Paper code:- 3BCA4

Paper sub:- computer Networking &LAN

UNIT:-1

Introduction to computer network

- **Computer network and uses of network goals:-**

Computer network:-

Computer network is a group of computers which are interconnected together to share resources

Basically Computer network is a Digital Communications network through which one can share information, resources, data.

Computer network is a system where the group of computers are interconnected through wires or optical cables or Wi-Fi.

Types of computer network:-

Basically computer networks can be classified in to 3 types they are

- **LAN – Local Area Network**
- **WAN – Wide Area Network**
- **MAN – Metropolitan Area Network**

These are the basic variations in the computer networks, again these networks can be classified into

- **WLAN – Wireless Local Area Network**
- **SAN – Storage Area Network or Server Area Network or System Area Network.**

LAN :-

The full form of LAN is Local Area Network

LAN is one type of computer network, that connects the standalone computers through a Ethernet cable or through Wireless technology.

LAN covers only a limited area that may be a room or a flat or a house or a building etc.

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At present time, there are two most common technologies to connect the LAN first one via cable i.e. Ethernet and the second one is Wireless technology i.e. Wi-Fi.

WAN :-

The full form of WAN is Wide Area Network

WAN is the second type of computer network, that connects the computers over a wide area.

WAN extends geographically over a wide area that interconnects multiple Local Area Networks.

WAN is a leased or Private Digital Tele Communications through which one can share a large amount of data or information for example Internet.

MAN :-

The full form of MAN is Metropolitan Area Network

MAN is the third type of Computer Network, that interconnects the computers over a Metropolitan area.

MAN is one type of Computer Network that can interconnect all the Local Area Networks with in a city or a Metropolitan to make one single WAN.

WLAN :-

The full form of WLAN is Wireless Local Area Network

WLAN is the wireless LAN that interconnects the group of systems through wireless technology.

WLAN is one type of LAN in which the computers are interconnected through Wi-Fi.

Like LAN, WLAN also covers only a limited area, that may be a room or a flat or a house or a building etc.

SAN :-

The Full form of SAN is Storage Area Network

SAN is one type of Computer Network, that interconnects the storage devices with servers

SAN enhances the accessibility of the storage devices

SAN is one type of computer network which is dedicated exclusively for storage devices.

The storage devices which are interconnected through SAN they cannot be accessible through other devices which are connected LAN or WAN.

Goals of Networks

Computer Network means an interconnection of autonomous (standalone) computers for information exchange. The connecting media could be a copper wire, optical fiber, microwave or satellite.

Networking Elements – The computer network includes the following networking elements:

- At least two computers
- Transmission medium either wired or wireless
- Protocols or rules that govern the communication
- Network software such as Network Operating System

Network Criteria:
The criteria that have to be met by a computer network are:

1. Performance – It is measured in terms of transit time and response time.

- Transit time is the time for a message to travel from one device to another
- Response time is the elapsed time between an inquiry and a response.

Performance is dependent on the following factors:

- The number of users
- Type of transmission medium
- Capability of connected network
- Efficiency of software

2. Reliability – It is measured in terms of

- Frequency of failure
- Recovery from failures
- Robustness during catastrophe

3. Security – It means protecting data from unauthorized access.

Goals of Computer Networks: The following are some important goals of computer networks:

1. **Resource Sharing –**
   Many organizations has a substantial number of computers in operations, which are located apart. Ex. A group of office workers can share a common printer, fax, modem, scanner etc.
2. **High Reliability –**
   If there are alternate sources of supply, all files could be replicated on two or, machines. If one of them is not available, due to hardware failure, the other copies could be used.
3. **Inter-process Communication –**
   Network users, located geographically apart, may converse in an interactive session through the network. In order to permit this, the network must provide almost error-free communications.
4. **Flexible access –**
   Files can be accessed from any computer in the network. The project can be begun on one computer and finished on another.

   Other goals include Distribution of processing functions, Centralized management, and allocation of network resources, Compatibility of dissimilar equipment and software, Good network performance, Scalability, Saving money, Access to remote information, Person to person communication etc.,

Application of N/We :-

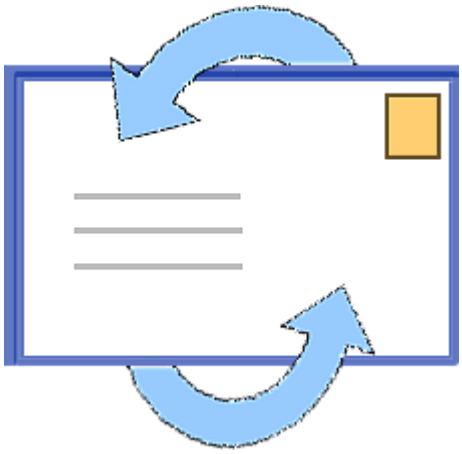
There are 2 types of network applications:-

- Pure network applications
- Standalone network application

(A) Pure Network Applications

These are applications created to be used in networks; using pure network applications on a single computer doesn't make sense. They help us to transfer data and communicate within a network. Such applications have a separate and distinct user interface that users must learn for instance:-

Outlook Express



Outlook Express, an email program | Source

1. Email Programs

They allow users to type messages at their local nodes and then send to someone on the network. It is a fast and easy way of transferring mail from one computer to another. Examples of electronic mail programs (Clients) are:-

- Pegasus Mail
- Outlook express
- Eudora Windows mail
- Fox mail
- Opera
- Poco mail
- Mozilla Thunderbird
- Windows mail

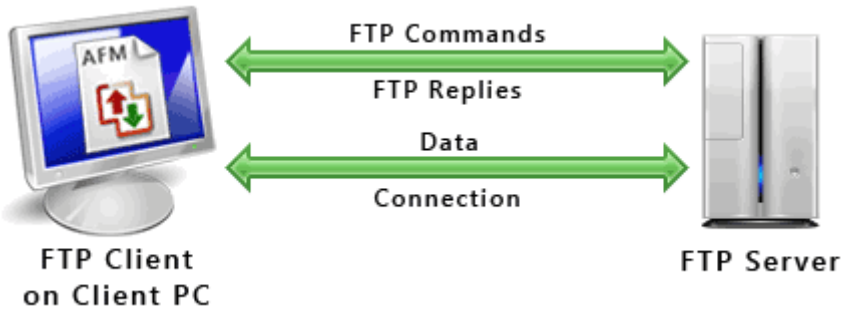
2. File Transfer Protocol (FTP)

This application facilities transfer of files from one computer to another e.g. from a client to a server. There are 2 common processes involved in FTP

Examples of FTP programs are:-

- FTP in Unix
- FTP in Linux or
- FTP in Windows

File Transfer Protocol Process



File transfer protocol process

3. Terminal Emulation (TELNET)

It allows a workstation to access the server for an application program. This enables you to control the server and communicate with other servers on the network. The workstation appears as a down terminal that is directly attached to the server. The user feels like he/she is using the server directly. *TELNET* enables PCs and workstations to function as dumb terminals in sessions with hosts on inter-networks.

4. Groupware

These applications are used to automate the administrative functions of a modern office for instance *video conferencing* and *chatting*. They facilitate the work of groups and improve on their productivity; they can be used to communicate, co-operate, coordinate, solve problems, compete, negotiate among others.

(i) Video Conferencing

This is the process of conducting a **conference** between two or more participants at different sites by using computer networks to transmit audio and video data. For example, a point-to-point (two-person) video conferencing system works much like a video telephone.

Each participant has a video camera, microphone, and speakers mounted on his or her computer. As the two participants speak to one another, their voices are carried over the network and delivered to the others speakers, and whatever images appear in front of the video camera appear in a window on the other participant's monitor.

(ii) Chatting

It is real-time communication between two users via computer. Once a chat has been initiated, either user can enter text by typing on the keyboard and the entered text will appear on the other user's monitor. The two must be online for a chat to be initiated. Most networks, cybers and online services offer a chat feature which enables computer users to chat as they go on with their work.

(B) Stand Alone Applications

These are applications that run on *stand-alone computers* (computers not connected to any other). In order to extend their activity, they are rebuilt to run on network environments e.g. word processors, spread sheets, database management systems, presentations graphics, project management etc. They function even when the computer is offline.

UNIT-2

Network structure

HOSTS: -

A host, more fully known as a network host, refers to a computer device which helps communicate with other hosts on a network. It includes the clients and servers which send or receive data, services, or applications. The idea of server and client can be interchangeable because a host can function either as a client and as a server, or as both at the same time. All servers are considered as the host but not all hosts function as servers. The term "host" is typically used if there are two computer systems that are connected by modems and the lines of a telephone connection system. Therefore, the system that has the data is called the host while the computer at which the user sits is referred to as the remote terminal.[1]

A host computer, or simply "host," is the ultimate consumer communication services. A host generally executes application pprograms on behalf of user(s), employing network and Internet communication services in support of this function.

Types of hosts :-

The following are the different types of hosts:

1. Cloud Host

This type of host allows a number of servers to act as one system to which the performance of the website can be guaranteed via multiple machines. It works as a service which allows clients to buy as many as they can of the service that they really need. A cloud host provides customers with seamless scalability, increased accessibility, superior reliability, and potential cost savings.[3]

2. Remote Host

This host refers to a server in a private network or the public internet. It is a host located in a different physical location than which the user has accessed using a private network or the internet and it provides the users with this remote access.

3. Web Host

This is known as a web server which stores and transmits the data for one or more websites. It sells or leases spaces for memory on its servers. This host provides services to the clients that will enable them to publish websites on the internet.

4. Hostname

This is the label that is assigned to the device on the network and is used to differentiate and distinguish one device from other devices on a specific network or over the internet. This is just a plain text name that will identify a host with a given domain. This is also used by DNS servers in order for a client to easily access a website through a common, easy-to-remember name and to avoid the need to remember a string of numbers just to open a website.

5. Virtual Host

This host provides the clients with the domain name registration, storage of files, and directory services for the files that the web page is built from. Through this, it enables a single host machine to resemble multiple and

several host machines. It also maintains a list of Multipurpose Internet Mail Extensions (MIME) types that it processes.

6. Host virtual machine

This server component provides computing resources to support a particular guest virtual machine. It intermediates between the host virtual machine and the guest virtual machine that isolates individual guest virtual machines from one another and it makes possible for a host to support several guests coming from different operating systems.

Communication subnet :-

IMPS :-

Immediate Payment service enabled a user to send money 24*7 using mobile number, Aadhaar number and Bank a/c, IFSC Code. IMPS service can be accessed using internet banking, mobile banking and ATM.

A person can make payments using the following options:

1. Using Mobile number & MMID (P2P)
2. Using Account number & IFS Code (P2A)
3. Using Aadhaar number (ABRS)

1 Using Mobile number & MMID (P2P)

IMPS offer an instant, 24*7 interbank electronic fund transfer service capable of processing person to person, person to account and person to merchant remittances via Mobile, Internet and ATM. It is a multichannel and multidimensional platform that make the payments possible within fraction of seconds with all the standards and integrity maintained for security required for even high worth transactions.

2 Using Account number & IFS Code (P2A)

Presently, IMPS Person-to-Person (P2P) funds transfer requires the Remitter customer to make funds transfer using Beneficiary Mobile Number and MMID. Both Remitter as well as Beneficiary needs to register their mobile number with their respective bank account and get MMID, in order to send or receive funds using IMPS.

In ABRS, a remitter can initiate IMPS transaction using the beneficiary's AADHAAR number, which acts as a financial address & which will be linked to the beneficiaries account number. ABRS facilitates in simplifying the IMPS payment initiation process as in this service the customer will have to input only AADHAAR number of the beneficiary for initiating an IMPS transaction. Another important utility of this service will be in disbursal of subsidy payment i.e. Electronic Benefit Transfer (EBT)/ Direct Benefit transfer (DBT) by the Government. ABRS will act as a catalyst in expanding financial Inclusion reach.

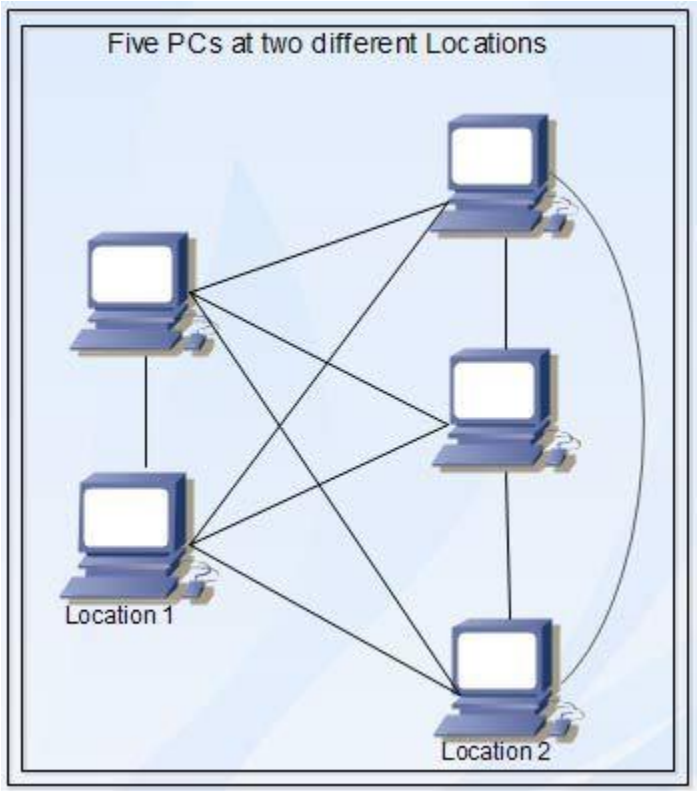
Point -to -point channels :-

The point-to-point scheme provides separate communication channels for each pair of computers. When more than two computers need to communicate with one another, the number of connections grows very quickly as number of computer increases. Above figure illustrates that two computers need only one connection, three computers need three connections and four computers need six connections.

As the Figure illustrates that the total number of connection grows more rapidly than the total number of computers. Mathematically, the number of connection needed for N computers is proportional to the square of N.

Point-to-point connections required = (N2 (N)/2.

