

Computer Network  $\Rightarrow$  A computer network is a set of devices connected through links.

A node can be computer, printer, or any other device capable to sending or receiving the data.

The links connecting the nodes are known as communication channels.

Computer Network uses distributed processing in which task is divided among several computers.

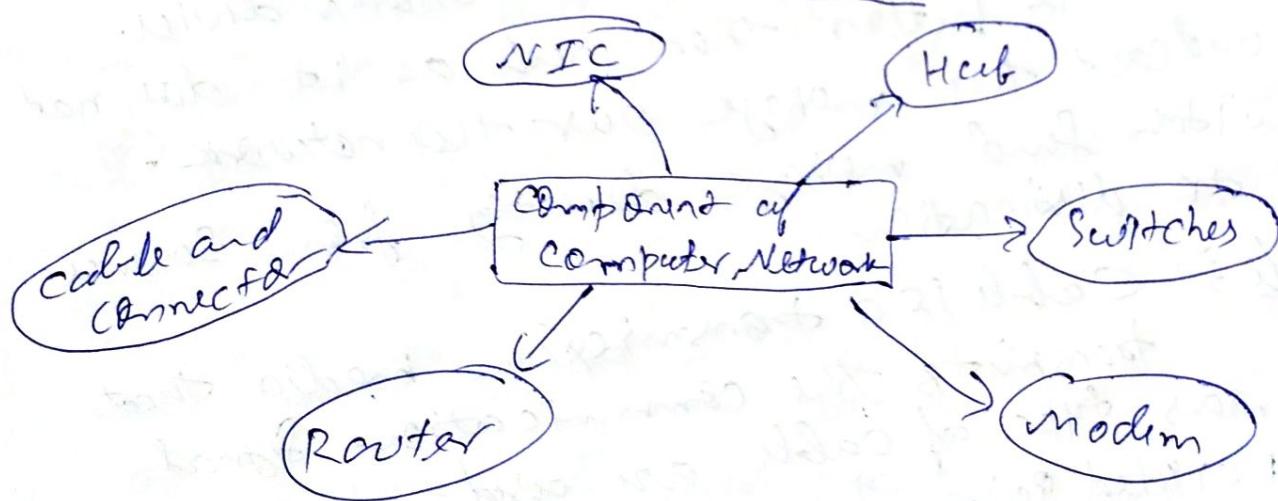
A Computer Network is a group of computers connected with each other through wires, optical fibers or optical link so that various devices can interact with each other through a network.

\* The Aim of the computer network is the sharing of resources among various devices.

Major Components

of a computer Network  $\Rightarrow$

① NIC (National interface card)  $\Rightarrow$



NIC ~~is~~ is a device that help the computer to communicate with another device. The network interface card contains the hardware address, the data link layer protocol use this address to identify the system on the network so that it transfer the data to the correct destination.

Modem  $\Rightarrow$  Modem connects the computer to the internet over the existing telephone line. A modem is not integrated with computer motherboard. A modem is a separate part on the PC slot found on the motherboard.

### Uses of Computer Network $\Rightarrow$

- a) Resource Sharing.
- b) Server - ~~client~~ client model (data store in central computer and access by another computer)
- c) Communication medium  $\Rightarrow$
- d) E-commerce.

### Features of Computer Network $\Rightarrow$

- a) Communication speed
- b) File sharing
- c) Back up and Roll Back
- d) Hard drive and CPU sharing
- e) Security
- f) Scalability
- g) Reliability.

### Computer Network Architectures $\Rightarrow$

- 0) Peer-to-Peer Network
  - 1) Client/Server Network.
- a) Peer-to-Peer  $\Rightarrow$  Peer-to-Peer network is a network in which all the computers are linked together with equal privilege and responsibility for sharing data. Peer-to-Peer is for small environment. No dedicated server in Peer-to-Peer Network.

There are two type of NIC.

a) wireless NIC  $\Rightarrow$  All modern laptops use NIC, the wireless NIC. In wireless that employs the radio wave technology.

b) wired NIC  $\Rightarrow$  cable use the wired NIC to transfer the data over the medium.

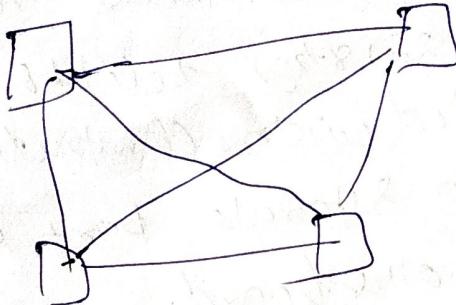
Hub  $\Rightarrow$  Hub is a central device that splits the network connection into multiple devices. When Computer requests for information from another computer, It finds the request to the hub. Hub distributes this request to all the interconnected computers.

Switch  $\Rightarrow$  Switch is a networking device that connects all the devices over the network to transfer the data to another device. A switch is better than hub as it does not broadcast the message over the network. Switch send message directly from source to destination.

Cable  $\Rightarrow$  Cable is a transmission media that transmits the communication signal. Various type of cable are used -

- i) Twisted Pair
- ii) Co-axial cable
- iii) Fibre optical

Router  $\Rightarrow$  Router is a device that connects the LAN to the internet. The router is mainly use to connect the internet to multiple computers.



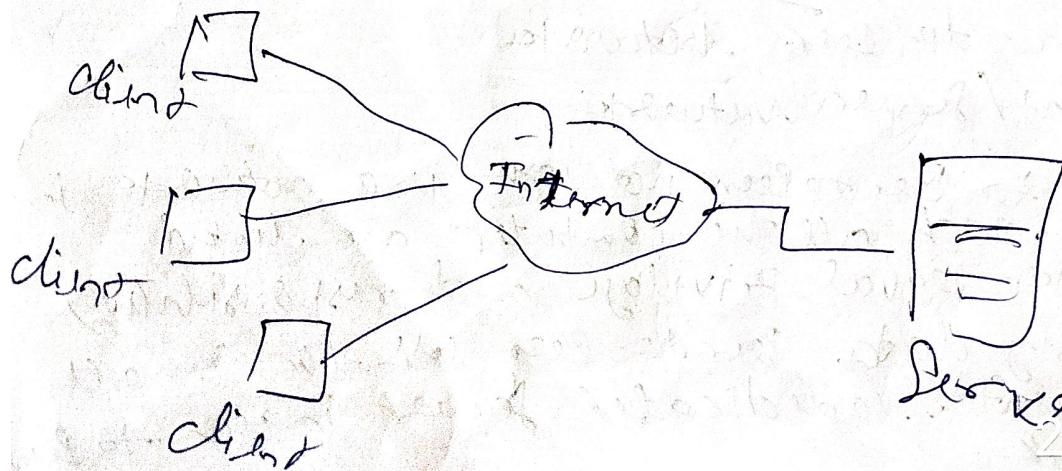
- advantages
- ① less cost
  - ② If one system is stop other can work
  - ③ It is easy to set up and maintain.

disadvantages

- ① It does not have any centralized system. It can not be backup the data as the data is different/different to each other.

② Client-Server Network  $\Rightarrow$  Client/Server network is a ~~model~~ network model designed for the end user called client, to access the resources such as soft. like video, from central computer known as server & central controller is known as a server while all other computer called client.

A server perform all the major operations such as security and network management. A server is responsible for managing all the resources such as file, printer, etc all client communicated with each other through server.



advantage ⇒ ① A client/server network contains the centralized system. Therefore hacker is ~~easy~~

② A client/server network has a dedicated server that improves the overall performance of the whole system.

③ Security is better

④ It also increase the speed of the sharing resources.

disadvantage ⇒ ① Extension

② It requires a dedicated network administrator to manage all the resources.

## Type of computer network

A computer network is a group of computers linked

to each other that enables the computers to communicate with another computer and share their resources, data and application.

① LAN (Local Area Network)

② MAN (Metropolitan Area Network)

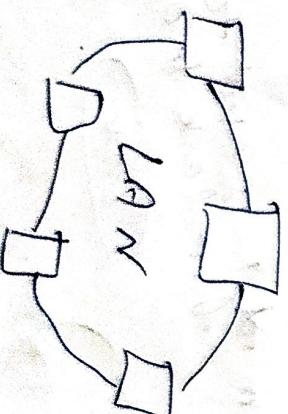
③ WAN (Wide Area Network)

④ PAN (Personal Area Network)

LAN ⇒ In LAN group of computers connected to each other in a small area such as Building, office etc LAN are used to connecting two or more personal computer through a communication medium such as twisted pair, coaxial cable etc.

- \* It is less costly as it is built with inexpensive hardware such as hub, network adapter and Ethernet card.

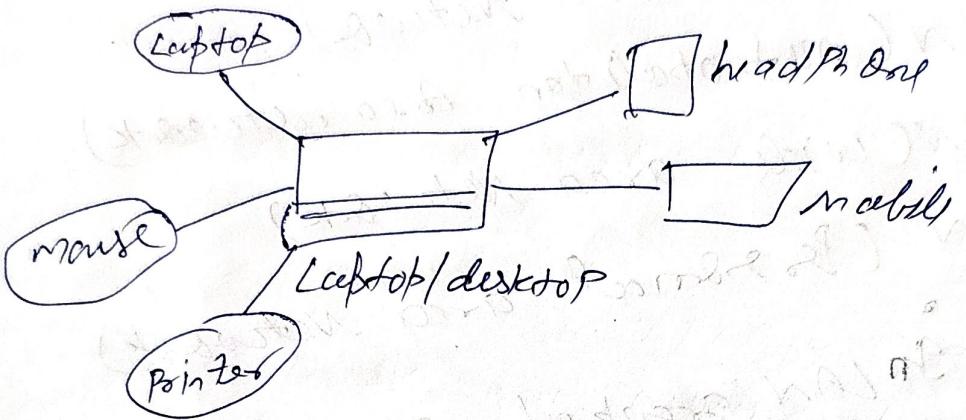
- \* Data rate is faster in LAN
- \* LAN provide high security.



- \* School, university, client-server architecture
- \* Need less number.
- \* Products needed

(11) PAN  $\Rightarrow$  PAN is a network arranged within an individual person, typically within a range of 10 meters.

\* Personal Area Network is used for connecting the computer devices of personal use i.e known as PAN.



Two types of PAN  $\Rightarrow$

(1) wired PAN

(2) wireless PAN

(12) MAN  $\Rightarrow$

A metropolitan area network is a network that covers a larger geographic area by interconnecting a different LAN to form a large network. In MAN various LAN are connected to each other through telephone exchange line speed 44 - 155 mbps.

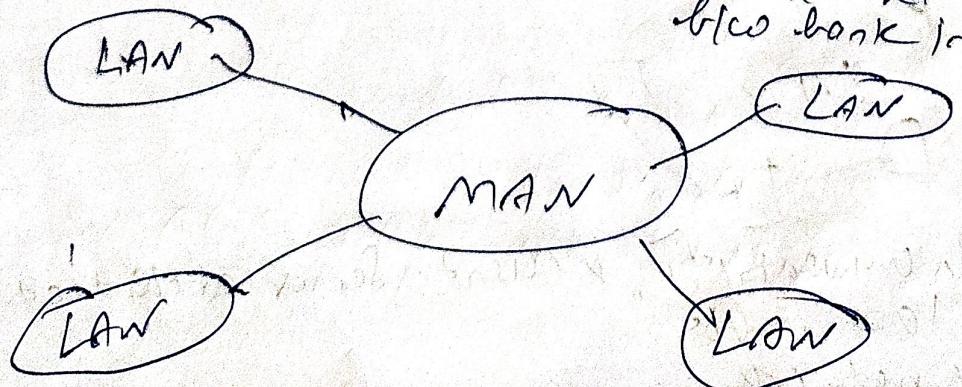
\* Telephone company

\* Point to Point connection can used in MAN.

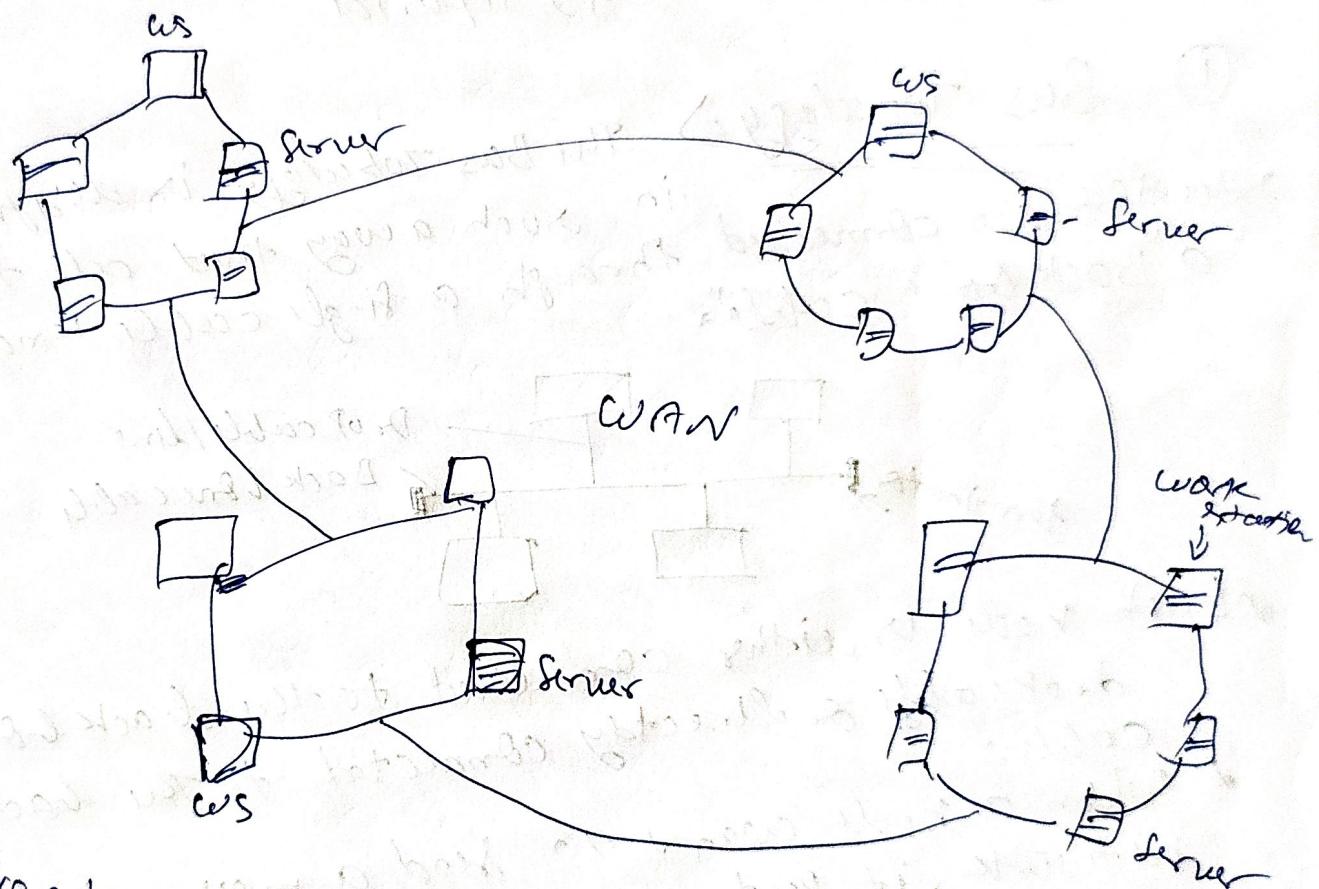
\* wireless connection.

