased reliability

Portability

Multi programming.

XX Fourth generation (1980 - 1990)

Technology :- Large Scale Integration (LSI)

Advantages :- Fast speed and very good performance

Required less space and size

Reduced cost

Increased reliability

Portability, Time sharing, Multitasking

### # Types of Operating Systems:

Various types of operating systems are:

Batch operating system

Multiprogramming system

Multitasking system

Time shared operating system

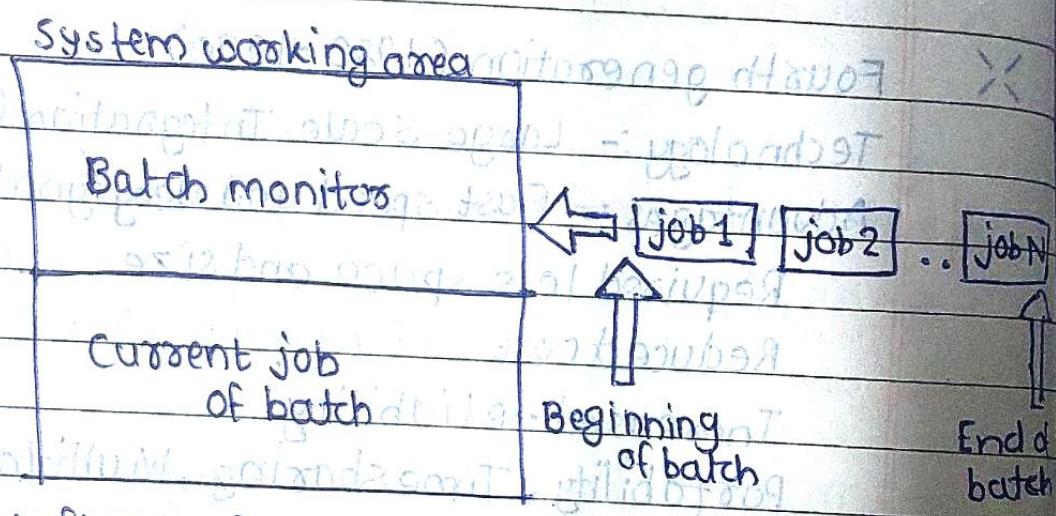
Multiprocessor system (Tightly coupled)

Distributed system (Loosely coupled)

Cluster systems

Real systems

**Batch operating system:** In this type of OS, batch (sequence of user jobs with similar needs) of jobs were submitted to the system and then those were executed automatically one by one without any human operator interruption. The job sequence was decided by an operator. After execution of job, it sends it to the particular user who owes it. Each job was an independent job in a batch.



Left side of the diagram is memory map in which half position is occupied by batch monitor known as system area and remaining memory contains current job of batch for execution.

### ~~Batch monitor functions :-~~

- ① **Scheduling :-** Scheduling decides which service request/job should be handled next, so it decides the order of job execution. It uses First Come First Serve scheduling.

② Memory management :- Partitioning, allocation,

deallocation of memory as per system

requirement is the role of memory management unit.

③ Sharing and protection :- Sharing of data and

IT applications resources results in reducing cost of hardware

and processing time. The protection functions

will prevent data and resources from unauthorised

access or any physical damage.