Adding the Nth computer requires N·l new connections which becomes a very expensive option. Moreover, many connections may follow the same physical path. Figure shows a point- to-point connection for five computers located at two different locations, say, ground and first floor of a building.



As there are five PCs, total ten connections will be required for point-to-point connection. Out of these ten connections six are passing through the same locution and thereby making point-to-point connection an expensive one. Increasing the PC by one in the above configuration at location 2 as shown in Figure will increase the total number of connections to fifteen. Out 'of these connections eight connections will pass through the same area.

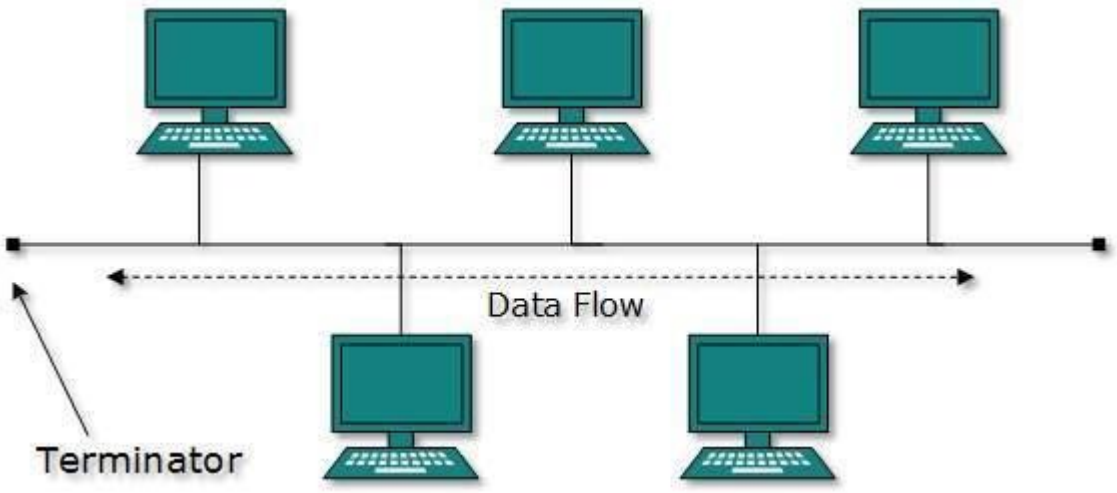
Difference topologies of point to point network:-

A Network Topology is the arrangement with which computer systems or network devices are connected to each other. Topologies may define both physical and logical aspect of the network. Both logical and physical topologies could be same or different in a same network.

Four types of topology :-

1 Bus Topology

In case of Bus topology, all devices share single communication line or cable.Bus topology may have problem while multiple hosts sending data at the same time. Therefore, Bus topology either uses CSMA/CD technology or recognizes one host as Bus Master to solve the issue. It is one of the simple forms of networking where a failure of a device does not affect the other devices. But failure of the shared communication line can make all other devices stop functioning.

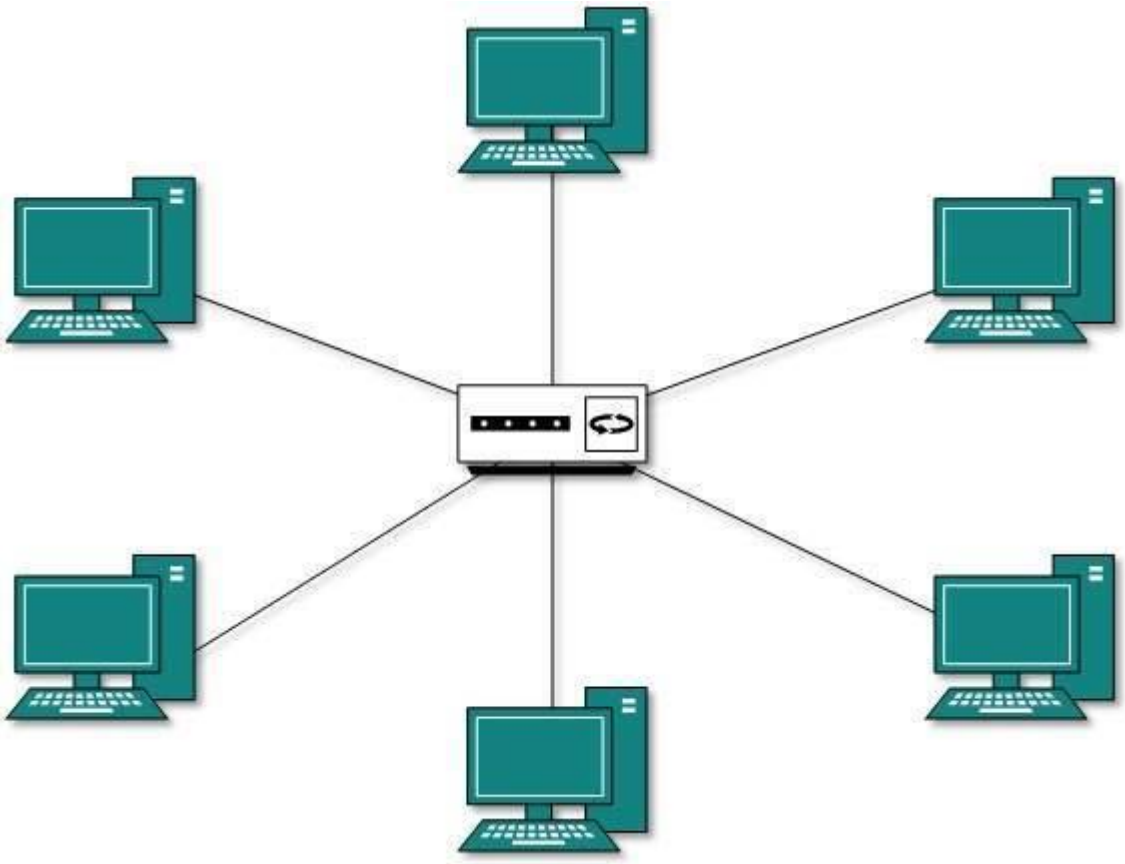


Both ends of the shared channel have line terminator. The data is sent in only one direction and as soon as it reaches the extreme end, the terminator removes the data from the line.

2 Star Topology

All hosts in Star topology are connected to a central device, known as hub device, using a point-to-point connection. That is, there exists a point to point connection between hosts and hub. The hub device can be any of the following:

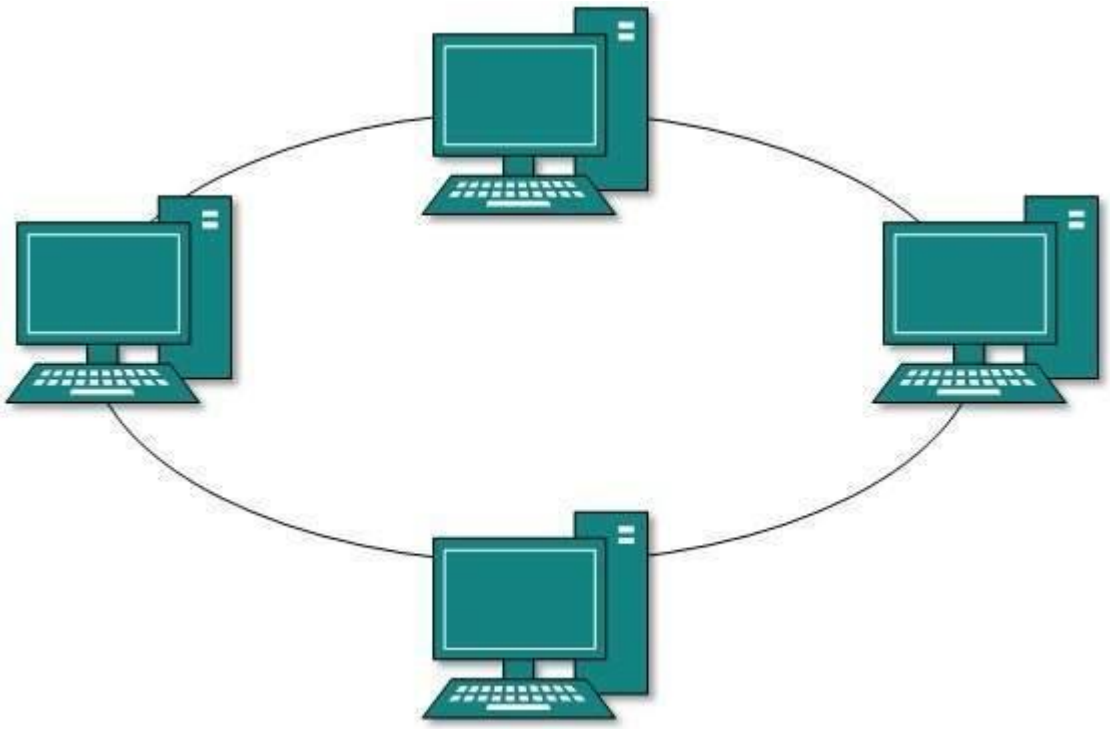
- Layer-1 device such as hub or repeater
- Layer-2 device such as switch or bridge
- Layer-3 device such as router or gateway



As in Bus topology, hub acts as single point of failure. If hub fails, connectivity of all hosts to all other hosts fails. Every communication between hosts, takes place through only the hub.Star topology is not expensive as to connect one more host, only one cable is required and configuration is simple.

3 Ring Topology

In ring topology, each host machine connects to exactly two other machines, creating a circular network structure. When one host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts. To connect one more host in the existing structure, the administrator may need only one more extra cable.

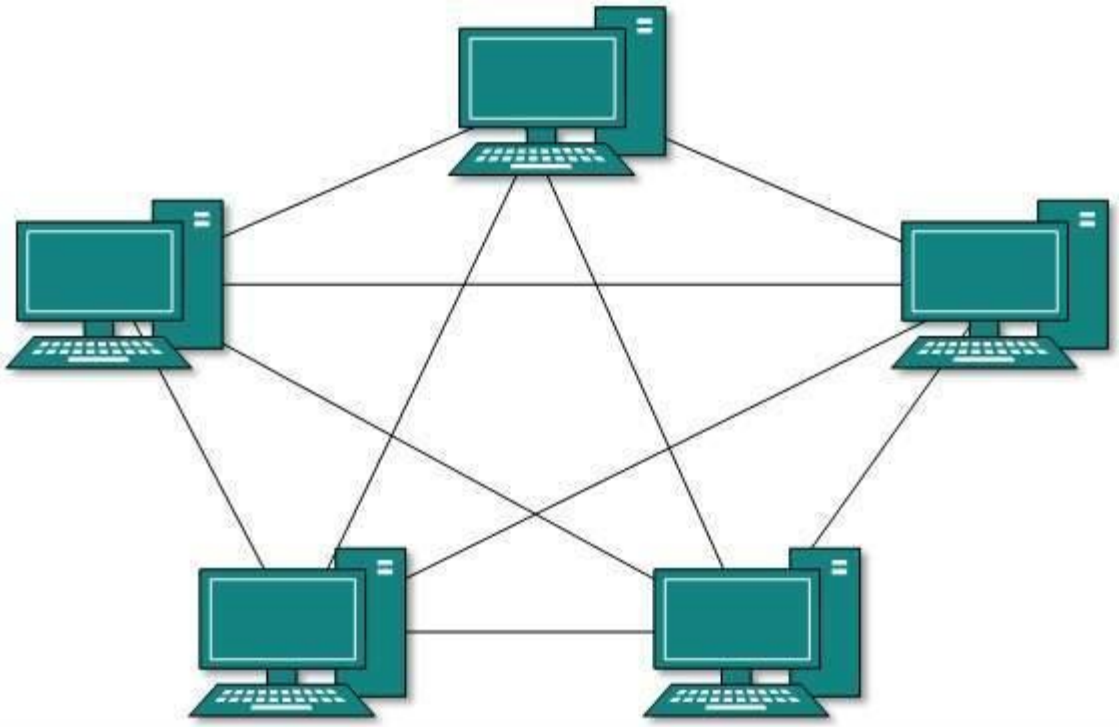


Hu

Failure of any host results in failure of the whole ring.Thus, every connection in the ring is a point of failure. There are methods which employ one more backup ring.

4 Mesh Topology

In this type of topology, a host is connected to one or multiple hosts.This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection to few hosts only.



Hosts in Mesh topology also work as relay for other hosts which do not have direct point-to-point links. Mesh technology comes into two types:

- **Full Mesh**: All hosts have a point-to-point connection to every other host in the network. Thus for every new host n(n-1)/2 connections are required. It provides the most reliable network structure among all network topologies.
- **Partially Mesh**: Not all hosts have point-to-point connection to every other host. Host connect to each other in some arbitrarily fashion. This topology exist where we need to provide reliability to some hosts out of all.

Broadcast channels :-

A broadcast channels (BCH) is a downlink channel in a GSM system. That is used by the base station to provide signalling information to the mobile station. The mobile station needs this information on to find a network, synchronize with it and to connect to it.

There are three types of broadcasting channels.

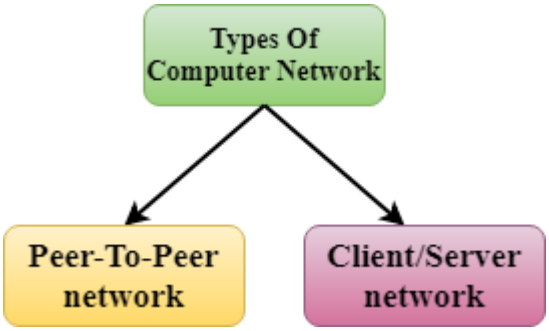
1. Broadcast control channel (BCCH).
2. Synchronisation channel (SCH).
3. Frequency correction channel (FCCH).

UNIT:-3
Network Architecture

Network Architecture:-

Computer Network Architecture is defined as the physical and logical design of the software, hardware, protocols, and media of the transmission of data. Simply we can say that how computers are organized and how tasks are allocated to the computer.