\* wire / cable / modem

\* It is used to communicate b/w bank in a city.



- (iv) WAN  $\Rightarrow$  A wide area-network that extends over a large geographical area such as states or countries. It is bigger than LAN.
- \* WAN is not limited to single location. It covers large area through a telephone line, fiber optic cable or satellite links.
  - \* Internet is the biggest WAN in the world.



### Advantage of WAN $\Rightarrow$

- i) Geographical area
- ii) Centralized data
- iii) Net update file
- iv) Exchange message
- v) Sharing of S/W and resources
- vi) Global business

(VII) High Bandwidth  
Corporate Area Network  
CAN (Campus area network)

A CAN is a network of multiple interconnected LTR in limited area. A CAN is smaller than MAN and WAN.

Disadvantage ⇒ ① Security issue.

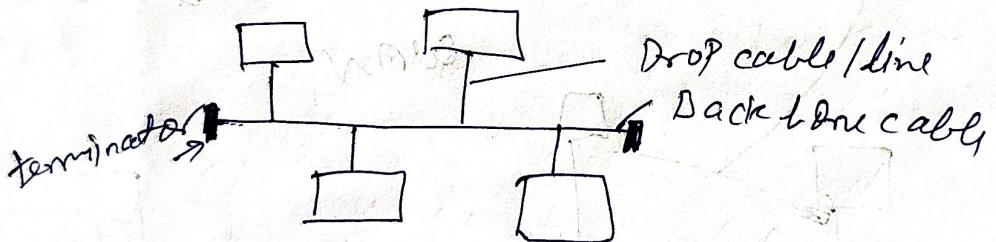
- ② Need Firewall and Antivirus software  
③ High setup cost.

## Topology ⇒

- a) Bus
- b) Ring
- c) Tree
- d) Star
- e) mesh
- f) Hybrid

### ① Bus Topology ⇒

The Bus Topology is designed such that all the stations are connected in such a way that all the stations share a single backbone cable known as "Backbone cable".



\* Each node is either connected to the backbone by drop cable or directly connected to the backbone by cable.

\* When a node wants to send a message over a network, it puts a message over a All the station available in the network will receive the message in the network addressed or not.

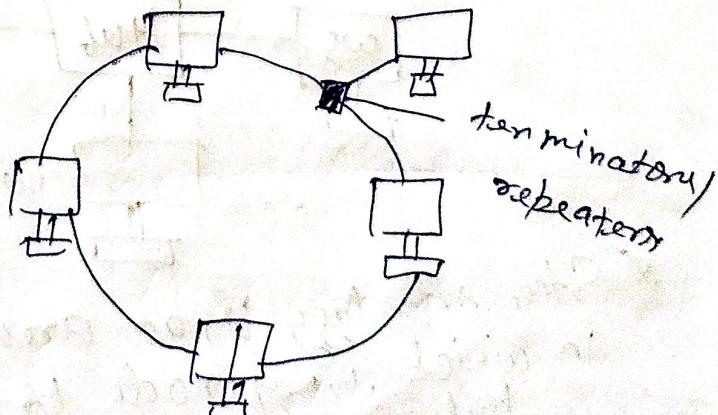
\* Bus topology mainly used in 802.4 standard network.

\* Configuration is simple.

\* CSMA/CD carrier sense multiple access

- Advantage ⇒
- ① Low-cost cabling ⇒ direct connection with backbone cable without use of hub  
so cost is less.
  - ② moderate - data-speed ⇒ ① 1000 Mbps  
isolated pair cable      ② co-axial cables or unshielded.
  - ③ Familiar Technology ⇒ all the components are easily available.
  - ④ Limited Failure ⇒ A failure affects the others i.e. one node not disadvantage ⇒
- ① Extensive cabling ⇒ It required lots of cabling.
  - ② ~~②~~ Signal Interference.
  - ③ Reconfiguration difficult ⇒ if add a new node then.
  - ④ if backbone cable is fail then system is fail.
- ⑤ Ring Topology ⇒

- ① Ring Topology is like bus topology, but with connected ends.
- ② The data flow in one direction.
- ③ The node that received a message from previous node will retransmit to the next node.

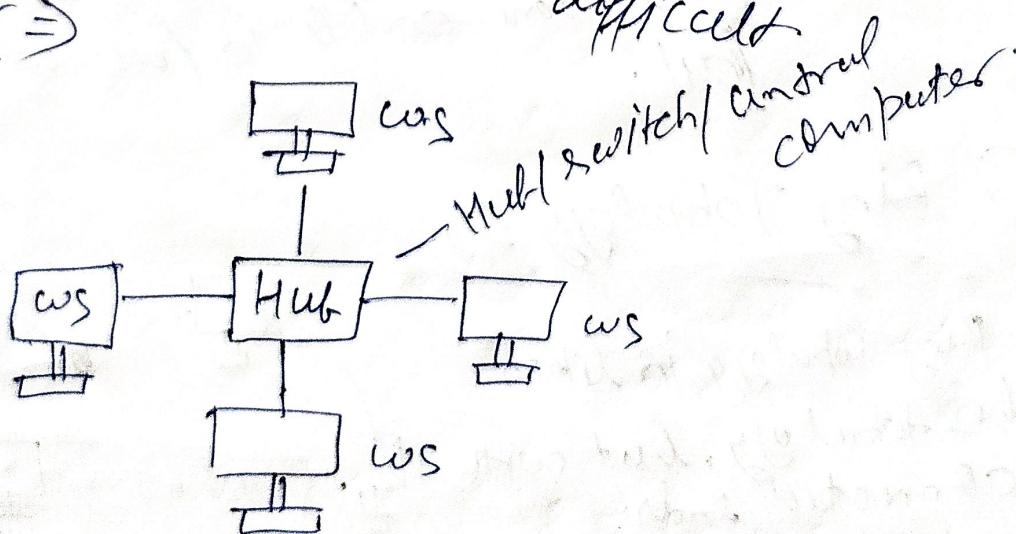


- \* The data flow is in a single loop continuously known as an endless loop.
- \* The data in a ring topology flow in a clockwise direction.
- \* The most common access method topology is token passing.

- advantages
- ① Network management → can be removed from the network without bringing the network down.
  - ② Product & Availability. (All device is easily available)
  - ③ cost - low
  - ④ Installation cost
  - ⑤ Reliable → communication is not dependent on system.

- disadvantage
- ① Failure → if one system fail then network is fail.
  - ② Communication delay.

⑥ Star → difficult



- \* Star topology is an arrangement of the network in which every node is connected to the central hub, switch or a central computer.

- \* A central computer is known as Server, and the peripheral devices attached to the server are known as clients.
- \* Coaxial cable or RJ-45 cable are used to connect the computers.

\* Star topology is the most popular topology in the network implementation.

Advantages →

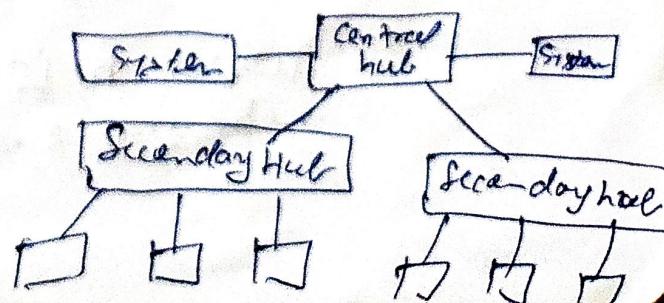
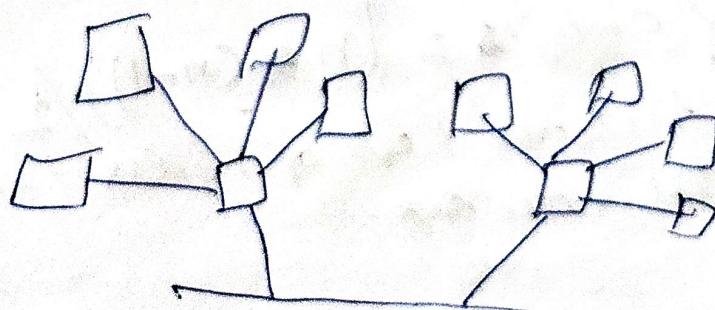
- ① Network control
- ② Limited failures
- ③ Familiar technology.
- ④ Easily expandable.
- ⑤ High data speed (100 mbps).

Disadvantage →

- ① Control point of failure.
- ② Cable

Tree →

- \* Tree topology combines the characteristics of "bus topology and star topology".
- \* A tree topology is a type of structure in which all the computers are connected with each other in hierarchical fashion.
- \* The top most node in tree topology is known as root node. & There is only one path exists b/w two nodes for data transmission.

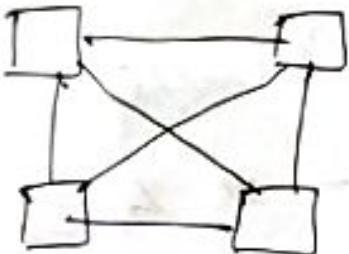


- advantage ⇒
- ① Support for broadband transmission.
  - ② Easily extendable.
  - ③ Easily manageable.
  - ④ Error detection.
  - ⑤ Limited failures.
  - ⑥ Point-to-Point wiring.

disadvantage ⇒ High cost → cables.

- ⑦ Failure → central hub/switch over.
- ⑧ Reconfiguration difficult.

mesh ⇒ mesh topology is an arrangement of the network in which computers are interconnected with each other through various redundant connections.



- \* There are multiple paths from one to another computer.
- \* It does not contain the **orange** central computer which acts as a central point of communication.

- \* Internet is an example of mesh.
- \* Mesh Topology is mainly used for wan implementation.
- \* mesh are mainly used for wireless network.
- \* mesh topology can be formed by using the formula :-

$$\text{No. of cables} = (n * (n - 1)) / 2 ;$$

where n is the number of nodes that represents the network.

## Type of mesh

a) Fully mesh Topology  $\Rightarrow$  In a full mesh topology each computer is connected to all the computers available in the network.

b) Partial mesh Topology  $\Rightarrow$  In a partial mesh topology not all but certain computers are connected to one computer with which they communicate frequently.

Advantage  $\Rightarrow$  ① Reliable.

② Fast communication

③ easier reconfiguration

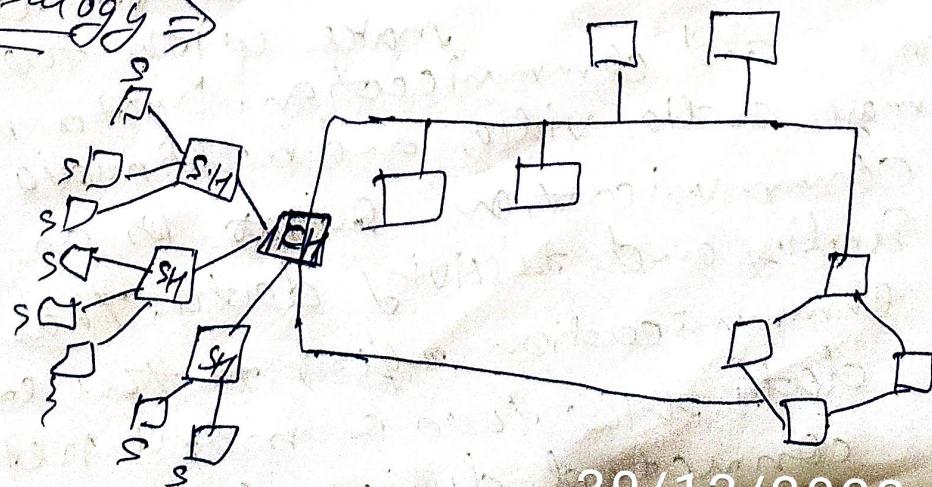
disadvantage  $\Rightarrow$  ① Cost  $\rightarrow$  costlier to implement

② Management

③ efficiency

$\rightarrow$  Redundant connections are high that reduce the efficiency of the network.

## Hybrid Topology



The combination of various different topology

is known as Hybrid topology.

- \* A Hybrid topology is a connection b/w different links and nodes to transfer the data.
- \* If similar topology is combined then it is called Hybrid topology.

