

Computer network

Data /

A collection of computer that are able to communicate which each other through some medium using hardware and software.

Two computer are said to be connected if they are able to exchange information or able to communication.

Every network include element to enable data transfer or sharing are given below.

- At least two computer (or computer like device)

- Network interfaces
- A connection medium
- Operating system, stimulate, algorithm and protocols.
- Data transfer models
there are mainly three modes of data transfer.

- ① Simplex
- ② Half duplex
- ③ Full duplex

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- ① Simplex: Data transfer only in one direction e.g., radio broadcasting.
- ② Half duplex: Data transfer in both directions, but not simultaneously i.e., in one direction at a time e.g. talk back radio. CB.
- ③ Full duplex: Data transfer in both directions, simultaneously e.g. telephone.

- what is router? full explain.
Router is a network device which works as a traffic controller. A main work of router is to chose a congestion free path through which the data packet will travel.

Router receive data packets to the sender, analyse and forward them. that data packet giving to receiver

Router is uses both LAN & WAN Network

• ADVANTAGES :- It provides connection b/w two dis-similar type of network

- ① Transmission rate is very high.
- ② It internally uses same algorithm to findout Congestion free Path.
- ③ It provides both wire or wireless facility.

Disadvantages: ① Router is more expensive compare to other network device.

- ② Router are complex to maintain.
- ③ Security issues.
- ④ It only work with routable protocol.

LAN	MAN	WAN
① LAN stand for local area network.	Man stand for metropolitan area network.	WAN stand for wide area network.
② It is used for building office.	It is used for city.	It is used for countries.
③ LAN Network range 0 to 100m	Man Network range 5 to 50km	WAN Network not found
④ Transmission speed of data high	Transmission speed average	Transmission speed slow

easy to maintain

Difficult

to maintain

Difficult

to maintain

• Math as

well as LAN

error rate

is high.

LAN network
error rate &
setup cost is
low

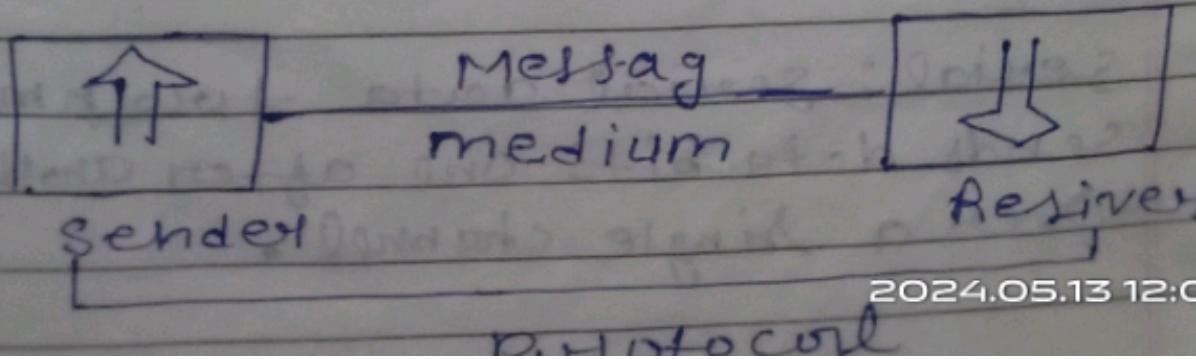
MAN hardware
rate & setup
cost is
large.

- **Data communication :-** Data Communication is the process of sending or receiving digital data between two or more computers via transmission medium such as a wire cable.

Component

① Message (ii) Sender ③ Receiver

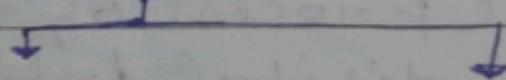
④ Transmission medium ⑤ Protocol



Data transmission: Data transmission refers to the process of transferring the data between two or more digital devices in analog OR ~~form~~ digital form. This data is transferred in the form of bits.

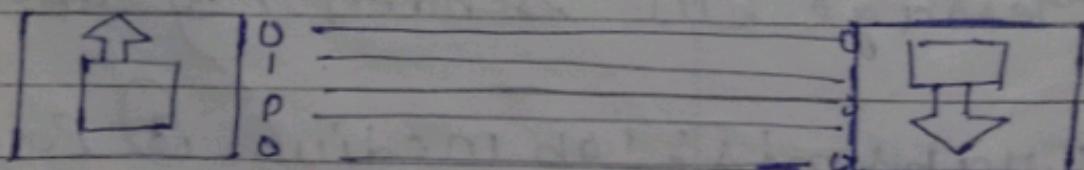
Type: (i) Parallel

(ii) Serial

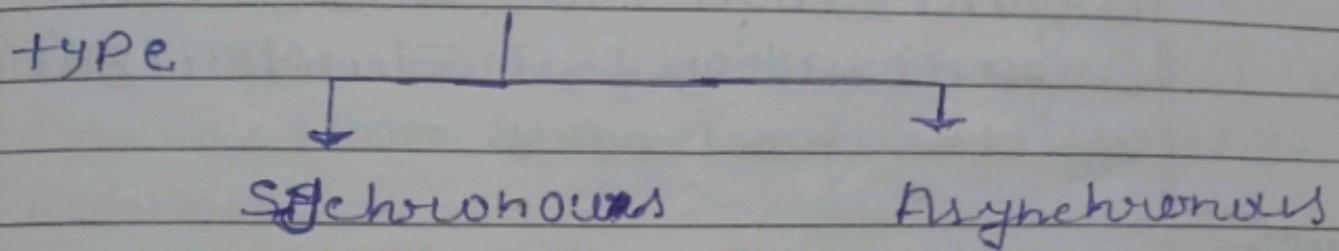
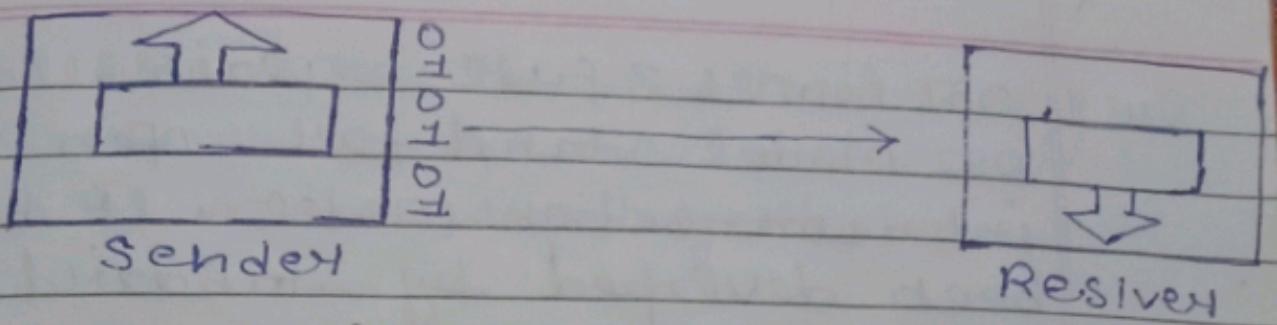


Synchronous ASynchronous

Parallel: Parallel data transmission sends multiple data bits at the same time over multiple channels.



