Unit I

Network

Introduction to network

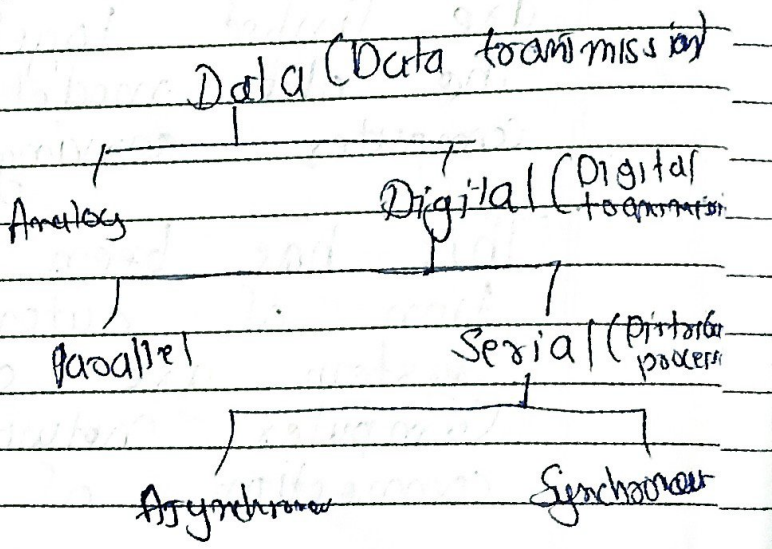
The field of communication is not now people have been communicating since early humans grunted and scratched pictures on cave walls. For thousands of year people communicated using little more than words, parchments, stone tablets and smoke signals. When we communicate; we are ~~storing~~ sharing information. This sharing can be local or remote communication between computers can be discussed in terms of levels user wants to transfer information from one location to other, whereas at the lowest level data are represented by binary information units (bits) moving between computer.

Network means a link, computers are linked together to share information. The old model is of a single computer serving all the organization.

This has been replaced by an interconnection of autonomous computers. These system are called computer networks. Computer network means the interconnection of autonomous computers.

Needs of Network

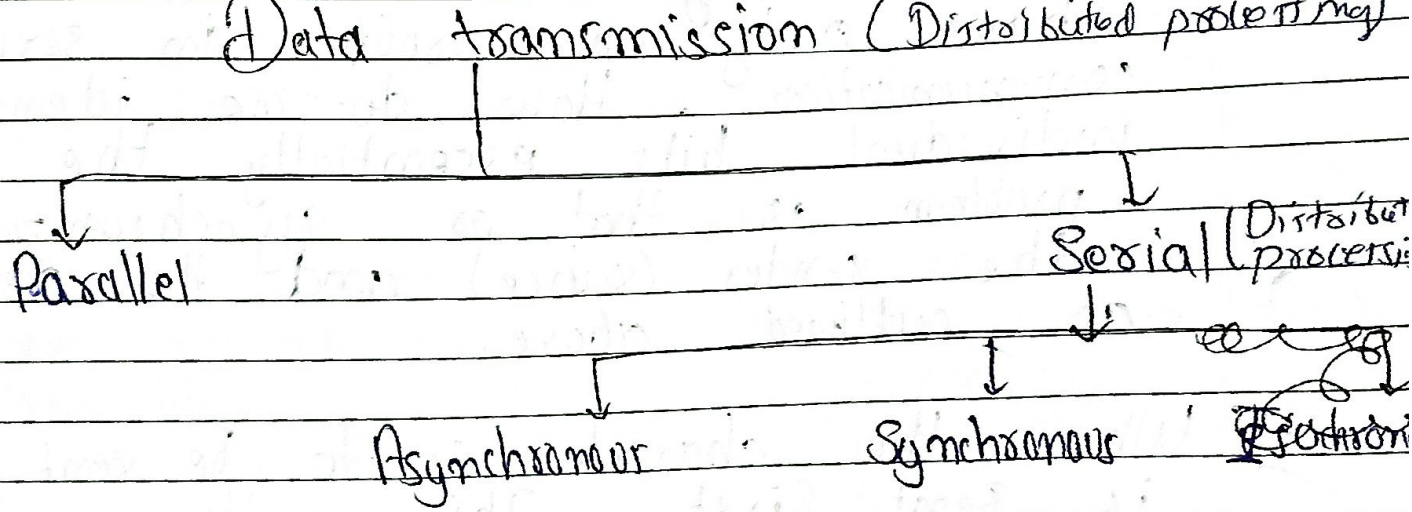
1) To provide sharing of resource such as information or processors.
2) To provide inter processor communication among users and processors.
3) It provides the network use with maximum performance at minimum cost.
4) It provides centralised control for a geographically distributed system.
5) It provider compatibility between dissimilar equipment and software.
6) It provides centralised management and allocation of network resources.
7) It provides distribution of processing function.



attenuation:- the loss of signal strength in networking cables or connections.

Digital transmission (Distributed processing)

A means of transmitting both digital and analog signals. Usually assume the signals is carrying digital (or digitized) data. can only be propogated a limited distance before attenuation distorts the signal and compromises the data integrity. A repeater retrieves the (digital) signal, recovers the (digital) data, e.g. a pattern of 1's and 0's; retransmits a new signal. A similar technique used for the analog signal where we assume that the data is digital or digitized; Repeater recovers the (digital or digitized) data and amplifies only the data and retransmits. Digital transmission is the preferred method for several reasons.



Data transmission

Transmission of binary data across a link can be accomplished in either parallel or serial mode. In parallel mode multiple bits are sent with each clock tick. In serial mode, a bit is sent with each clock tick. While there is only one way to send parallel data, following are three subclasses of serial transmission:

1) Asynchronous
2) Synchronous

1) Asynchronous communication mode

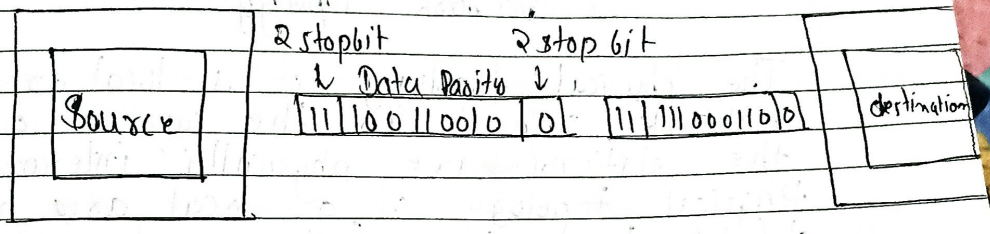
We learnt why serial communication is preferred to parallel communication is ~~is~~ over a long distance. However, we have only one problem in serial communication. How do we identify individual bits essentially the problem is that of synchronizing the sender (source) and the receiver as outlined above.

1) When the character is to be sent bit 0 is sent first. This positive voltage is called start bit. All the bit of character, according to scheme used (ASCII / EBCDIC) then follows each of

which could have 0 or 1 value.

