

**Transmission media:** it is a way in which data is transmitted from one place to another

Guided or Wired communication media (Twisted pair cable, Co-axial cable, Fiber-optic cable)

<b>Twisted Pair Cable</b>	
<p>A <b>twisted pair cable</b> comprises of two separate insulated copper wires, which are twisted together and run in parallel. The twists between are helpful in reducing noise (electromagnetic interference) and crosstalk.</p> <p><b>Applications of Twisted-Pair Cables to provide voice and data channels.</b></p> <ul style="list-style-type: none"> <li>• In telephone lines</li> <li>• In DSL lines</li> <li>• In LANs</li> </ul>	<p><b>Reason for Twisting</b></p> <p>All transmissions are prone to noise, interferences, and crosstalks. When the wires are twisted, some part of the noise signals is in the direction of data signals while the other parts are in the opposite directions. Thus the external waves cancel out due to the different twists. The receiver calculates the difference in the voltages of the two wires for retrieving data. Thus a much better immunity against noise is obtained.</p>
<b>Coaxial cables(COAX)</b>	
<p>Coaxial cables, commonly called coax, are copper cables with metal shielding designed to provide <b>immunity against noise and greater bandwidth.</b></p> <p>Coax can <b>transmit signals over larger distances at a higher speed</b> as compared to twisted pair cables.</p> <ul style="list-style-type: none"> <li>•</li> </ul>	<p><b>Applications of Coaxial Cables</b></p> <ul style="list-style-type: none"> <li>• In analog telephone networks: A single coaxial network can carry about 10,000 voice signals.</li> <li>• In digital telephone networks: A coax has a data rate of 600 Mbps.</li> <li>• In cable TV networks</li> <li>• In traditional Ethernet LANs</li> <li>• In MANs</li> </ul>
<b>Optical Fiber Cables</b>	
<ol style="list-style-type: none"> <li>1. Optical fiber cables are transparent, flexible fibers made up of glass or plastic through which light waves can pass.</li> <li>2. Fiber optic cables need to be connected so that there is no leakage of light signals</li> </ol>	<p><b>Applications of Optical Fiber Cables</b></p> <ul style="list-style-type: none"> <li>• <b>Medical</b></li> <li>• <b>Defense/Government</b></li> <li>• <b>Data Storage</b></li> <li>• <b>Telecommunications</b></li> <li>• <b>Networking</b></li> <li>• <b>Industrial/Commercial</b></li> </ul> <p><b>Broadcast/CATV- wiring CATV, HDTV, internet, video on-demand and other applications</b></p>

Cable	Twisted pair	Coaxial cable	Fiber optic
Signal form	electricity	electricity	Light
cost	least	moderate	High
speed	low	moderate	High
Ease of use	Easy to install	Professional installation	Professional installation
reliability	low	moderate	High
Real life application	Telephone network	Tv cable	Data transmission & telephone line
Data transmission rate	10Mbps – bps	100Mbps	>100Gbps
Data transfer range	100m	185m - 500m	-

Unguided Media(Wireless communication):- **Radio waves, Microwaves , Infrared , Bluetooth, Satellite**

- It transport electromagnetic waves without using a physical conductor.
  - The mediums used in wireless communications are air, vacuum and even water.
1. **Radio waves** – are used to transmit television and radio programs.
  2. **Microwaves** – are used to transmit satellite television and for mobile phones.
  3. **Infrared** – is used to transmit information from remote controls.
  4. **Visible light** – is used in photography.

**Radiowaves**- Radio waves are normally **omnidirectional** (useful for **multicasting**, in which there is **one sender but many receivers**.).

- When an antenna transmits radio waves, they are propagated in all directions. This means that the sending and receiving antennas do not have to be aligned.  
**e.g. AM and FM radio stations, cordless phones and televisions**

**Disadvantage of Radio waves**

- Radio waves transmitted by one antenna are susceptible to interference by another antenna that is sending signals of the same frequency

**Microwaves**- are transmitted from the transmitters placed at very **high towers to the receivers at a long distance**.

Microwaves are transmitted in **line of sight fashion**, and also **propagated through the surfaces**.

**Advantages**

- Maintenance easy than cables.
- Suitable when cable can not be used.

**Disadvantages**

- Repeaters are required for long distance communication.
- Less Bandwidth available

**Satellite**

Geostationary satellites are placed around 36000 KM away from the earth's surface.

In satellite communication transmitting station transmits the signals to the satellite. (It is called **up-linking**). After receiving the signals (microwaves) it amplifies them and transmit back to earth in whole visibility area.

Receiving stations at different places can receive these signals. (It is called **down-linking**).