Serial: Serial data transmission sends data bits one after another over a single channel.



Synchronous: the synchronous transmission a lot of data is sent in a block. each block has many characters.

tion

bus: Router full explain?

Router is a network devi

~~store~~

Ques. 1. OSI MODEL ? Full explain -

OSI model stand for "open system interconnection model. it has been developed by standard Organization ISO (International Organization for Standardization) in the year 1984.

remember

- It is 7 layer architecture where each layer having specific functionality.

2. Bridge? Full explain -

Bridge is a network device that is used to separate LAN into no of section.

It operates both physical as well as data link layer of OSI model

ADVANTAGES ① By using bridge device we can extends networks.

②

It broadcast the data to each node like HUB & repeater

collision can be avoided easily

④ It is more intelligent.

• DISADVANTAGE ① it doesn't establish connection between two different networks.

② It is more expensive.

③ The transmission rate of node is slower than repeater.

Q: What is data transmission? with type.

Data transmission refers to the process of transferring the data between two or more digital device in analog or transferred in the form of bits.

Type

① Parallel

② serial

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synthesis

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Parallel data transmission:

Parallel data transmission sends multiple data bits the same time over multiple channels.

Serial transmission:

Serial data transmission sends data bit one after another over a single channel.

Type of serial data transmission

Synchronous:-

The synchronous transmission a lot of data is sent in a block each block has many characters.

Asynchronous:-

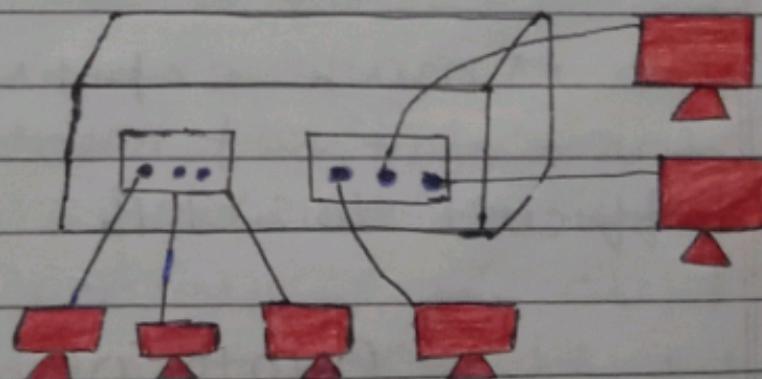
In asynchronous transmission only one character is sent at a time whether that a character is number or alphabet.

Ques: what is switch? Full explain.

Switch is a network device that connects multiple computers together in the network.

It is ~~more~~ mainly used to send the private message as well as there is no wasting of data.

Switch can only identify that which device is connected with port by using MAC address that it delivered message on particular destination machine.



Switch figure

Remember

Switch is more intelligent than HUB.

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- ADVANTAGES :-
 - ① It generally used to unicast the message.
 - ② It provide more security than HUB.
 - ③ Switch support full duplex data transmission mode.
 - (4) If a node fails, there will be no effect in the entire network.
- Disadvantages
 - ① If switch is failed then entire network will be failed.
 - ② It is more expensive.
 - ③ Difficult to setup.

Protocol

As we know protocol is nothing but set of rules.

Types :- TCP / IP
TCP stands for transmission control protocol
whereas IP stands for internet

Protocol. • TCP is used to transfer the data over the internet. It divides the data into small packets and sends it to the destination through networks. While ~~IP~~ IP is used for addressing through which data reaches the destination.

- HTTP:- HTTP is an application Protocol that is used in the address bar of the web browser before www. Whenever we enter anything in the address bar of browser so it brings that website in front of us.
- FTP:- FTP stands for file transfer protocol. It is used to transfer the file server to ~~or~~ client machine and vice versa. It uses TCP/IP Protocol to enable data transfer.
- SMTP: SMTP stands for simple mail transfer protocol. ~~transfor~~ It is used to send and receive the emails in the network.

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There are two more protocol used with SMTP (POP & IMAP) all these protocol work with the help of TCP/IP.

- POP:- POP stand for Post office Protocol. It is a mail box which is actually a message access protocol through which a user can fetch the email from the server. POP protocol works on TCP/IP protocol and helps the SMTP protocol to end communication.

IMAP:- IMAP STAND FOR internet Mail access Protocol. It is also a mail box which is actually an improvement version of POP. By using IMAP the main advantage is we can retrieve or deleted email from the server.

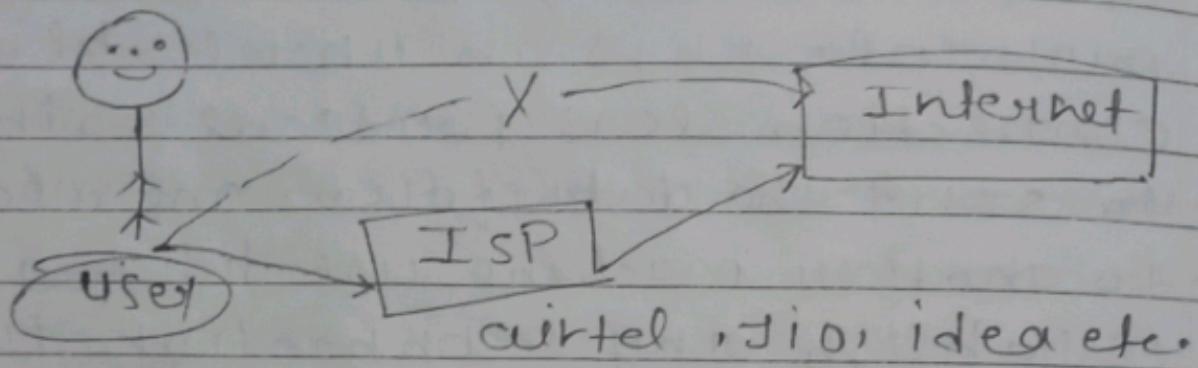
- PPP: PPP stands for Point to Point Protocol. It is used to transfer data between two directly connected devices.
- UDP: UDP stand for user datagram protocol. It is an unreliable and connection less protocol so in order to send the data from one machine to another machine we did not establish any connection it compare to ~~TCP~~ TCP/IP protocol.
It is use to transfer the data in a short distance.

