* UNIT - 3 *

* COMPUTER NETWORKS *

Introduction to computer networks: Computer network consists of two or more computers that are interconnected with each other and share resources such as printers, servers, hardware and exchange the data in the form of files and facilitating electronic communication. Computers on a network can be connected through twisted pair cables, telephone lines, radio waves, electromagnetic waves, satellite and optical fibre cables.

Advantages of computer network:

1) **File sharing:** It facilitates the user to share and access files stored on a remote computer thus saves time and gives more flexibility. It allows multiple users to collaborate on the same project through network.

2) **Resource sharing:** It facilitates the user to share limited and expensive resources among number of computing devices.

3) **Increased storage capacity:** A standalone computer has limited storage capacity but when computers are connected together, the storage memory of all these computers can be made available for each computer.

4) **Increased cost efficiency:** Commercial software packages are costly and take time for installation. Networks allow software stored (or) installed on one computer can be shared among other computers.

5) **Load sharing:** A single computer will take more time to carry out all the tasks and will slow down. Networks allow transfering extra jobs to other machines connected in the same network for

execution. This will improve the performance of a system.

6. Facilitating communication: A network facilitates the users to communicate easily and efficiently through electronic mail and instant messaging there by allowing the exchange of important messages in a speedy manner without wasting paper.

Types of connection: A network of is two (or) more devices connected through links. A link is a communi-cation pathway that transfers data from one device to another.

Point to point (uni casting): A point to point connec-tion provides a dedicated link between two devices. The entire capacity of the link is reserved for transmission between those two devices.

Point to multipoint: A multipoint connection is one in which more than two specific devices share a single link, it has broad casting (or) multi casting.

(i) Broad casting: One node can send data to the all connected system over a sharing link.

(ii) Multi casting: One node can send data to the subscribed nodes belong to all connected nodes.

Transmission modes: The direction in which data can be transmitted between any two linked devices is of 3 types

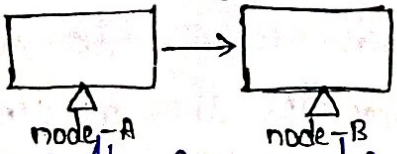
(i) simplex

(ii) Half duplex

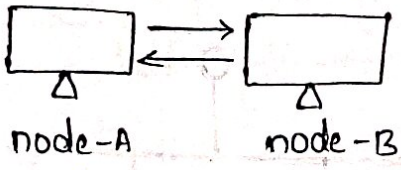
(iii) full duplex

(i) Simplex transmission: It is a uni directional data transmission only one of the device send data and

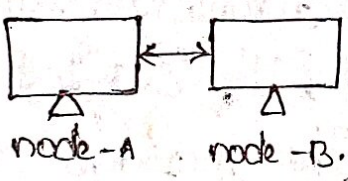
other one can only receive data.



(ii) Half Duplex: It is a bi-directional, the linked devices cannot send and receive data at the same time. When one device is sending data the other one can receive.



(iii) Full duplex: It is a bi-directional, the linked devices can send and receive data simultaneously. The linked device can send the data at the same time it receives data.



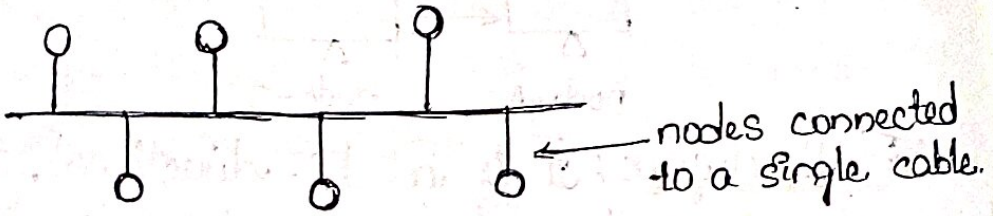
Network Topologies: Network topology refers to the schematic description of an network arrangement connecting various nodes through links i.e., actual geometric layout of computers and other devices connected to the network. They are

1) Bus topology.
2) Star topology.
3) Ring topology
4) Mesh topology.
5) Hybrid topology.

1) Bus topology: In a bus topology each node (i.e., computer or server) is connected to a single cable called "Bus". All the nodes are share the same

communication channel.

When a node wants to send a message to another node it creates the message and adds the address of the recipient to it. Then it checks whether the line (bus) is free (or) not. If the bus is free, it plays the message on the line (bus) else it wait until the bus (channel) becomes available.



When the message is placed on the bus (line), each and every node connected to it checks the destination address mentioned on it. If the node address does not match the intended address, it ignores the message. The message is picked up and open only by the receiver. The receiving device also sends acknowledgment to the sending device before it frees the line.

Advantages:

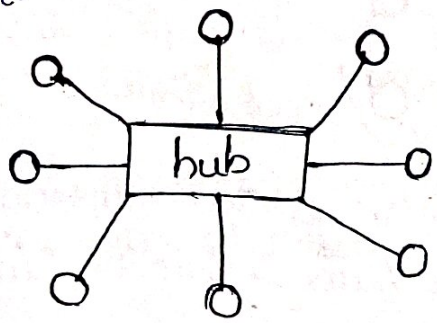
1) Easy to install and to connect a new device to the network.
2) Requires less cable length than other topologies.
3) Inexpensive as only one cable is required.
4) Failure of a single node does not affect the network.

Disadvantages:

1) Damage in the cable results in shutting down of the entire network.
2) In the case of network shut down it becomes very

difficult to identify the problem.
3) As the number of nodes increases, the speed of the network slows down.

2) Star topology: In a star topology, each node is connected to a central hub with a point to point connection.



The hub (host node) controls the communication between other nodes. The hub acts as a signal repeater. When a node has to send a message to another node connected to the network. It will first send that message to the hub. The hub will regenerate the message and then send it to the destination node.

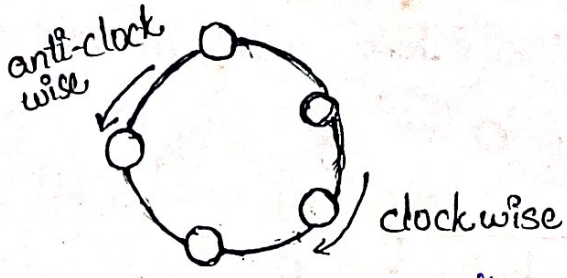
Advantages:

1) Easy to install.
2) New nodes can be connected easily.
3) Network does not get disturbed when a device is added (or) removed from it.
4) Easy to detect faults.
5) Failure of any node (expect the hub) does not affect the network.

Disadvantages:

1) It requires more cable length than bus topology.
2) If the central hub fails, entire network shut down.
3) More expensive than bus topology because of the cost of hub, cables etc.

(3) Ring topology: In a ring topology, all the nodes connected to each other in the shape of closed loop, so that every node is connected directly to two other nodes.



In a ring topology, messages travel through the ring in a circular shape. In the same direction (either clock wise (or) anti-clock wise).