Advantage => Reliable  $\Rightarrow$  if any part fail then rest affect the other.

- (i) Scalable  $\Rightarrow$  size is easily expandable by adding new device or topology.
- (ii) Flexible  $\Rightarrow$  design on the requirement of organization.
- (iii) Efficient  $\Rightarrow$  strength is maximum and weakness is minimum.

Disadvantage => Complex design.

- (i) costly Hub
- (ii) costly Infrastructure.

Transmission mode =>

- (i) Simplex mode
- (ii) Half-Duplex
- (iii) Full-Duplex.

Data communication =>

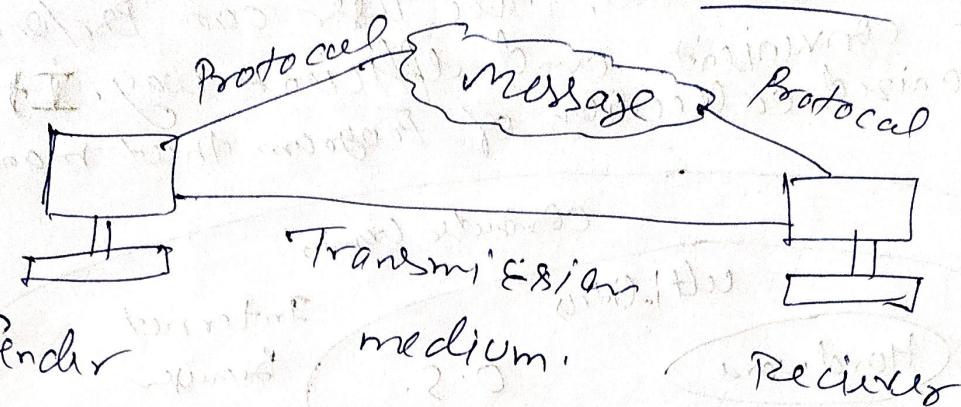
Data Communication is made with two words Data and communication. Data means Image, audio, video, and multimedia files.

Communication ~~process~~ is an act of sending and receiving data. Thus data communication refers to the exchange of

data b/w two or more networked or connected device. These 20/12/2022 05:43

must capable of sending and receiving data over a communication medium.

Component of data communication  $\Rightarrow$



Transmission medium  $\Rightarrow$

It is the path through which the message travels from source to destination.

Protocol  $\Rightarrow$  Set of rule.

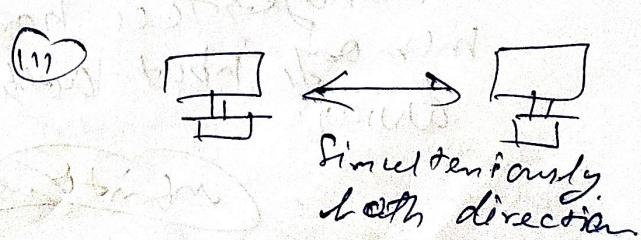
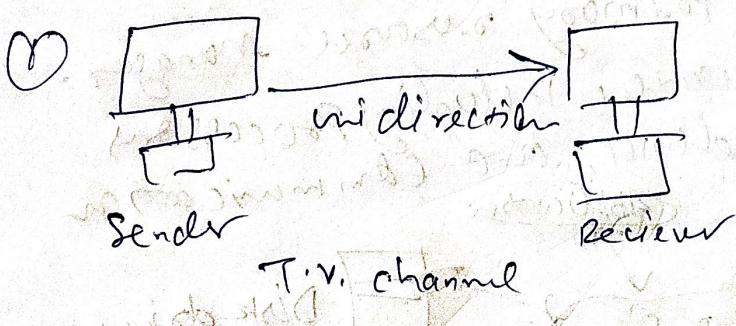
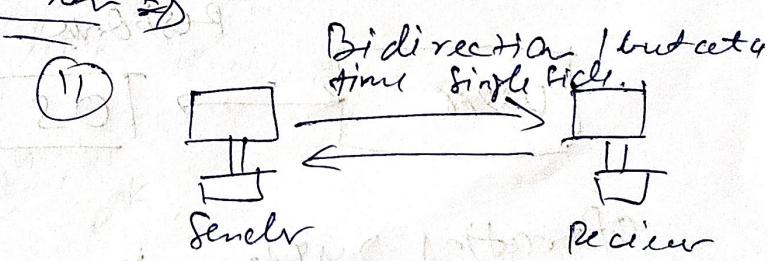
It is a set of rule that needs to be followed by the communication parties in order to have successful and reliable communication.

Type of data communication  $\Rightarrow$

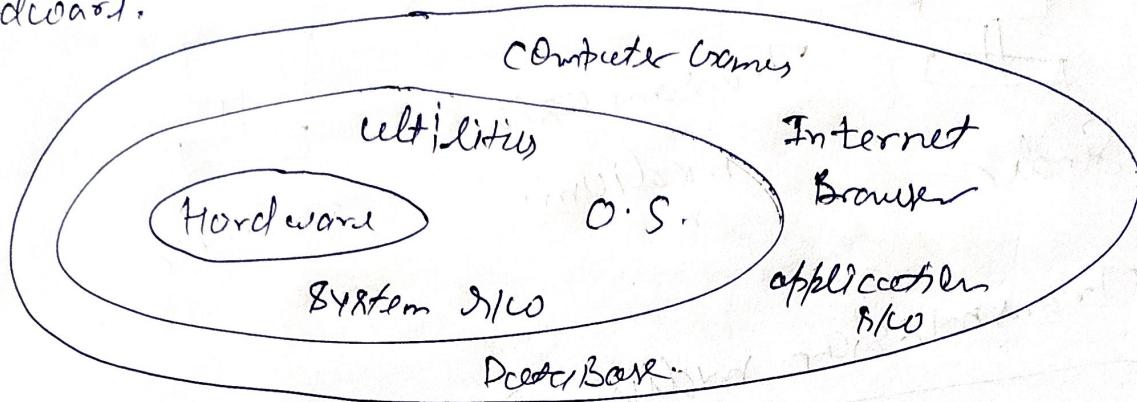
(i) Simplex.

(ii) Half-Duplex.

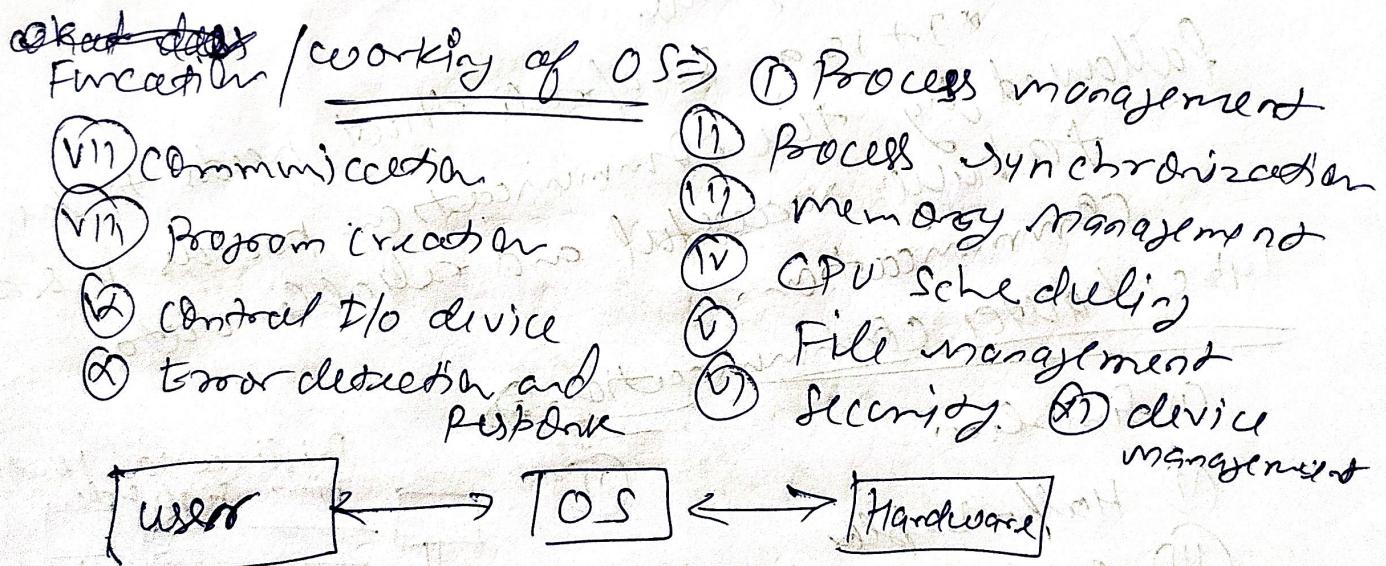
(iii) Full-Duplex.



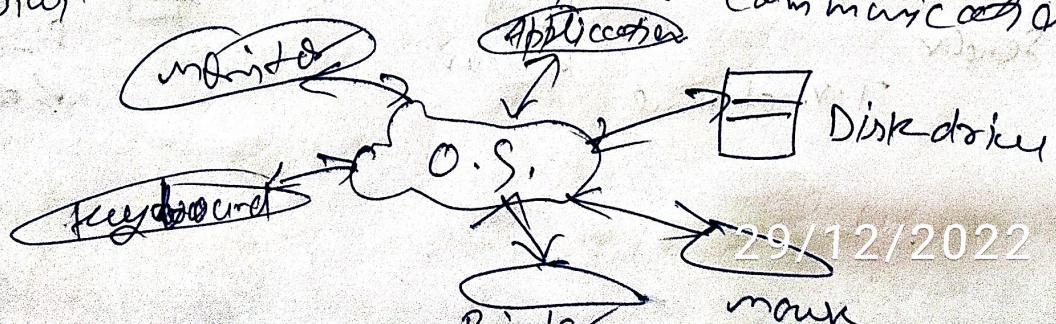
Operating System  $\Rightarrow$  \* Operating system can be defined as an interface b/w user and hardware. It provides an environment to the user so that, the user can perform his task in convenient and efficient way. It is a well-organized collection of programs that manages the hardware.



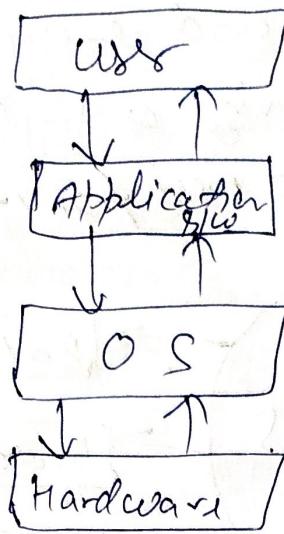
It is responsible for execution of all the processes, resource allocation, CPU management, file management, and many other tasks.



Operating System is a primary resource manager. It manages the hardware, including processor, memory, input-output devices, and communication devices.



• An OS is a system program that serve as an interface between the computing system and end-user.



Advantage of OS

- ⇒ (i) It is helpful to monitor and regulate resources.
- (ii) It is used to create a interaction and computer hardware.
- (iii) The performance of the computer system is based on CPU.
- (iv) The disadvantage of the computer system is based on hardware.

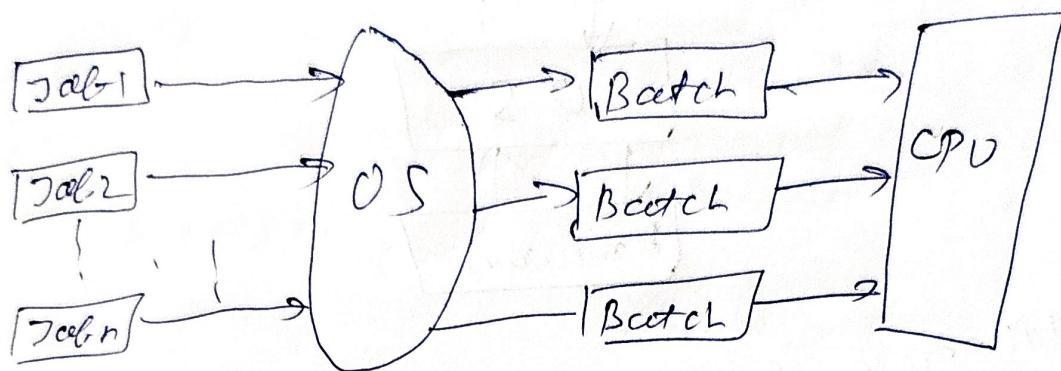
disadvantage

- ⇒ (i) It allows few task that can run at the same time.
- (ii) If any error occurs in OS then system is destroyed.
- (iii) The cost of OS is very high.

Type of OS

- ⇒ (i) Batch OS
- (ii) Multiprogramming OS
- (iii) Multiprocessing OS
- (iv) Multitasking OS
- (v) Network OS
- (vi) Real-Time OS
- (vii) Time Sharing
- (viii) Distributed O.S.

① Batch OS  $\Rightarrow$  In 1970, Batch OS was very popular.  
For this technique similar type of Job were batched together and executed in time. People were used to having a single computer which was called a mainframe.



The user did not directly interact with the computer system for job executions in a simple batch OS. The job was then submitted to the computer operator, who was usually in the form of Punch card. The program's output included result and registers and memory dump in the event of a program ~~error~~. The output appeared after some time that could take days, hours, minutes etc.

The main role was to transfer control from one job to another. Job with similar requirements were batched together and processed through the processor to improve processing speed. The operator were used in the program to create batches with similar needs. The computer ran batch one by one when they became available.

Advantages  $\Rightarrow$  ① This system can easily manage large Job.

⑪ The Batch process can be divided into two several stage to increase processing speed.

⑫ CPU utilization get improved.

⑬ The use of resident monitor improves computer efficiency as it eliminates CPU time b/w two jobs.

disadvantages

①

Batch Processing suffer from starvation.