Multiprogramming System :- In multiprogramming

Operating system, OS keeps several jobs in

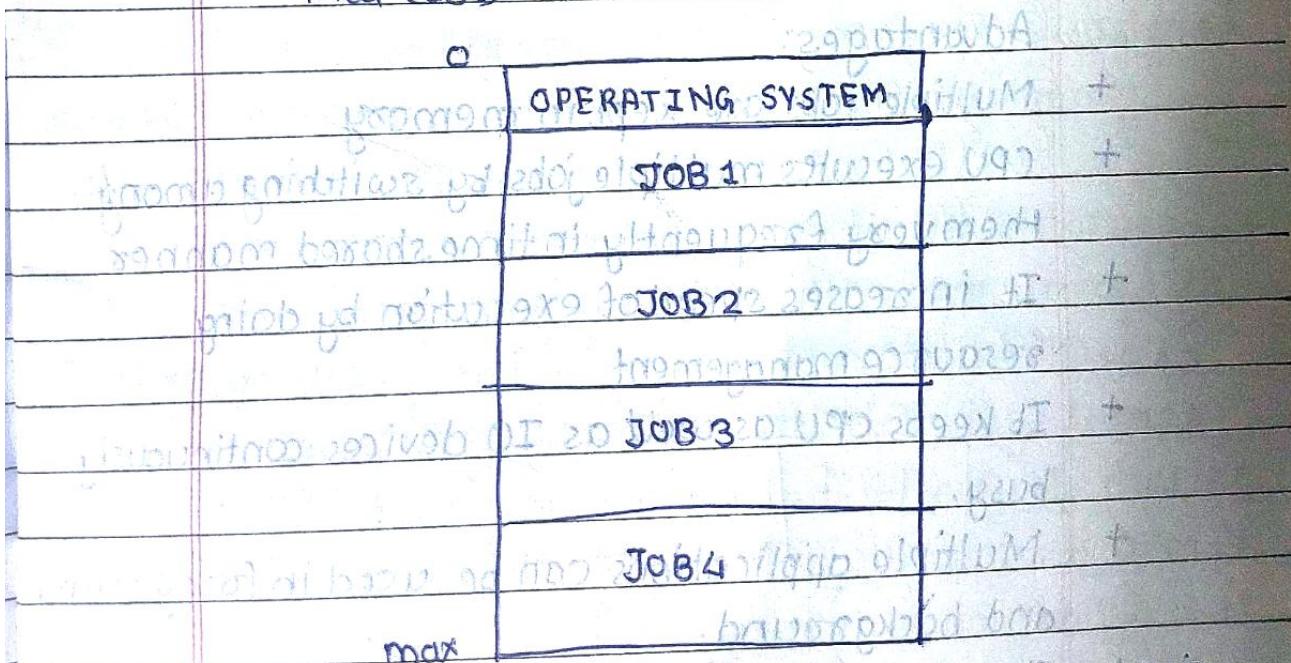
memory simultaneously and picks and executes

one of the job in memory. While executing,

job may have to wait in the middle for some

task, so OS quickly switch to another job in

that case.



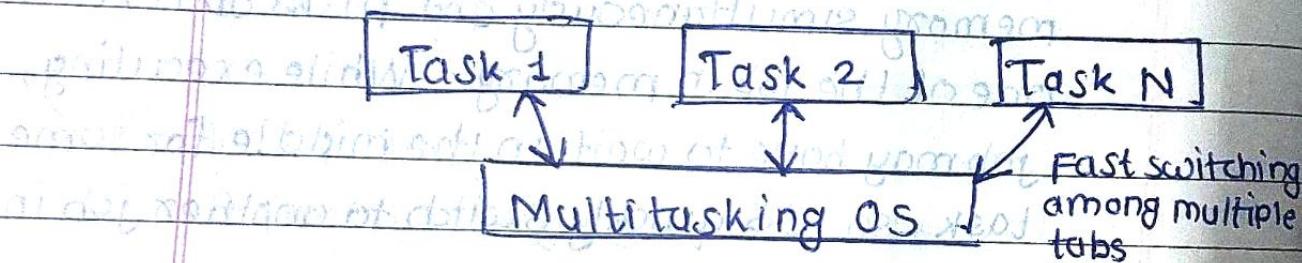
Above diagram is a layout for Multiprogramming system.

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Multi-tasking system : It is a logical extension of multi programming. In multitasking, the CPU executes multiple jobs by switching among them very frequently that the users can interact with each program while it's running. It requires an interactive computer systems, in which users give instructions directly using an input device and waits for immediate results on an output device.

Response time should be less.

Multi-tasking OS.