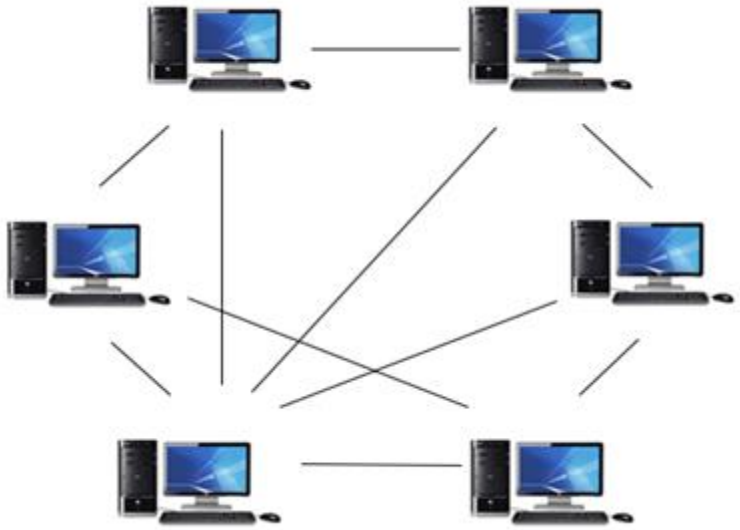
The two types of network architectures are used:



- Peer-To-Peer network
- Client/Server network

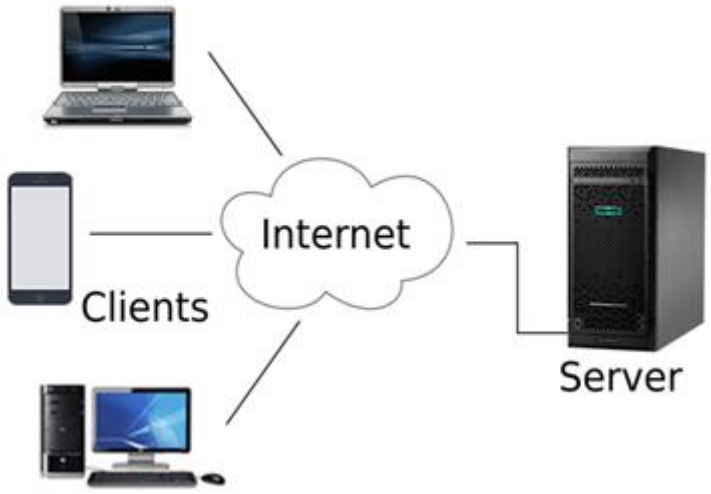
Peer-To-Peer network

- Peer-To-Peer network is a network in which all the computers are linked together with equal privilege and responsibilities for processing the data.
- Peer-To-Peer network is useful for small environments, usually up to 10 computers.
- Peer-To-Peer network has no dedicated server.
- Special permissions are assigned to each computer for sharing the resources, but this can lead to a problem if the computer with the resource is down.



Client/Server Network

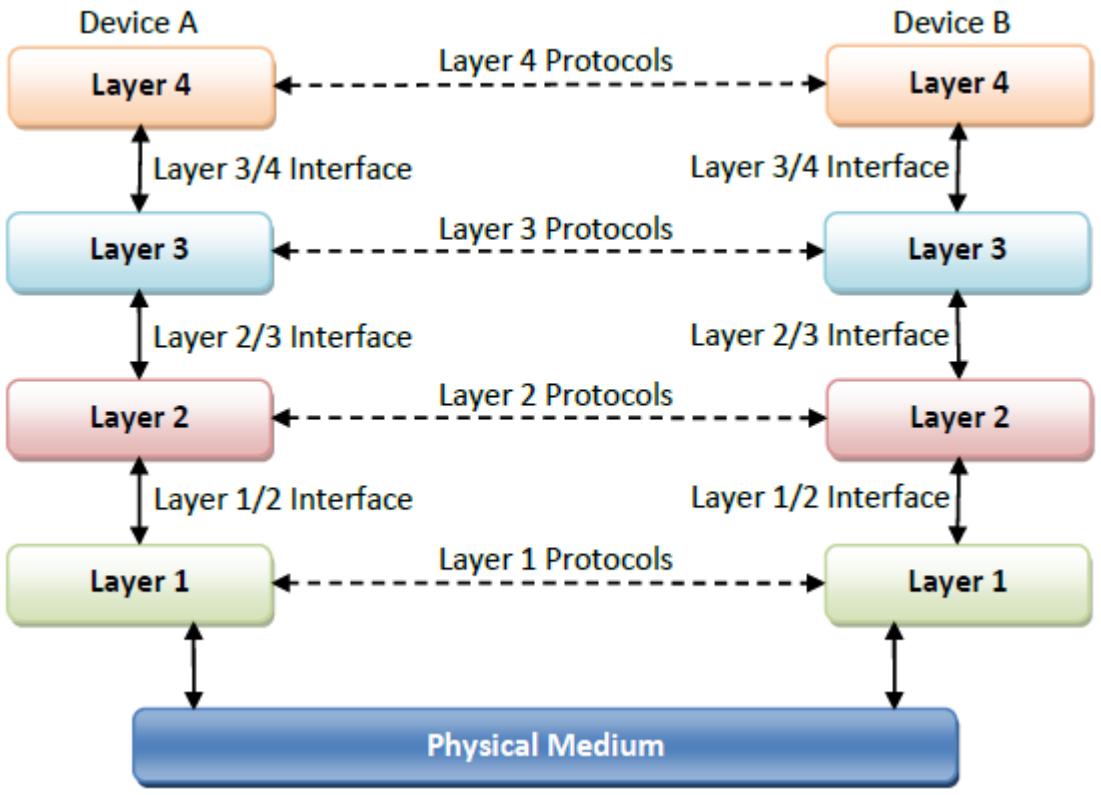
- Client/Server network is a network model designed for the end users called clients, to access the resources such as songs, video, etc. from a central computer known as Server.
- The central controller is known as a **server** while all other computers in the network are called **clients**.
- A server performs all the major operations such as security and network management.
- A server is responsible for managing all the resources such as files, directories, printer, etc.
- All the clients communicate with each other through a server. For example, if client1 wants to send some data to client 2, then it first sends the request to the server for the permission. The server sends the response to the client 1 to initiate its communication with the client 2.



Protocol Hierarchies

Most networks are organized as a stack of layers, one on the top of another. The number of layers and their names vary from network to network. Each layer has a specified function and adheres to specified protocols. Thus we obtain a stack of protocols.

The following figure illustrates a four-layer network −



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The above figure represents communication between Device A and Device B. The data stream from one device to the other is not sent directly but has to pass through a number of layers. The layers in the same levels are called peers and have a set of protocols for communication. Between each adjacent layer is an interface that defines the services that are being offered by a lower layer to the next higher layer. The dotted arrows depict virtual communication between peer layers, while the solid arrows represent the physical communications between the adjacent layers.

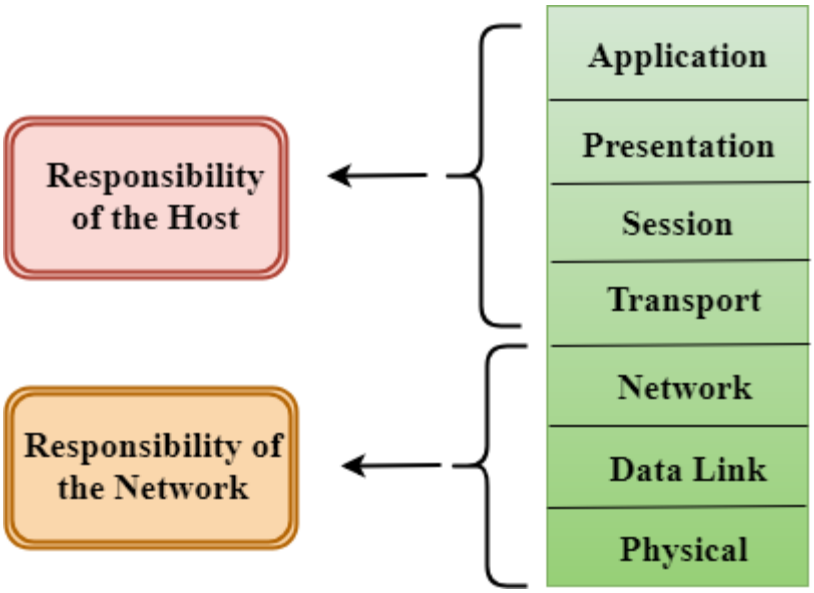
Let us consider a situation where Device A wants to send a message to Device B. Device A passes its information to the highest layer. As soon as a data stream reaches a layer, it performs some specified functions on it and passes it to the layer below. This continues until the data stream reaches the lowest layer. Layer 1 passes a bit stream of 0s and 1s to the physical medium that communicates it to the Layer 1 of the receiving end. Each layer in the receiving end performs certain functions on the data stream adhering to the protocol with its peer and passes it to the layer above. This continues until the information reaches the highest layer. The highest layer then conveys the message to Device B in the same format sent by Device A.

UNIT: - 4

OSI Reference model

- OSI stands for **Open System Interconnection** is a reference model that describes how information from a software application in one computer moves through a physical medium to the software application in another computer.
- OSI consists of seven layers, and each layer performs a particular network function.
- OSI model was developed by the International Organization for Standardization (ISO) in 1984, and it is now considered as an architectural model for the inter-computer communications.
- OSI model divides the whole task into seven smaller and manageable tasks. Each layer is assigned a particular task.
- Each layer is self-contained, so that task assigned to each layer can be performed independently.

Characteristics of OSI Model:



- The OSI model is divided into two layers: upper layers and lower layers.
- The upper layer of the OSI model mainly deals with the application related issues, and they are implemented only in the software. The application layer is closest to the end user. Both the end user and the application layer interact with the software applications. An upper layer refers to the layer just above another layer.

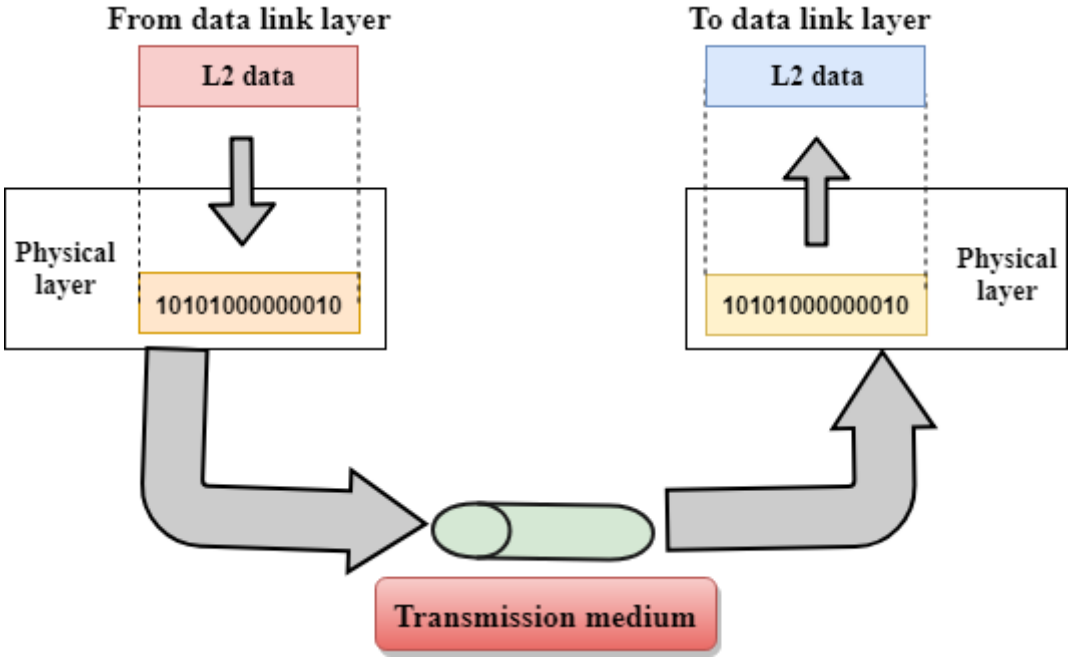
- The lower layer of the OSI model deals with the data transport issues. The data link layer and the physical layer are implemented in hardware and software. The physical layer is the lowest layer of the OSI model and is closest to the physical medium. The physical layer is mainly responsible for placing the information on the physical medium.

Difference layer of OSI model

There are the seven OSI layers. Each layer has different functions. A list of seven layers are given below:

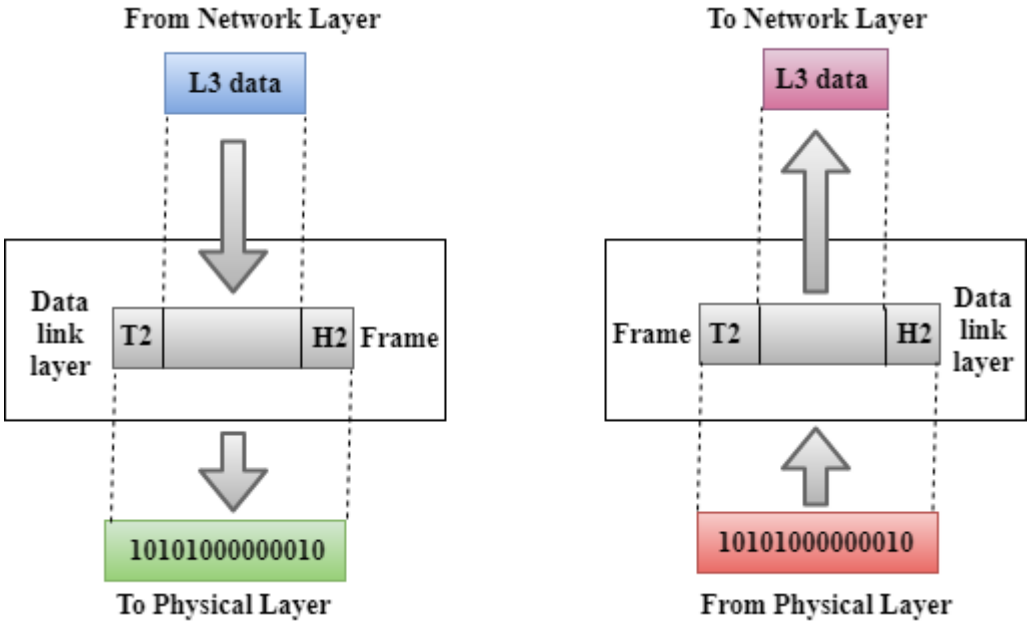
1. Physical Layer
2. Data-Link Layer
3. Network Layer
4. Transport Layer
5. Session Layer
6. Presentation Layer
7. Application Layer

1 Physical layer



- The main functionality of the physical layer is to transmit the individual bits from one node to another node.
- It is the lowest layer of the OSI model.
- It establishes, maintains and deactivates the physical connection.
- It specifies the mechanical, electrical and procedural network interface specifications.