**Advantage**- Area coverage is too large .

**Disadvantage**- High investment

**INFRARED** – is a type of light that is not visible to the human eye. It cannot be used outside a building for communication purposes as cannot pass through solid objects like walls and can be easily contained in a room. Infrared signals cannot be used for long distance communication.

**e.g.** remote control used for TV, DVD players, stereo system , photographers use film that is sensitive to infrared rays to take pictures, doctors use infrared lamps to treat skin diseases and relieve pain of sore muscles, devices used for communication between keyboards, mouse , printers

**BLUETOOTH**- Bluetooth is a specification for the use of low-power radio communications to wirelessly link phones, computers or other network devices over short distances.

Common use on cell phones is to enable communication between mobile phones, laptops, PCs, PDA, printers, digital cameras, mouses, and wireless headsets/earpieces.

It covers short distances up to 10 meters and communicate at low band width at less than 1Mbps

**Network protocol: - HTTP, FTP, PPP, SMTP, TCP/IP, POP3, HTTPS, TELNET, VoIP**

Protocol-is a set of rules that determine how data is transmitted between different devices in network

<p><b>HTTP</b> is a protocol used to transfer files from a web server onto a browser in order to view a web page that is on the internet</p> <p><b>HTTP- (hypertext transfer protocol)-</b></p> <ol style="list-style-type: none"> <li>1. It is used for viewing web pages.</li> <li>2. In standard HTTP, all information is sent in clear text.</li> <li>3. It is vulnerable to hackers.</li> </ol>	<p><b>HTTPS-( hypertext transfer protocol Secure)</b></p> <ol style="list-style-type: none"> <li>1. HTTP with a security feature.</li> <li>2. It encrypts the data that is being retrieved by HTTP.</li> <li>3. It uses encryption algorithms to scramble the data that's being transferred.</li> <li>4. In this all information is sent in encrypted text.</li> </ol>
<p><b>FTP-(file transfer protocol)-</b></p> <ol style="list-style-type: none"> <li>1. It is used to transfer files over a network.</li> <li>2. It is standard protocol that is used to transfer files between computers and servers over a network.</li> <li>3. FTP is the language that computers use to transfer files over a TCP/IP network.</li> <li>4. Sometimes FTP servers will require an account with a username and password and sometimes we can just log in anonymously.</li> <li>5. FTP common uses:             <ol style="list-style-type: none"> <li>a) transferring files between computers.</li> <li>b) gives the ability of website designers to upload files to their web servers.</li> </ol> </li> <li>6. It is not a secure protocol.</li> <li>7. Data being transferred is not encrypted.</li> <li>8. Data is sent in clear text.</li> <li>9. Should only be used on a limited basis.</li> </ol>	<p><b>POP3-(post office protocol 3)</b></p> <ol style="list-style-type: none"> <li>1. It is used for retrieving email from an email server.</li> <li>2. It is download the email to your device from a mail server and only download inbox's email.</li> <li>3. In pop3, the email is deleted on the mail server once it's downloaded to a device.</li> <li>4. It does not sync folders.</li> <li>5. In pop3, downloaded email is viewable without an internet connection.</li> <li>6. POP3 saves storage space on the mail server.</li> </ol> <p><b>Disadvantages:</b></p> <ol style="list-style-type: none"> <li>1. We need a backup plan for our email in case device crashes or is lost.</li> <li>2. Device is more vulnerable to viruses since the emails are fully downloaded.</li> </ol>
<p><b>SMTP-(simple mail transfer protocol)-</b></p> <ol style="list-style-type: none"> <li>1. It is used for sending email i.e. It is designed to send and distribute outgoing E-mail.</li> <li>2. It is a set of commands that authenticates and directs the transfer of email.</li> <li>3. SMTP- we can say smtp is "sending mail to people". It is similar to a mailman.</li> <li>4. It uses TCP protocol. (TCP guarantees email delivery (assuming that the email address exists)).</li> </ol>	<p><b>telnet</b> - is an internet facility that facilitates remote login. Remote login is the process of accessing a network from a remote place without actually being at the actual place of working.</p> <p><b>Q</b> Which protocol is used in creating a connection with a remote machine ?</p> <p><b>Answer:</b> Telnet : It is an older internet utility that allows us to log on to a remote computer system. It also facilitates terminal emulation purposes.</p>
<p><b>Point - to - Point Protocol (PPP)</b> is a communication protocol of the data link layer that is used to transmit multiprotocol data between two directly connected (point-to-point) computers.</p> <p><b>VoIP: Voice over Internet Protocol.</b></p>	<p><b>TCP/IP</b> - for Transmission Control Protocol/Internet Protocol</p> <ol style="list-style-type: none"> <li>1. used to interconnect network devices on the internet</li> <li>2. used as a communications protocol in a private computer network</li> <li>3. TCP/IP specifies how data is exchanged over the internet by providing end-to-end communications</li> </ol>

## Network devices

### (Modem, Ethernet card, RJ45, Repeater, Hub, Switch, Router, Gateway, WIFI card)

A **repeater** is a powerful network hardware device that regenerates an incoming signal from the sender before retransmitting it to the receiver.