⑪

No interaction.

Batch Processing wait for user input for job that are dependent on

⑫

multi programming

OS  $\Rightarrow$  multiprogramming is an allocation of CPU to Batch OS needs two type of I/O time. A multiprogramming OS: CPU time and

~~Batch OS~~ Programming OS may run many programs on a single processor computer. If one program must wait for I/O transfer to use the CPU. The other program is share CPU time. As a result, various job may multiprogramming into load of system resources. The key component of a multiprogramming system are file systems, command processor, transient area, and I/O.

⑬ advantages

①

It provides less response time.

②

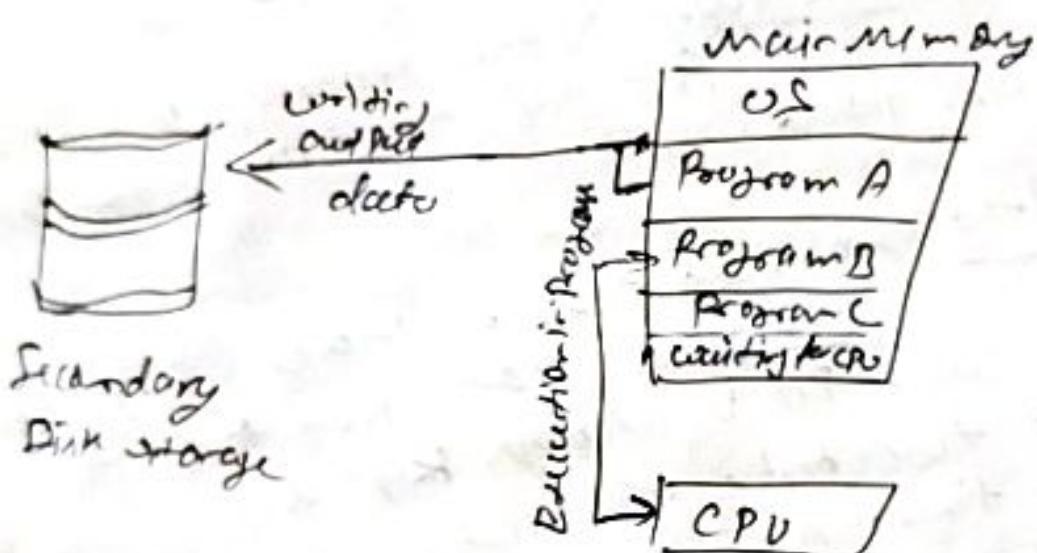
The resource is used smartly.

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- (iii) It may help to run various job in a single application simultaneously.
- (iv) It may help to improve CPU utilization and never gets idle. (v) response time can also be reduced.

disadvantages :-

- ① CPU scheduling is required.
- ② It is highly complicated.
- ③ The harder task is to handle all processes and tasks.

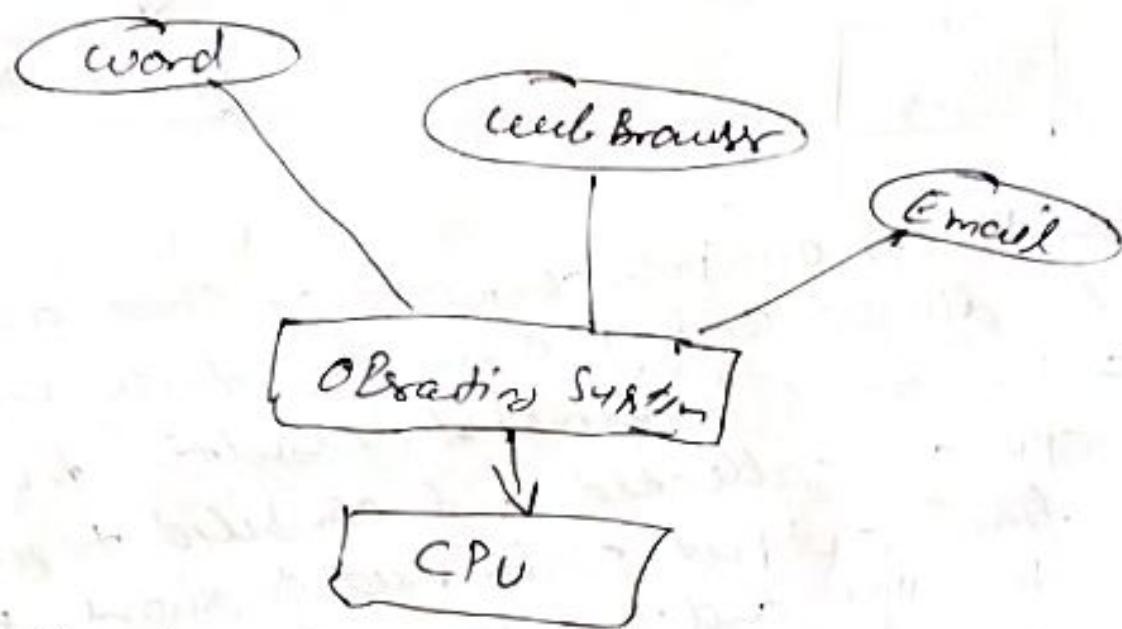


### Types of multiprogramming :-

- ① multitasking OS :- A multitasking OS enables the simultaneous operation of two or more programs. The OS decides by at a time. A programme that has been switched out of memory is temporarily stored on the disk until it is required once more. It allows tasks at the same time.
- advantages :- This OS is more suited to supporting multiple users simultaneously.

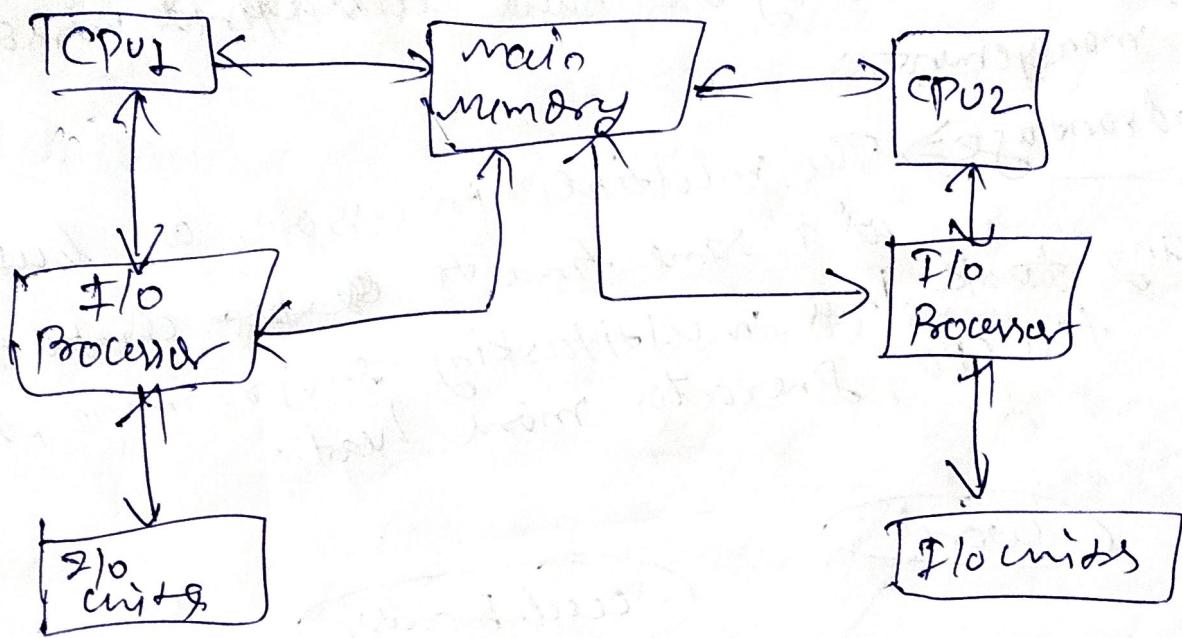
⑪ The multitasking OS have well defined memory management.

~~disadvantage~~ ⇒ The multiple processes are better at a same time to ~~one~~ complete any task in a multitasking environment, so few CPU generates more load.



Multitasking OS ⇒ A multitask OS allows many users to share processing time on a powerful central computer from different terminals. The OS accomplishes this by rapidly switching b/w terminals, each of which receives a limited amount of processor time on the central computer. The OS changes among terminals so quickly that the user seems to have continuous access to the central computer.

Multiprocessing OS ⇒ In multiprocessing, parallel computing is achieved. There are more than one processors present in the system which can execute more than one process at the same time. This will increase the throughput of the system.



multiple CPU are interconnected so that a job can be divided among them for faster execution. When a job is finished, results from all CPU are collected and compiled to give the final output. Jobs need to share main memory and they may also share other system resources among themselves. multiple CPU can also be used to run multiple jobs simultaneously.

Advantage →

- ① Increase reliability
- ② Increase throughput
- ③ The economy of scale.

Disadvantage →

- ① more complex
- ② cost high as compare to other.

Type of multiprocessor →

- ① ~~Symmetrical~~ Symmetrical multiprocessor O.S.
- ② Asymmetrical multiprocessor

Algorithm Complexity  $\Rightarrow$  The complexity of an algorithm  $f(n)$  gives the running time and/or storage space required by the algorithm in terms of  $n$  as the size of input data.

Space Complexity  $\Rightarrow$  Space complexity of an algorithm represents the amount of memory required by the algorithm in its life cycle.

Space complexity  $S(P) = C + SPC()$

Space complexity

$C$  = Fixed Part (Program size, variables, constants and)

$SPC()$  = Variable Part (variable whose size depend on the size of problem).

also:  $SUM(A, B)$

Start

$C \leftarrow A + B + 0$

Stop.

$A, B, C$  are three variables, and  $+ \times$  constant.

$$S(P) = 1 + 3 = 4$$

Time Complexity  $\Rightarrow$  Time complexity of an algorithm represent the amount of time required by the algorithm to run to completion.  $T(n)$ , where  $n$  is the no of input.

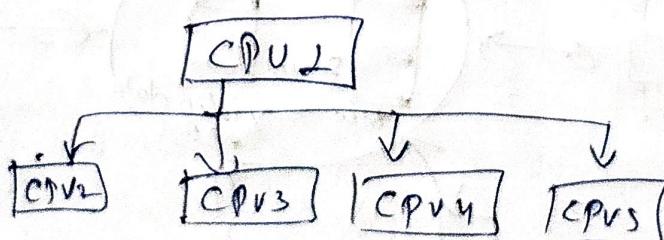
Asymptotic Notation  $\Rightarrow$  They represent the efficiency of algorithms. They allow the comparison of various algorithm. Asymptotic notation in a way of comparing in that ignores constant factors and small input size.

⑩ Symmetrical multiprocessing OS  $\Rightarrow$  It occurs when many processors work together to process programs using the same OS and memory. Each CPU executes free OS operation. When memory is shared it means all processor communicate with each other. CPU scheduling policies are very simple. It is also called "shared-everything" system. Because the processor share memory, and the I/O bus or data path not more than 16.

Advantage  $\Rightarrow$  ① Fault tolerant if some of the processor are not working then whole system is not stop.

Disadvantage  $\Rightarrow$  ① very difficult to balance the workload among processors ② specialized synchronization schemes are necessary for managing multiple processors.

⑪ Asymmetric multiprocessor OS  $\Rightarrow$  In an asymmetric multiprocessing system, there is a master-slave relationship b/w the processors. One processor act as master or supervisor processor while others are treated as slaves.



In this type of system, each processor is assigned a specific task and there is a designated master processor that coordinates the activity of other processor.

① advantages  $\Rightarrow$  ① faster because each processor have a single job.

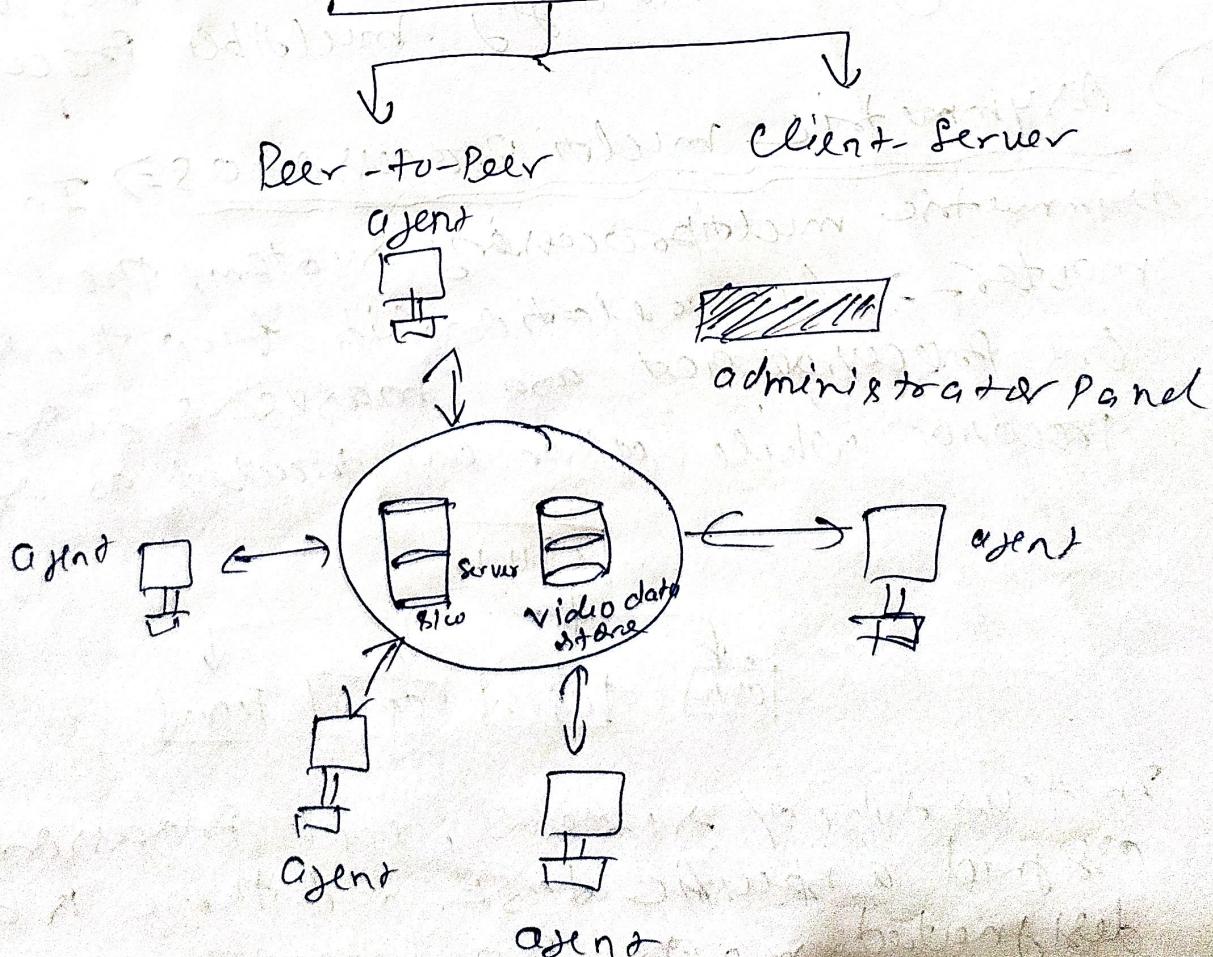
disadvantage  $\Rightarrow$  ① unequally burdened.

it means one is in process and one is in the idle condition.