In a ring topology, each device acts as a repeater to regenerate the signal. A node receives the data (or) message from any of its two adjacent nodes then it checks the destination address. If the message is addressed to it, it accepts the data and process it otherwise, it just regenerates the signals and passes it to the next node in the sequence.

Advantages:

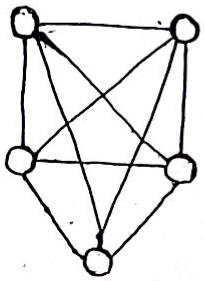
1) Ring topology is best suited for networks that do not have hub.
2) It is more reliable than star topology, as the communication does not depends upon a single hub.
3) It is easy to install.
4) Every node has equal chance to transmit data.
5) It is can span over longer distances.

Disadvantages:

1) Ring topology causes delay in communication.
2) Incase of network failure, it is difficult to find the fault.

(3) If one node fails, the entire network is shut down. Because, the ring is not complete.
(4) It is difficult to add (or) remove nodes from the network.

(5) Mesh topology: It is also known as "completely connected network", each node is connected to other nodes in the network using a separate physical link. i.e., if there are 'n' nodes then there would be $\frac{n(n-1)}{2}$ physical links are required. A message can be pass any of the several possible paths from source to destination.



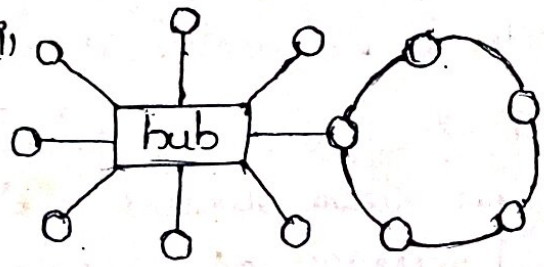
Advantages:
(1) Failure of a node does not affects the entire network. Only the communication with that particular nodes are affected.
(2) Communication is fast as there is a direct link between the nodes.
(3) Each connection can have its own data load, so that the traffic problem is eliminated.
(4) Ensures security of the data because every message travels along the direct link.
(5) It is easy to detect the network errors.

Disadvantages:
(1) It is most expensive network as for 'n' nodes $\frac{n(n-1)}{2}$ physical links are required.
(2) It is difficult to install.

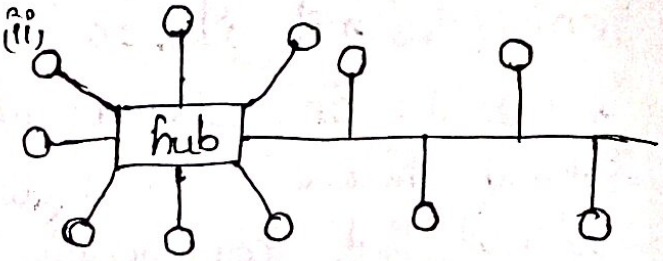
(5) Hybrid topology: Hybrid topology is a combination of two (or) more topologies very commonly used two hybrid topologies are

(i) star - ring topology (ii) star - bus topology.

(i)



(ii)



Advantages:

1) Trouble shooting is easy.
2) Easily expandable network.
3) Very reliable.

Disadvantages:

1) Complex of design.
2) Very costly.

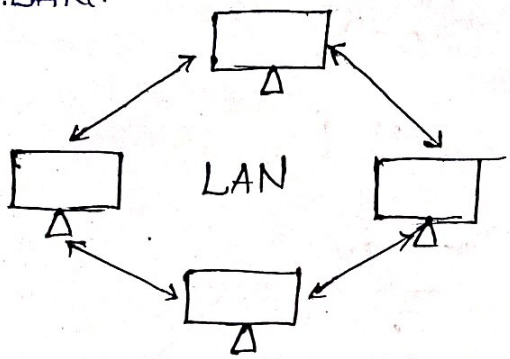
Types of networks: Network can be categorised into different types depending on size complexity level of security geographical range.

1) Local Area Network (LAN)
2) Metropolitan Area Network (MAN)
3) Wide Area Network (WAN).
4) Personal Ara Network (PAN).
5) Campus Area Network (CAN).

1) Local Area Network (LAN):

* LAN is a computer network widely used for local communication.
* LAN connects computers in a small area like a room, building, office (or) a small ~~area like a room~~ upto few kilometers.

* LAN can be connected to other LAN's over any distance via telephone lines of radio waves.
* A LAN may be setup as wired (or) wireless connections.
* A LAN that is completely wire is called wireless LAN (or) W.LAN.



*LAN's are privately owned networks, within a purpose to share resources and to exchange information.
*LAN runs at a speed of "10 Mbps to 100 Mbps" and has low delays.
*LAN are generally connected using the star, bus & ring topologies.

Advantages:

1, The data is transferred at an extremely faster than in LAN.
2, LAN provides higher security.
3, They cannot extended to the wide area.

2, Metropolitan Area Networks (MAN):

*MAN is a computer network spread over a city, the cable television network is an example of MAN.
*The computers in a MAN are connected using co-axial cables (or) optical fibre cables.
*The MAN connects several LAN spread over city.

Advantages:

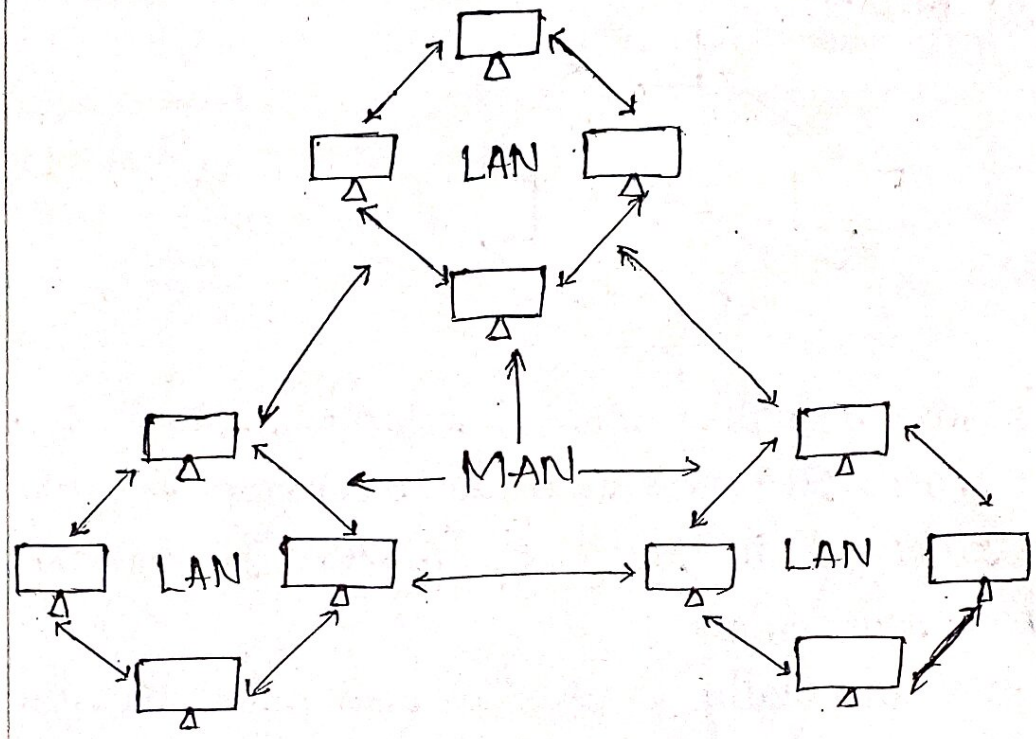
1, MAN gives the good efficiency of data.
2, Local E-mails can be sent fast and free.