OR

**Repeater** is a device that amplifies a signal being transmitted on the network. It is used in long network lines, which exceed the maximum rates distance for a single run.

HUB	Definition	SWITCH
A hub is a common connection point, also known as a network hub, which is used for connection of devices in a network. It works as a central connection for all the devices that are connected through a hub.		A switch is a small hardware device which is used to join multiple computers together with one local area network (LAN).

#### Difference between HUB and SWITCH

A Hub works on the basis of broadcasting.	Switch works on the basis of MAC address.
A Hub is a multiport repeater in which a signal introduced at the input of any port appears at the output of the all available ports.	A Switch is a tele-communication device which receives a message from any device connected to it and then transmits the message only to the device for which the message is intended.
Hub is not an intelligent device that may include amplifier on repeater.	A Switch is an intelligent device as it passes on the message to the selective device by inspecting the address.
Hub is cheaper as compared to switch	Switch is an expensive device than hub.

**Modem** is a device that enables a computer to send or receive data over telephone or cable lines.

The data stored on the computer is digital whereas a telephone line or cable wire can transmit only analog data.

The **main function of the modem** is to convert digital signal into analog and vice versa.

An **Ethernet card** is the communications hub for your computer; it connects to a network using a network cable.

The **gateway** converts information, data or other communications from one protocol or format to another. A router may perform some of the functions of a gateway. An Internet gateway can transfer communications between an enterprise network and the Internet.

**RJ-45** is short for Registered Jack-45. It is an eight-wire connector, used to connect computers on LAN's especially Ethernets.

OR

RJ – 45. It is an eight wired connectors used to connect computers on a LAN.

**Router-** is a device that establishes connection between two network and it can handle network with different protocols.

Routers make sure that the data packets are travelling through the best possible paths to reach their destination.

For example, a router can link Ethernet with any other type of network.

**Wi-Fi Card** - are small and portable cards that allow the computer to connect to the internet through a wireless network. The transmission is through the use of radio waves.

## Network types: types of networks (PAN, LAN, MAN, WAN)

### Personal Area Network(PAN) –

- Spread in the proximity of an individual. Cover an area of a few meters radius.
- Set up using **guided media(USB cable) or** unguided media (**Bluetooth, Infrared**).
- Owned, controlled, and managed by a single person.

Examples: A network of devices such as computer, Phone, MP3/MP4 Player, Camera etc. Transferring songs from one cell phone to another is a PAN of two phones. Transferring files from a PC to an MP3 player is a PAN between the two.

### Local Area Network (LAN) –

- LANs are the most frequently used/discussed networks.
- It is one of the most common one of the simplest types of network.
- It is designed for small physical areas such as an office, group of buildings.
- Any of different types of topologies can be used to design LAN like Star, Ring, Bus, Tree etc.

Advantages of LAN	Disadvantages of LAN
<ul style="list-style-type: none"><li>• Resource Sharing</li><li>• Software Applications Sharing</li><li>• Easy and Cheap Communication</li><li>• Centralized Data</li><li>• Data Security</li><li>• Internet Sharing</li></ul>	<ul style="list-style-type: none"><li>• High Setup Cost</li><li>• Privacy Violations</li><li>• Data Security Threat</li><li>• LAN Maintenance Job</li><li>• Covers Limited Area</li></ul>

Example -limited area (within building, school, office),

### Metropolitan Area Network(MAN):–

- Spread within a city .
- Cover an area of a few kilometres to a few hundred kilometres radius.
- Set up using all types of all guided and unguided media.
- Owned and operated by a government body or a large corporation.

Example – network(connecting computers) within city

**Wide Area Network (WAN)** –Slightly more complex than a LAN, a WAN connects computers across longer physical distances. The Internet is the most basic example of a WAN, connecting all computers together around the world. Because of a WAN's vast reach, it is typically owned and maintained by any single person or owner.

### Characteristics of WAN

- Covers large distances(states, countries, continents).
- Communication medium like satellite, public telephone networks etc and routers are used establish connection.

**Examples:** A network of ATMs, BANKs, National Government Offices, International Organizations' Offices etc., spread over a country, continent, or covering many continents.