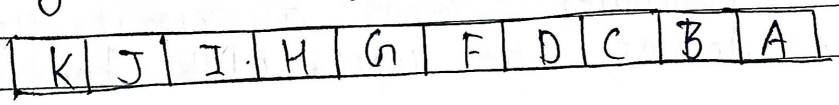
2) A parity bit, if used then follows.

3) On the end 1, 1.5 or 2 stop bits are added. The stop bit again corresponds to the idle state, which is bit. On the context 1.5 bits only means that the signal with negative denoting 1 is bit 1. On this context 1.5 bit only means that signal with negative voltage denoting 1 is generated for 1.5 times the normal bit interval.



Synchronous Communication MODE

On a synchronous communication the whole block of data bits is transferred at once, instead of one character at a time. The block of bits may consist 0/1 character. It could well be a digitized Image, it could be anything.



Transmitter → Receiver

The point is: How does the receiver know the first character or when to start the clock for sampling? In order to perform this synchronization, each data block is preceded with a unique synchronizing bit pattern. We use the syn (abbreviation of synchronization) transmission control character.

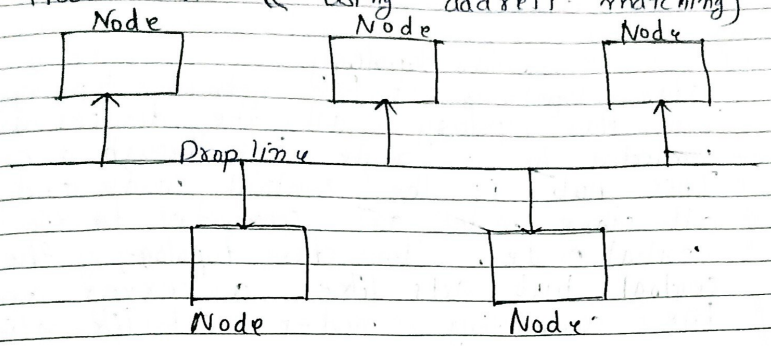
Network Topology

The physical topology of a local area network refers to the way in which the stations (nodes) are physically interconnected. Physical topology of a local area network should have the following desirable features.

Bus topology

Bus topology also called horizontal topology. On bus topology, multiple devices are connected one by one, by means of connectors or drop cables. When one computer sends a signal up (and down) the wire, it calls the

All the computers on the network receive the the information, but only one accepts the information (using address matching)



Advantages of Bus topology:

- In bus topology, nodes are directly connected to the cable without passing through a hub.
- A failure in one node will not have any effect on other nodes
- Coaxial or twisted pair cables are mainly used in bus based networks.
- low cost

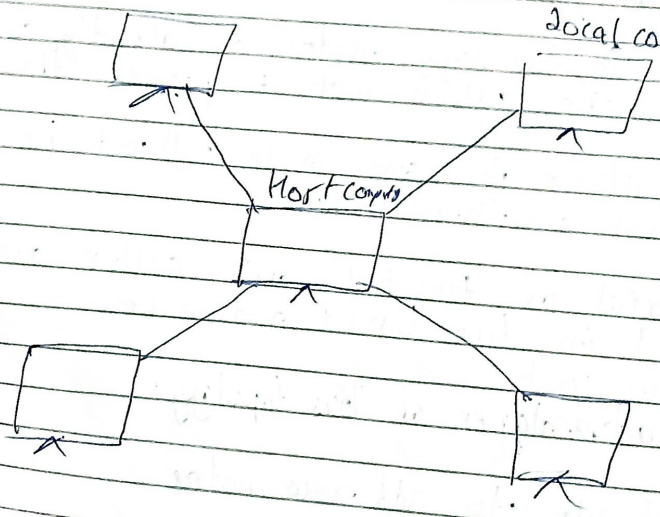
Disadvantages of Bus topology:

- Difficult to add new nodes
- Failure of cable affect all devices on the networks
- Security is very low

- Adding new devices to the network could slow down networks.

Star topology

Star topology is a network topology. In star topology, all the devices are connected to a single hub through a cable. This hub is the central node and all other nodes are connected to the central node. In star topology, the central hub acts like a server and the connecting nodes act like clients.



Advantage of Star topology

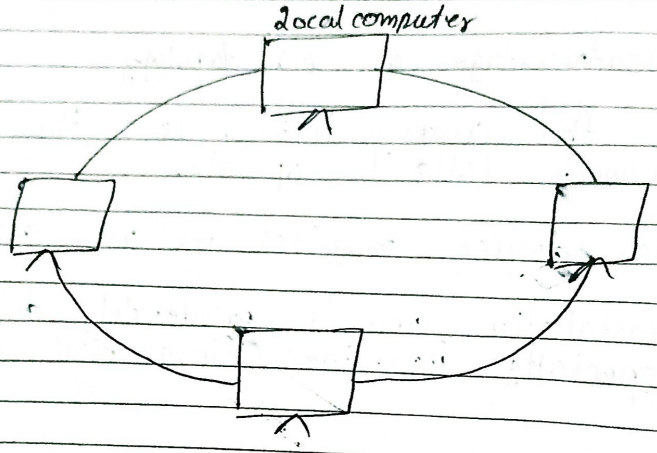
- It is easy to modify and add new nodes to a star network without disturbing the rest of network.
- Trouble shooting techniques are easy
- Failures of any node do not bring down the whole star network.

Disadvantage of star topology

- If the central hub fails, the whole network fails to operate.
- Each device requires its own cable segment
- Installation can be moderately difficult, especially in the hierarchical network.

Ring topology

In a ring topology, each computer is connected to the next computer, with the last one connected to the first. The signals travel on the cable is only one direction, since each computer retransmits what it receives. Ring is an active network. Termination is not required.



Advantage of Ring topology

1) Cable failures are easily found.

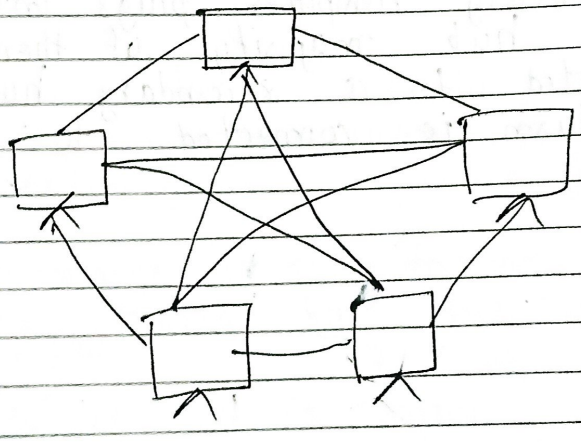
2) Because every node is given equal access to the token, no single node can monopolize the network.

Disadvantage of Ring topology

1) Adding or removing node break the network.
2) It is difficult to troubleshoot a ring network.
3) Failure of one node on the ring can affect the whole network.
4) Cost of cable is more in ring network.