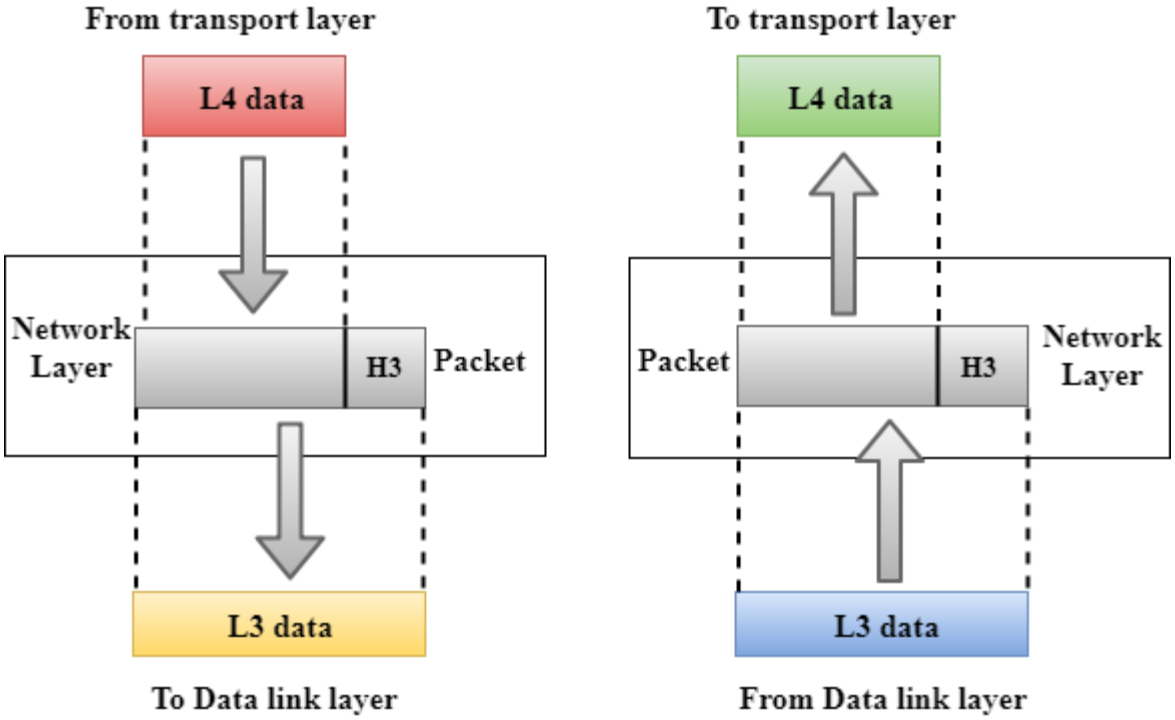
2 Data-Link Layer



- This layer is responsible for the error-free transfer of data frames.
- It defines the format of the data on the network.
- It provides a reliable and efficient communication between two or more devices.
- It is mainly responsible for the unique identification of each device that resides on a local network.
- It contains two sub-layers:
    - **Logical Link Control Layer**
        - It is responsible for transferring the packets to the Network layer of the receiver that is receiving.
        - It identifies the address of the network layer protocol from the header.
        - It also provides flow control.
    - **Media Access Control Layer**

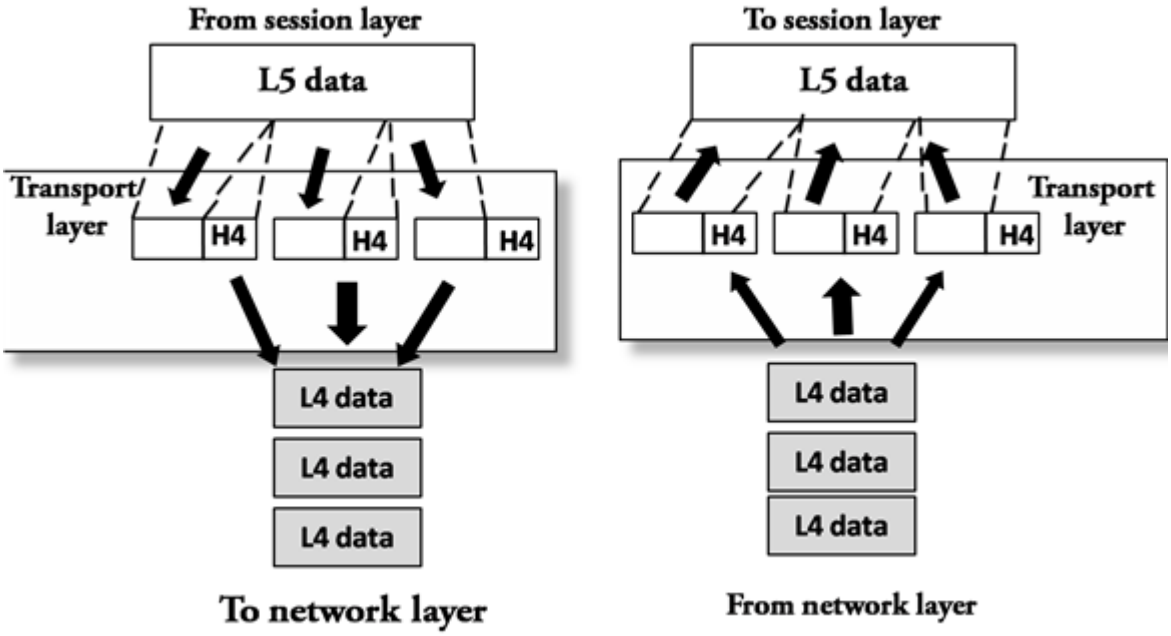
- A Media access control layer is a link between the Logical Link Control layer and the network's physical layer.
- It is used for transferring the packets over the network.

3 Network Layer



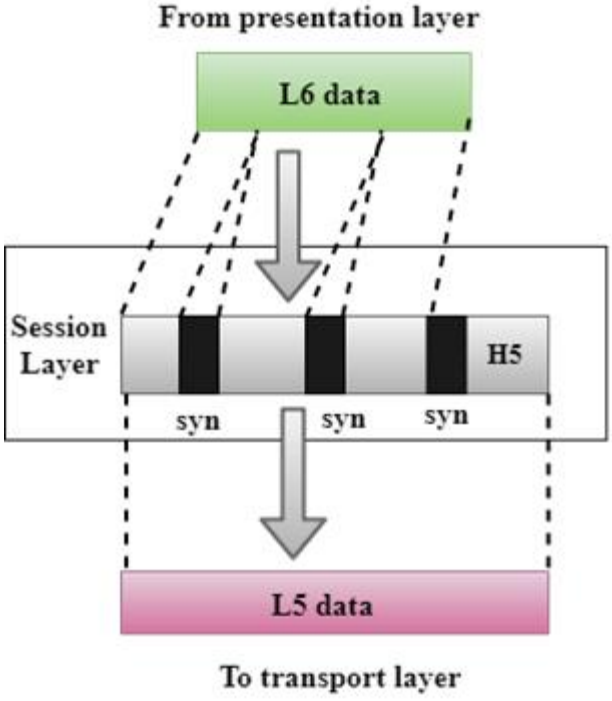
- It is a layer 3 that manages device addressing, tracks the location of devices on the network.
- It determines the best path to move data from source to the destination based on the network conditions, the priority of service, and other factors.
- The Data link layer is responsible for routing and forwarding the packets.
- Routers are the layer 3 devices, they are specified in this layer and used to provide the routing services within an internetwork.
- The protocols used to route the network traffic are known as Network layer protocols. Examples of protocols are IP and Ipv6.

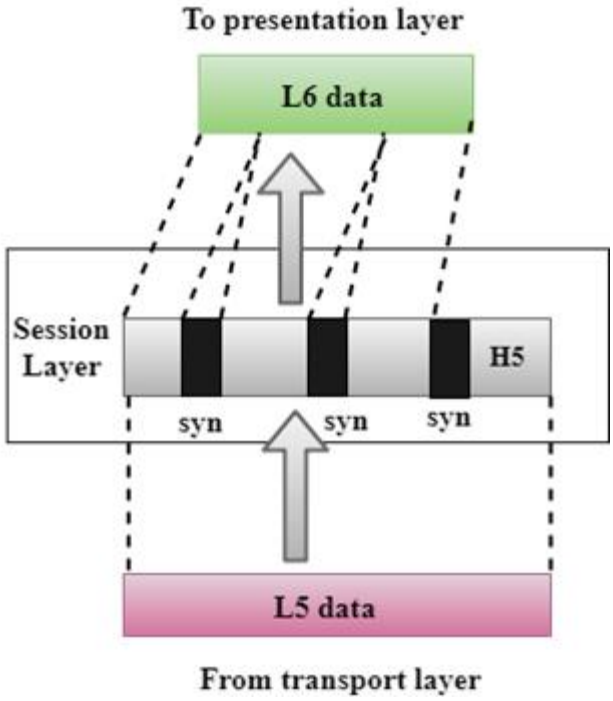
4 Transport Layer



- The Transport layer is a Layer 4 ensures that messages are transmitted in the order in which they are sent and there is no duplication of data.
- The main responsibility of the transport layer is to transfer the data completely.
- It receives the data from the upper layer and converts them into smaller units known as segments.
- This layer can be termed as an end-to-end layer as it provides a point-to-point connection between source and destination to deliver the data reliably.

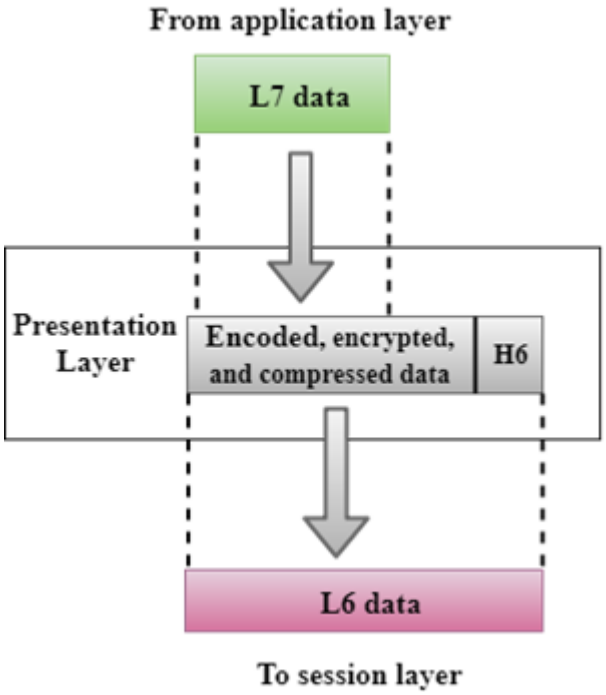
5 Session Layer

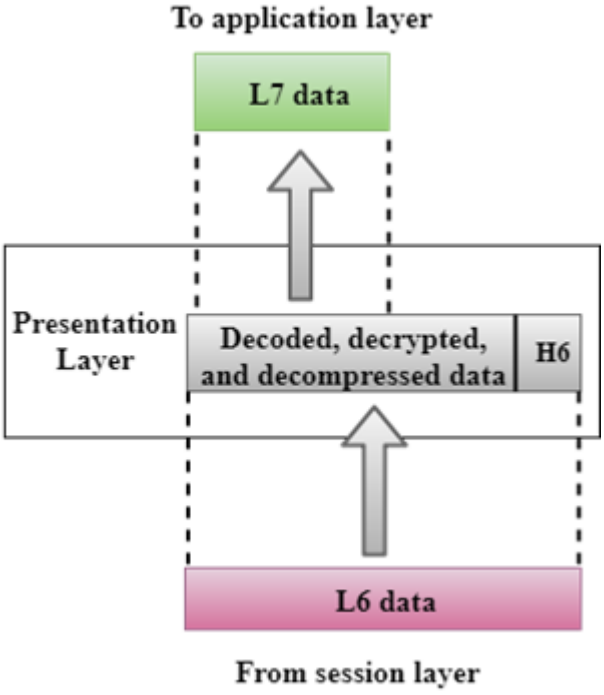




- It is a layer 3 in the OSI model.
- The Session layer is used to establish, maintain and synchronizes the interaction between communicating devices

6 Presentation Layer

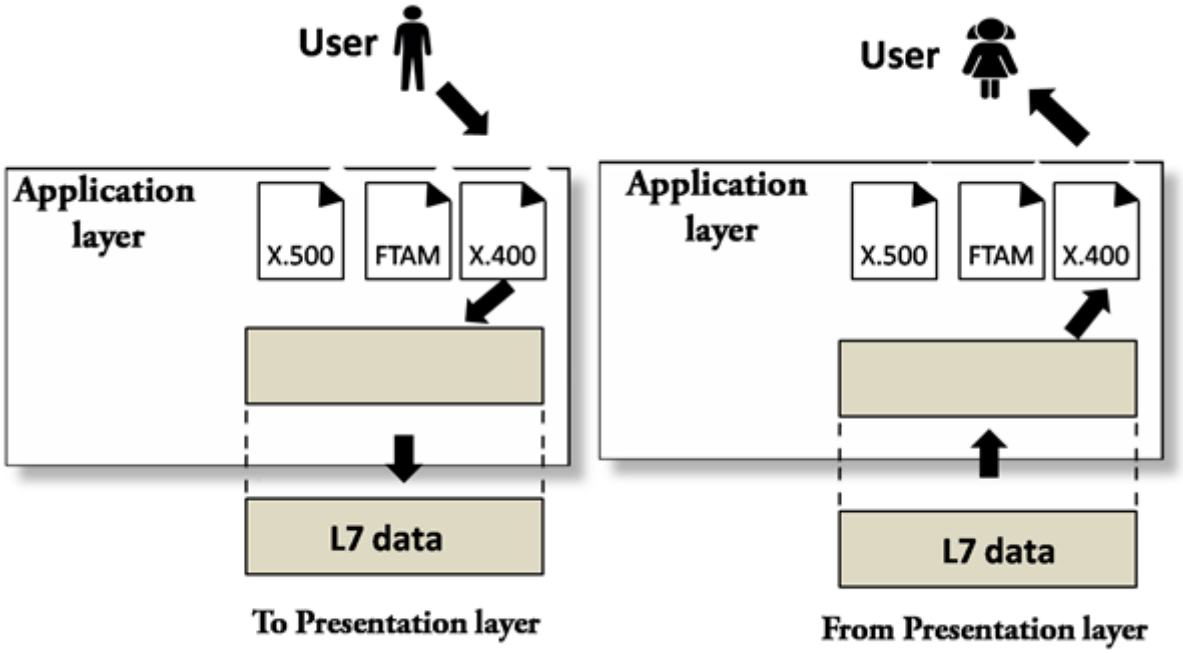




By: Abhay Kumar Mishra, Department of B.C.A. , Maharaja College ,Ara

- A Presentation layer is mainly concerned with the syntax and semantics of the information exchanged between the two systems.
- It acts as a data translator for a network.
- This layer is a part of the operating system that converts the data from one presentation format to another format.
- The Presentation layer is also known as the syntax layer.