Advantages of WAN	Disadvantages of WAN
<ul style="list-style-type: none"><li>• Long distance business can connect on the one network.</li><li>• Shares software and resources</li></ul>	<ul style="list-style-type: none"><li>• Need a good firewall to restrict unauthorized access</li></ul>

<ul style="list-style-type: none"> <li>• Messages can be sent very quickly to wide range of nodes</li> <li>• Hardware devices can be shared.</li> </ul>	<ul style="list-style-type: none"> <li>• Setting up a network can be an expensive, slow and complicated.</li> <li>• Maintaining a network is a full-time job</li> <li>• Security is a major issue when many different people have the ability to use information</li> </ul>
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A Good Network layout provides the following features			
• Communication speed	• Security	• File sharing	• Scalability
• Back up and Roll back is easy	• Software and Hardware sharing	• Reliability	

<p>How to decide Network Layout –</p> <ul style="list-style-type: none"> <li>❖ The network layout can be best which provide less installation and maintenance cost as well as easy installation and maintenance.</li> <li>❖ It is only possible when it is properly designed with shortest cable length and fulfill our network requirements.</li> </ul>
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Web page	Website
Single document on the internet	A collection of related web pages linked together under same domain
Development requires minimum amount of time	Development takes a long time
Web page has content about a single entity	Has content about several entities
Address of the URL of web page depends on website	URL of website does not depends upon webpage
It is the content that is to be displayed on a website	Website is a place used to display the content
Webpage URL has an extension Like cbseacademics.in/syllabus.html	No extension used in URL of a website cbseacademics.in

Baud & bits per second (bps,Kbps,Mbps,Gbps,Tbps)- It's used to measurement for the information carry of a communication channel.Measurement Units :-bit

1 Byte= 8 bits, 1 Kbps ( Kilo Byte Per Second)= 1024 Bytes ,

1 Kbps (kilobits Per Second) = 1024 bits,1 Mbps ( Mega bits Per Second )=1024 Kbps

- **Bandwidth(data transfer rate) (Hz, KHz,MHz)**- amount of information transmitted or receives per unit time.

IP address, switching techniques (Circuit switching, Packet switching)

**Topology** - is the arrangement of the various elements (links, nodes, etc.) of a computer network.

### **BUS Topology**

Bus topology is a network type in which every computer and network device is connected to single cable. When it has exactly two endpoints, then it is called Linear Bus topology. It transmits data only in one direction. Every device is connected to a single cable

#### **Advantages-**

1) short cable length 2) easy to extend

#### **Disadvantages-**

1) fault diagnosis is difficult 2) nodes must be intelligent to select the data sent.

### **STAR Topology**

In this type of topology all the computers are connected to a **single hub through a cable**. This **hub is the central node** and all others nodes are connected to the central node. It is used in most existing information networks involving data processing or voice communications

**Advantages-** 1) one device per connection 2) easy to extend

**Disadvantages** – 1) long cable length 2) central node dependency

### **TREE Topology**

It has a root node and all other nodes are connected to it forming a hierarchy. It is also called **hierarchical topology**. It should at least have three levels to the hierarchy.

**Advantages-** 1) Easy to extend 2) fault isolation is easy

**Disadvantages** – 1) dependent on the root computer 2) complex access protocols

#### **Q Write two advantage and disadvantage of networks.**

Ans **Advantage:**

☒ We can share resources such as printers and scanners.

☒ Can share data and access file from any computer.

**Disadvantage:**

☒ Server faults stop applications from being available.

☒ Network faults can cause loss of data.

#### **Q What are the factors that must be considered before making a choice for the topology?**

Ans There are number of factors to consider in before making a choice for the topology, the most important of which are as following :

**(a) Cost.**

**(b) Flexibility**

**(c) Reliability**

**Q What are the similarities and differences between bus and tree topologies?**

Ans . **Similarities:**

☒ In both Bus and Tree topologies transmission can be done in both the directions, and can be received by all other stations.

☒ In both cases, there is no need to remove packets from the medium.

**Difference:**

☒ Bus topology is slower as compared to tree topology of network.

☒ Tree topology is expensive as compared to Bus Topology

**Q .Write the two advantages and two disadvantages of Bus Topology in network.**

Ans **Advantage:**

☒ Easy to connect a computer or peripheral to a linear bus.

☒ Requires less cable length than a star topology.

**Disadvantage :**

☒ Slower as compared to tree and star topologies of network

☒ Breakage of wire at any point disturbs the entire network

**Q Briefly mention two advantages and two disadvantages of Star Topology in network.**

Ans **Advantage:**

☒ Easy to install and wire.

☒ No disruptions to the network when connecting or removing devices.

**Disadvantage :**

☒ Requires more cable length than a linear topology.

☒ If the hub, switch, or concentrator fails, nodes attached are disabled.