(3) MAN provides a high security.

Disadvantages:

1, Difficult to manage.

2, Additional cables are required to connect LAN's.



(3, Wide Area Network (WAN):

* WAN is a network that connects computers over long distances like cities, countries, continents (or) world wide.
* WAN uses public leased (or) private communication links to spread over long distances.
* WAN uses telephone lines, satellite link and radiowave etc. to connect computers.
* Internet is a common example of WAN.

Advantages:

1, WAN provides a large geographical area.

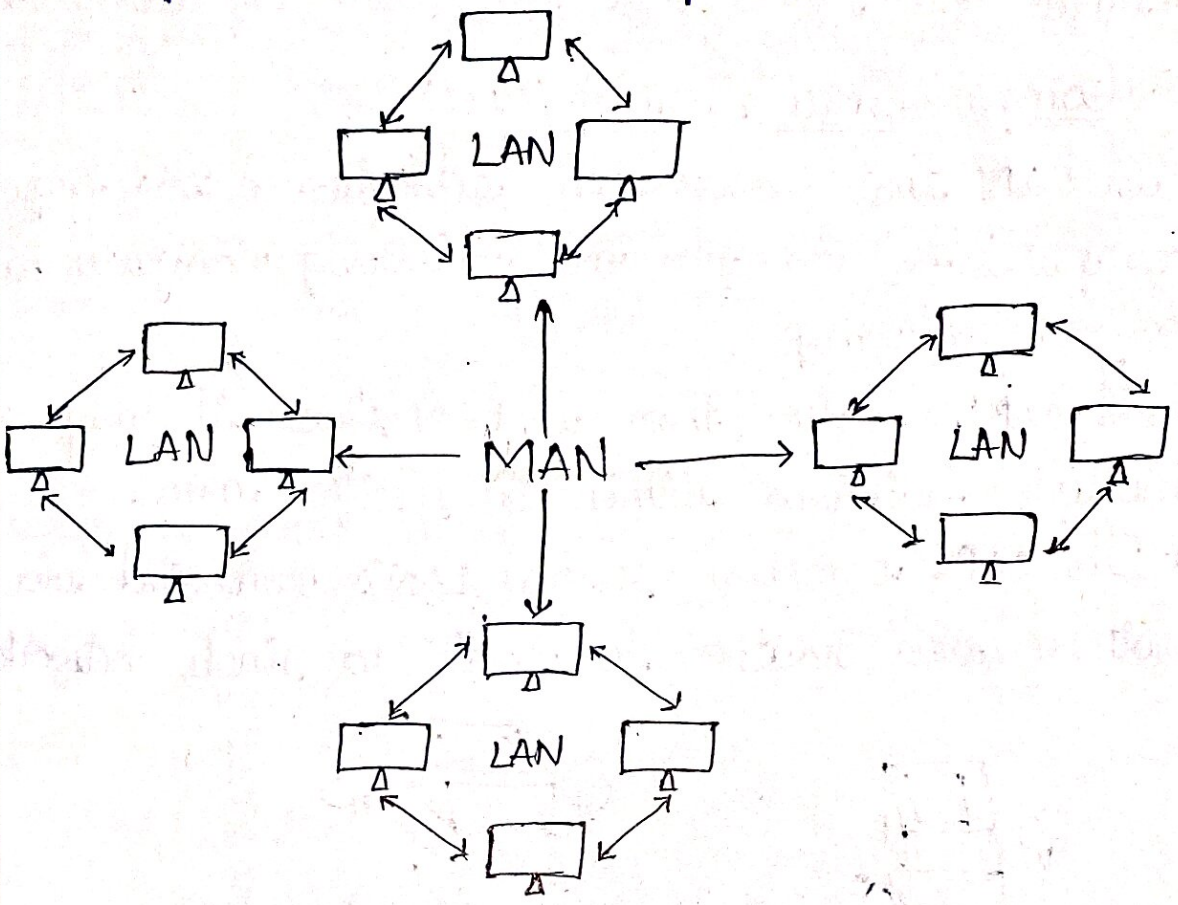
2, The data is centralised.

3, Sharing software resources.

4, High band with increases the data transfer rate.

Disadvantages:

1) WAN's need fire well and antivirus software.
2) Instalation cost is very high.
3) Fixing the problem is very difficult.

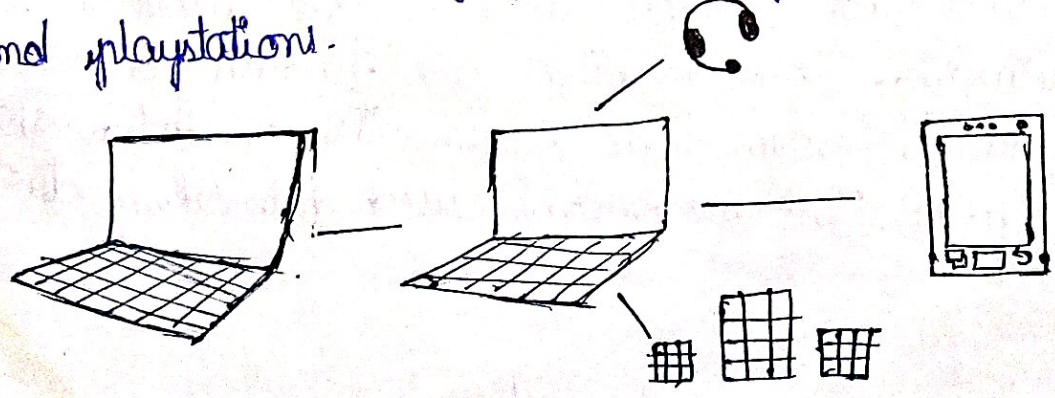


4) Personal Area Network (PAN):

*PAN is the interconnected between devices written within the range of a person's private space, typically within a range of 10mtrs (or) 30mtrs.

*PAN is used for connecting the computer devices for personal use.