7 Application Layer

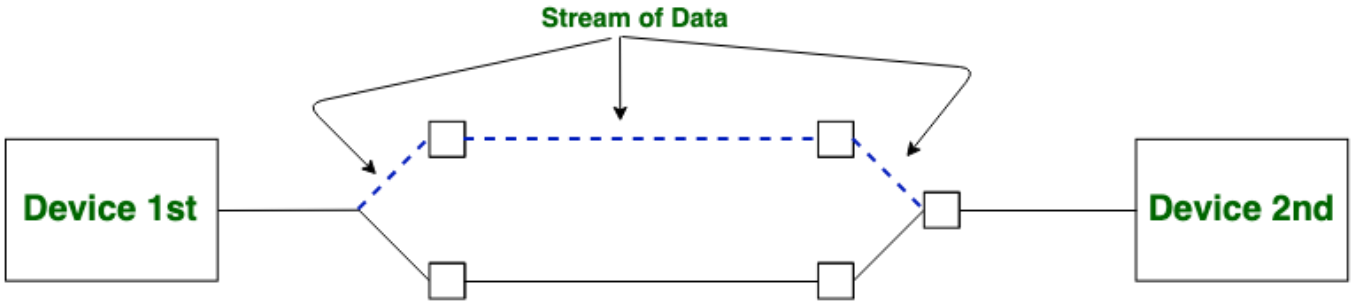


- An application layer serves as a window for users and application processes to access network service.
- It handles issues such as network transparency, resource allocation, etc.
- An application layer is not an application, but it performs the application layer functions.
- This layer provides the network services to the end-users.

Connection oriented and connection less services :-

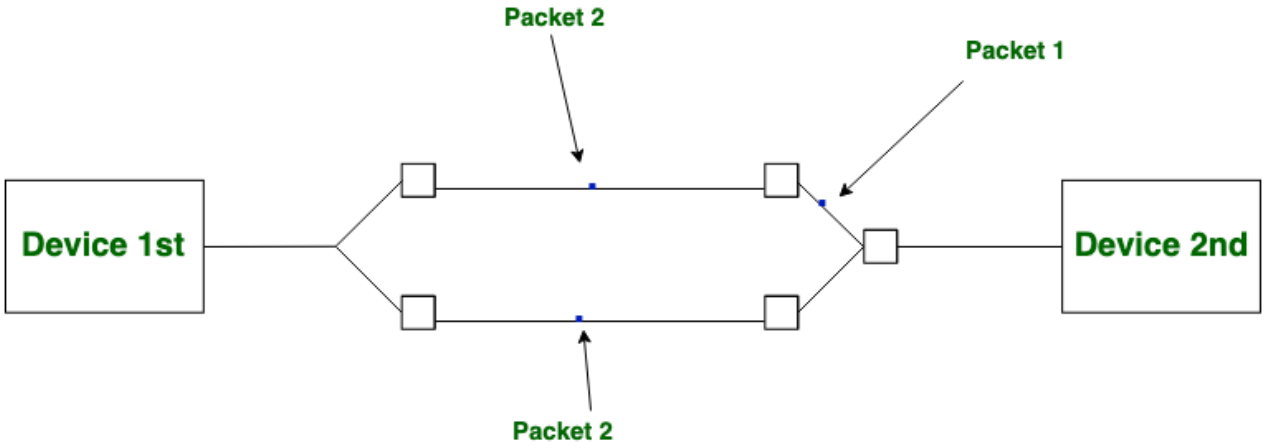
Both Connection-oriented service and Connection-less service are used for the connection establishment between two or more than two devices. These type of services are offered by network layer.

Connection-oriented service is related to the telephone system. It includes the connection establishment and connection termination. In connection-oriented service, Handshake method is used to establish the connection between sender and receiver.



CONNECTION-ORIENTED SERVICE

Connection-less service is related to the postal system. It does not include any connection establishment and connection termination. Connection-less Service does not give the guarantee of reliability. In this, Packets do not follow same path to reach destination.



CONNECTIONIESS SERVICE

UNIT:-5

Transmission Media

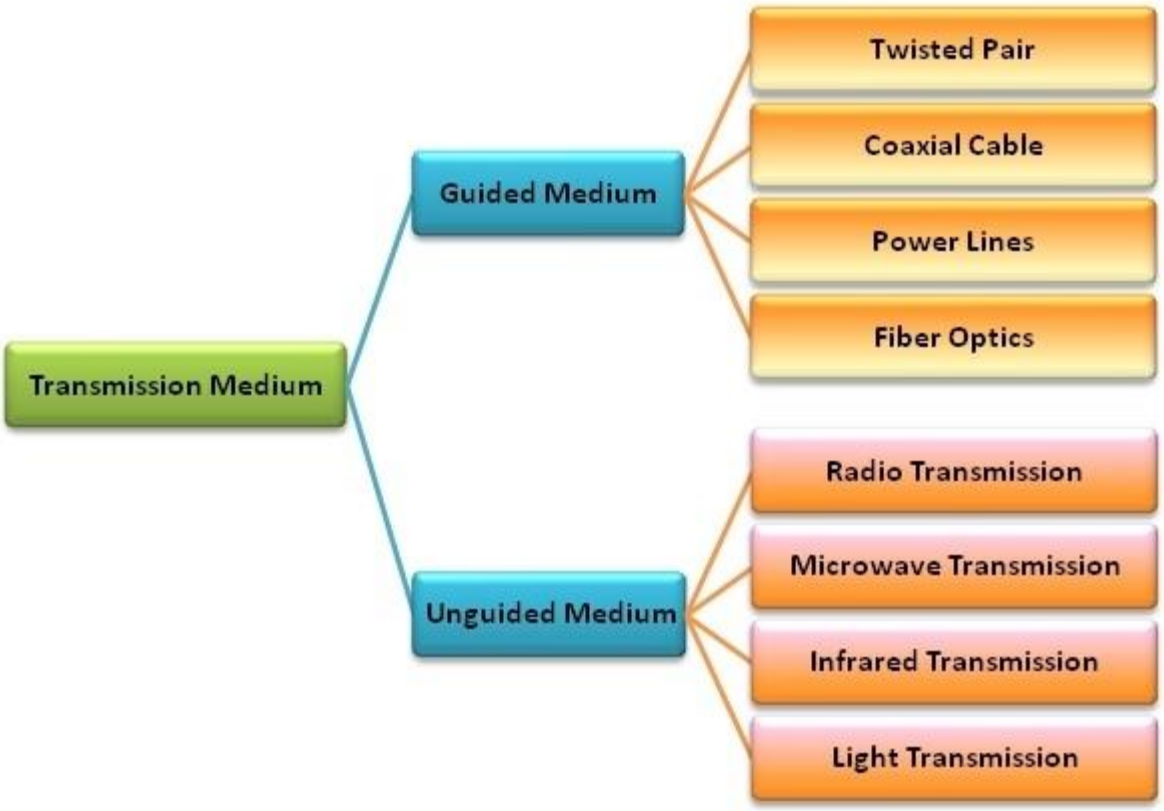
Transmission Media:-

The transmission medium can be defined as a pathway that can transmit information from a sender to a receiver. Transmission media are located below the physical layer and are controlled by the physical layer. Transmission media are also called communication channels.

Transmission media are of two types −

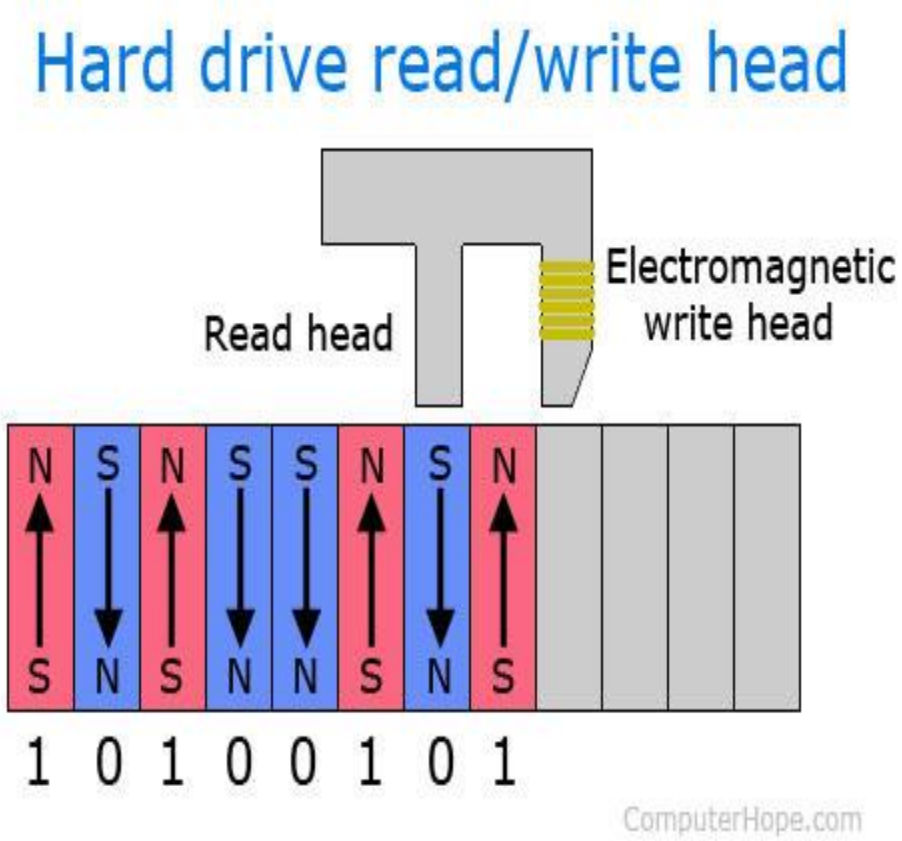
- Guided Transmission Medium
- Unguided Transmission Medium

The following chart categorizes transmission media −



Magnetic Media

One of the most convenient way to transfer data from one computer to another, even before



the birth of networking, was to save it on some storage media and transfer physical from one station to another. Though it may seem old-fashion way in today's world of high speed internet, but when the size of data is huge, the magnetic media comes into play.

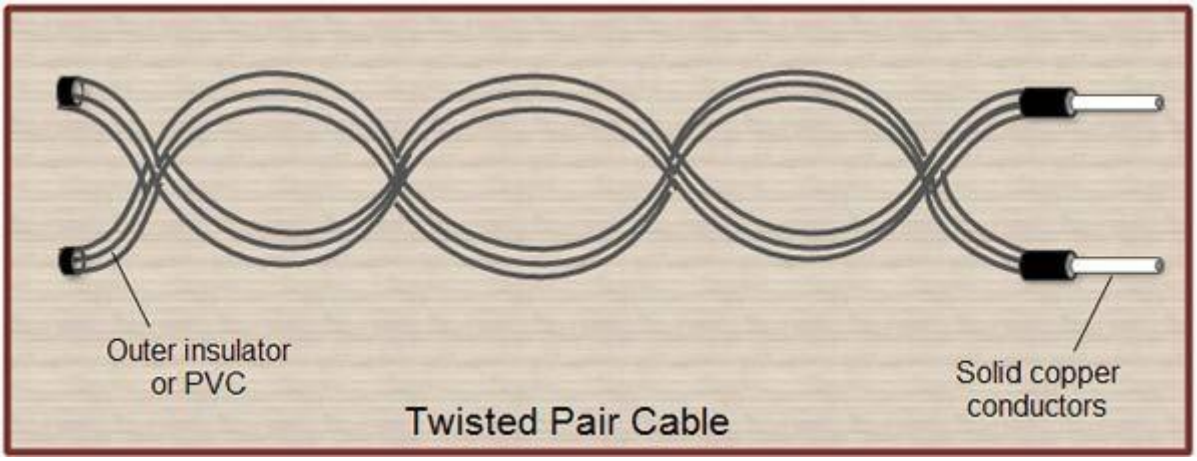
For example, a bank has to handle and transfer huge data of its customer, which stores a backup of it at some geographically far-away place for security reasons and to keep it from uncertain calamities. If the bank needs to store its huge backup data then its, transfer through internet is not feasible. The WAN links may not support such high speed. Even if they do; the cost too high to afford.

In these cases, data backup is stored onto magnetic tapes or magnetic discs, and then shifted physically at remote places.