### Advantages:

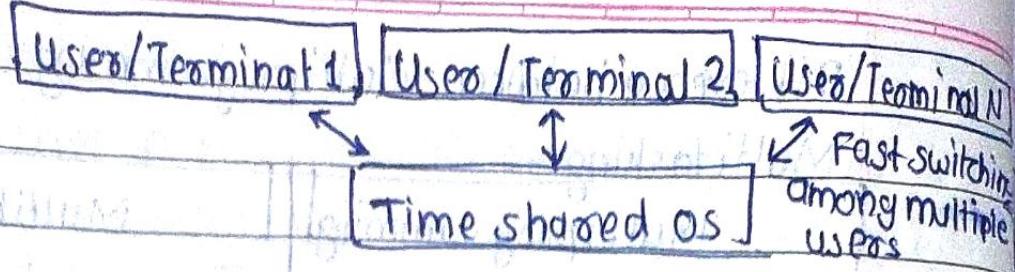
- + Multiple jobs are kept in memory
- + CPU executes multiple jobs by switching among them very frequently in time shared manner
- + It increases speed of execution by doing resource management
- + It keeps CPU as well as IO devices continuously busy.
- + Multiple applications can be used in foreground and background.
- + It uses time sharing process / principles to speed up processing speed

## Difference between Multiprogramming & Multitasking:-

Multiprogramming	Multitasking
① Multiple jobs are kept in memory. Each job is executed one by one.	① Multiple jobs are kept in memory. CPU executes multiple jobs by switching among them.
② Follows non-primitive approach	② Follows primitive approach
③ User cannot perform input and output interactively	③ User can perform input and output interactively.
④ Some program application takes place in foreground and background	④ Multiple application can be used in foreground and background.
⑤ Response time may not be very small	⑤ Response time is very small.
⑥ It is an older version of multiprogramming	⑥ It is an extension of multiprogramming

➤

Time Shared Operating System:- Time sharing is a logical extension of multiprogramming. In time shared system, the CPU executes multiple jobs from multiple users by switching among them frequently that the user feels that the entire computer system is dedicated to his use only, even though it is being shared among many users. Here, time is managed properly for multiple users in an interactive manner and at a reasonable cost.



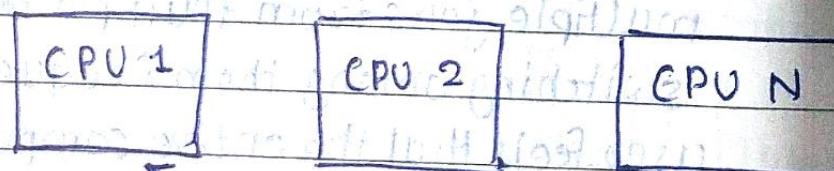
### Advantages:

- ① Time management among tasks is done in an interactive manner.
- ② It increases speed of execution.
- ③ Response time is less. It is accomplished through swapping.
- ④ Time sharing principles speed up the processing speed.
- ⑤ It is economical.

### Disadvantages:

- ① Time sharing systems are difficult and complicated.
- ② They are expensive to build.
- ③ Time management involves complicated algorithms.
- ④ Effective time management can become difficult in case of more users.

### Multiprocessor system (Tightly coupled systems):



Multiple processors sharing resources

Multiprocessor systems have two or more processors in close communication, sharing the computer bus and sometimes the clock, memory and peripheral devices.

### Advantages:

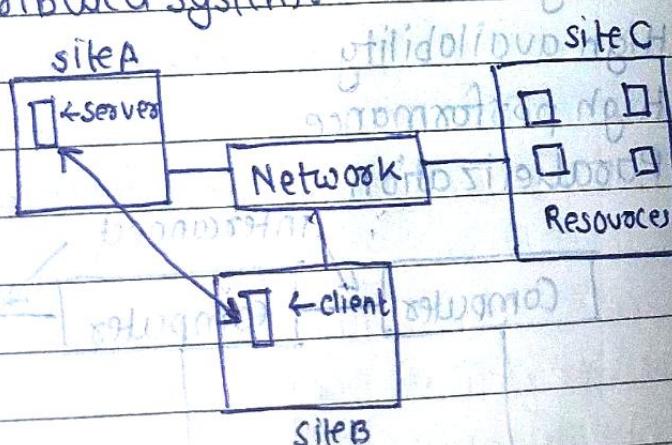
- ① Increased throughput
- ② Economy of scale
- ③ Increased reliability.

### Types of Multiprocessor systems:

① Asymmetric Multiprocessing :- In this, a boss processor controls the system; the other processors either look to the boss for instruction or have predefined tasks.