Protocol Port No.

- ① FTP → 21
- ② SMTP → 25
- ③ PPP → 210
- ④ IMAP → 143
- ⑤ HTTP → 80
- ⑥ HTTPS → 443

• What is ISP? full explain.

ISP stand for "Internet service provider" it is a company which provides internet service to its customers it is called ISP.



• Category of ISP

- (1) Tier 1 → has all over the world
- (2) Tier 2 → only for country (jio, vodafone)
- (3) Tier 3 → only for city (MTNL)

• What is HUB? full explain.

HUB is a network device that is used to connect multiple computers in a network.

All the information send to the HUB is automatically send to each port to every device.

- ③ A HUB is less expensive, less intelligent & less complicated.
- ④ HUB generally used to connect computers in a LAN.
- ⑤ Transmission mode of HUB is half duplex

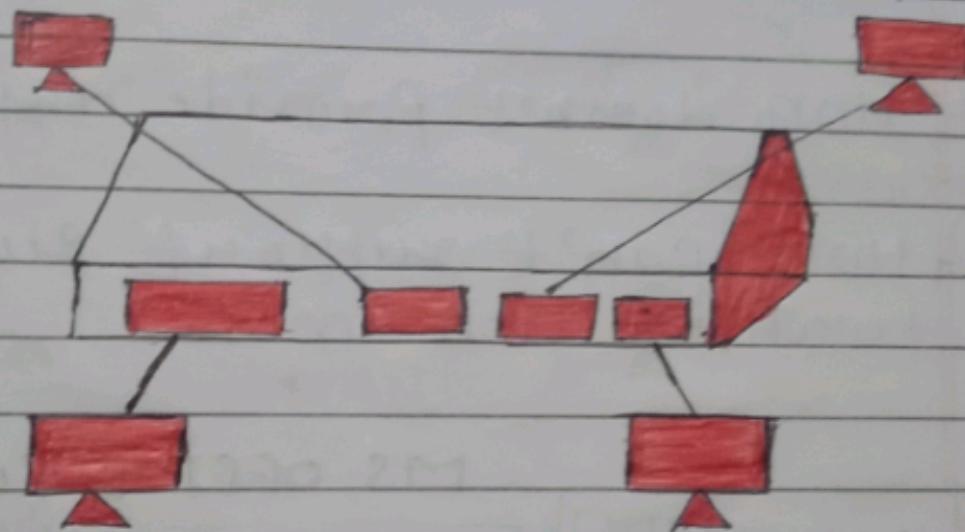


Fig HUB

- ADVANTAGES ① The HUB can broadcast the message.
- ② It is less expensive than anyone can use it.
- ③ Easy installation.
- ④ Robust.

- DISADVANTAGES: ① If the HUB is failed the entire network will be failed.
- ② We can't send private/personal data through hub.
- ③ HUB doesn't provide any security.
- ④ HUB can't support full duplex transmission mode.

MS OFFICE full explain.

MS: MS office is a application software which was developed and published by Microsoft in the year 1990. It widely used in business and educational sectors through which we can create, view & edit document, spreadsheets, presentations and data entry database.

i) founded → "Bill Gates".

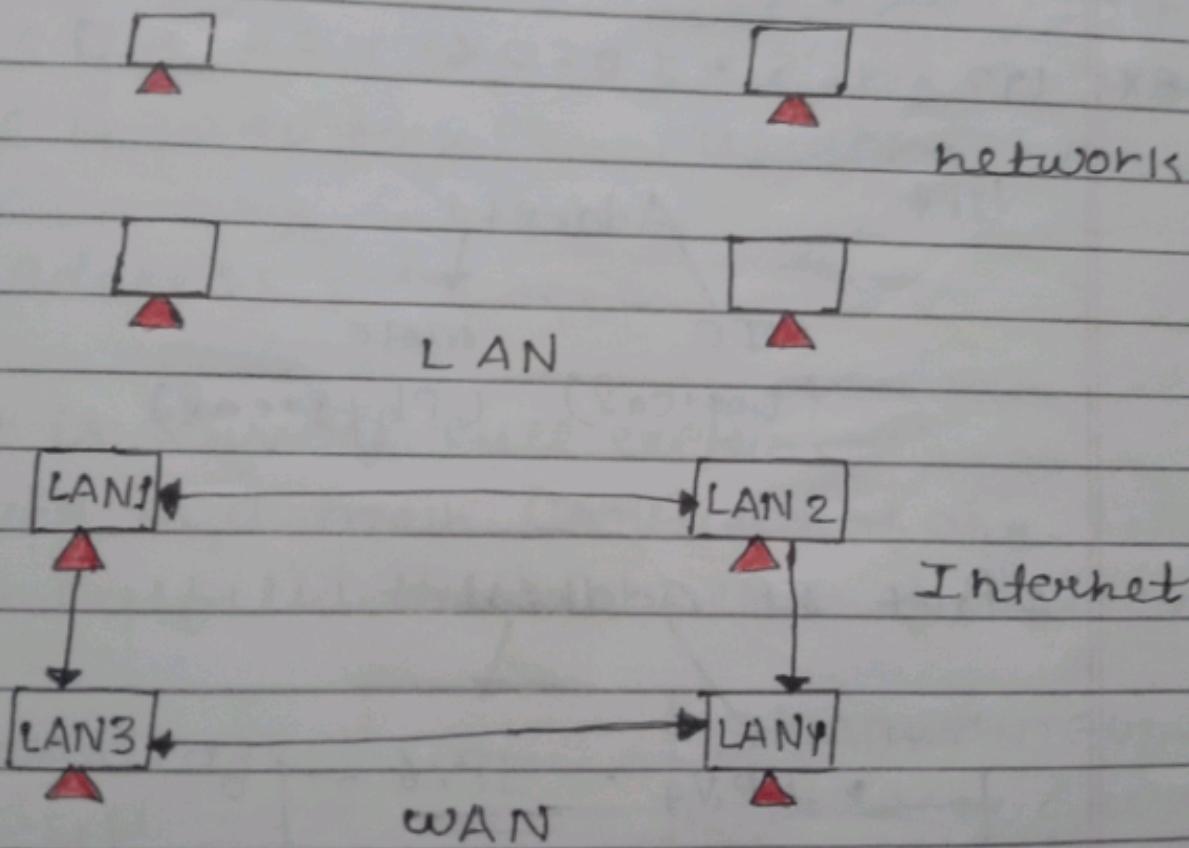
ii) CEO → "Satya Nadella"