Twisted Pair Cable

A twisted pair cable is made of two plastic insulated copper wires twisted together to form a single media. Out of these two wires, only one carries actual signal and another is used for ground reference. The twists between wires are helpful in reducing noise (electro-magnetic interference) and crosstalk.

Teflon(r) are some of the substances that are used for insulation purposes.

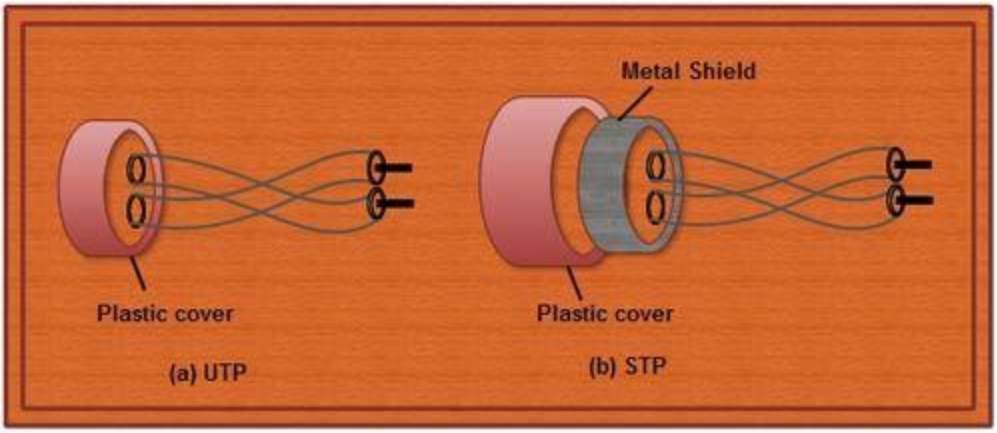


There are two types of twisted pair cables:

- Shielded Twisted Pair (STP) Cable
- Unshielded Twisted Pair (UTP) Cable

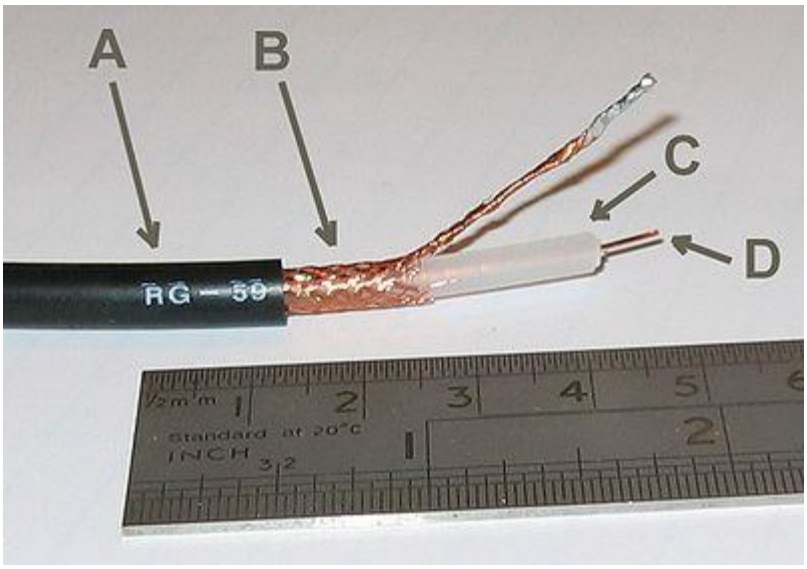
STP cables comes with twisted wire pair covered in metal foil. This makes it more indifferent to noise and crosstalk.

UTP has seven categories, each suitable for specific use. In computer networks, Cat-5, Cat-5e, and Cat-6 cables are mostly used. UTP cables are connected by RJ45 connectors.



Coaxial Cable

Coaxial cable has two wires of copper. The core wire lies in the center and it is made of solid conductor. The core is enclosed in an insulating sheath.The second wire is wrapped around over the sheath and that too in turn encased by insulator sheath.This all is covered by plastic cover.



RG-59 **flexible coaxial cable** composed of:

A. Outer plastic sheath

B. Woven copper shield

C. Inner dielectric insulator

D. Copper core

Cross-sectional view of a coaxial cable

Because of its structure, the coax cable is capable of carrying high frequency signals than that of twisted pair cable. The wrapped structure provides it a good shield against noise and cross talk. Coaxial cables provide high bandwidth rates of up to 450 mbps.

There are three categories of coax cables namely, RG-59 (Cable TV), RG-58 (Thin Ethernet), and RG-11 (Thick Ethernet). RG stands for Radio Government.

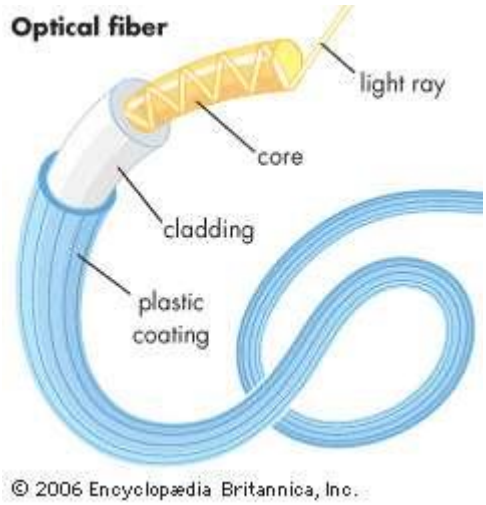
Cables are connected using BNC connector and BNC-T. BNC terminator is used to terminate the wire at the far ends.

Fiber Optics

Fiber Optic works on the properties of light. When light ray hits at critical angle it tends to refracts at 90 degree. This property has been used in fiber optic. The core of fiber optic cable is made of high quality glass or plastic. From one end of it light is emitted, it travels through it and at the other end light detector detects light stream and converts it to electric data.

Fiber Optic provides the highest mode of speed. It comes in two modes, one is single mode fiber and second is multimode fiber. Single mode fiber can carry a single ray of light whereas multimode is capable of carrying multiple beams of light

Fiber Optic also comes in unidirectional and bidirectional capabilities. To connect and access fiber optic special type of connectors are used. These can be Subscriber Channel (SC), Straight Tip (ST), or MT-RJ



Communication satellite :-

A **communication satellite** is a **microwave repeater station** in a space that is used for telecommunication, radio and television signals. A communication satellite processes the data coming from one earth station and it converts the data into another form and send it to the second earth station.

Advantages of Satellite

The advantages of Satellite Communications are as follows −

- The Coverage area is very high than that of terrestrial systems.
- The transmission cost is independent of the coverage area.
- Higher bandwidths are possible.

Disadvantages of Satellite

The disadvantages of Satellite Communications are as follows −

- Launching satellites into orbits is a costly process.
- The bandwidths are gradually used up.
- High propagation delay for satellite systems than the conventional terrestrial systems.

UNIT:- 6

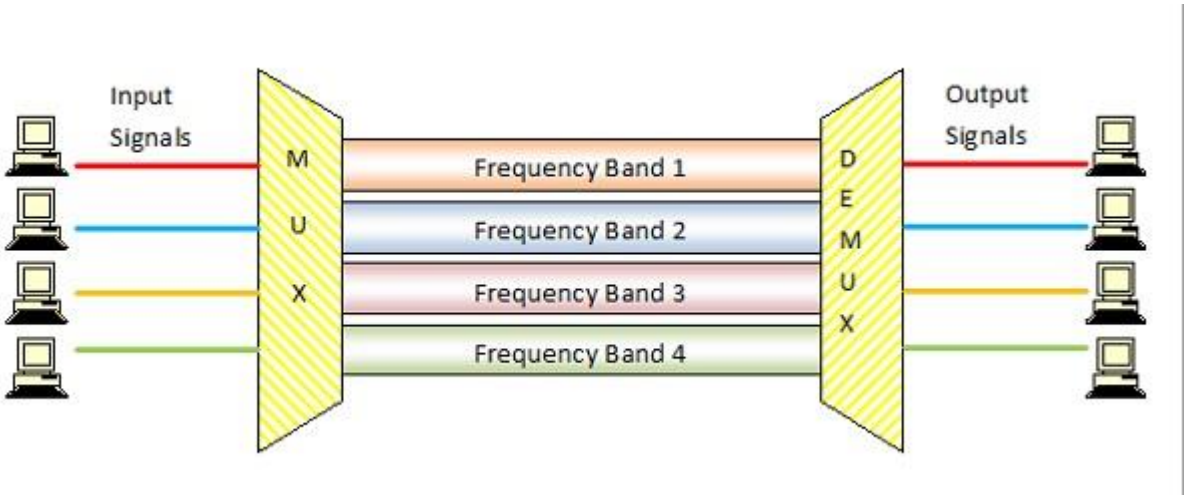
Transmission & switching

FDM and TDM :-

FDM:- Frequency division multiplexing (FDM) is a technique of multiplexing which means combining more than one signal over a shared medium. In FDM, signals of different frequencies are combined for concurrent transmission.

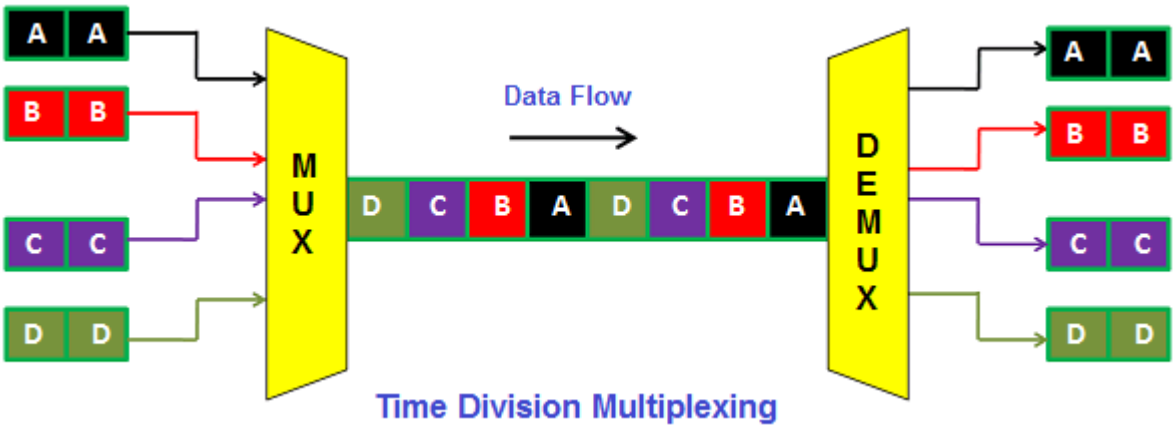
Example

The following diagram conceptually represents multiplexing using FDM. It has 4 frequency bands, each of which can carry signal from 1 sender to 1 receiver. Each of the 4 senders is allocated a frequency band. The four frequency bands are multiplexed and sent via the communication channel. At the receiving end, a demultiplexer regenerates the original four signals as outputs.



Here, if the frequency bands are of 150 KHz bandwidth separated by 10KHz guard bands, then the capacity of the communication channel should be at least 630 KHz (channels : 150 × 4 + guard bands : 10 × 3).

TDM:- Time Division Multiplexing is a technique in which multiple signals are combined and transmitted one after another on the same communication channel.
At the receiver side, the signals are separated and received. Each signal is received by a user at a different time.
Time Division Multiplexing is also simply referred to as TDM. It is the digital multiplexing technique.
In frequency division multiplexing, all signals of different frequencies are transmitted simultaneously. But in time division multiplexing, all signals operate with the same frequency are transmitted at different times.
In frequency division multiplexing, the sharing of a channel is done on the basis of frequency. But in time division multiplexing, the sharing of a channel is done on the basis of time.

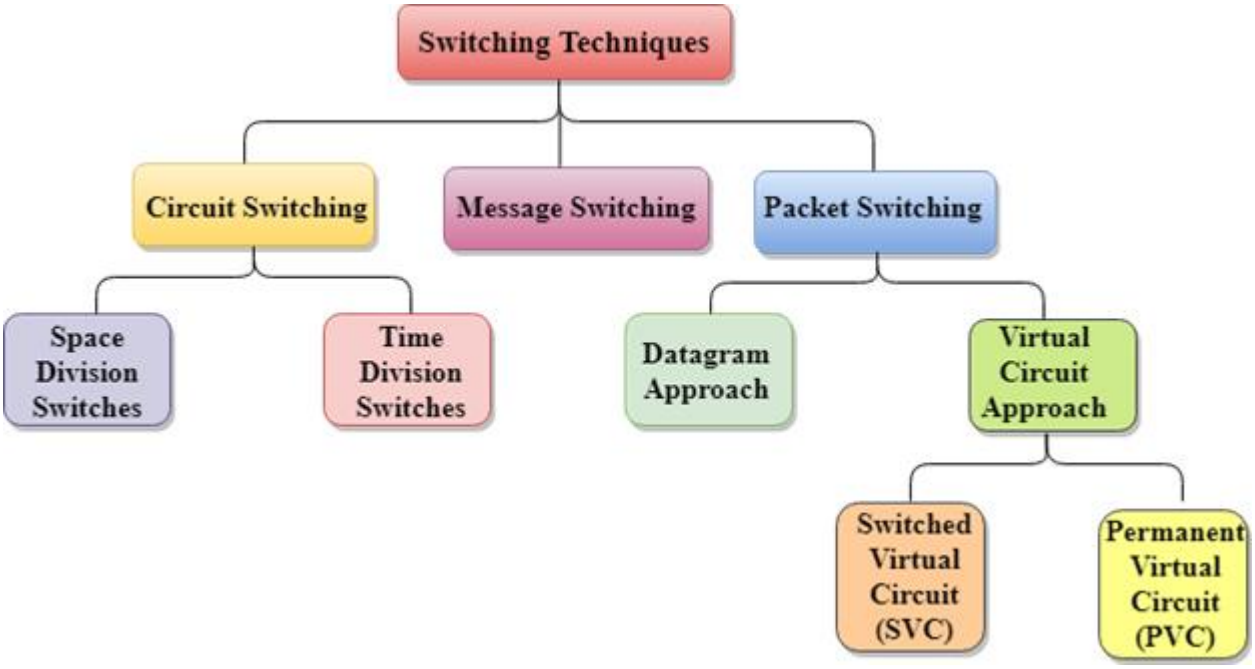


Switching techniques

In large networks, there can be multiple paths from sender to receiver. The switching technique will decide the best route for data transmission.