Mesh topology

The mesh topology has a link between each device in the network. It is more difficult to install as the number of devices increases. Mesh networks are easy to troubleshoot. Much of the bandwidth available in mesh configuration is wasted.



Advantage of mesh topology

1) Troubleshooting is easy.
2) Isolation of network failures is easy.

Disadvantage of mesh topology

1) Difficulty in installation
2) Costly of maintaining redundant links.
3) Difficulty of reconfiguration

Tree topology

A tree topology is a variation of a star. As in a star, nodes in a tree are linked to a central hub that controls the traffic to the network. However, not every computer plugs into the control hub majority of them are connected to a secondary hub which in turn is connected to the central hub.

1)

2)

1)

2)

Advantages of tree topology

1) It allows more devices to be attached to a single hub and can therefore increase the distance a signal can travel between devices.

2) It allows the network to isolate and prioritise communication from different computers.

Disadvantages of tree topology

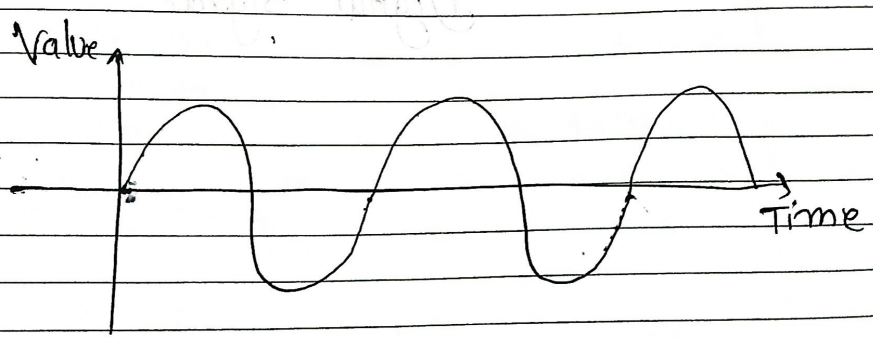
1) If the central hub fails the system break down.

2) The cabling cost is more.

Transmission Technology
(Analog Signal or Digital Signal)

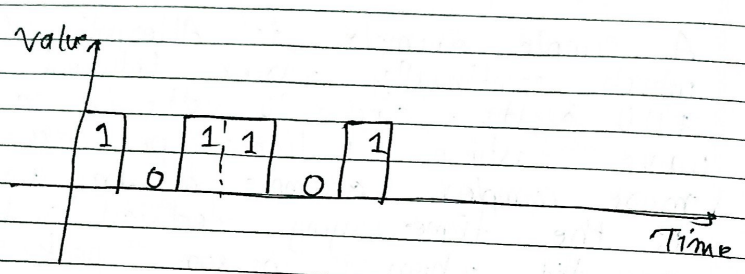
* **Analog Signal :** An analog signal is a continuous wave form that changes smoothly over time. An analog signal can take on any value from a specified range of values. As the wave move from value A to B, it passes thro and includes an infinite number of values along its path.

A simple example is Alternating Current (AC), which continually varies between about +110 volts and -110 volts in a ~~single~~ sine wave fashion 60 times per second. A more complex example of an analog signal is the timevarying electrical voltage generated when a person speaks into a dynamic microphone or telephone.



Analog Signal

★ Digital signal: Transmission of signals that vary discretely with time between two values of some physical quantity, one value representing the binary number 0 and the other representing 1. With copper cabling, the variable quantity is typically the voltage or the electrical potential. With fibre optic cabling or wireless communication, variation in intensity or some other physical quantity is used.

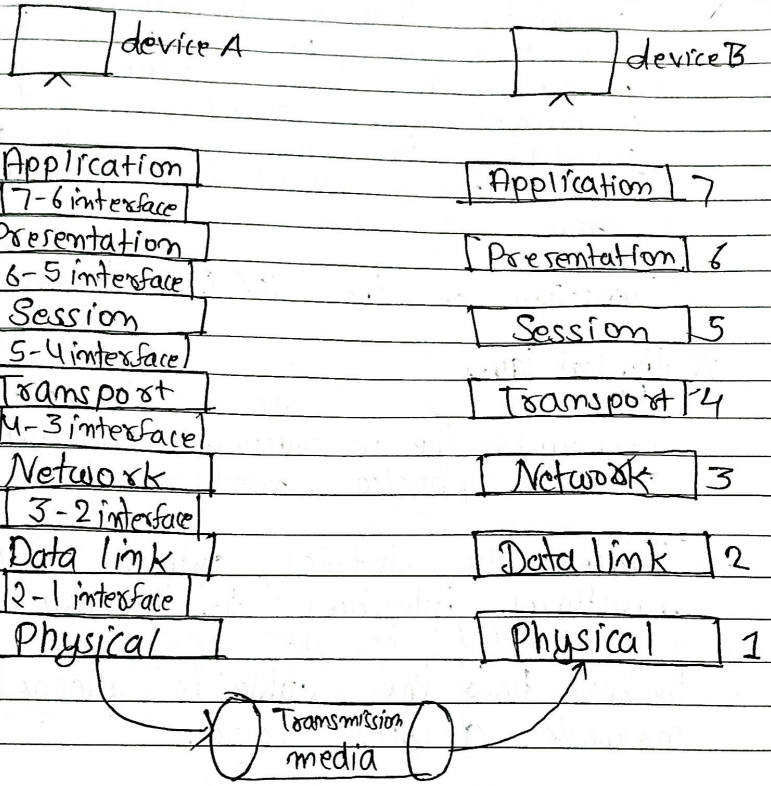


Digital Signal

Distributed Processing

Parallel Trans

OSI Model



Layered architecture of the ISO/OSI Model

Functions of the ISO/OSI layers

1. Physical layer

OSI stands for open system interconnection.

- This layered approach was selected as a basic for the OSI Reference Model to provide flexibility and open-ended capability through defined interfaces. The interfaces permit some layers to be changed while leaving other layers unchanged. (In principle, as long as standard interfaces to the adjacent layers are adhered to, an implementation can still work.) It is a 7 layer architecture with each layer having specific functionality to perform.

Function of the ISO/OSI layers

1. Physical layer (GFC)

- Physical layer is the lowest layer of the OSI model.
- Transmits the unstructured raw bit stream over a physical medium.
- Relates the electrical, optical, mechanical and functional interfaces to the cable.
- Bit rate control: The physical layer also defines the transmission rate i.e. the no. of bits sent per second.
- Defines how the cable is attached to the network adapter card.
- Defines data encoding and bit synchronization.
- Physical topology :- Physical layer specifies how the different nodes are arranged.
- Transmission mode :- Physical layer also defines how the data flows between the two connected devices like simplex, half-duplex and full duplex.

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2. Data link layer
- The data link layer is responsible for the node-to node delivery of the message.
- Sends data frames from the Network layer to the physical layer.
- Packages raw bits into frames for the Network layer at the receiving end.
- Responsible for providing errors free transmission of frames through the physical layer. It makes the physical layer appear error free to the upper layer.