Latest version → MS Office 2019.

What is Internet full explain?

Internet is a network of networks that is used to interlink any different type of computer all over the world.

ex



ARPANT 1969 first network of America development.

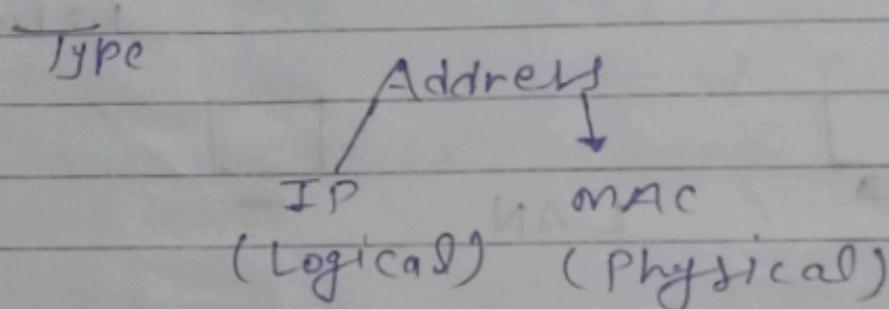
It Internet bad mai iska name
Pola.

Ques: What is IP address? Full explain?

IP address stands for "Internet Protocol address". An IP Address is a unique no. provided to each and every devices.

It is in the form of integer numbers which is separated by dots.)

Ex 192 • 168 • 10 • 26



2 Part IP Address

• IPv4 • IPv6 •

→ length 32 bits

→ Octet 4

→ Range 0 to 255

→ 4 billion (2^{32}) use

length 128 bits

→ Octet 8

→ Range 0 to FFFF

→ 340 trillion (2^{128})

Ex → 192 • 168 • 10 • 26 Ex: 3F BB : 1806 : 150 : 4

USE OF IP -

- 1) Private IP (use for home connect to internet)
- 2) Public IP → Business work website Public

CLASS OF IP:

CLASS A → 0 to 126 (128 to 255, 0, 1, 10)

CLASS B → 128 to 191 (192 to 255, 0, 1, 10)

CLASS C → 192 to 223 (192 to 255, 0, 1, 10)

CLASS D → 224 to 239 (used for multicasting)

CLASS E → 240 to 255 (used for research)

* IP address :

• what is server? full explain.

Server is a main computer of any network that fulfills the request of other computers.

ADVANTAGE

① Backup

② Security

③ Storage

535)

Type

④ File Server

⑤ Application Server

⑥ Mail Server

DISADVANTAGE

(1) ~~Failure~~ Server fail.

(ii) Server is more expensive

(4) Web Server

(5) Database

Server.

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System Analyses And design

Date / /

- What is system?

System is group of elements or components which work together accomplish a common task.

characteristics

- i) Organization
 - ii) integration
 - iii) Interaction
 - iv) Interdependence
- Central Objectives

- Organization: It implies structure and order.

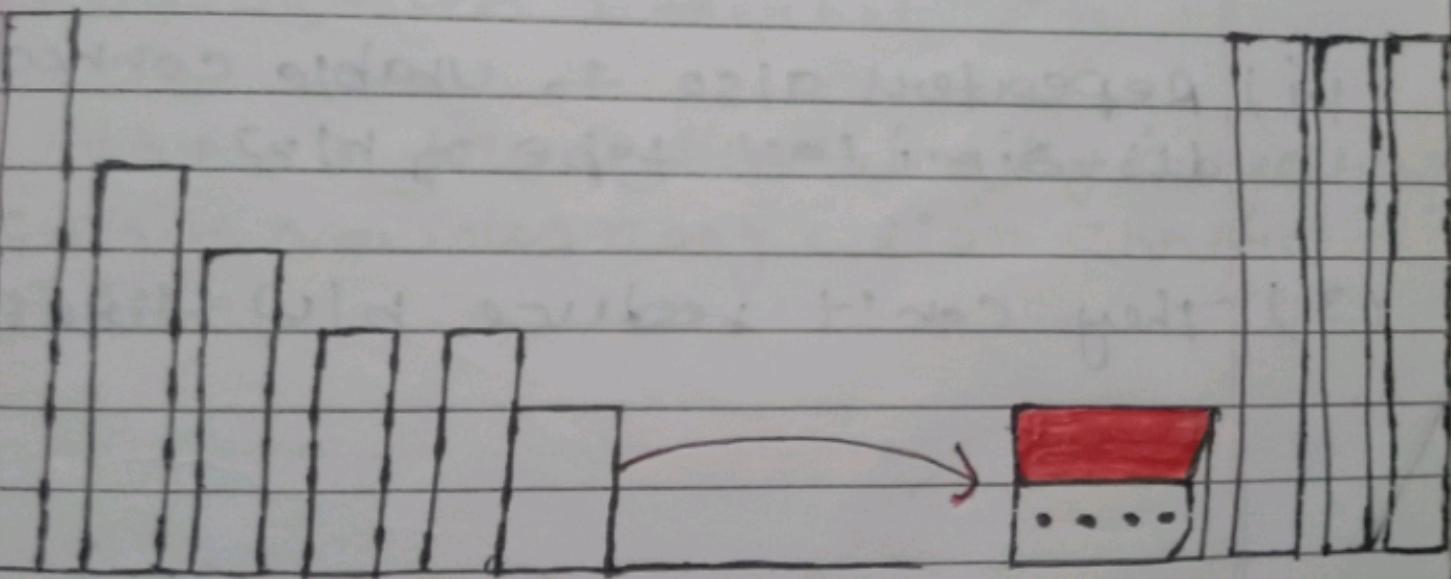
There are 6 element in a system.