Switching technique is used to connect the systems for making one-to-one communication.

Classification Of Switching Techniques

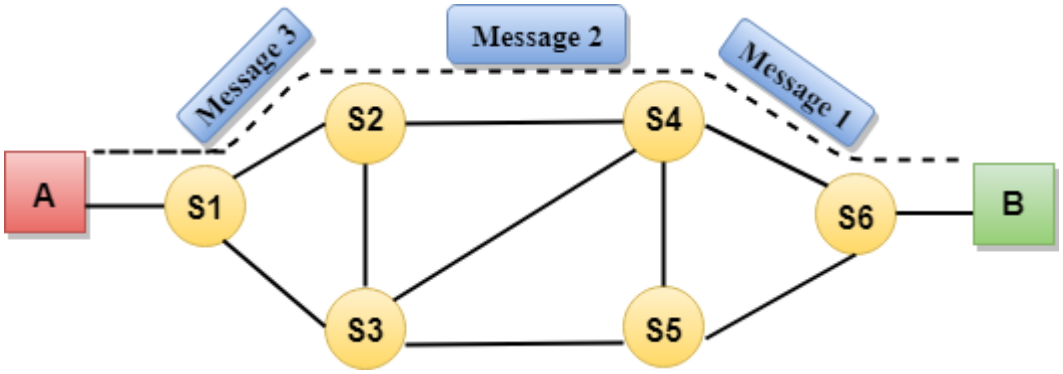


Circuit (CKT) Switching

- Circuit switching is a switching technique that establishes a dedicated path between sender and receiver.
- In the Circuit Switching Technique, once the connection is established then the dedicated path will remain to exist until the connection is terminated.
- Circuit switching in a network operates in a similar way as the telephone works.
- A complete end-to-end path must exist before the communication takes place.
- In case of circuit switching technique, when any user wants to send the data, voice, video, a request signal is sent to the receiver then the receiver sends back the acknowledgment to ensure the availability of the dedicated path. After receiving the acknowledgment, dedicated path transfers the data.
- Circuit switching is used in public telephone network. It is used for voice transmission.
- Fixed data can be transferred at a time in circuit switching technology.

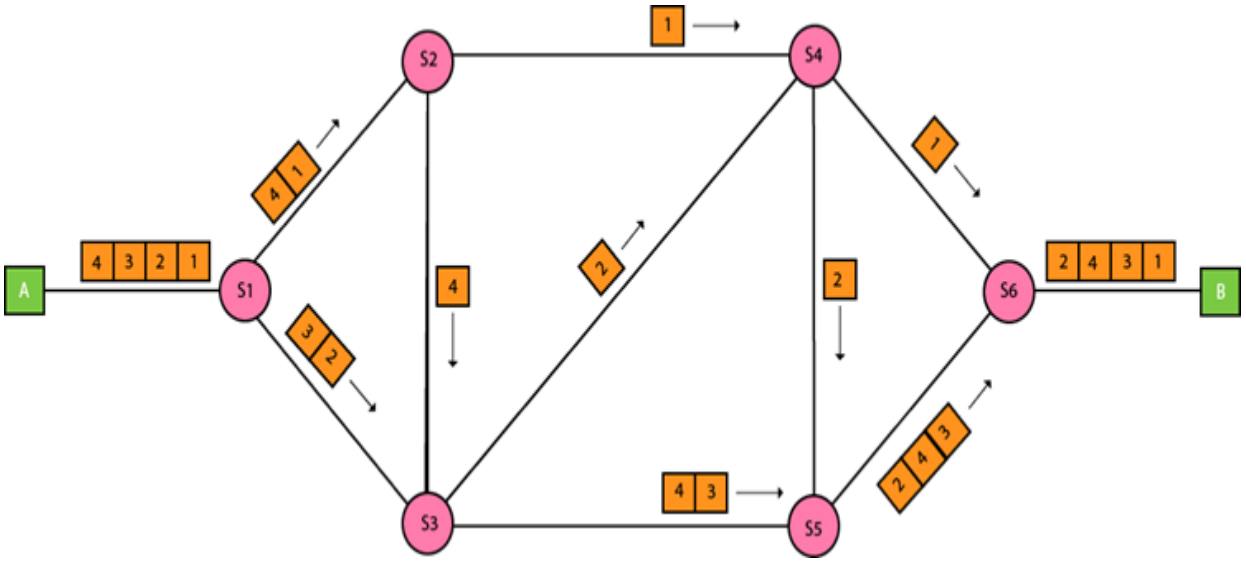
Communication through circuit switching has 3 phases:

- Circuit establishment
- Data transfer
- Circuit Disconnect



Packet Switching

- The packet switching is a switching technique in which the message is sent in one go, but it is divided into smaller pieces, and they are sent individually.
- The message splits into smaller pieces known as packets and packets are given a unique number to identify their order at the receiving end.
- Every packet contains some information in its headers such as source address, destination address and sequence number.
- Packets will travel across the network, taking the shortest path as possible.
- All the packets are reassembled at the receiving end in correct order.
- If any packet is missing or corrupted, then the message will be sent to resend the message.
- If the correct order of the packets is reached, then the acknowledgment message will be sent.



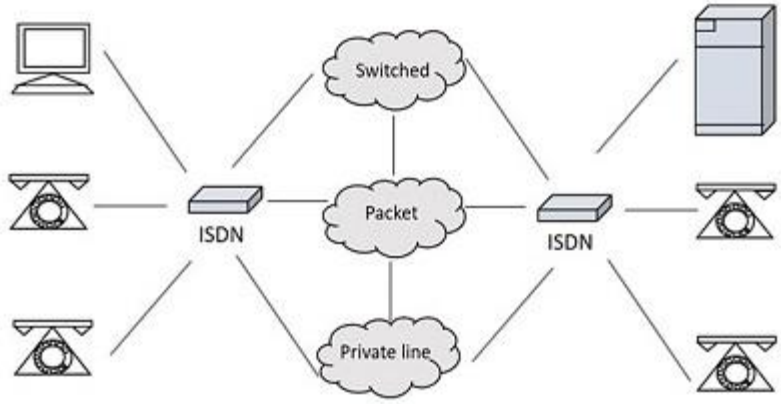
HYBRID SWITCHING

Hybrid, as the name implies, is a combination of techniques. Various combinations of hybrid switching have appeared in data communications over the years, but have been relegated for the most part to CPE, outside the classical telephone world. In the broader context, IEEE 802.xx LLC (logical link control) and a combination of higher layer Ethernet packets mapped to Internet packets could be labeled a hybrid. However, continued innovation and development emerging after the 1984 deregulation of the long distance telephone business led to newer approaches to transmission and switching such as SONET/SDH, ATM, and other packet- or cell-based technologies. T

ISDN:-

ISDN was first defined in the CCITT red book in 1988.The **Integrated Services of Digital Networking**, in short ISDN is a telephone network based infrastructure that allows the transmission of voice and data simultaneously at a high speed with greater efficiency. This is a circuit switched telephone network system, which also provides access to Packet switched networks.

The model of a practical ISDN is as shown below.



ISDN supports a variety of services. A few of them are listed below −

- Voice calls
- Facsimile
- Videotext
- Teletext
- Electronic Mail
- Database access
- Data transmission and voice

The ISDN has several kinds of access interfaces such as −

- Basic Rate Interface (BRI)
- Primary Rate Interface (PRI)

- Narrowband ISDN
- Broadband ISDN

Basic Rate Interface (BRI)

The Basic Rate Interface or Basic Rate Access, simply called the **ISDN BRI Connection** uses the existing telephone infrastructure. The BRI configuration provides **two data** or bearer channels at **64 Kbits/sec** speed and one control or delta channel at **16 Kbits/sec**. This is a standard rate.

Primary Rate Interface (PRI)

The Primary Rate Interface or Primary Rate Access, simply called the ISDN PRI connection is used by enterprises and offices. The PRI configuration is based on T-carrier or T1 in the US, Canada and Japan countries consisting of **23 data** or bearer channels and one control or delta channel, with 64kbps speed for a bandwidth of 1.544 M bits/sec.

Narrowband ISDN

The Narrowband Integrated Services Digital Network is called the **N-ISDN**. This can be understood as a telecommunication that carries voice information in a narrow band of frequencies. This is actually an attempt to digitize the analog voice information. This uses 64kbps circuit switching.

Broadband ISDN

The Broadband Integrated Services Digital Network is called the **B-ISDN**. This integrates the digital networking services and provides digital transmission over ordinary telephone wires, as well as over other media. The CCITT defined it as, “Qualifying a service or system requiring transmission channels capable of supporting rates greater than primary rates.”

UNIT:-7

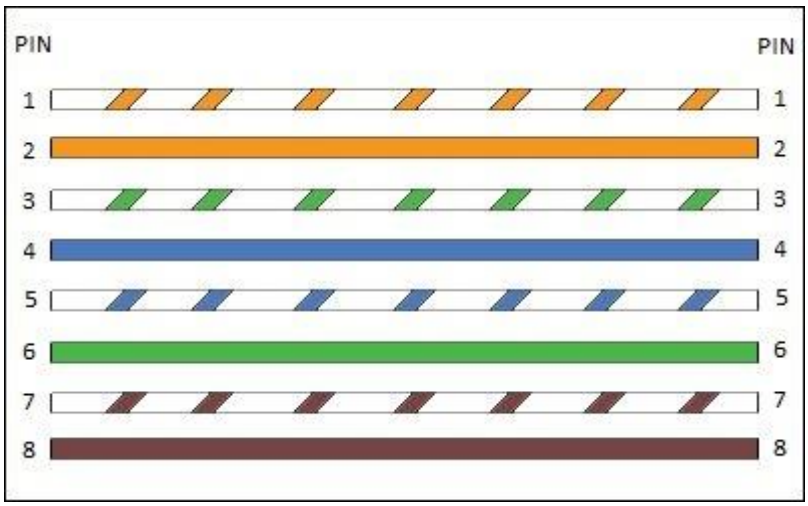
Broadcast network & their protocols

Types of Ethernet cables :-

Ethernet cables can come in two forms when it comes to wiring:

1. Straight-through cable

This cable type has identical wiring on both ends (pin 1 on one end of the cable is connected to pin 1 at the other end of the cable, pin 2 is connected to pin 2 etc.):

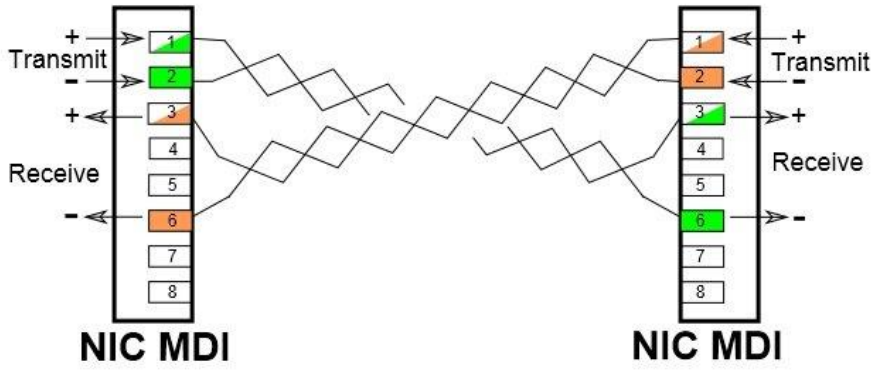


This type of cable is used to connect the following devices:

- computer to hub
- computer to switch
- router to hub
- router to switch

2. Crossover cable

With the crossover cable, the wire pairs are swapped, which means that different pins are connected together – pin 1 on one end of the cable is connected to pin 3 on the other end, pin 2 on one end is connected to pin 6 on the other end (Photo credit: Wikipedia):

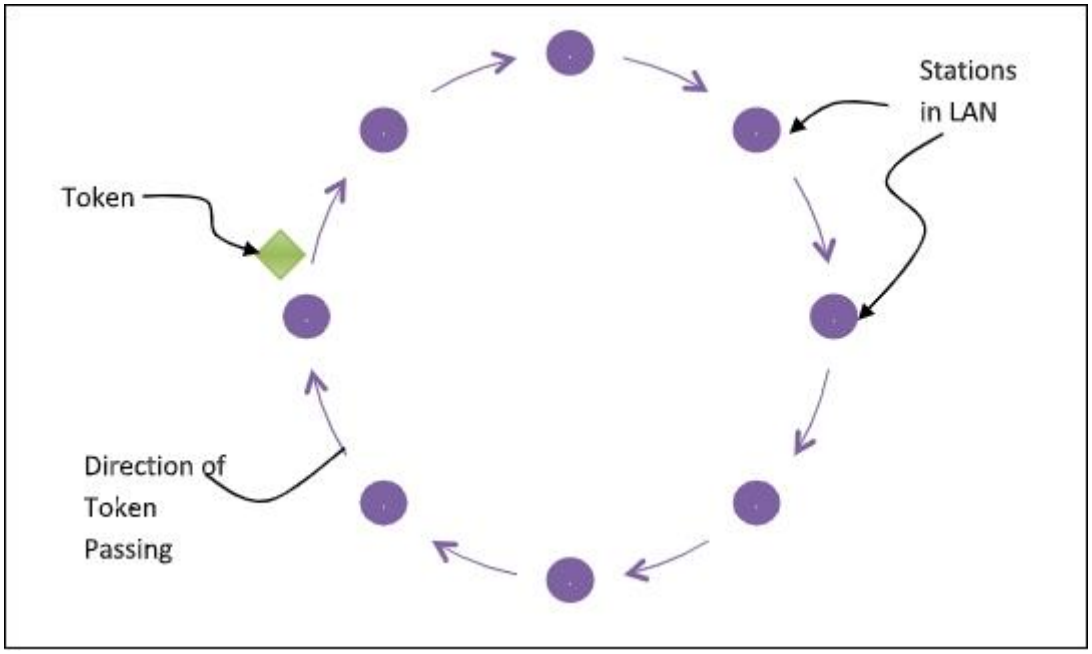


This type of cable is used when you need to connect two devices that use same wires to send and receive data.