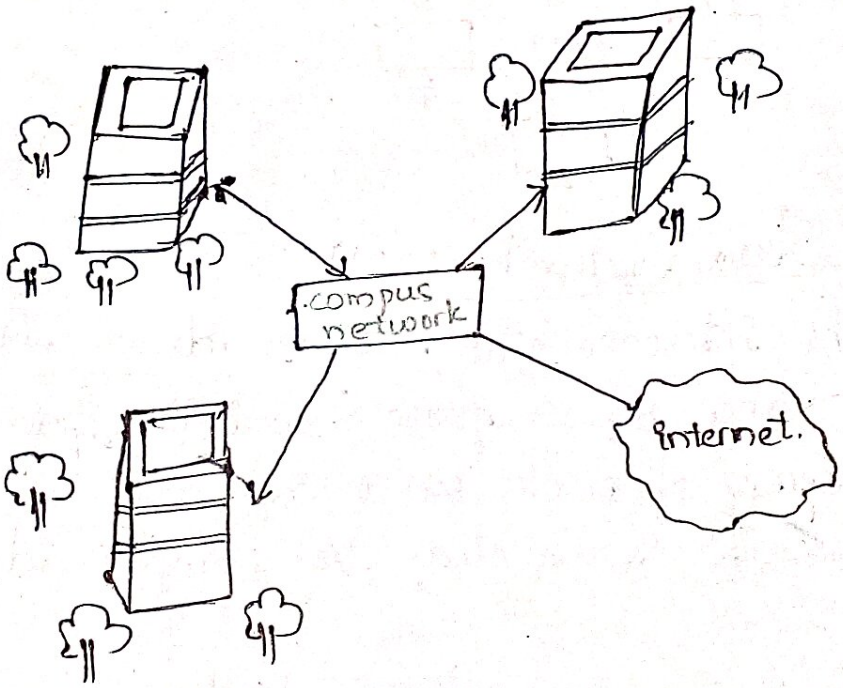
*The devices that are used to develop the personal area network are laptop, mobiles, phones, media players and playstations.



There are two types of personal area network.
(i) Wireless PAN: Wireless PAN is developed by using wireless technology like WiFi, bluetooth. It is low range network.
(ii) Wired PAN: Wired PAN is created by using the USB. (universal serial bus)
(or) coporate

(5) Campus Area Network (CAN):

* A CAN that covers an educational (or) coporate campus. The examples are university compures and coporate buildings.
* A CAN is larger than a LAN since it may span multiple buildings within a specific area.
* The CAN combines several LAN's connected via switches and routers to create a single network.



Network devices: Computer networking devices are communication devices that enable users to create a network. These devices are known as network equipment, intermediate systems (IS) or Interworking unit (IWU). The commonly used networking devices are

→ hub → router
→ repeater → gateway
→ switch → network interface card.
→ bridge

Hub: A hub is device to which different devices are connected so that they can communicate with other. Every computer is a network directly connected to the hub. When the idata packets arrive at the hub, it broadcasts them to all the devices connected to it. Hence, every device picks the message but only the destined device processes the packet and all the other computer just doesn't discard it.

The main function of the hub is amplify the signals and broadcast them to all the devices connect to it. They are two types of hub.

1) Active hub
2) Passive hub

1) Active hub: Active hubs have their own power supply and can clean, boost and relay the signal along with the network. It serves as both a repeater as well as wiring centre.

2) Passive hub: These hubs takes power supply from the active hubs. These are does not cleaning and boosting along with the network.

Repeater: Network repeaters are electronic devices that regenerate incoming, electrical, wireless or optical signals.

Repeaters are used to extend LAN. It has only two ports and can connect only two segments of a network. The repeater regenerates the signals before sending them to the other segments. This can cause a propagation

delay without a repeater the data can only span a limited distance.

For sending signals longer distance repeater regenerates for increasing the signal strength, the signals and removing unwanted noise.

Switch: A switch is a device that can be used in all places where a hub is used it is much better than the hub because it has a switching table within it. The switching table stde the address of every computer (or) device connected to it and sends the data only to the destined device rather than broadcasting. Due to this, the network traffic is reduced.

Bridge: A bridge is a device that connects two (or) more LAN's. A bridge receives data from one LAN to forward it to another LAN, it first regenerates the signals and then forwards the data to the other LAN.

A bridge reads the address of the receiving device specified on the data packet to identify the destination of the packet. It forwards the packet only to the network to reach which the receiving device is connected, there by reducing the traffic on other network segments.

Router: A router is an intelligent device that routes data to destination computers. It is used to connect two logically and physically different networks, two LAN's, two WAN's and a LAN with a WAN.

Routers use special software known as routing table that stores the address of devices connected to the network. The major task of a router is to route the data packets between two networks on

the best possible path for fast data transmission.

Gateway: A gateway is a very complicated networking device that is used to connect two (or) more dissimilar networks that use entirely different protocols. A gateway acts as a translator between two dissimilar networks. It accepts data formatted by one network and convert-s it into a format that can be easily accepted by other network.

A gateway can be used to monitor incom-ing, outgoing traffic to check for any malicious activity within the network.

Network Interface Card: The network interface card is also known as a "Network adapter" or a "LAN card". The computer or communicate with other device by properly installed and configured LAN card. The communication cables that connect different devices to form a network are connected via this card.

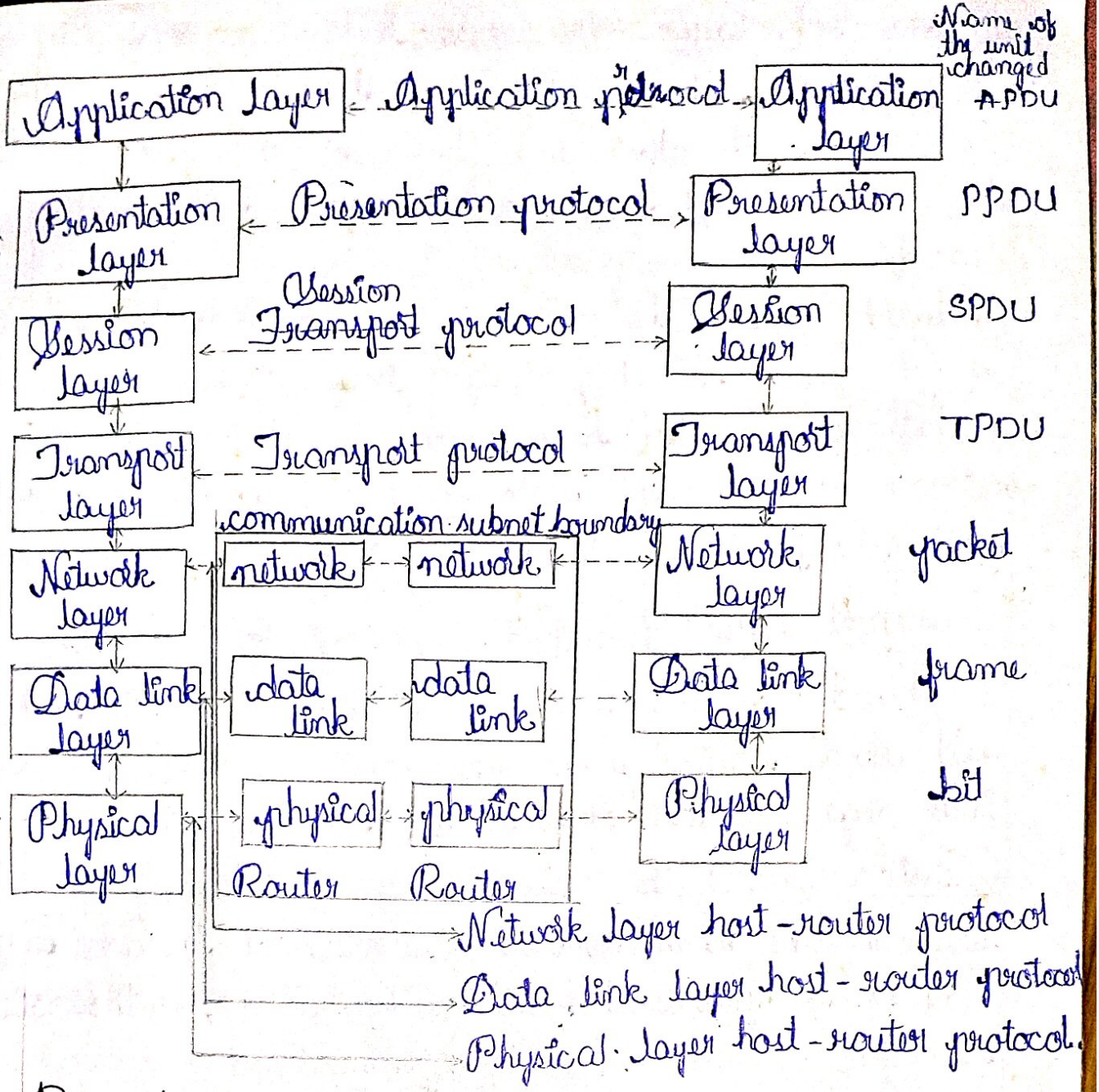
Network Interface cards are of two varieties
wired
wireless.