- i) Inputs and output
- ii) Processor
- iii) Control
- (4) Feedback
- (5) Boundaries & Interface
- (6) Environment

(Computer networks)

- what is repeater? full explain.
Repeater is a network device through which we can "boost up" the weak signals. When the signal travels in the network after having some distance the intensity of the signal becomes low.

In order to regenerate the weak signal we should use repeater device.



it is used:

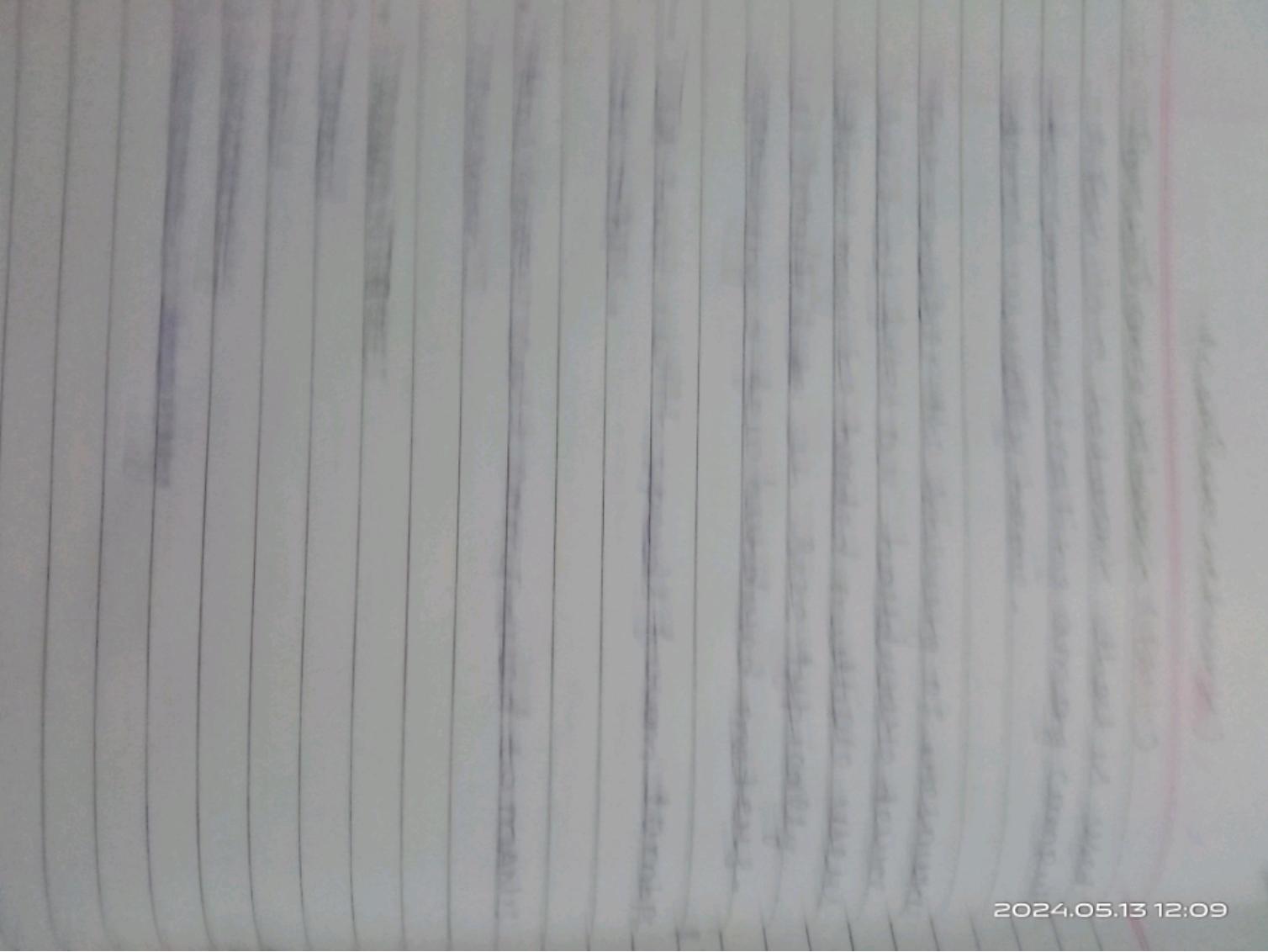
Advantage: (i) It is used to regenerate the weak signal.

- (2) It is cheaper than other networking device.
- 3) Repeater has the ability to extend the length of signal.
- 4) Increase/maintain the signal to performance.

Disadvantages:

- i) It required no of repeater after some distance.

- i) Repeaters also to unable connect dissimilar type of nw.
-) They can't reduce b/w traffic.



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- campus area network
A can is a network (CAN) interconnected by multiple nodes in a limited geographic area.
A can is smaller than a wide area LAN.

- A can is also known as a campus LAN or a network.

ADVANTAGES

- Speed
- Reliability
- Cost-effective interconnection
- Better for every consumer.

Storage area network (SAN)

A SAN is a specialized high-speed network that provides block-level network access to storage. SANs are typically composed of hosts, switches, storage elements, and storage devices that are interconnected using a variety of technologies, topologies, and protocols.

Advantages

- 1) Low expense
- 2) Fault tolerance
- 3) Disk mirroring
- 4) Real time update
- 5) Administrator control.

Peer to Peer model

Peer-to-Peer computing or networking is a distributed application architecture that partitions tasks or workloads between peers. Peers are equally privileged, equipotent participants in the network. They are said to form a peer-to-peer network of nodes.