② if the process handling a specific task fails, the entire system will go down.

③ Network OS  $\Rightarrow$  An OS, which includes S/W and associated protocol to communicate with other computer via a network conveniently and cost-effectively, is called Network OS.

#### Type of Network OS



Advantage ⇒ ① Network traffic reduced due to tree division b/w client and server.

② Less expensive to set up and maintain.

Disadvantage ⇒ ① The failure of any node in a system affects the whole system.

② Security and performance ~~and~~ are important issues. So trained Network administrators are required for network administration.

(V) Real-time OS ⇒ In real-time system, each job carries a certain deadline within which the job is supposed to be completed, otherwise, the huge loss will be there, or even if the result is produced, it will be completely useless.

a) Hard-Real Time.

b) Soft-Real Time.

Advantage ⇒ ① Easy to layout, develop and execute real-time application under the real-time OS.

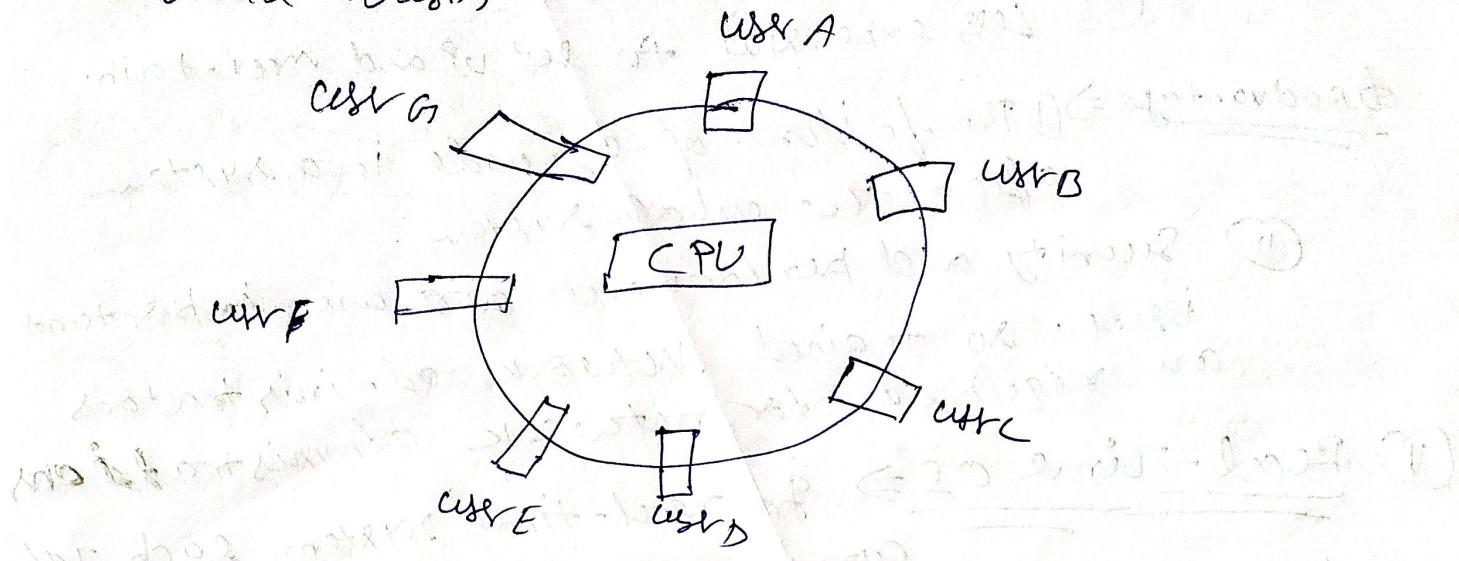
② The maximum utilization of device and systems.

Disadvantage ⇒ ① Very costly to develop.

② very complex.

(VI) Time-Sharing OS ⇒ In this OS, computer resources are allocated in a ~~and~~ time-dependent fashion to several programs simultaneously. Thus it helps to provide a large number of user direct access to the main computer. It is a logical extension of multi-programming. In this, the CPU is switched among multiple

Programs given by different users on a scheduled basis.



A Time sharing OS allows many users to be served simultaneously. So sophisticated CPU scheduling schemes and I/O management are required.

- Advantage ⇒ ① It provides effective utilization and sharing of resources.  
② This system reduces CPU idle and response time.

disadvantage ⇒ ① It is very difficult and expensive to build.

(VII) Distributed OS ⇒ The Distributed OS is not installed on a single machine. It is divided into parts, and these parts are loaded on different machines. A part of the distributed OS is installed on each machine to make their communication possible. Distributed OS are much more complex, large, and sophisticated than Network OS because they also have to take care of varying networking protocols.

advantages ⇒

① It provides sharing of resources.

② Fault-tolerant.

disadvantage ⇒ Protocol overhead can dominate computation cost.

Real-time OS ⇒ Real-time OS are used in environment where a large number of events, mostly external to the computer system, must be accepted and processed in a short time or within certain deadline.

① Hard Real-time OS ⇒ These OS guarantee that critical tasks be completed within a range of time.

② Soft-Real-time ⇒ These OS provides some relaxation in the time limit.

③ Firm Real-time OS ⇒ These type of OS have to follow deadline as well. In spite of its small impact, missing a deadline can have unintended consequences, including a reduction in the quality of the product.

Function of OS ⇒ An OS is a program that acts as a user-computer GUI (Graphical User Interface). OS perform various functions.

① ~~OS~~ Security ⇒ OS uses Password Protection to protect user data and similar other techniques. It also prevents unauthorized access to programs and user data.

(1) Instruction) OS establishes a mutual understanding b/w the various instructions given by the user.

(II) Central over system performance  $\Rightarrow$  monitors overall system health to help improve Performance. records and Response time b/w service requests and system response to having a complete view of the system health.

(III) Job accounting  $\Rightarrow$  OS keeps track of time and resources used by various task and user, this information can be used to track resource usage for a particular user or group of users.

(IV) Error detecting  $\Rightarrow$  The OS constantly monitors the system to detect the errors and avoid the malfunctioning of a computer system.

(V) Memory management  $\Rightarrow$  OS handles the responsibility of storing any data, system program, and user programs in memory.

(VI) File management  $\Rightarrow$  The OS is helpful in making changes in the stored file and in replacing them. It also plays an important role in transferring various files to a device.

VII) Process Management  $\Rightarrow$  The Process is the unit that accomplishes the execution of a program. It can be defined as an execution where a program runs.

(ix) Job Priority  $\Rightarrow$  The work of Job Priorities. Priority is creation and should be determined what action system. It is done first in a computer.

Classification of OS  $\Rightarrow$  OS can be classified as follows:

a) Multi-user  $\Rightarrow$  In this OS two or more user to use their programs at the same time. Some of OS permits hundreds or even thousands of user simultaneously.

b) Single-user  $\Rightarrow$  Just allow one user to use the programs at one time.

c) Multiprocessor  $\Rightarrow$  Supports opening the same program more than just in one CPU.

d) Multi-tasking  $\Rightarrow$  Allow multiple programs running at the same time.

e) Single-tasking  $\Rightarrow$  Allow different part of a single program running at any one time.

f) Real-time  $\Rightarrow$  Responds to input instantly.

VIII Process Management ⇒ The Process is the execution of a program that accomplishes the specified work in that ~~process~~ unit where a program runs.

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- f) Real-time ⇒ Responds to input instantly.

## Elements of Command Band OS

CLI (Command Line Interface). It is an interface for the user that is used to issue commands in successive lines of text or command line to execute the task. It is a platform or medium in which users react to a visible prompt by writing a command and receiving a response from the system, and the user has to be compelled to type command & train of command to execute the task.

Most OS include a CLI. whereas windows and Linux include both CLI and a GUI. The user must have good knowledge of using the CLI and complete knowledge of the correct syntax of the commands. Overall CLI uses less memory and executes faster than the GUI.

Advantage: ⇒ ① It provides fast performance as compared to GUI. user may execute the various job by entering command & in the CLI.

② It may be used with a low-resolution low-cost monitor.

③ Required less memory (RAM)

④ Faster the device

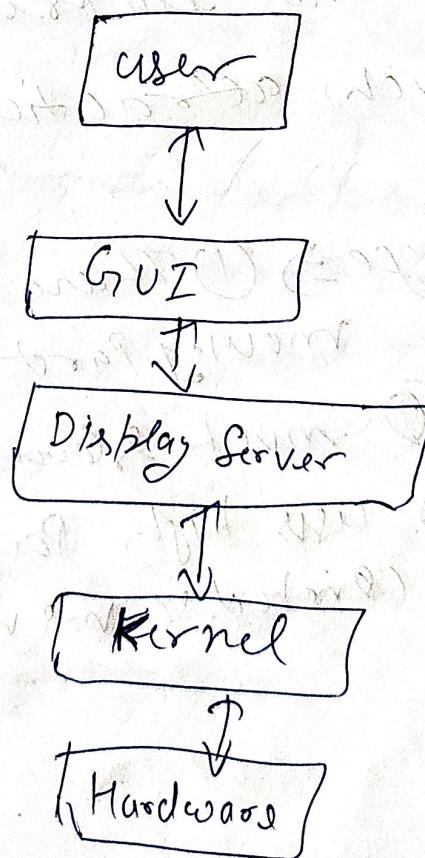
⑤ CLI allow device communication

- (V) CLI can be run on any CPU.
- (VI) All OS support CLI. windows, Linux and Mac each have their command-line Interface.

Disadvantage => (1) It's difficult to remember all of the CLI's command.

- (II) The mostly commands in CLI may not be undone or reversed. So the user must be very careful to use the command in CLI.
- (III) If user deleted a file by accident, it causes difficulties because it may contain crucial information.

## GUI (Graphical User Interface) =>



GUI is an interface that allows users to interact with different electronic devices.

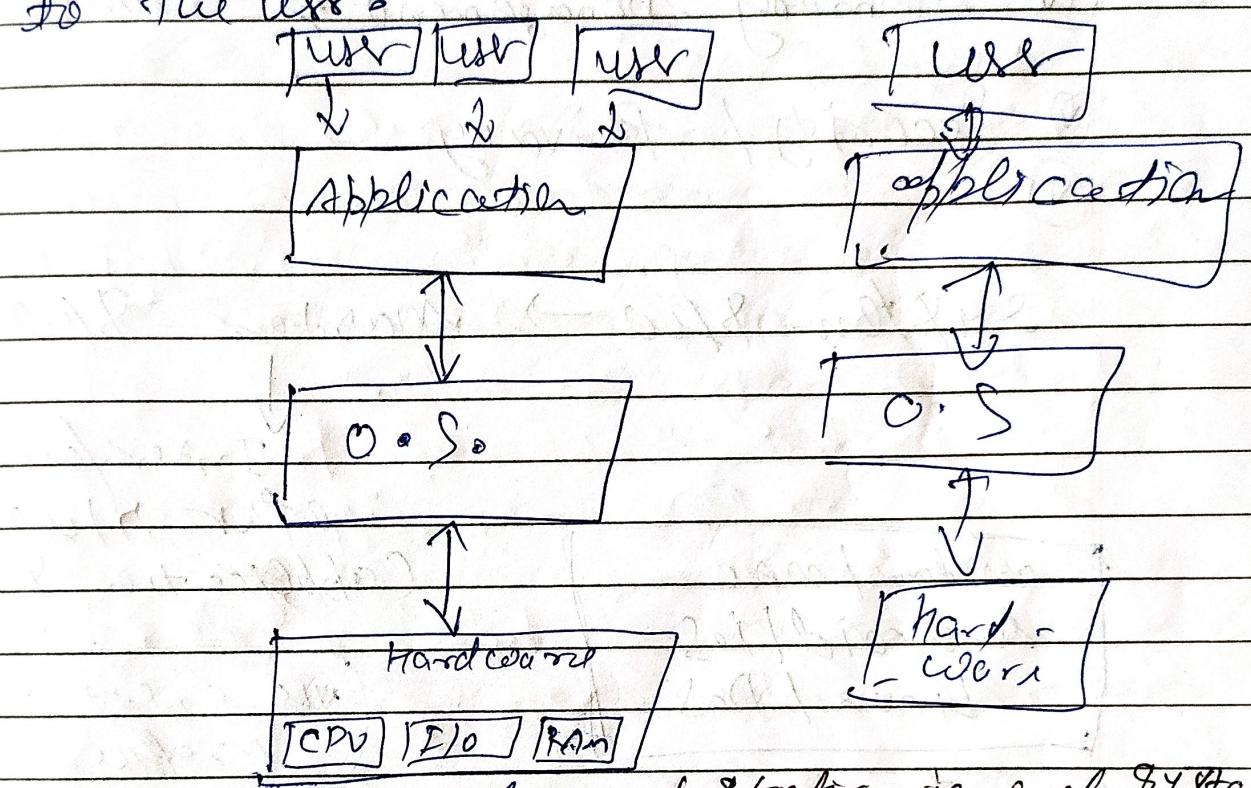
It is a visual representation of communication presented to the user for easy interaction with the machine. The action in a GUI are usually performed through direct manipulation of graphical element like buttons and icons. Communication can be performed by interacting with these icons rather than usual text-based or command-based communication.