Most modern desktop computers use a wired NIC, laptops are connected with both wired and wireless LAN cards.

Open system interconnection model: The open system inter connection model (OSI) developed by the International standards organization (ISO) in 1984. The OSI model has the following layers, with each layer performi-ng a particular task.

* Physical layer
* Data link layer
* Network layer
* Transport layer
* Session layer
* Presentation layer
* Application layer.

Application layer Message format, human - machine interfaces
Presentation layer Translation (coding into 0's & 1's), compression, Encryption.
Session layer Authentication, permissions, session restoration
Transport layer Reliable, message delivery from process to process
Network layer Network addressing, Routing (or) Switching
Data link layer Error detection, flow control.
Physical layer Bit stream, Physical medium, method of representing bits.



Physical layer: The physical layer is connected with transmitting raw bits 0's and 1's. It converts the raw system stream bits into electric signals, optical signals (or) electromagnetic signals depending on whether the underlying network uses the cable.

The physical layer establishes maintaining and terminates physical connection between computers. It decides how many volts should be used to represent 0 and 1. It decides data rate (No. of bits transmitted per second). It decides the mode of data transmission (simplex, half duplex (or) full duplex).

Data link layer: The data link layer converts data packets into a stream of bits (1's & 0's) called as 'Frames'. The data link layer is also responsible for error control, flow control and reliable data transfer.

Network layer: The network layer controls the operation of the subnet. A key design issue is determining how packets are routed from source to destination. The network layer accepts data packets determines the best path (or) reach a device that is closer to the receiver

Transport layer: Transport layer specifies the details to handle reliable transfer of data. It handles end to end error control and flow control breaking up data into segments and reassembling the segments.

Session layer: The session layer maintaining a session between the communicating devices. It includes applic-ations for password and authentication, authorization, dialogue control maintain synchronization between sender and receiver.

Presentation layer: This layer specifies the presentation and representation of data. Its function include trans-lation of representation of the data into a an identifiable format at the receiverend, encryption and decryption of data.

Application layer: This layer specifies how can applic-ation uses a network.

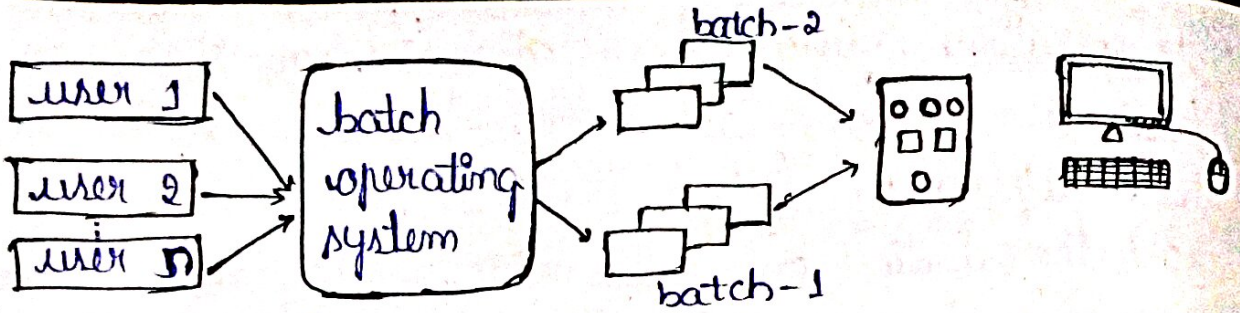
The application layer provides services to supp-ort end user applications such as web browsing, e-mail, file transfer and remote access by using the protocols HTTP and HTTPS, SMTP, FTP, telnet.

Operating system: An operating system is an interface between a computer user and computer hardware. An operating system is a software which performs all the basic tasks like file management, memory memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers. Some popular operating systems are windows, LINUX, UNIX etc. The following are some of the important functions.

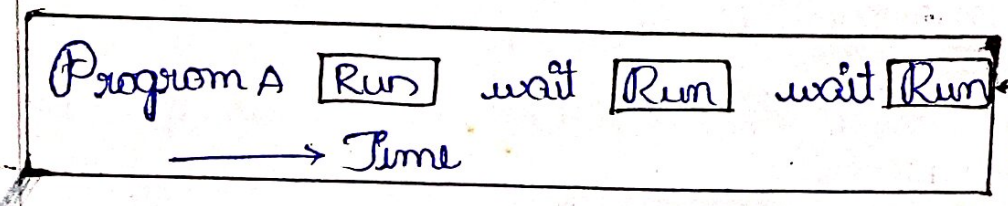
* memory management.
* process management.
* devices management.
* file manggement.
* security management.
* control over system performace.
* provides user interface
* controlling peripheral devices.

Evalution of operating system: The evaluation of various types of operating systems can be briefly described folbws.

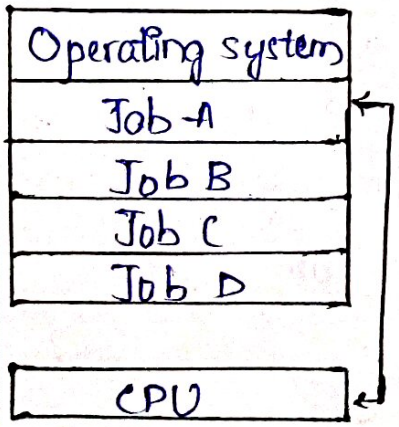
Batch system: This type of O.S was used in earlier agc. To speed up processing jobs with similar needs were batched together was run through the computer as a group. The definite feature of a batch system is the lack of interaction between the user and the job while the job is executing. In this execution environment, the CPU is often idle.