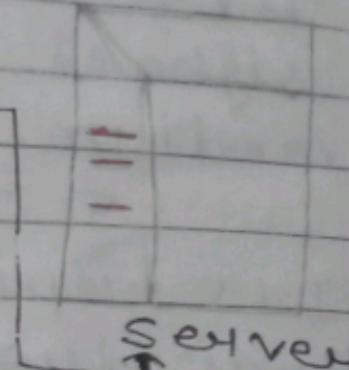
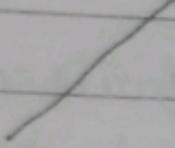
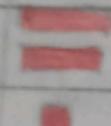
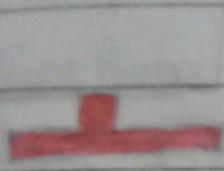
Client Server model

Client Server model is a distributed application structure that partitions tasks or workloads between the providers of a resource or service called servers, and service requesters called clients.



clients

Internet



server

Difference

client / server

server has the
control ability while
client don't

Peer-to-Peer

All computers have
equal ability

High cabling cost cheaper cabling cost

easy to manage

hard to manage

One Powerful Computer
acting as server.

No server is needed.

* Physical Layer

One of the major function of the physical layer is to move data in the form of electromagnetic signals across a transmission medium.

- It's responsible for movement of individual bits from one hop to next.
- ii) Physical characteristics of interface and medium.

- Representation of bits.
- Data rate.
- synchronization of bits.
- Data LINK LAYER: Data linklayer is responsible for moving frames from one hop to the next.
- concerned.
 - framing
 - physical addressing

- flow control
- Error control.
- Access control.

3. Network layer:- The network layer is responsible for the delivery of individual packets from the source host to the destination host.

• concerned.

- logical addressing
- Routing

4. TRANSPORT LAYER : The transport layer is responsible for the delivery of a message from one process to another.

• concerned.

Service - point addressing.

□ Segmentation and reassembly

□ connection control

□ flow control

□ Error control.

4. SESSION LAYER: The session layer is responsible for dialog control and synchronization.

- Concerned.
- Dialog Control
- Synchronization

5. PRESENTATION LAYER: The presentation layer is responsible for translation, compression and encryption.

- Concerned.

- Translation
- Encryption
- Compression

* APPLICATION LAYER: The application layer is responsible for providing services to the user.

- Concerned.

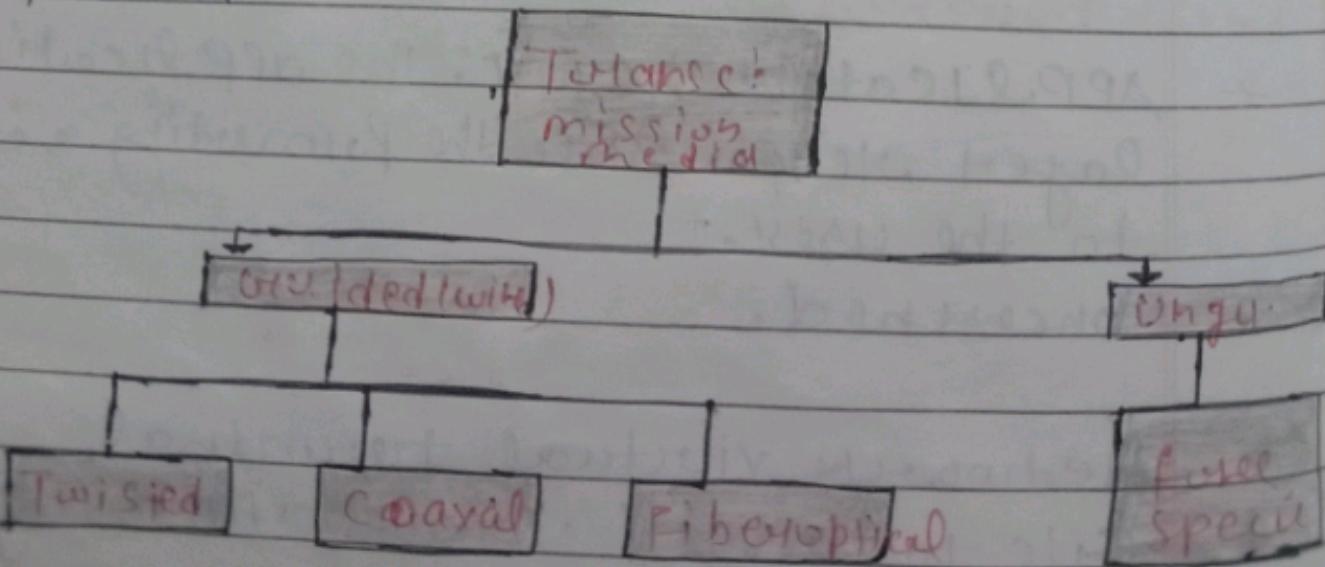
▫ Network virtual terminal
File transfer, access and management
mail services.

* what is transmission media?

In data communication.

- * Transmission media is a pathway that carries the information from ~~sender~~ to receiver.
- we use different type of cables or waves to transmit data.
- Data is transmitted normally through electrical or electronic signals.

CLASSIFICATION OF TRANSMISSION Media.



Twisted-Pair CABLE:

A Twisted Pair consists of two conductors.

Basically copper bused with its own plastic insulation twisted together.

Transmission

- **Digital to digital conversion:** The process of converting binary 1 and 0s created by a computer into a series of voltage pulses that can be transmitted across a wire. This is known as digital-to-digital encoding.
- **Line Coding:** Line coding is the process of converting digital data to digital signals. We assume that data, in the form of text, numbers, graphical image, audio, video are stored in computer memory as sequences of bits.
- **Characteristics:**
 - Single Element versus Data element.
 - Data rate versus signal rate.
 - Bandwidth
 - Self-synchronization
 - Built-in error detection
 - Immunity to noise and interference
 - Complexity.
 - Baseline wandering.

* Line Coding Schemes: We can roughly divide line coding schemes into five broad categories as shown in

Line Coding Schemes: We can roughly divide line coding schemes into five broad categories as shown in figure.

Line coding

Unipolar	-NRZ
Polar	-NRZ, RZ
Bipolar	-AMI and
Multilevel	-B31Q
Multilevel Transition	-MLT-3

Unipolar Schema: In a unipolar schema, all the signal levels are one side of the time axis either above or below.

NRZ (NON return to zero) non-return to zero schema in which the positive voltage defines bit 1 and the zero voltage defines bit 0.

Returns to zero (RZ): return-to-zero schema which uses three values: positive, negative and zero.