- ① advantage ⇒
  - ① It is much easier to use several tasks.
  - ② It also easy to manage when you use a GUI.
  - ③ The use of shortcut key is one of the most important features of a GUI.
  - ④ It is much attractive.

- disadvantages ⇒
  - ① There are various moving part in a GUI.
  - ② much slower as CLI.
  - ③ uses high Power and considerable memory.

## Operating System $\Rightarrow$

- $\rightarrow$  O.S. is a system software.
- $\rightarrow$  It works as an interface between user and hardware.
- $\rightarrow$  Windows
- $\rightarrow$  Primary goal to provide ~~convenience~~ Convenience to the user.



Architecture of O.S. / ~~reflective view of system components~~  
Throughput  $\Rightarrow$  No. of tasks executed per unit time

- $\Rightarrow$  Throughput high
- $\Rightarrow$  Linux provides more throughput.

① Convenience and throughput are basic goal of any O.S.

## Functionality of O.S

- i) Resource manager (cover met other user cannot access two)
- ii) Process management (multiple task executed at a time) (CPU scheduling)
- iii) Storage management (disk file system) (hard disk)
- iv) Memory management → (RAM)
- v) Security / Privacy.
- vi) System software → master S/W

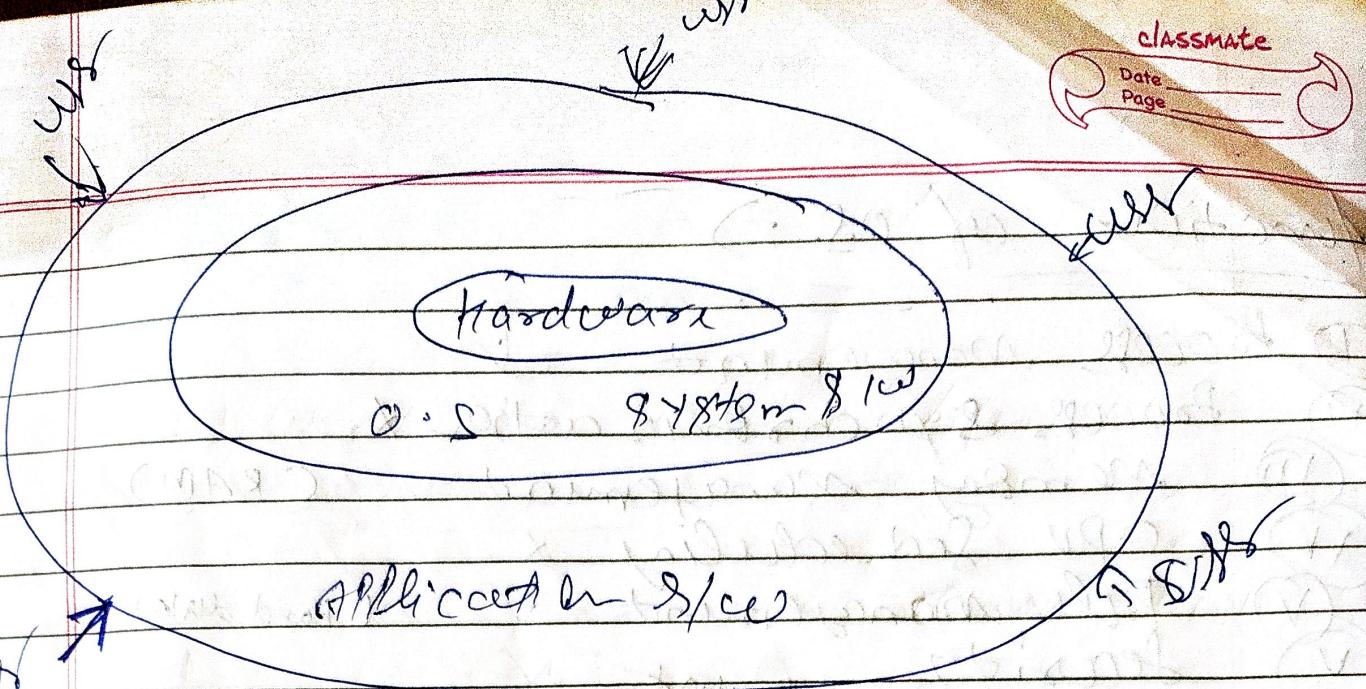
Windows / Mac  
Android / iOS  
Linux / DOS

Interface to application S/W  
Applications S/W, utilities  
VLC, C, C++, Microsoft  
Office,

System S/W

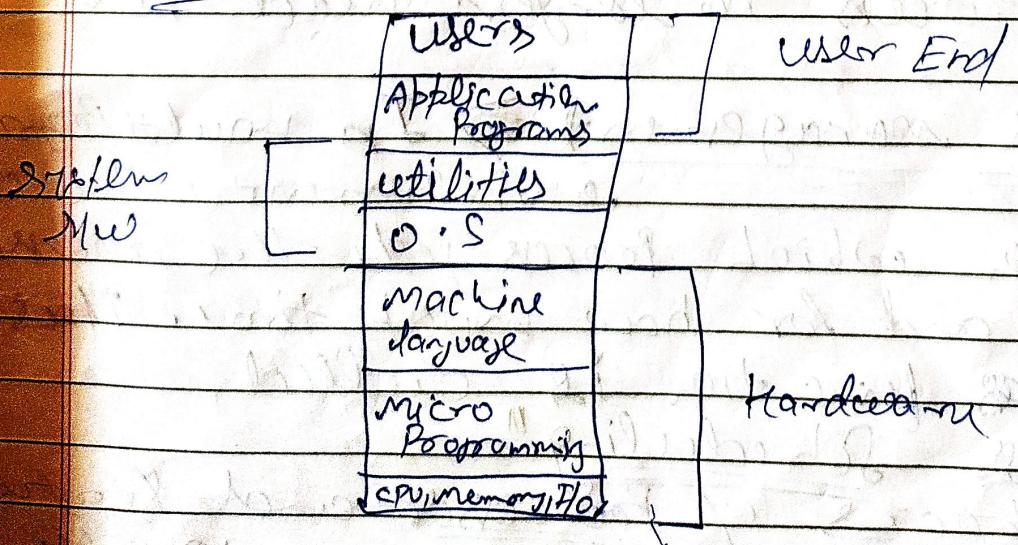
⇒ Operating Systems can be defined as an interface b/w user and the hardware. It provides an environment to the user so that, the user can perform its task in convenient and efficient way.

⇒ If a program starts, after being initially loaded into the computer by a load program manages all of the application programs in a computer.



- $\Leftarrow$  Hierarchical view of computer systems
- $\Rightarrow$  An OS can be defined as an interface between user and hardware. It is responsible for the execution of all the processes, resource allocation, CPU management, file management and many other tasks.
- $\Rightarrow$  The purpose of an OS is to provide an environment in which user can execute programs in convenient and efficient manner.

### Structure of Computer system



## functions of OS $\Rightarrow$

- ① Process Management ✓
  - ② Process Synchronization & Memory management ✓ (RAM)
  - ③ CPU Scheduling &
  - ④ File management ✓ (Hard disk)
  - ⑤ Security management
  - ⑥ Device management
- ⑦ Memory management  $\Rightarrow$  refer to the management of primary memory
- of main memory. main memory provides a fast storage that can be accessed directly by the CPU.

- $\Rightarrow$  Keep track of Primary memory.
- $\Rightarrow$  In multi Programming The OS decides which process ~~will~~ will get memory and how much.
- $\Rightarrow$  Allocates free memory when a process requests it to do so.
- $\Rightarrow$  De-allocates free memory when a process no longer need it.

- ⑧ Process management  $\Rightarrow$  In multi Programming environment, The OS decides which process gets free process when and for how much time. This process function is called "Process Scheduling".
- $\Rightarrow$  Keep track of processes and status of processes. The program responsible for this task is known as process controller.

- ⇒ Allocates the Processor to a Process.
- ⇒ De-allocates Processor when a Process is no longer required.

### (iii) Device management ⇒ An operating system manages

device communication via their respective drivers.

- ⇒ keeps track of all devices. Program responsible for this task is known as File I/O controller.

- ⇒ Decides which ~~process~~ gets the device and for how much time.
- ⇒ allocates other device in the efficient way.
- ⇒ De-allocates devices.

### (iv) File management ⇒ A file system is

<sup>Hard disk</sup>

normally organized into directories for easy navigation and usage. These directories may contain files and other directories.

- ⇒ keeps track of information, locations, uses, status etc. The collective facilities are often known as file system.

- ⇒ Decides who gets the resources.

- ⇒ Allocates the resources.

- ⇒ De-allocates the resources.

### (v) Security ⇒ By means of Password and other similar techniques, it prevents unauthorized access to programs and data.

Batch  $\Rightarrow$  Batch is responsible to create ~~classmate~~  
Batch of similar job.

Idle CPU  $\Rightarrow$  CPU is in waiting condition not move to next job.

## Type of O.S. $\Rightarrow$

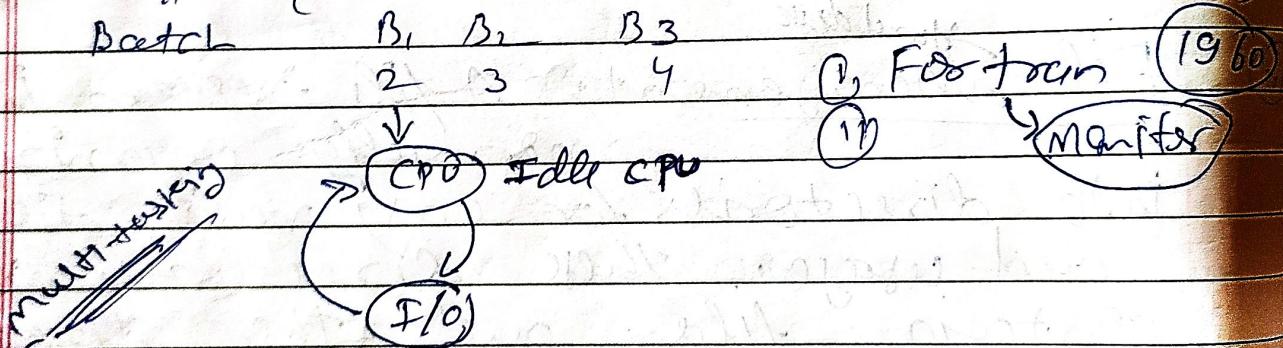
(1) Batch O.S.  $\Rightarrow$  The user of a Batch O.S. do not interact with the computer directly. Each user prepares his job on an offline device like punch cards and submit it to the computer operator.

Problem  $\Rightarrow$  Lack of interaction b/w the user and job.

(2) CPU is often idle, because the speed of the mechanical I/O device is slow than the CPU.

(3) Difficult to provide the desired priority & (4) No time to execution adt.

$\Rightarrow$  Similar type of job combine (Punch card, Paper tape, magnetic tape)



(5) Time sharing O.S.  $\Rightarrow$  Time-sharing is a technique which enable many people located at various terminals to use particular computer system at a same time. Time sharing ~~and~~ or multitasking is a logical extension of multiprogramming. Processor's time which is shared among multiple users simultaneously is termed as time sharing. In multiprogrammed batch systems, the objective is to maximize processor utilization.

Whereas in time-sharing system ~~the main~~  
objective is to "minimize response time".  
Date \_\_\_\_\_  
Time \_\_\_\_\_

advantage:-

- (i) provides the advantage of quick response.
  - (ii) avoids duplication of I/Os.
  - (iii) reduces CPU idle time.
- disadvantage:-
- (i) Problem of reliability
  - (ii) Problem of data communication
  - (iii) question of security and integrity of user programs and data.

(iii) Distributed OS  $\Rightarrow$  Distributed system uses multiple central processors to serve multiple real-time applications and multiple users.  
Data processing job are distributed among the processors accordingly.  
The processors communicate with one another through various communication links. These are referred as loosely coupled system or distributed system.  
Processors in a distributed system may vary in size and type. These processors are referred as sites, nodes, computers and so on.

advantage:-

- (i) with resource sharing facility, a user of one size may be able to use the resources available at another

- (i) speed up the exchange of data with one another via electronic mail.
  - (ii) if one site fail in a distributed system, the remaining sites can potentially continue operating.
  - (iii) Better service to the customers.
  - (iv) Reduction of load on the host computer.
  - (v) Reduction of delays in data processing.
- \* Distributed o.s. use multiple CPU to execute multiple process. Multiple processor communicate with each other through multiple communication. dis. loosely couple system

#### (vi) Network OS $\Rightarrow$ A Network OS run

————— In a Server and

Provides the server the capability to manage data, user, groups, security, applications, and other networking fns. The primary purpose of the network os is to allow shared file and printer access among multiple computers in network, typically a local area network, a private or other network too. Microsoft windows server 2008, 2003, 2000, xp, linux, mac os x, etc.

advantage  $\Rightarrow$  (i) Centralized servers are highly reliable.