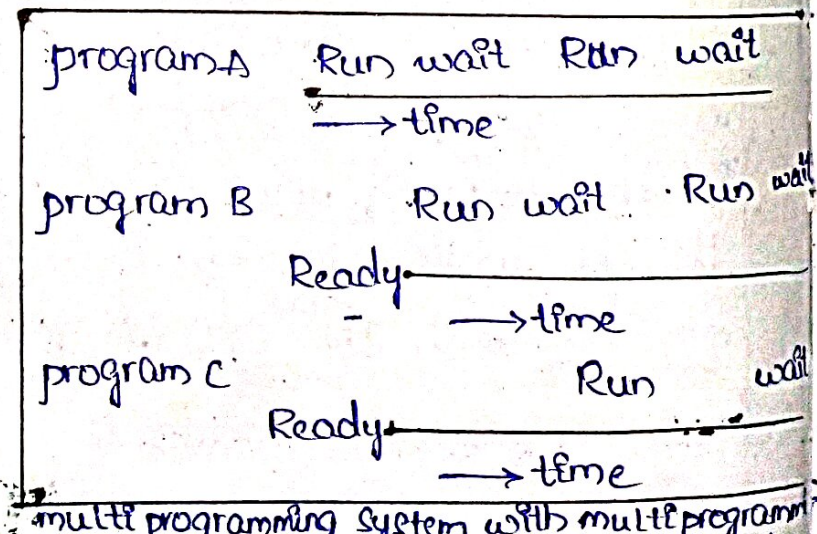


Single user single tasking operating system: As the name indicates, single user, single taskly O.S allowed one person to be executed at a time. They are designed to enable a single user to do a single job effectively at any point of time.



Multi programming operating system: In this type of operating system, more than one programmes will reside into main memory. The operating system picks and begins to execute one of the jobs in the memory. Eventually, the job may have to wait for some task. The operating system simple switches to and executes another job. When the first job finishes waiting and gets the CPU back. As long as there is always some job to execute, the CPU will never be idle.





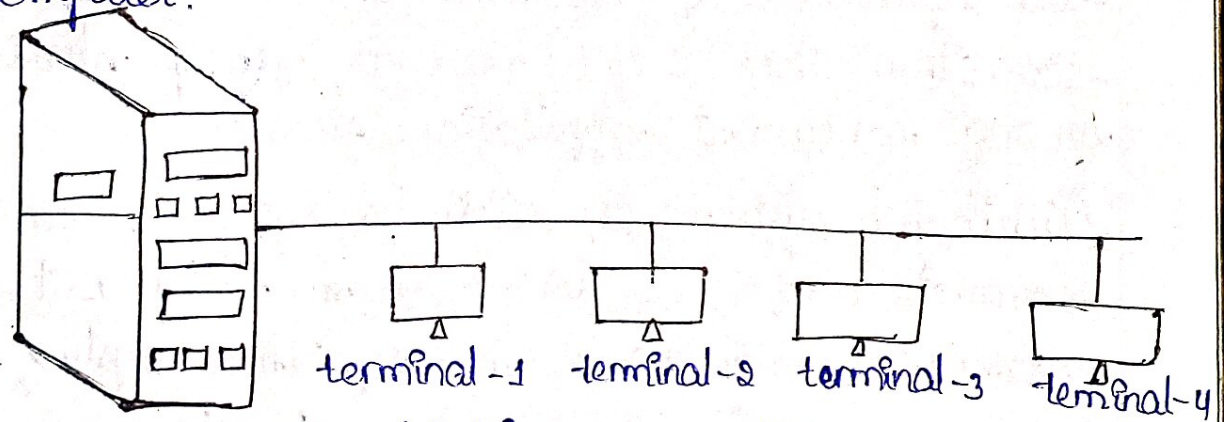
multi programming system with multi programming system (i.e., 3 programs).

Single user multi tasking operating system: A single user multi tasking operating system allows a single user to simultaneously perform several tasks. This operating system normally used in our desktops and laptops.

For example when we are typing a document in microsoft word while listening to a song and downloading a file from the internet, we are actually doing three jobs at the same time.

Multi user Multi tasking Operating system:

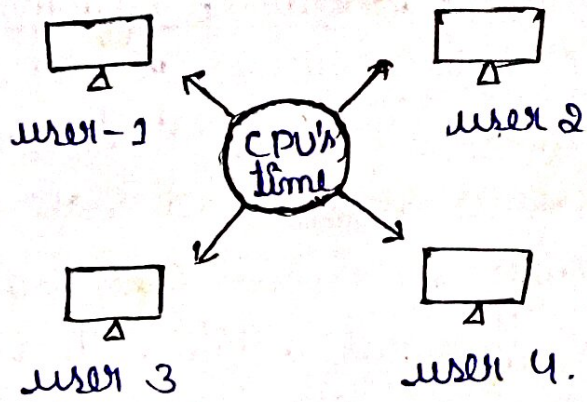
A multi user operating system enables multiple users on different computers to access a single system. It allows more than one user to connect to the main computer to perform more than one job at a time. Hence users on multiple terminals can access the same data and application programs that are stored on the main computer.



server

Multi user operating system.

Time sharing systems: A time shared operating system allows the many users to share the computer simultaneously. A time-shared operating system uses CPU scheduling and multi-programming to provide each user with small portion of a time shared computers.



Real time operating systems:

Real time operating system is a special purpose operating systems, used when there are rigid time requirements on the operation of a purpose (or) the flow of the RTO is used in embedded system such as cell phones, air conditioners, digital homes, cars and so on.

Process control system: Process controls are dedica-ted systems. They are dedicated to single applica-tion. Thus there is no need to manage sharing among concurrent application programs.

Distributed system: A distributed system is an inter-connection of two (or) more nodes but the processes do not share memory. These system are also called as "loosely coupled systems".

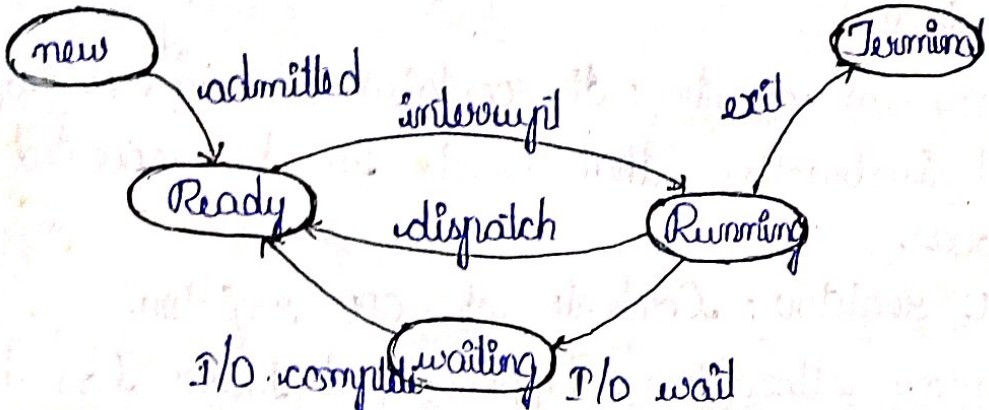
Process management: A process is an active program i.e., the program under execution is known "process". The execution of a process must progress in a sequential fashion.