3. Network layer (NFCn)
- The network layer is responsible for the source to destination delivery of a packet, possible across multiple networks.
- Responsible for addressing messages and translating logical addresses and names into physical addresses.
- The network layer works for the transmission of data from one host to the other located in different networks.
- Determines the route from the source to the destination computer. i.e selection of the shortest path to transmit the packet, from the number of routes available.
- Manages traffic such as packet switching, routing and controlling the congestion of data.

4. Transport layer (NFCn)
- Responsible for packet creation.
- Provides an additional connection level beneath the

Session layer.

- Ensure that packet are delivered error free, insequence with no loser or duplications.
- Unpacks, reassembler and sends recipt of messages at the receiving end.
- Provider flow control, error handling and solver transmission problem.

5. Session layer

- Allows to application on different computer to stablish use and end a connection called a session.
- Performs name recognition and security.
- Provide synchronization by placing check point in the data stream.
- Implements dialogue control between communicating processes.
- Dialog controller: The session layer allows two systems to start communication with each other in half duplex or full-duplex.

6. Presentation layer (translation layer)
- The data from the application layer is extracted here
- Determines the format used to exchange data among the networked computers.
- Translates data from a format from the application layer into a intermediate format and manipulated as per the required format to transmit over the network
- Responsible for protocol conversion, data translation, data encryption, data compression, character conversion and graphics expansion.
- Redirector operates at this level.

7. Application layer
- Server as a window for application to access network service.
- Handles general network access, flow control and error recovery.
- The application layer enables the user, whether human or software, to access the network.
- Mail service: Provide email service

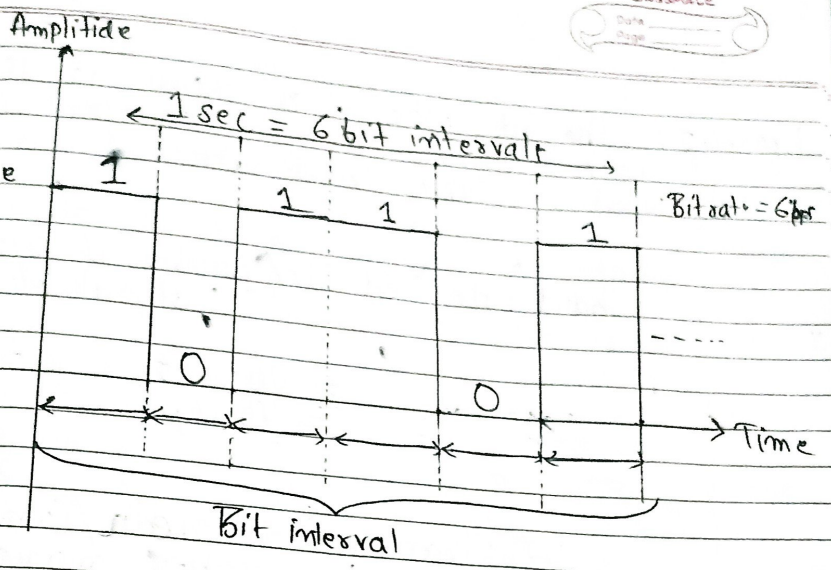
Data - rate and limits

Convert the analog signal of sound waves produced by human speech into digital electrical pulses by sampling the sound wave at discrete intervals.

Bit interval and baud rate are used to describe digital signals.

The bit interval is the time required to send one signal bit. The bit rate is the number of bit intervals per second. This means that the bit rate is number of bits sent in one second, usually expressed in bits per second (bps)

Baud rate refers to the number of signal units per second that are required to represent those bits. Baud rate is less than or equal to the bit rate.



Bit rate and Bit interval

Example 1: A signal carries three bits in each signal element. If 1200 signal elements are sent per second, find the baud rate and the bit rate.

Solve:- Baud rate = Number of signal elements
= 1200 bps

Bit rate = baud rate X Number of bits per signal element

= 1200 X 3 = 3600 bps.

Example 2: The bit rate of a signal is 2000. If each signal element carries five bits, what is the baud rate?

Solve

Baud rate = Bit rate / Number of bits per signal element

= 2000/5

= 400 bps

1)

Transmission media / Communication channel / Communication media

Media is the general term used to describe the data path that forms the physical channel between sender and receiver. Transmission media can be twisted pair wire such as that used for telephone installation (wired media are refferred to as bounded media and wireless media are referred to as bounded media and wireless media are sometimes referred to as unbounded media.

2)

Classification of transmission media

The transmission medium can be mainly classified into two types

1) Bounded or guided media
2) Unbounded or Un-guided media

1) Bounded or guided media

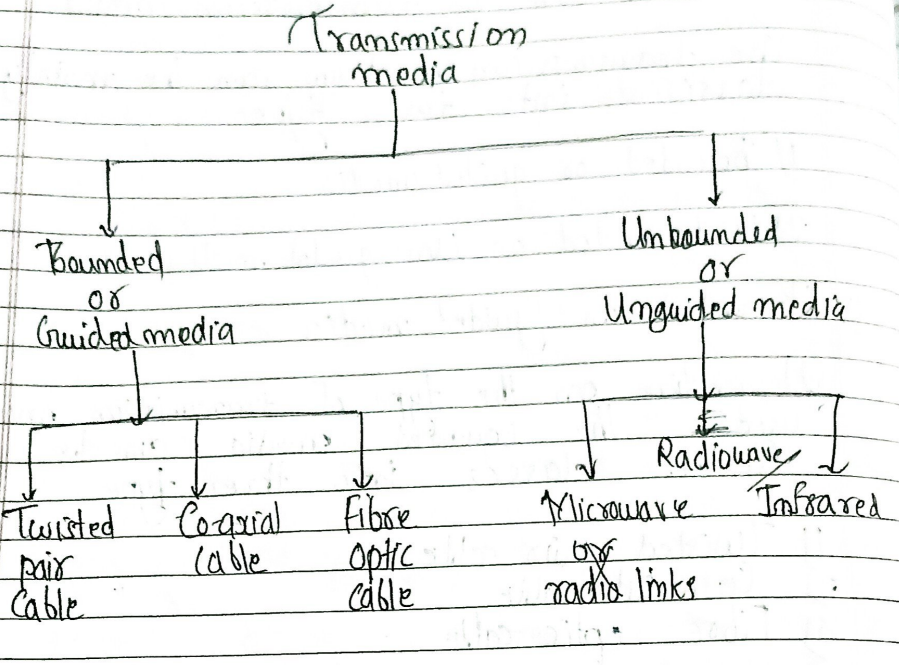
Depending on the type of transmission medium used, the bounded media can be further classes into three type.