(ii) Security is server managed.

(iii) Upgrades to new technology and hardware can be easily integrated into the system.

(iv) Remote access to servers is possible from different locations and type of systems.

disadvantage (i) High cost of buying and running a server.

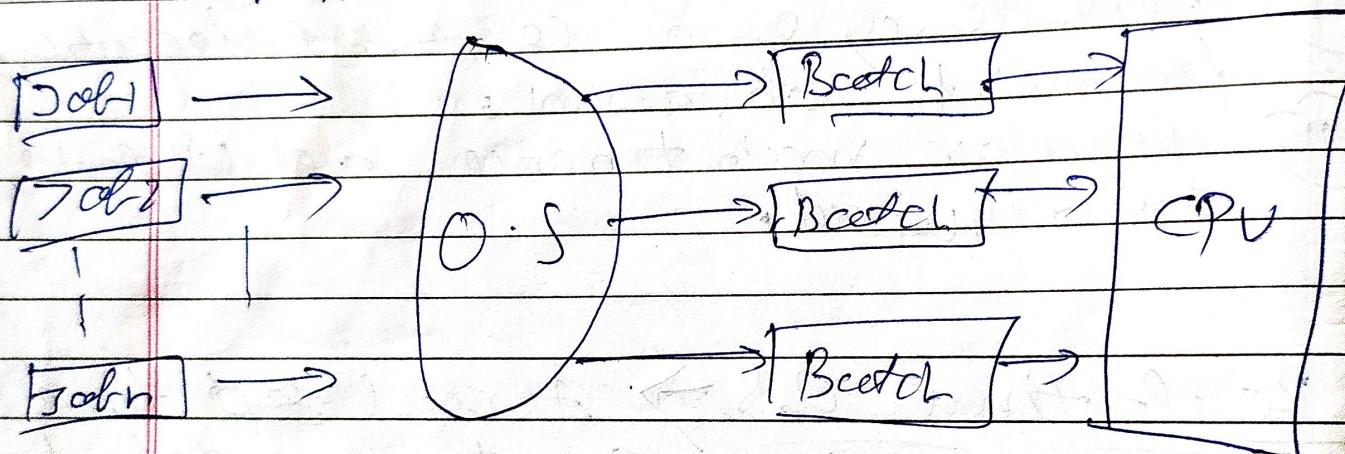
(ii) Dependency on a central location for most operations.

(iii) Regular maintenance and updates are required.

(v) Real-time O.S.  $\Rightarrow$  A real ~~time~~ time system is defined as a data processing in which the time interval required to process and respond to inputs is so small that it controls the environment. The time taken by the system to respond to an input and display of required updated information is termed as the response time. So in this method, the response time is very less as compared to Online processing.

## Type of OS

- ① Batch OS  $\Rightarrow$  This type of OS does not interact with the computer directly. There is an operator which takes similar jobs having the same requirement and groups them into batches. It is the responsibility of the operator to sort jobs with similar needs.

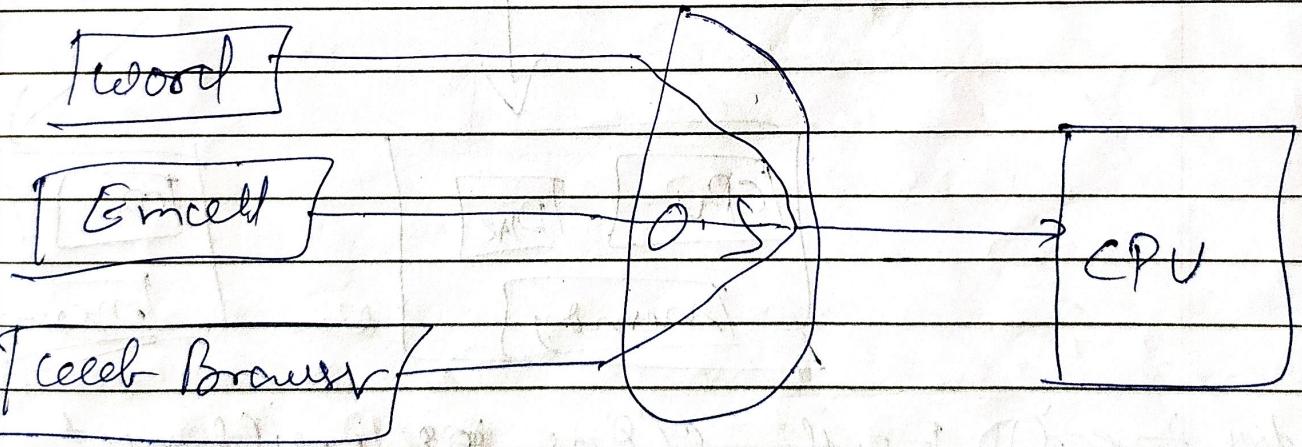


advantages  $\Rightarrow$  It is very difficult to guess or know the time required for any job to complete. Processors of the batch systems know how long the job could be when it is in queue.

- ⑩ Multiple users can share the batch system.
- ⑪ The idle time for the batch system is very less.
- ⑫ It is easy to manage large work repeatedly in batch systems.

- disadvantage  $\Rightarrow$  It is some time ~~classmate~~
- Date \_\_\_\_\_  
Page \_\_\_\_\_
- ① The computer operators should be well known with Batch system.
  - ② Batch systems are hard to debug.
  - ③ The other jobs will have to wait for an unknown time if any job fails.
  - Ex) Bank statements, Payroll system etc.

④ Time-Sharing OS  $\Rightarrow$  Each task is given some time to execute so that all the tasks work smoothly. Each user gets the time of CPU as they use a single system. These systems are also known as "multitasking" system. The time that each task gets to execute is called quantum. After this time interval is over OS switches over to the next task.



Advantages  $\Rightarrow$

- ① Each task gets an equal opportunity.
- ② Fewer chances of duplication of files.
- ③ CPU idle time can be reduced.

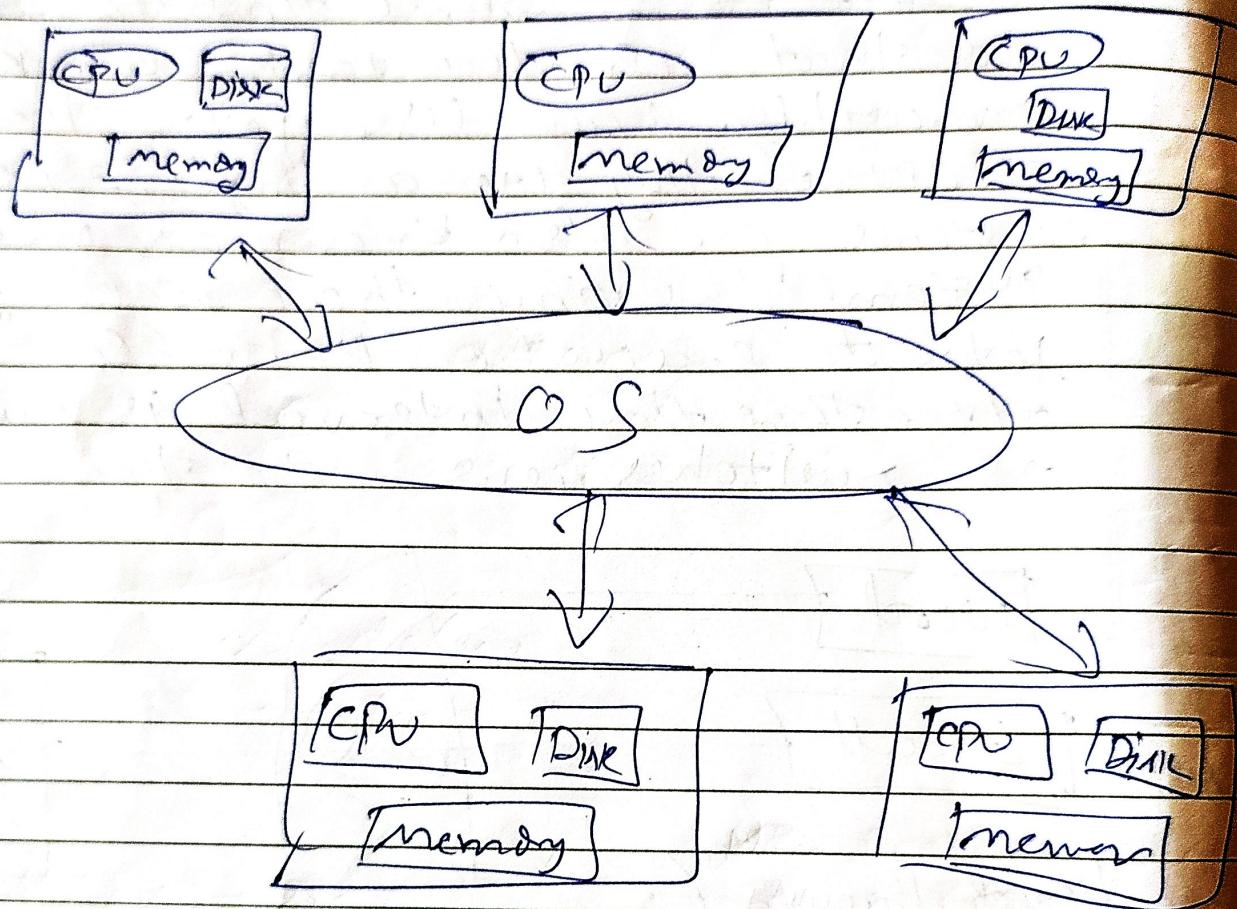
disadvantage of ①: Reliability Problem

- ① Data communication problem
- Ex) multics, unix, etc.

## Environment

Date  
Page

- (iii) Distributed OS → It is always possible that one user can access files or programs which are not actually present on his system but stored in other systems connected with in their network.



advantages:

- ① Failure of one will not affect the other all systems independent to each other.

② Electronic mail increase the data exchange speed.

③ Since resources are being shared, computation is highly fast and durable.

④ Load is best distributed.

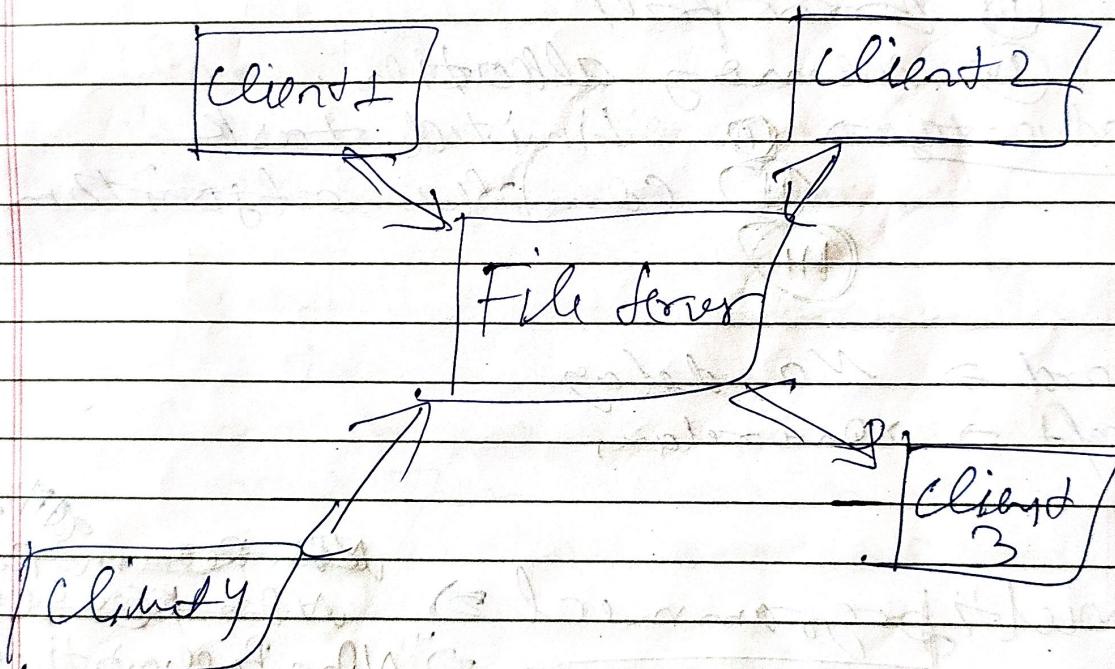
⑤ Delay of data processing is reduced.

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disadvantage  $\Rightarrow$  ~~Fail one the main network will stop the entire communication~~

- (1) Expensive. (2) Complex.  
~~local. location etc~~

(3) Network OS  $\Rightarrow$  These systems run on a server and provide the capability to manage data, user, groups, security, application and other networking fn. These type of OS allow shared access of files, printer, security, application, and other networking over a small private network.



advantage (1)  $\Rightarrow$  Highly stable centralized server  
(2) Security concerns are handled through servers. (3) New technology and hardware ~~upgradation~~ are easily integrated into the system. (4) Server access is possible remotely from different locations and types of system.

disadvantage (1) Server are costly  
(2) Maintenance and updates are required regularly ~~Ex: Linux, Mac OSx, etc~~

⑤ Real time OS  $\Rightarrow$  The time interval required to process and respond to inputs is very small. This time interval is called response time.  
Real time system are used where there are time requirements that are very strict like missile systems, air traffic control, robotics.

advantage :-

- ① maximum consumption
- ② task shifting
- ③ error free
- ④ memory allocation.