Multilevel schemes: The desire to increase the data speed or decrease the required bandwidth has resulted in the creation of many schemes.

2B1Q The first multilevel scheme we discuss, two binary, binary quaternary uses data patterns of size 2 and encodes the 2-bit pattern as one element belonging to a four-level signal.

8B6T: A very interesting schema is eight binary + six ternary. This code with 10BASE-T cable as we will see in.

4D-PAM5 - four Dimensional five-level Pulse amplitude modulation. The 4D means that data is sent over four wires at the same time.

Multiline transmission MLT-3 NRZ and differential Manchester are classified as differential encoding but use two transition rules to encode binary. The multiline transmission three level schema uses three level and three transition rules to move between the levels.

If the reset bit is 0, there is no transition.

If the reset bit is 1 and the current level is not 0, the reset level is 0.

If the reset bit is 1 and current level is 0, the reset level is the opposite of the last nonzero level.

Block coding: block coding changes a block of m bits into a block of n bits, where n is larger than m . block coding is preferred to an m BlnsB encoding technique.

4B/5B: The four binary five binary coding scheme was designed to be used in combination with NRZ-L. Recall the NRZ-L has a good signal rate, one-half that of biphase but it has a synchronization problem.

B8ZS: Bipolar with 8-zero substitution is commonly used in North America.

000V00V0. The V in the sequence denotes violation; this is a nonzero voltage that breaks an AMI rule of ~~no~~ encoding.

HDB3: high-density bipolar 3 zeros is commonly used outside of North America. In this technique which is more conservative than B8ZS, four consecutive zero level voltages are replaced with a sequence of 000V0 or B00V.

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ANALOG - TO - DIGITAL CONVERSION

Analog - to digital conversion is an electronic process in which a continuously variable or analog signal is changed into a multilevel digital signal without altering its essential content.

Pulse Code Modulation (PCM)

The most common technique to change an analog signal to digital data is called pulse code modulation.

TRANSMISSION MODES of primary concern when we are considering the transmission of primary concern when we are considering the wiring is the data stream.

DIGITAL TO ANALOGUE CONVERSION

Digital to analog conversion is the process of changing one of the characteristics of an analog signal based on the information digital data.

ANALOG TO ANALOG CONVERSION

Analog - to analog conversion can be accomplished in three ways: amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM). AM and PM usually categorized together.

Date / /

Ques: What is Data communication? full explain.

Data transmission is the process of sending or receiving digital data between two or more entities via transmission media such as a wire cable.

• Component:-

i) Data communication system has five components.

message

(1) Sender (2) receiver

Transmission medium (3) Protocol

* ADVANTAGES OF COMPUTER NETWORKS

- (1) File Sharing
- (2) Resource Sharing
- (3) Better Connectivity and Communication.
- (4) Internet access
- (5) Entertainment
- (6) Inexpensive System
- (7) flexible access.

* Disadvantages of Computer network

- 1) Lack of data security and privacy.
- 2) presence of computer viruses and malwares.
- 3) lack of Independence
- 4) Lack of Robustness
- 5) need an efficient handling.

use of Computer networks

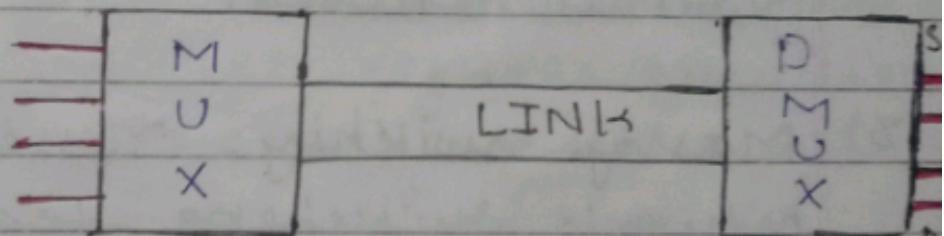
-) Financial Services;
-) Business
-) Email services
-) Mobile applications
-) Directory Services.

* Difference between IPV4 and IPV6

	IPV4	IPV6
1) The length of IPV4 is 32 bit	The length of IPV6 is 128 bit.	
2) In IPV4, around 4 billion unique IP address are generated (2^{32})	In IPV4, around 340 Trillion unique ip address are generated (2^{128})	
3) The range of IPV4 address is 0 to 255	The range of IPV4 address : 0 to FFFF (65535)	
4) Ex :- 192-168-1-08.253	20.1: B8:1904:FB89: 1808:1751:CH83	
5) It consists of 4 octets each having 8 bit	It consists of 8 Octets, each has 16 bits.	
IPV4 has to the five classes.	It doesn't have any class	

Microwave: Microwave is a form of electromagnetic radiation with wavelength ranging from about one meter to one millimeter corresponding to frequencies between 300 MHz and 300 GHz respectively.

Multiplexing: In telecommunications and computer networking, multiplexing is a method by which multiple analog or digital signals are combined into one signal over a shared medium.



There are 3 type of multiplex

- (1) FDM: frequency Division multiplex
- (2) WDM: Wavelength Division Multiplex
- (3) TDM: Time Division multiplexing.

Switching: Switching is the mechanism in computer network that help in deciding the best route for data transmission if there are multiple paths.

is the Internet.

There are 3 common type of switching:

- 1) circuit
- 2) Packet switching
- 3) Message

1) Circuit switching: Circuit switching is a type of network configuration in which a physical path obtained and dedicated to a single connection between two endpoints in the network for duration of a dedicated connection.

2) Packet switching: Packet switching is the transfer of small pieces of data across various network.

3) Message switching: Message switching is a network switching technique in which data is routed in its entirety from the source node to the destination node, one hop at a time.

TELEPHONE NETWORK

The telephone network is made of three major components

Definition: A Telephone network is a telecommunication network that connects telephone, which

allow telephone calls between two or more parties, as well as newer features such as fax and internet.

. There are three component of telephone network.

i) local loop 2) trunk 3) switching office.

(1) **loop local:** A local loop is the wired connection from a telephone company's central office.

2) **Trunk:** A network trunk is a communication line or link designed to carry multiple signals simultaneously to provide network access between two points.

Switching office: Switching office are the actual telephone switches that provide telephone service to contact centers. You must register a switching office before you configure a switch with DNS and Agent logging.