1) Twisted pair cable
2) Co-axial cable
3) Fibre optic cable

2) Unbounded or Unguided media

Depending on the method of transmission the unbounded media can be further classified into three types

1) Radio links
2) Microwave links ~~or Radio links~~
3) Infrared / Radio waves



Twisted Pair Cable

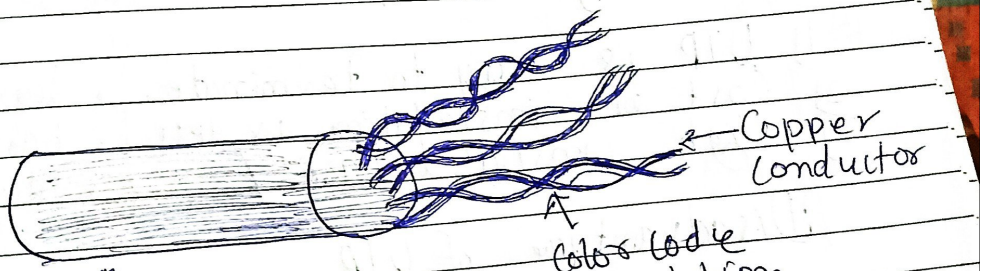
Twisted pair is least expensive and most widely used. A twisted pair (TP) consists of two insulated copper wires arranged in regular spiral pattern. A wire pair acts as a single communication link. TP may be used to transmit both analog and digital signal. Compared to other commonly used transmission media, TP is limited in distance, bandwidth and data rate when

two copper wires conduct electric signal in close proximity, a certain amount of electromagnetic interference (EMI) occurs. This type of interference is called cross talk. Twisting the copper wire reduces cross talk. TP cable comes in two varieties

- Unshielded twisted pair cable
- Shielded twisted pair cable

Unshielded twisted pair (UTP) cable

UTP is a set of twisted pair of cable within a plastic sheet. UTP is ordinary telephone wire. This is the least expensive of all the transmission media. Commonly used for LAN, and is easy to work with and simple to install.



Uses of UTP :

1) Used in LAN. It support upto 100 Mbps data transmission speed. (Mega bit per second)

2) It support transmission speed of 16 Mbps and three twists per foot.

3) It support data transmission speed upto 10 Mbps. At least device twist per foot and used in telephone system.

4) It support data transmission speed upto 44 Mbps, and suitable for voice data transmission.

5) Mostly used in telephone system and UTP is suitable for voice and low speed data communication.

Advantage of UTP

1) UTP is easy to terminate.
2) Cost of installation is less.
3) High installed base.

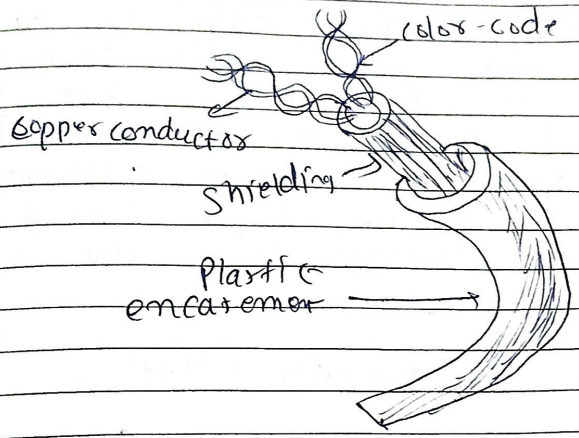
- least expensive
- Easy to install
- High-speed capacity

Disadvantage of UTP

1) It is very noisy.
2) It covers less distance.
3) UTP suffers from interference.

Shielded twisted Pair (STP) cable

STP offers a protective shielded around the copper wire. STP provides better performance a lower data rates. They are not commonly used in network. Installation of STP is easy. Special connectors are required for installation.



Application of STP cable

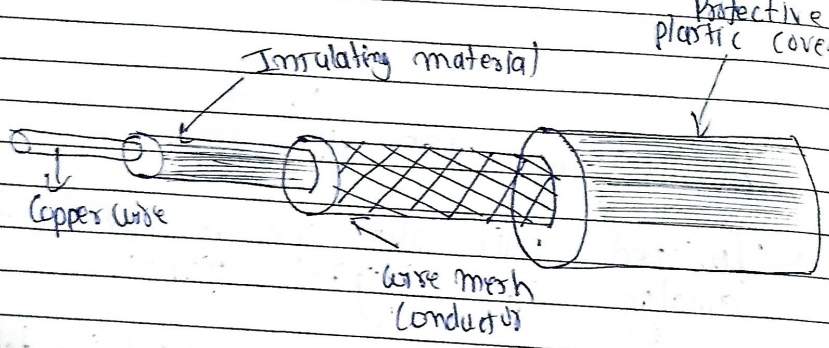
1) Twisted pair cable can be used for both analog and digital signal.

2) Twisted pair cable are used in telephone number

3) In LAN, TP wires are mainly used for low cost, low performance application.

Coaxial Cable

It is made up of two conductors that share a common axis. It consists of hollow outer cylindrical conductor that surrounds a single inner wire conductor. Coaxial cable is used to transmit both analog and digital signal inner wire conductor. Data transfer rate of coaxial cable is in between TP and Fibre optic cable. Coaxial cable is classified by size (RG) and by the cable resistance to direct or alternating electric currents and speed of twisted pa Coaxial cable is more than twisted pair cable



Characteristics of Co-axial cable

Coaxial cable has the following characteristics

1) 10 Mbps is the transmission rate.
2) Maximum cable length for thinnest is 185 meters and for thicknet is 500 meters.
3) Flexible and easy to work with thinnest
4) Ethernet designation to 10 base 2 (thinnest) or 10 base 5 (thicknest)
5) Less expensive than fibre optics cable but more expensive then twisted pair.
- Coaxial cable is used to transmit both analog and digital signal
6) Good resistance to electrical interference.

Advantage of Co-axial cable

1) Coaxial cable can be used for data transmission. i.e. analog and digital data transmission.
2) It has higher bandwidth.
3) Easy to handle and relatively inexpensive as compared to fibre optic cable.
4) It can be used for longer distance of

higher data rates.

5) Excellent noise immunity.

Disadvantage of Co axial cable

1) Distance is limited

2) Number of node connection is limited.

3) Proper connectors and terminations are must.

Application of Coaxial cable

1) In analog and digital data transmission.

2) In telephone networks.

3) In ethernet LAN.

4) In cable television network.

Fibre optic cable (FOC)

A fibre optic cable is a light pipe which is used to carry a light beam from one place to another plat. Light is an electromagnetic signal and can be modulated by information. Since the frequency of light is extremely high, it can accomodate wide bandwidths of information, also highes data rate can be achieved achieved with excellent reliability. The modulated light travel along the fibre and at the receiving end, is converted to an electrical signal by means of a photo electric cell. Thus the original input signal is recovered at the receiving end.

Advantage of fibre optic cable

1) In fibre optical cable both analog and digital are used.

2) In fibre optical cable speed of data transfer is more than twisted pair cable and coaxial cable.

3) In fibre optical cable, fibre glass is used that why the speed of data transfer is high.

4) The chance of data loss is very less in fibre optical cable

5) Fiber optical is longlastic.

6) For long distance data transmission this cable is used.

7) Fiber optic cable is secure and easy to install.