Token Ring

Token ring (IEEE 802.5) is a communication protocol in a local area network (LAN) where all stations are connected in a ring topology and pass one or more tokens for channel acquisition. A token is a special frame of 3 bytes that circulates along the ring of stations. A

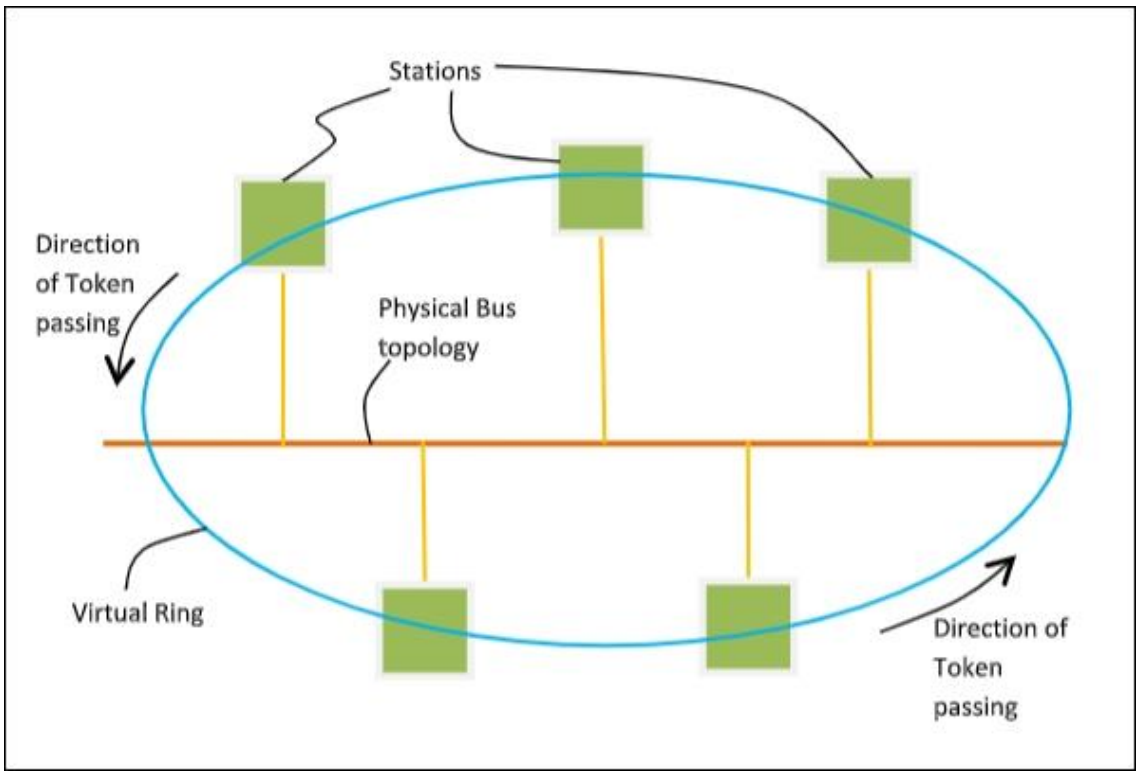
station can send data frames only if it holds a token. The tokens are released on successful receipt of the data frame.



Token Bus

Token Bus (IEEE 802.4) is a standard for implementing token ring over virtual ring in LANs. The physical media has a bus or a tree topology and uses coaxial cables. A virtual ring is created with the nodes/stations and the token is passed from one node to the next in a sequence along this virtual ring. Each node knows the address of its preceding station and its succeeding station. A station can only transmit data when it has the token. The working principle of token bus is similar to Token Ring.

. This is depicted in the following diagram −



WAN repeaters:-

The WAN repeater system is a network of linked repeaters using the AllStar Link technology. AllStar is similar to the all familiar EchoLink and IRLP, using the Internet to connect multiple repeaters together, however, AllStar has many advantages over these other systems. By using wider bandwidth and higher dynamic range, the audio throughput is better than any other popular technology. The system is fully programmable, making it easy to connect and disconnect repeaters from the system using easy to remember codes. WAN is comprised of many repeaters located mainly in Pennsylvania, however we have a strong presence in Maryland and Washington DC as well. Each repeater is represented as an individual node on the AllStar system.

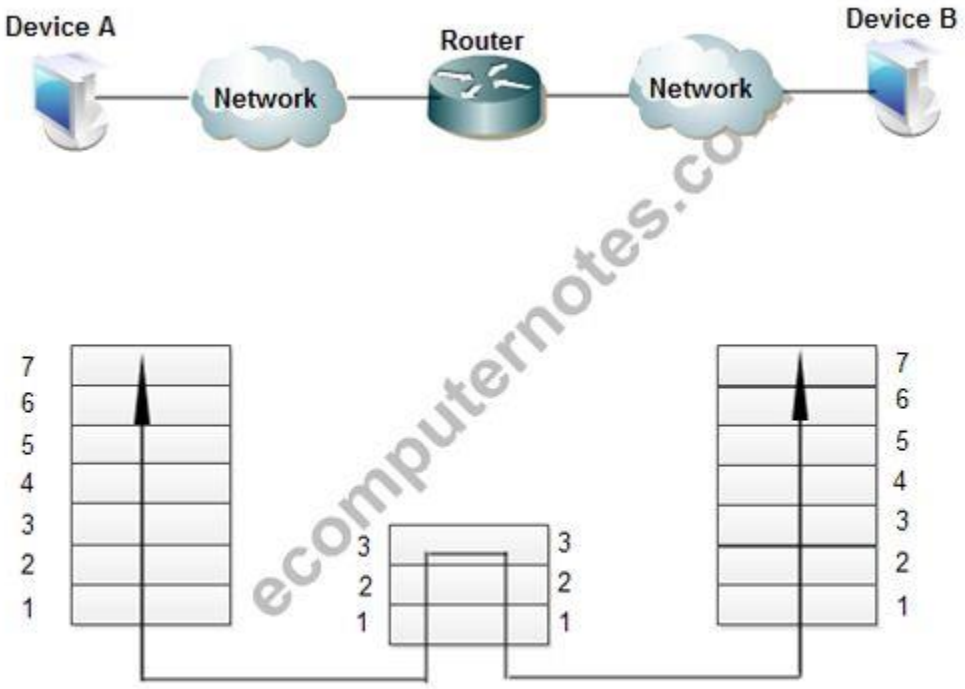
Bridge:-

A bridge is a type of computer network device that provides interconnection with other bridge networks that use the same protocol.

Bridge devices work at the data link layer of the Open System Interconnect (OSI) model, connecting two different networks together and providing communication between them. Bridges are similar to repeaters and hubs in that they broadcast data to every node. However, bridges maintain the media access control (MAC) address table as soon as they discover new segments, so subsequent transmissions are sent to only to the desired recipient.

Routers:-

A router has access to the network layer address or logical address (IP address). It contains a routing table that enables it to make decisions about the route i.e. to determine which of several possible paths between the source and destination is the best for a particular transmission. These routing tables are dynamic and are updated using routing protocols.



A Router in the OSI Model

Types of Routers

There are several types of routers in the market.

Broadband Routers

Broadband routers can do different types of things. Broadband routers can be used to connect computers or to connect to the Internet.

Wireless Routers

Wireless routers create a wireless signal in your home or office. So, any PC within range of Wireless routers can connect it and use your Internet.

GATWAY:-

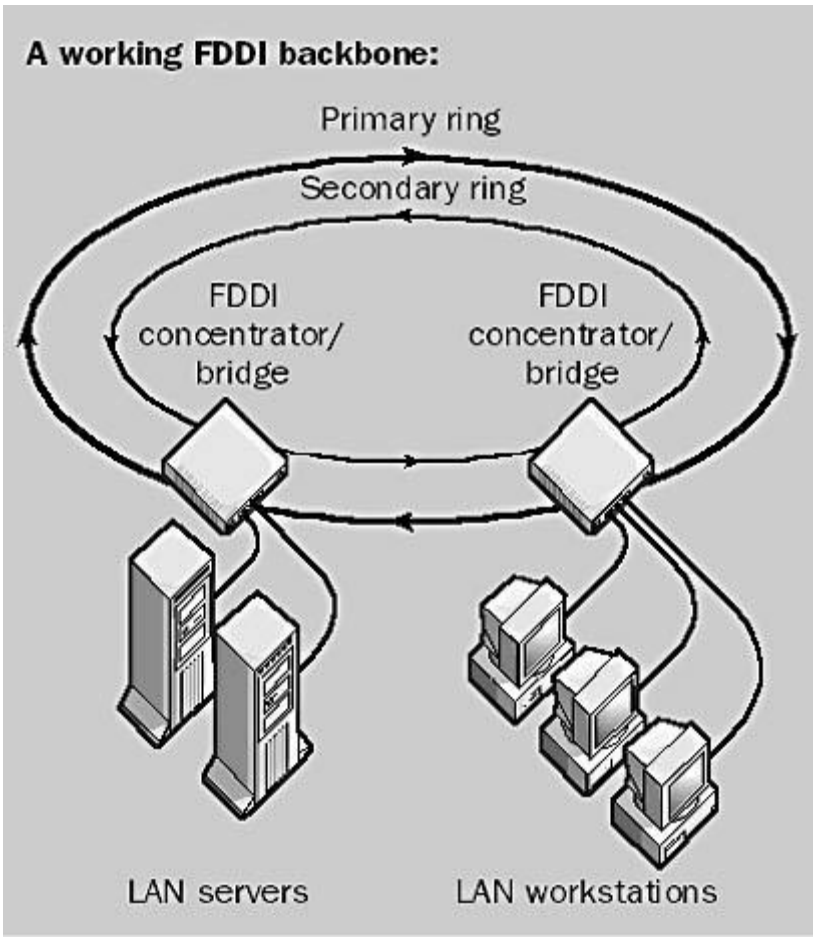
A gateway is a node (router) in a computer network, a key *stopping point* for data on its way to or from other networks. Thanks to gateways, we are able to communicate and send data back and forth. The Internet wouldn't be any use to us without gateways (as well as a lot of other hardware and software).

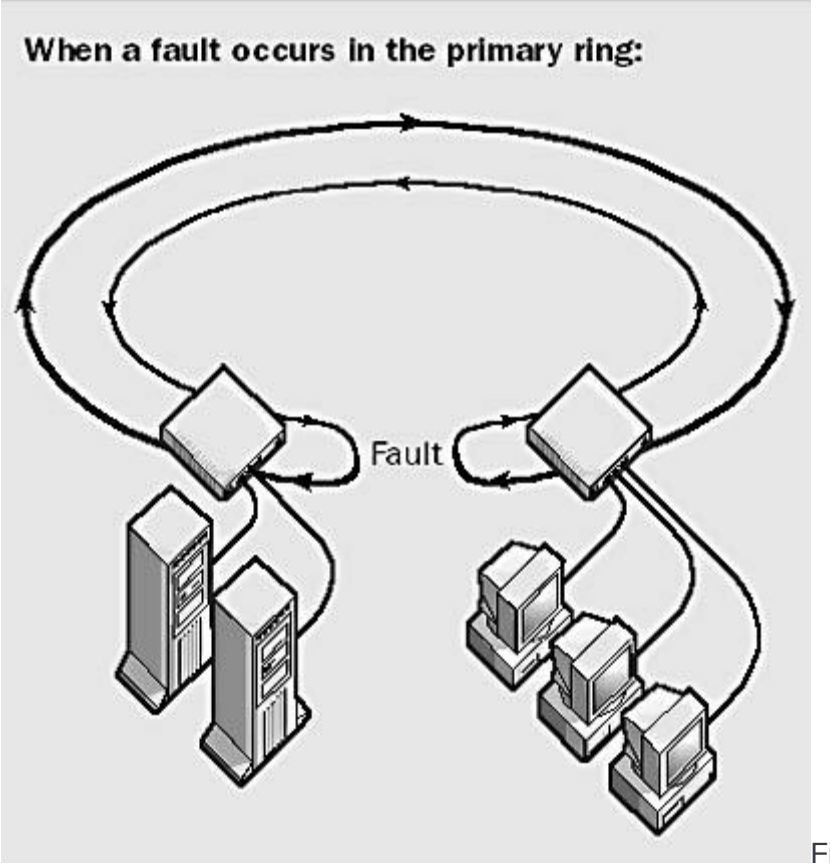
In a workplace, the gateway is the computer that routes traffic from a workstation to the outside network that is serving up the Web pages. For basic Internet connections at home, the gateway is the Internet Service Provider that gives you access to the entire Internet.

FiberFiber Distributed Data Interface (FDDI):-

Fiber Distributed Data Interface, or FDDI, is a high-speed network technology which runs at 100 Mbps over fiber-optic cabling, often used for network backbones in a local area network (LAN) or metropolitan area network (MAN).

A high-speed network technology, conforming to the Open Systems Interconnection (OSI) reference model for networking and the American National Standards Institute (ANSI) standard X3T9, which runs at 100 Mbps over fiber-optic cabling; often used for network backbones in a local area network (LAN) or metropolitan area network (MAN).





Fiber Distributed Data Interface

(FDDI).

FDDI uses a timed token-passing technology similar to that of token ring networks as defined in the IEEE 802.5 standard

TCP/IP

The Internet Protocol (IP) is the address system of the Internet and has the core function of delivering packets of information from a source device to a target device. IP is the primary way in which network connections are made, and it establishes the basis of the Internet. IP does not handle packet ordering or error checking. Such functionality requires another protocol, typically TCP.

The TCP/IP relationship is similar to sending someone a message written on a puzzle through the mail. The message is written down and the puzzle is broken into pieces. Each piece then can travel through a different postal route, some of which take longer than others.

THANKING YOU !