ADVANTAGES OF TELEPHONE NETWORK:

- 1) Easy and quick to use
- 2) Low expensive
- 3) 3G And 4G
- 4) Distance is not a matter.
- 5) No barrier
- 6) Teleconferencing
- 7) Audio, video, image
- 8) Tracking System.

DISADVANTAGES OF TELEPHONIC-NET

- 1) It has no transmission speed.
- 2) Can cause miscommunication.
- 3) Causes many number and harassment over calls have increased.

What is repeater
A repeater is an electronic device
that simply regenerates a signal.
A connecting device between two segments
of a LAN
It works Physical layer of OSI model.

Important of repeater
It can extend physical length of LAN
Repeater can divide the network in
to segments.
Range of LAN can be increased

function

- It receives a signal before it become
too weak or corrupted
- Regenerates the original bit patterns
The repeater forward the unchanged
signals.

It works with Physical layer.

Difference Between OSI & TCP/IP

	OSI	TCP/IP
i)	Stand for Open System Interconnection	TCP/IP Stand for Transmission Control Protocol
ii)	Developed by ISO 1984.	ARPNet : 1982

The OSI model follows a vertical stack approach. The TCP/IP model follows a horizontal approach.

The OSI model is designed to support multiple network layers. The TCP/IP model is designed to support a single network layer.

* P2P : - (Peer to Peer) In P2P architecture there is an always-on host called the Server which provides service requested from many other hosts called client.

Transmission media :

Transmission media can be defined as anything that can carry information from a source to destination.

On the basis of transmission of data the transmission media can be classified into categories

- 1) Guided (Physical)
- 2) Unguided (wireless)

Diagram :-

Transmission media

Guided media

Unguided media

Twisted Pair, coaxial, fiber optic

Cable

Cable

Cable

Radio, micro, Infra
wave wave wave

i) * Guided transmission media:

Guided media are those that provide a channel from one device to another.

The three guided media commonly used for data transmission are.

(1.) Twisted pair:- A twisted pair consists of two or insulated copper wires, typically about 1 mm thick.

The wires are twisted together in a helical form, just like a DNA molecule.

Type of Twisted Pair

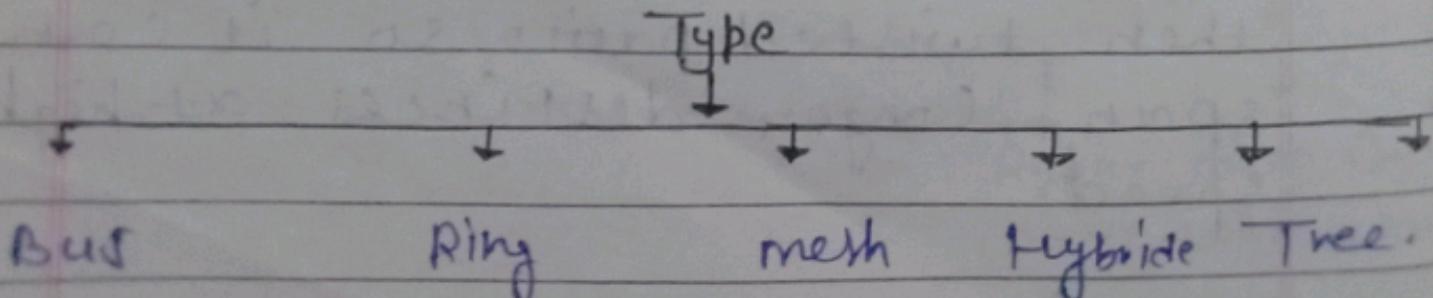
- 1) UTP (unshielded twisted pair)
- 2) Shielded Twisted Pair

* Coaxial Cable:- It has better shielding than twisted pair, so it can span longer distances at high speed.

3.* fiber optics:- A fiber-optics Cable is made of glass or plastic and transmit signals in the form of light.

- * Unguided transmission media:
Unguided media transport electric magnetic waves without using a physical conductors.
 - 1) Radio transmission
 - 2) microwave
 - 3) Infrared.

Topology:- The Physical arrangement of the Computer System node which is connected to each other via communication medium is called topology.



Ring: Ring topology is a type of network topology in which each device is connected to two other devices on either side via an RJ-45 cable or coaxial cable.

Star:- A star network is implemented at a spoke-hub distribution paradigm in computer networks.

Bus:- Bus topology, also known as line topology is a type of network topology in which all devices in the network are connected by one central RJ-45 network cable.

Mesh: Mesh topology is a type of networking where all nodes cooperate to distribute data among each other.

Hybrid:- It is the combination of two or more different topology.

* Difference between Port address, logical address, physical address.

PORT	LOGICAL	PHYSICAL
1) The transport layer header	If packet process we need	If the frames are to be
2) Includes a type of Address.	Network boundary we need	Distributed different.
3) from a specific process that state the defined the on one computer logical address machine, so to specific of the sender address and the process on and receiver. another computer.	Header which header will	Destination Machine's Address.

Ques: How do layers of Internet model correlate to the layers of OSI model. The application, presentation, and session layer of the OSI model are represented by the application layer in the Internet.

Date / /

What is responsible for the link layer in the Internet model.
The Data link layer is responsible for multiplexing data streams, data frame detection, medium access and error control.

* Network Layer:- TCP/IP Stack Index networking Protocol. (IP) Inter uses four Protocol.

ARP, RARP, ICMP, IGMP;

- IP (Internet Networking) It is connectionless and unreliable and best effort delivery service.
- ARP (Address Resolution Protocol) :- it is use associated logical address with physical address.

RARP:- (Reverse Address Resolution protocol) :- allows a host to discover its internet address when its node only physical network to a network a first time one WAN Computer is successfully booted.

ICMP (Internet Control msg Protocol)
it is mechanism used by host and gateway to some get notification of data gram problem due to

Date / /

SNMP : Simple network management protocol. As SNMP represents, it manages various device connected to TCP/IP network.

SMTP : SMTP stand for simple mail Transfer Protocol. It covers methods of sending and receiving email from one client to another over the Internet.

SNMP vs SMTP

Computer and network system connected to the Internet and communicates via the Internet protocol suite , over TCP/IP protocol. SNMP and SMTP are protocols used with TCP/IP protocol stack.