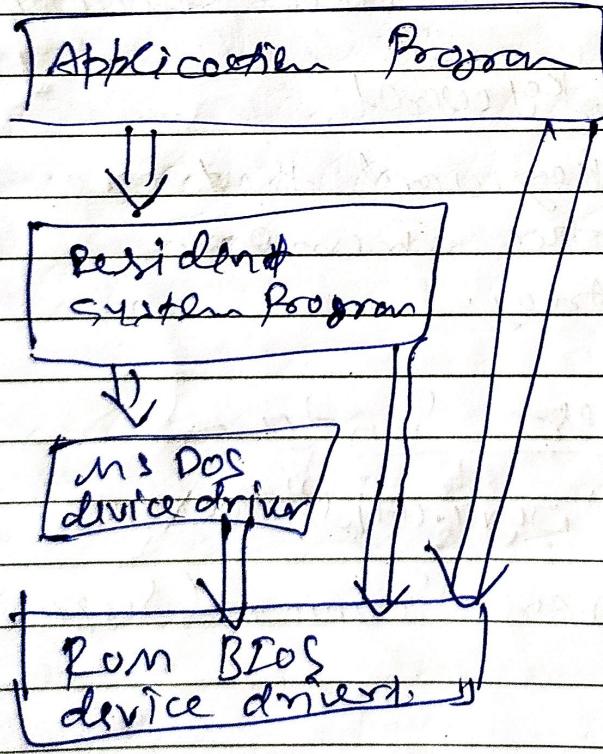
disadvantages

- 1 Limited task
- 2 complex algorithm

## Different approaches or structures of OS

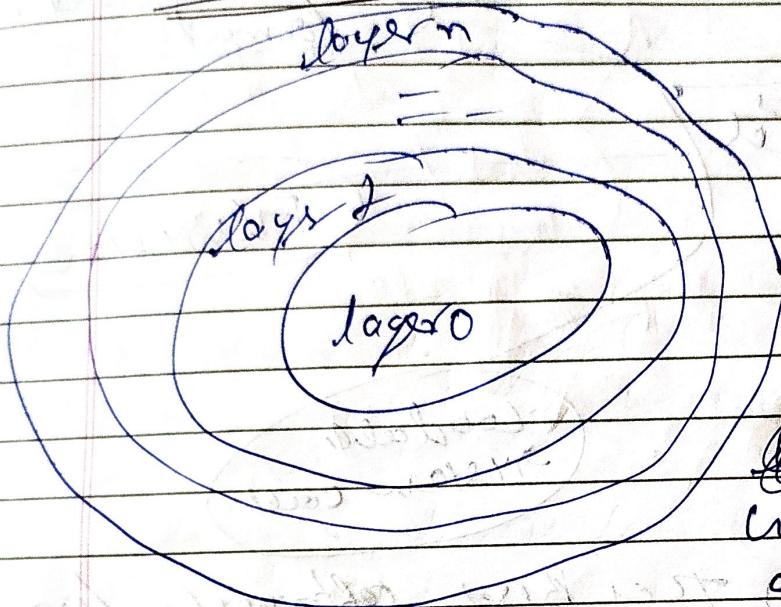
Operating systems can be implemented with the help of various structures. The structure of OS depends mainly on how the components are connected to each other.

- (1) Simple Structures Such type of OS do not have well defined structure and are small. Simple & limited system / hardware interface and levels of functionality are not well balanced. MS DOS.



- ⑩ clay for kernel developer to develop ~~clarity~~  
on OS.
- ⑪ Since Better application Performance because  
few Interface b/w application program  
and hardware

### ⑫ Layered structures



In this model  
OS broken into  
number of layers.  
The Bottom layer  
is called Hard layer  
and top layer  
most layer is  
user interface.  
~~the interface~~  
~~the interface~~  
User interface  
can be example  
of this type.

Careful planning of layered is necessary.  
These layers are so designed that each layer is worth of  
freelance layer only.

### ⑬ Micro-kernel

example of this type.

This structure design the OS by removing  
all non-essential component from the  
kernel and implementing them as system  
and user program. This resulting in a  
smaller kernel called the micro-  
kernel.

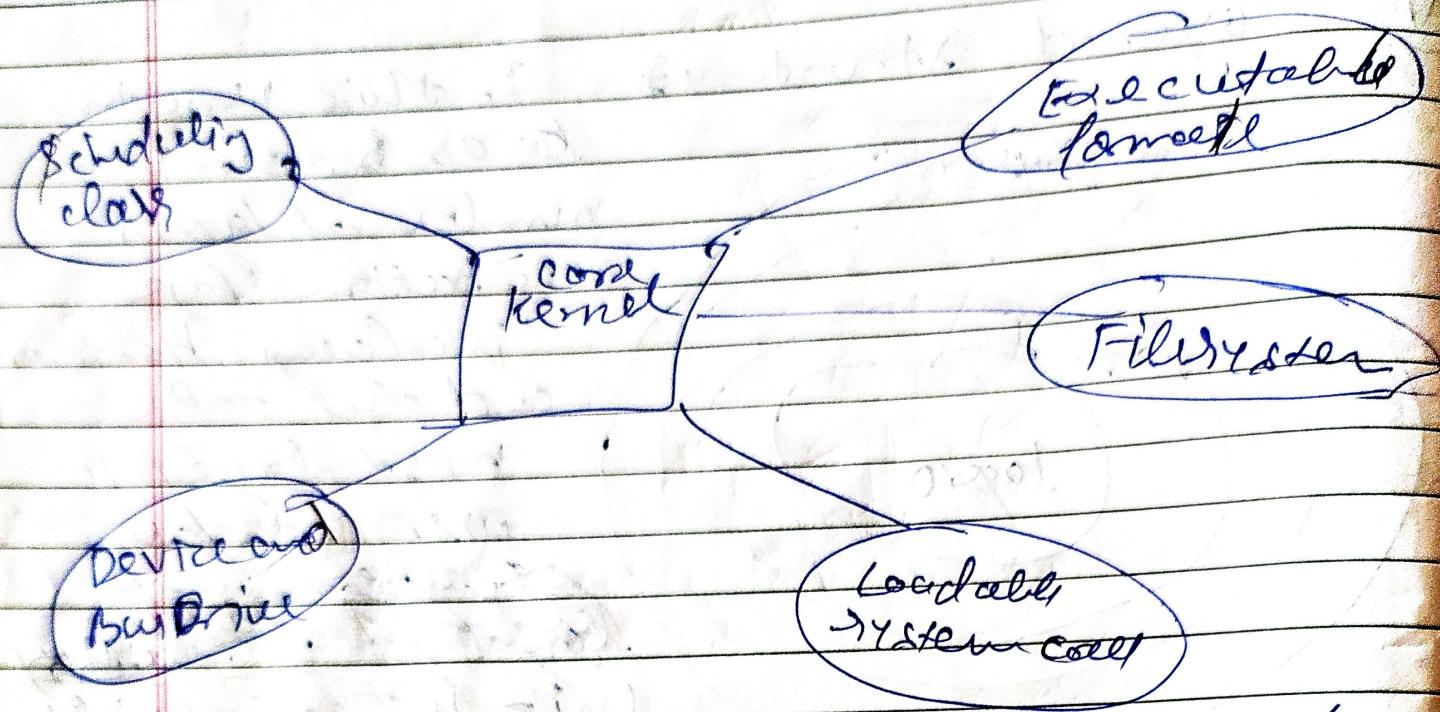
It make the OS portable to various  
platform.

As micro kernel is smaller so  
these can be tested effectively.

~~disadvantages~~ Increase the level of inter  
module communication

Degrade the system performance

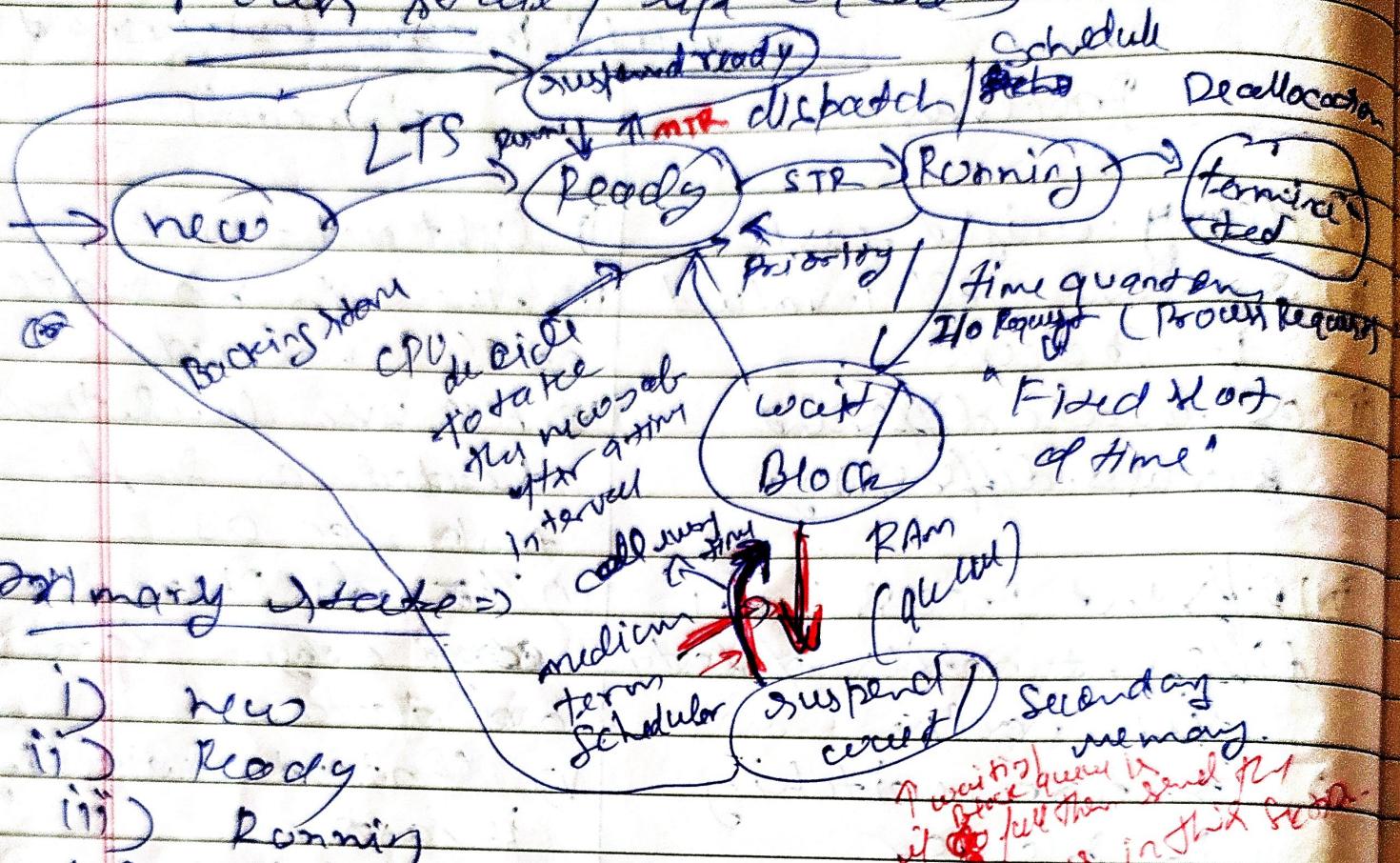
## ⑥ modular structure



It is considered as the best approach for OS. It involves designing of a modular kernel. The kernel has only the core component and other services are added as dynamically loadable modules. to the kernel either during run time or boot time. It is similar to layered structure but more flexible than layered structure as a module can call one another module.

System call → In Linux OS we directly use system call. with the help of ~~command prompt~~. text editor. when we write any program in text editor we directly call read(), write(), close()

## Process State / life cycle



## Priority Scheduling

- i) new
- ii) ready.
- iii) running
- iv) wait/Block
- v) terminated,

if new  $\Rightarrow$  creates a new "process".

not initially placed in to secondary memory

"ready"  $\Rightarrow$  (RAM) placed into RAM  
main memory (queue) Policy.  
 $\Rightarrow$  Job & Job Scheduler

LTS  $\Rightarrow$  Long term Scheduler  $\Rightarrow$   
(multiprogramming concept)

LTS is responsible for moving processes  
from  $\Rightarrow$  nice to ready position.

iii) running  $\Rightarrow$  to execute free process in this  
step. Actually we will get 2022 15:48

process in this system

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provide the CPU to the process. ~~and~~ <sup>CLOUTERATE</sup>  
process is executed. Only one task ~~can execute~~  
at a time in one processor system.

### CPU Scheduler

STR  $\Rightarrow$  Short term Scheduler  $\Rightarrow$

$\rightarrow$  Pick a Process from Ready state  
~~to~~  $\rightarrow$  running state.

Non Preemptive  $\Rightarrow$  if a task is fully completed no jump to the next process.  
~~else~~  $\Rightarrow$  this called Non Preemptive multiprogramming using Non Preemptive.

Polling  $\Rightarrow$  when move from one task to another in a regular time interval is called Polling. ~~This~~ multitasking is the example of Polling.

MTR (medium term scheduler)  $\Rightarrow$  Process swapping scheduler. swap the process from main to addditional state  $\Rightarrow$  Secondary memory and vice versa.

Suspend / wait  $\Rightarrow$  If the waiting queue is full then CPU sends the process into the secondary memory back. If this condition is called suspended / wait condition. It is performed by medium term scheduler.

~~or~~ Suspend is also possible in ready state if free queue of ready state is full and some VIP process is want to execute. Then this process is mark suspend ready at when space in present in Ready queue.

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Entered into the ready queue  
medium terminal is also responsible  
for this.

Backing store If a process is suspended  
certainly condition and say  
it means placed into the secondary  
memory, and stay to insert into  
existing block condition here if  
block queue is not empty then  
this process is Backing store. It  
means move to the suspended  
Ready state.

1 → ← → Java → →

Swing is a GUI library in Java  
JTable is a component of swing  
library.