Disadvantages of fiber optic cable

1) High initial cost :- The initial installation or setting up cost is very high compared to all other systems

2) Maintenance and repairing cost :- The maintenance and repairing of the fibre optic systems is not only difficult but expensive also.

Types of Fibers optic cable

There are three types of Fibre optic cable

1) Plastic core and cladding

2) Glass core with plastic cladding

3) Glass core and glass cladding

1) Plastic core and cladding : Plastic fibers have several advantages over glass fiber. First, plastic fibers are more flexible and consequently, more rugged than glass. They are easy to install, can better withstand stress, are less expensive, and weight approximately 60% less than glass. The disadvantages of plastic fibers is their high attenuation characteristic; they do not propogate light as efficiently as glass. Consequently, plastic fiber are limited to relatively short runs, such as within a single building or a building complex.

2) Glass core with plastic cladding : Fibers with glass cores exhibit low attenuation characteristics. However, PCS fibers and slightly better than SCS fibers. Also, PCS fibers are less affected by radiation and are therefore more attractive to military applications.

3) Glass core and glass cladding :- SCS fibers have the best propagation characteristics and they are easier to terminate than PCS fibers. Unfortunately, SCS cables are the least rugged, and they are more susceptible to increases

in attenuation when exposed to radiation.

2) Unguided media

a) Radio transmission

Radio waves have frequencies between 10 kiloherz (KHz) and 1 Giga herz (GHz). Radio waves include the following types

a) Short wave

b) Very high frequency (VHF) television and FM radio

c) Ultra high frequency (UHF) radio and television.

Radio frequency characteristics.

Some of the characteristics of radio waves are as follows :-

a) Radio waves are easy to generate

b) They can travel long distance.

c) They can penetrate building easily. so they are widely used for communication both indoors and outdoors.

d) Radio waves are omni directional meaning that they travel in all direction from the source, so that the transmitter and receiver do not have to be carefully aligned physically.

e) The properties of radio waves are frequency dependent. At low frequencies, radio waves pass through obstacles well, but the power falls off sharply with distance from the source.

(b) Microwave Transmission

Above 100 MHz, the waves travel in straight line and can therefore be narrowly focused concentrating all the energy into a small beam. Using a parabolic antenna (like the satellite TV dish) gives a much higher signal to noise ratio, but the transmitting and receiving antennas must be accurately aligned with each other. Before the advent of fiber optics, these microwaves formed the heart of the long distance telephone transmission system. In its simplest form, the microwave link can be one hop, consisting of one pair of antennas spaced as little as one or two km apart, or can be a backbone, including multiple several hops, spanning several thousand kilometers. A single hop is typically 30 to 60 km in relatively flat regions for frequencies in the 2 to 8 GHz bands. b/w mountain peaks, a very long hop length can be achieved. Hop distance is excess of 200 km are in existence.

The voice, video or data channels are combined by a technique known as multiplexing to produce a BB signal. The signal is frequency modulated to an IF and then upconverted (heterodyned) to the RF for transmission through the atmosphere. The reverse process occurs at the receiver. The microwave transmission frequencies are within the approximate range 2 to 24 GHz. The frequency bands used for digital microwave radio are recommended by the CCIR.

Characteristics of microwave communication

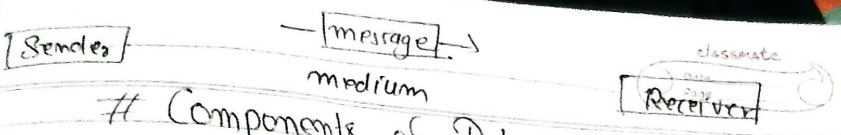
1) Microwave transmission is weather and frequency dependend

2) The frequency band of 10 GHz is the routine use.

3) Microwave communication is widely used for long distance telephone, communication, cellular telephone communication / cellular telephone, television distribution and other users, that a several shortage of spectrum has developed.

4) Microwave is relatively inexpensive as compared to fiber optics system.

5) Microwave system can carry 2,50,000 voice channels at the same time.



Components of Data communication

A communication system is made up of the following components.

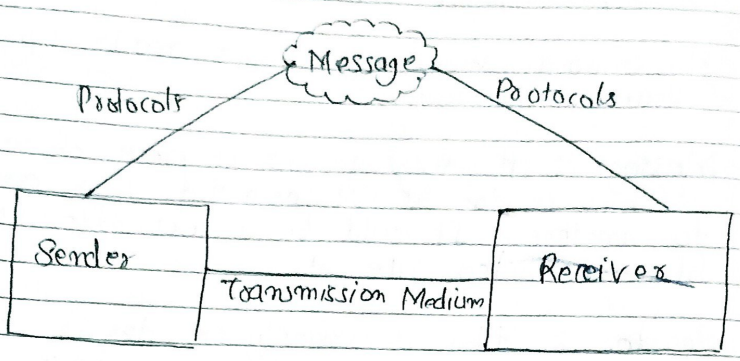
1. Message : A message is a piece of information that is to be transmitted from one person to another. It could be a text file, an audio file, a video file etc.

2. Sender : It is simply a device that sends data message. It can be a computer, mobile, telephone, laptop, video camera, or workstation etc.

3. Receiver : It is a device that receives messages. It can be a computer, telephone mobile, workstation, etc.

4. Transmission Medium / Communication channels : Communication channels are the medium that connect two or more workstations. Workstations can be connected by either wired media or wireless media.

5 Protocol (Set of rules) : When someone sends the data (The sender), it should be understandable to the receiver also otherwise it is meaningless.
For ex :- Sonali (Khushi) sends a message to lucky. If khushi writes in ~~English~~ Tamil and lucky cannot understand ~~english~~ Tamil, it is a meaningless conversation.



Transmission mode / types of communication mode

Communication between two devices can be simplex, half duplex and full duplex.

(i) Simplex :- (one direction only)

In simplex mode, the communication is unidirectional, as on a one way street. Only one of the two device on a link can transmit; the other can only receive.

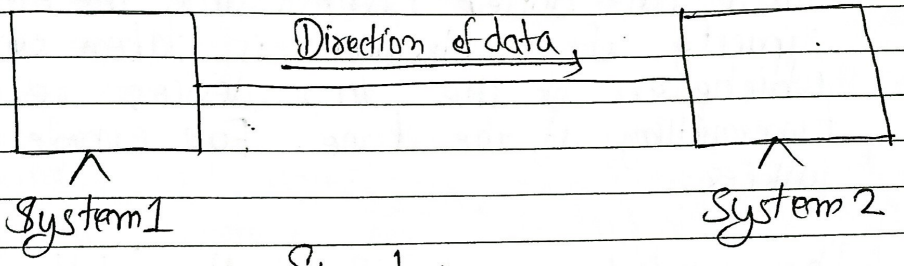
The examples include

- TV and radio broadcasting or pager.
- Keyboards and traditional monitors are both examples of simplex devices. The keyboard can only introduce input; the monitor can

only accept output.