(or)

A process is defined as an entity which repre-ents the basic unit of work to be implemented

in the program.

* Process states: The different states that a process is in during its execution are explained below



New: The process is new state when it has just been created.

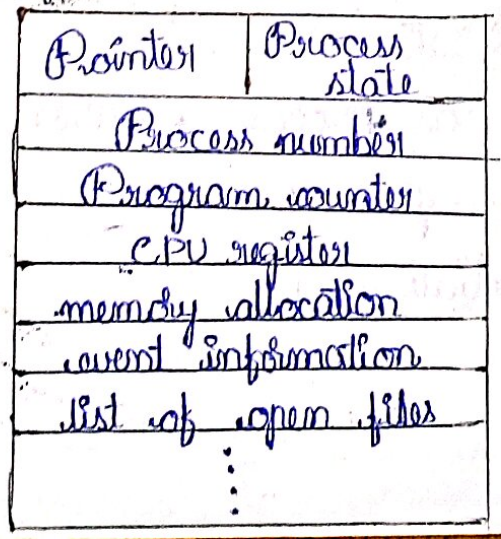
Ready: The process is waiting to be assigned, the processor by the short term schedule.

Running: The process instructions are being executed by the processor.

Waiting: The process is waiting for some event such as I/O to occur.

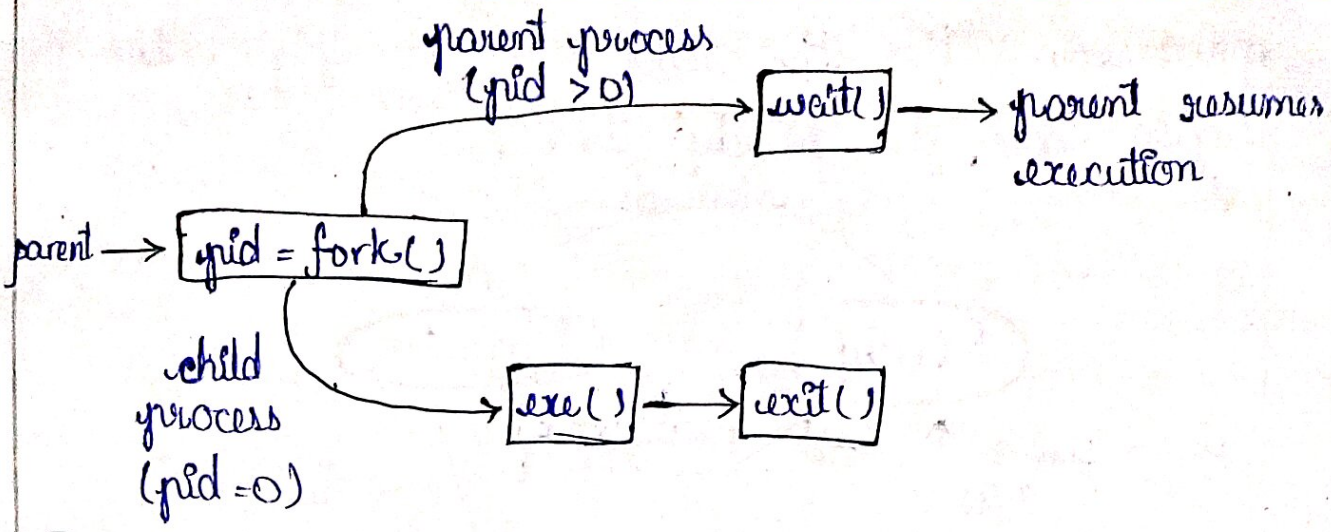
Terminated: The process has controlled completed its execution.

* Process Control Block: A process control block is associated with each of the processor. It contains important details about that particular process. These are as follows:



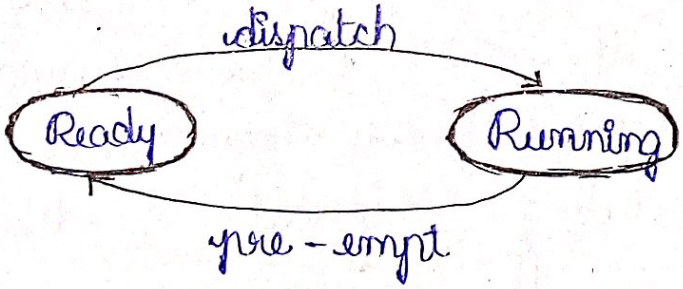
Process control block

Pointer: Which point to the PCB of other processes.
Process state: It specifies the control current state of the process (i.e., new, ready, running, waiting (or) terminated).
Program counter: It contains the address of the next instruction that needs to be executed in the process.
CPU registers: Contents of CPU registers.
Memory allocation: Upper and lower bounds of the memory required for the process.
Event information: States of various flags and switches, priority of the process.
List of open files: These are the different files that are associated with the process.
* Process operations: There are many operations that can be performed as on some of these are process creation, process pre-emption, process blocking and process termination.
Process creation: Process need to be created in the system for different operations. This can be done by the following events.
* User request for process creation.
* System initialization.
* Execution of a process creation system called by a running process.
* Batch job initialization.



Process creation using fork ( ): A process may be created by another process using fork ( ). The creating process is called the "parent process" and the created process is "child process". A child process can have only one parent but a parent process may have many children.

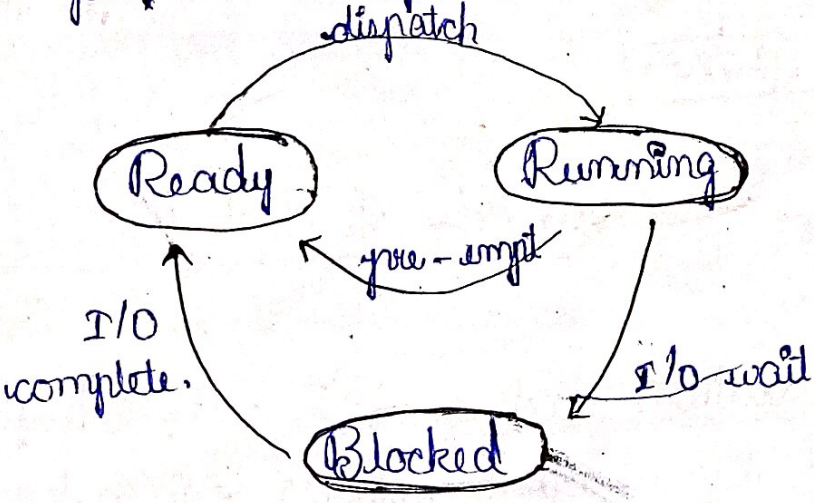
Process Pre-emption: An interrupt mechanism is used in pre-emption that suspends the process executing currently and the next process to execute is determined by the short-term scheduler. Pre-emption makes sure that all processes get some CPU time for execution.