② Symmetric Multiprocessing (SMP) :- In this, all processors are peers. Each processor has its own set of registers, as well as a private or local cache.

### Distributed system:-



Distributed system is a collection of processors that do not share any memory or clock. Instead each node has its own local memory. The nodes communicate with one another through various networks, such as high speed buses and internet.

### Advantages of Multiprocessor systems:

- ① Resource sharing
- ② Computation speedup
- ③ Load sharing
- ④ Reliability
- ⑤ Communication

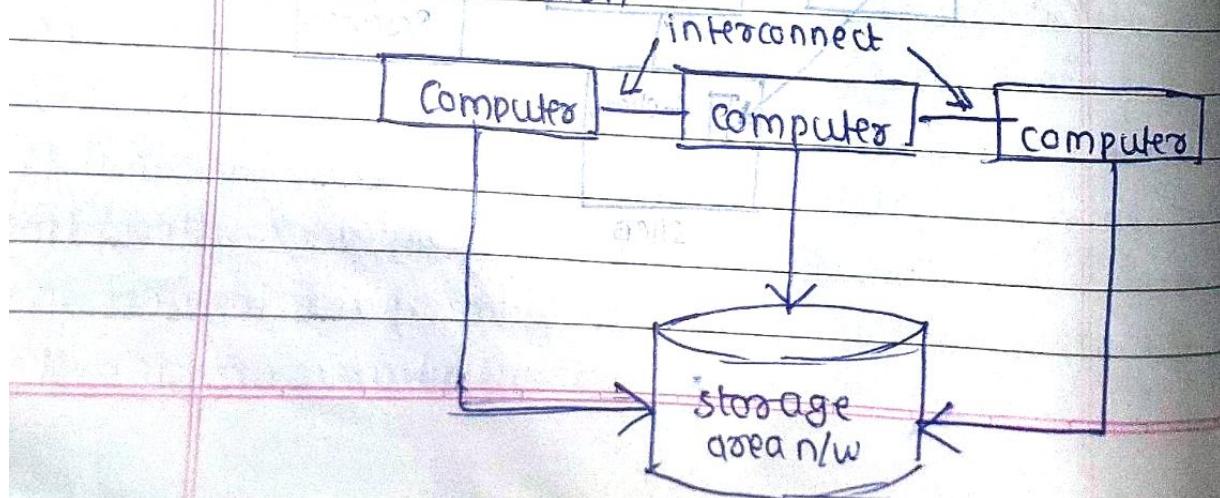


Clustered System :- Clustered system is a

multiprocessor system which gathers together multiple CPU's. They share storage and are closely linked via Local Area Network (LAN) or high speed connection

### Advantages:-

- ① High availability
- ② High performance
- ③ Parallelization

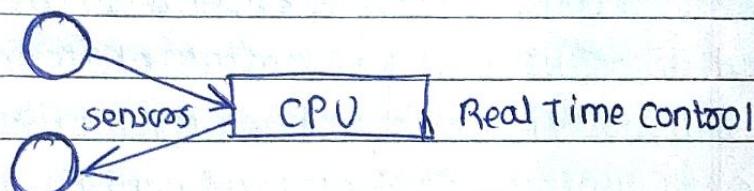


## Types of clustered systems:

- ① Asymmetric clustering :- One machine is in hot standby mode which monitors the other machines which are running applications (active servers). If that server fails, the hot standby host becomes active server.
- ② Symmetric clustering :- In this, two or more hosts are running applications and monitoring each other.



Real time systems :- A real time system has well defined, fixed time constraints - Processing must be done within the defined time period, otherwise system will fail.



## Characteristics :-

- ① Single purpose
- ② Small size
- ③ Inexpensively mass produced
- ④ Specific timing requirements

## Types :

- ① Hard real time systems :- It is strict and critical tasks must be completed within their deadlines.
- ② soft real time systems:- It is less restrictive, here critical task will get a higher priority.

### Single processor system

- ① Single processor is used
- ② Performance is less
- ③ Economical
- ④ Unreliable
- ⑤ Less throughput

### Multiprocessor system

- ① More than one processors are used
- ② Performance is good
- ③ Expensive
- ④ Reliable
- ⑤ Increased throughput