Simplex is a form of communication in which signals are sent in only one direction. This is different from duplex transmission, in which signals can simultaneously be sent and received by a station. ~~, and from~~

Simplex transmission occurs in many common communication applications, the most obvious being broadcast and cable television. It is not used in true network communication because stations on a network generally need to communicate both ways. Some forms of network communication might seem to be simplex in nature, such as streaming audio or video, but the communication actually takes place using bidirectional network traffic, usually Transmission Control Protocol {TCP} traffic.

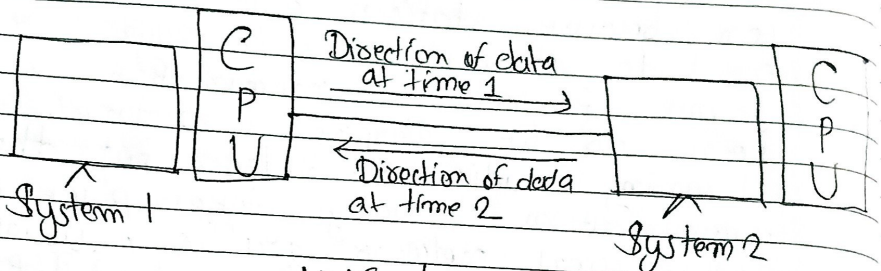


Simplex

(ii) Half-duplex

In half-duplex mode, each station can both transmit and receive, but not at the same time. For half-duplex, both end devices can send and receive (they must alternate).

When one device is sending, the other can only receive, and vice versa.



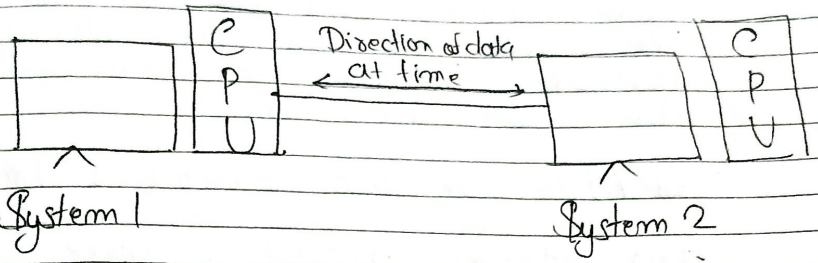
Half duplex

In a half-duplex transmission, the entire capacity of a channel is taken over by whichever of the two devices is transmitting at the time. For example, Walkie-talkies.

The simplest example is a walkie-talkie: You have to press a button to talk and release the button to listen. When two people use ~~walkie~~ waikie-ta Ikiet to communicate.

(iii) Full- Duplex

In full- duplex mode (also called duplex), both stations can transmit and receive simultaneously.



full-duplex

The full-duplex mode is like a two-way street with traffic flowing in both directions at the same time.

In full- duplex communication, both stations send and receive at the same time, and usually two communication channels are required. However, you can also achieve full-duplex communication using a multiplexing technique whereby signals travelling in different directions are placed into different time slots. The disadvantage of this technique is that it cuts the overall possible transmission speed by half.

One common example of full-duplex communication is the telephone network.

Introduction to TCP/IP (Some topic in Unit 5)

The internet protocol, like any other communication protocol is a set of rules which govern every possible communication over the internet. Since the development of the ARPANET, TCP/IP together has emerged as the controlling body.

TCP/IP are two protocols → Transmission control protocol and internet protocol. These two protocols however is a suite of many other protocols which provide for reliable communication across the internet and the web.

TCP/IP model

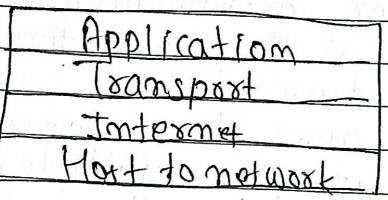


fig → TCP/IP

Internet layer

The goals / requirements discussed earlier led to the selection of a packet switching network which is based on a connectionless internet layer. This layer is called as the internet layer and it holds the whole architecture together. The task of this layer is to allow the host to insert packets in any network and then make them travel independently to the destination. The order in which the packets are received can be different from the sequence in which they were sent, Then the higher layer are supposed to arrange them in the proper order.

Transport layer

This is the layer above the internet layer. It's functions are same as those of a transport layer in OSI model. This layer allows the peer entities of the source and destination machines to converse with each other. The end to end protocols used are TCP and the flow control.

3) Application layer

TCP/IP model does not have session or presentation layers, because they are of little importance in most applications. The layer on top of transport layer is called as application layer

4) Host-to-network layer

This is the lowest layer in TCP/IP reference model. The host has to connect to the network. Using some protocol & this protocol varies from host to host and network to network

Protocols in various layers

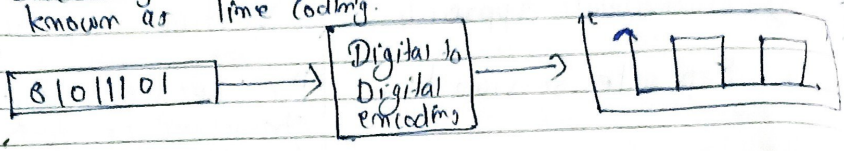
Layer	Protocol
Application layer	TELNET, FTP, SMTP, DNS, HTTP, NNTP
Transport layer	TCP, UDP
Internet (network)	IP
Host-to-network	ARPANET, SATNETLAN, Packet radio

D16 OSI and TCP/IP model

OSI	TCP/IP
1) OSI has 7 layers	TCP/IP has 4 layers
2) Transport layer delivery of packets	Transport layer does not delivery of packets
3) Horizontal approach	Vertical approach
4) Separate session layer	No session layer, characteristics are provided by transport layer.
5) Separate presentation layer	No presentation layer characteristics are provided by application layer.
6) Network layer provides both connectionless and connection oriented services.	Network layer provides only connection less services.
7) OSI is truly a general model.	TCP/IP can not be used for any other application
8) It has a problem of protocol fitting into a model.	It The model does not fit any other protocol stock.

★ Digital to digital line encoding scheme

Digital-to-digital encoding is the representation of digital information by a digital signal. When binary 1s and 0s generated by the computer are translated into a sequence of voltage pulses that can be propagated over a wire, this process is known as digital-to-digital encoding. This process is also known as line coding.



The sender side encrypts digital data into digital signals, while the receiving side decoder the digital signals to regenerate the digital data. The primary goal of utilizing line coding is to prevent the overlapping of pulse.

Example is sending data from computer to printer.

Modulation scheme

Modulation can be digital or analog input wave of analog scheme varies continuously like a sine wave.

When we transfer data from one system to another system at that time we use analog and digital signal. The process by which data/information is converted into electrical / digital signals for transferring that signal over a medium is called "modulation". It increases strength for maximum reach of the signals. The process of extracting information / data from the transmitted signal is called "demodulation". A modem is a device that performs both modulation and demodulation processes. The various forms of modulation are designed to change the characteristic of carries waves.