Process pre-emption.

Process Blocking: The process is blocked if it is waiting for some event to occur. This event may be I/O as the I/O events are executed in the main memory and don't require the

processor. After the events is complete, the process again goes to the ready state.



Process Termination: After the process has completed. The execution of its last instruction, it is completed or terminated. The resource held by a process are released after it is terminated.

A child process can be terminated by its parent process if its task is no longer relavent. The child process sends its status information to the parent process before it terminates. Also, when a parent processes are terminated as well as the child processes cannot be run if the parent processes are terminated.

Process Scheduling: The act of determining which process is in the ready state and should be moved to the running state is known as "process scheduling".

The prime aim of the process scheduling system is to keep the CPU busy all the time and to deliver minimum response time for

all programs. For achieving, this the scheduler must apply appropriate rules for swapping process IN and OUT of CPU. There are two types of process scheduling.

1, Non pre-emptive scheduling.
2, Pre-emptive scheduling.

1, Non pre-emptive scheduling: When the currently executing process gives up the CPU voluntarily. The first process is completely executed and then the CPU executes the next process. The process is repeated until all the processes are executed. There is no need for a CPU scheduling policy in a non pre-emptive scheduling. The execution of second job will strictly follow the execution of the first.

2, Pre-emptive scheduling: The O.S. decides to favour of another process, pre empting the curre-ntly executing process. In pre-emptive scheduling, each process is given a small amount of time to execute. When the time slice expires, the currently executing process is suspended and the CPU is dotted to another process for the same, amount of time. This process repeats until all priority process comes, the lower priority process is suspended and the higher priority is executed Some pre-emptive scheduling are as follows.

First come-first Serve: In the first come first serve (FCFS) the process that entres the memory.

first will be executed first. A ready queue is maintained such that it contains all the processes that need the CPU time. The scheduling is just take first process and executes it and then allocates CPU to the next process in the sequence. The main drawback of the FCFS policy is poor performance as long waiting times for small processes.

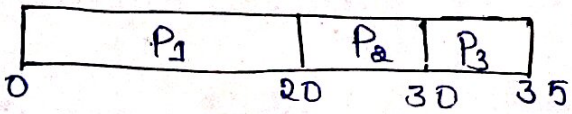
Shortest job first: In this technique, the CPU time requirement of each process must be known in advance so that a ready queue can be maintainable such that it stores the processes increasing order of their CPU time requirements. This is the best approach to follow, it is very difficult to implement, as prior knowledge of the time required cannot always be known in advance. It may lead to "Starvation" of long jobs that had entered very early in the system.

Round Robin: In this technique, the CPU is alloted to each process on the FCFS basis for a specified time (called the time quantum). If the first process is completely executed in this quantum, it is suspended and CPU is allocated to the second process for the same time quantum. This technique is repeated until all the processes are completely executed.

Ex: Consider three processes P_1, P_2 and P_3 with CPU time requirements given as 20ms, 10ms and 5ms

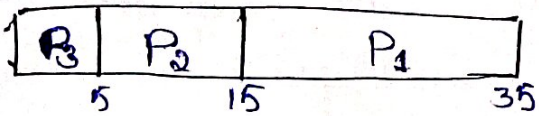
show the scheduling process using FCFS. SJF and round robin policies take time quantum as 5ms.

FCFS

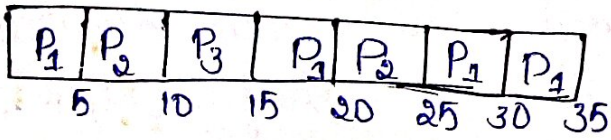


P.N	I
P_1	20
P_2	10
P_3	5.

SJF



Round Robin



Command Interpreter: A command interpreter is the part of a computer operating system. A comm--and interpreter understands and executes commands that are entered interactively by a human being (or) from a program. In some operating systems, the command interpreter is called the "shell."

A command interpreter allows the user to interact with a program using comma--nds in the form of text files. It was frequently used until the 1970's. However in modern times many command interpreters are replaced by graphi--cal user interfaces and menu-driver interfaces.

Purpose of command interpreter:

Command interpreters serve many purposes and are more useful than graphical user interfaces in some cases.

* Command interpreters have large range of commands and queries available for different operations. Also, it is much faster to type than to click as is done using graphical user interfaces.

first will be executed first. A ready queue is maintained such that it contains all the processes that need the CPU time. The scheduling is just take first process and executes it and then allocates CPU to the next process in the sequence. The main drawback of the FCFS policy is poor performance as long waiting times for small processes.

Shortest job first: In this technique, the CPU time requirement of each process must be known in advance so that a ready queue can be maintainable such that it stores the processes increasing order of their CPU time requirements. This is the best approach to follow, it is very difficult to implement, as prior knowledge of the time required cannot always be known in advance. It may lead to "Starvation" of long jobs that had entered very early in the system.

Round Robin: In this technique, the CPU is alloted to each process on the FCFS basis for a specified time (called the time quantum). If the first process is completely executed in this quantum, it is suspended and CPU is allocated to the second process for the same time quantum. This technique is repeated until all the processes are completely executed.

Ex: Consider three processes P_1, P_2 and P_3 with CPU time requirements given as 20ms, 10ms and 5ms

to control hardware devices.

DOS commands can be typed in either upper (or) lower case.

Features of DOS:

* It is a single user operating system.
* It controls program.
* It is machine independence.
* It manages computer files.
* It manages computer memory.
* It manages computer input and output operations.

Types of DOS commands:

* Internal commands: Commands such as DEL, Copy, Type etc are the internal commands that remain stored in computer memory.
* External commands: Commands like FORMAT, DISKCOPY etc are the external commands and remain stored on the disk.

Windows Operating System: The windows operating system is the extension of the disk operating system.

It is the most popular and simplest operating system. It can be used by any person who can read and understand basic english, as it does not require any special training.

However, the windows operating system requires DOS to turn run the various application programs initially. Because of this reason, DOS should be install into the memory and then

windows operating system can be executed.

Elements of windows operating system:

* Graphical user interface.
* Icons (pictures, documents, applications, program icons). etc).
* Task bar.
* Start button.
* Hardware compatibility.
* Software compatibility.
* Help etc.

Unix Operating Systems: Unix is computer O.S which is capable of handling activities from multiple users.

Unix was developed in 1969 by a group of AT & T employees as "Ken Thompson, Dennis Ritche, Douglas Mcilroy and Joe Ossanna" at Bell labs.

The unix operating system is a set of programs that act as a link between the computer and the user.

Computer programs that allocate the system resources and co-ordinates all the details of the computer's internals is called the "Operating system (or) the Kernel".

* It is a multi user and multitasking operating system several users can use a unix O.S at the same time, each user can also run multiple programs at the same time.

*It has comparative complex functionality and, hence an untrained user cannot use it only the one who was taken training can use this system.

Linux Operating system: Linux is one of popular version of unix operating system. It is open source as its source code is freely available. It is free to use. Linux was designed considering unix compatibility. Its functionality list can is quite similar to that of unix.