Advantages of modulation

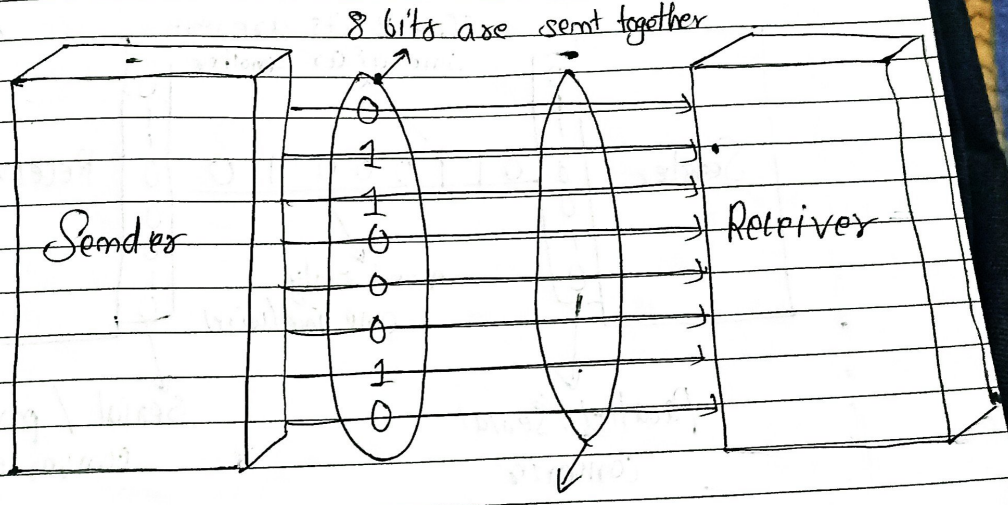
- It reduces the cost of wires.
- It increases the range of communication
- It reduces the size of the antenna.
- It also allows the adjustment of the bandwidth.

★ Parallel and seral transmission

Parallel transmission :-

Binary data may be organized into group of n bit each. Computer produce and consume data in groups of bits. By grouping 8 bits, we can send data n bits at a time instead of 1. This is called parallel transmission.

In parallel transmission is a conceptually simple one: Use n wires to send n bits at one time. That way each bit has its own wire and all n bits of one group can be transmitted with each clock tick from one device to another.



Parallel transmission

Advantages :

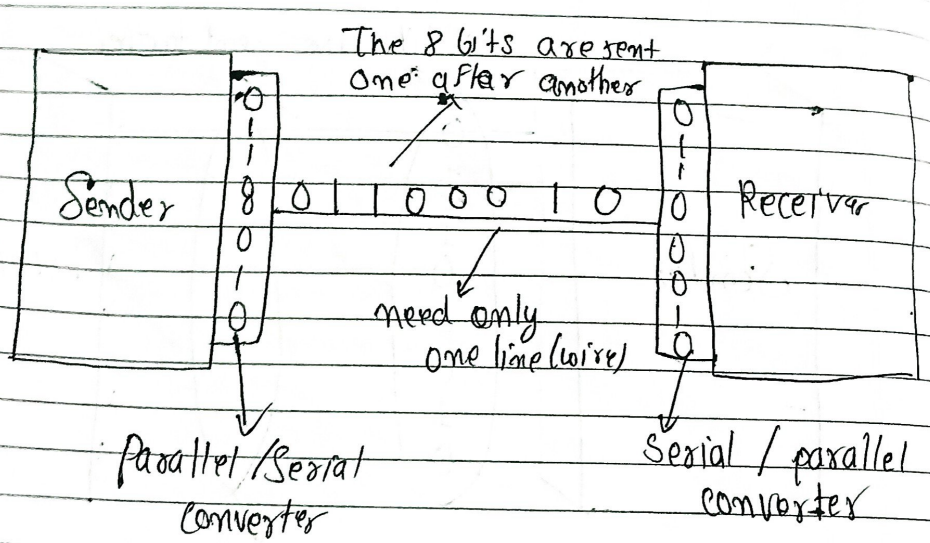
1. Speed is fast

Disadvantage:

2. Cost is more.

Serial Transmission

In serial transmission one bit follows another, so we need only one communication channel rather than n to transmit data between two communicating devices.



Advantages:

1. Only one communication channel is required.
2. It reduces the cost of transmission over parallel by roughly a factor of n.

Disadvantage:

1. Slow transfer speed.

☆ Multiplexing techniques

Multiplexing is a technique used to combine and send the multiple data streams over a single medium. The process of combining the data streams is known as multiplexing and hardware used for multiplexing is known as a multiplexer.

Multiplexing is achieved by using a device called multiplexer (MUX) that combines n input lines to generate a single output line.

Demultiplexing is achieved by using a device called demultiplexer (DEMUX) available at the receiving end. DEMUX separates a single into its component signal.

Generally Multiplexing are divided into two parts :

(i) FDM

- The full form of FDM is Frequency division multiplexing
- It is an analog technique.
- FDM is a technique in which the available bandwidth of a single transmission

(ii)

medium is subdivided into several channels.

Advantages of FDM:

- FDM is used for analog signal.
- FDM process is very simple and easy modulation

Disadvantages of FDM:

- FDM technique is used only when low-speed channels are required.
- It requires a high bandwidth channel.

Application of FDM:

- FDM is commonly used in TV networks.

(ii) TDM

- TDM is also known as time division multiplexing
- It is a digital technique
- In FDM technique, all signals operate at the same time with different frequency, but in case of TDM technique, all signals

operate at the same frequency with different time.

- In TDM technique, data is not transmitted simultaneously rather the data is transmitted one-by-one

There are two types of TDM:

- Synchronous TDM
- Asynchronous TDM

☆ Peer to peer network:-

A peer to peer network is one in which two or more pcs share files and access devices such as printers without requiring separate server computer or server software. Each PC on the network is equal with each other directly and do not have a centralized PC monitoring and controlling the communication on the network. An important goal in peer to peer network is that all the events provide resources, including bandwidth, storage space and computing power.

The distributed nature of peer to peer network also increases robustness

Nodes :- which can send and receive data.
Ex :- Computers, printers, tablet etc

Computer Network

Computer network वो network होता है जिसमें आपस में दो autonomous (different) device से data shared कर सकते हैं। with the help of wired or wireless connection to share some resource (h/w or s/w) interconnected by a single technology e.g internet.

- Computer network is a link between computer to shared data
- For shared data between computer (nodes) we have good internet connection

Application of CN

1) Business and Commerce :- flipkart, Amazon
2) Education : online exams, virtual classrooms.
3) Healthcare : electronic health records, electro, remote patient monitoring etc
4) Government Services : E-governance, online public services, secure communication between government service.
5) Entertainment : online gaming, social media platforms etc
   Ex :- netflix, youtube etc
6) Travel and Hospitality :
   Online ticket booking, hotel reservation, GPS and navigation service etc.

Data communication

Data communication means sender can send the data to the receiver with the help of transmission media