Biyani's Think Tank

Concept based notes

Data Communication Network

MCA –II SEM

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Preface

I am glad to present this book, especially designed to serve the needs of the students. The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self-explanatory and adopts the "Teach Yourself" style. It is based on question-answer pattern. The language of book is quite easy and understandable based on scientific approach.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Mr. Rajeev Biyani, *Chairman* & Dr. Sanjay Biyani, *Director* (*Acad.*) Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this endeavour. They played an active role in coordinating the various stages of this endeavour and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

Author

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Syllabus

Overview, evolution of computer networks, computer telephony. Data communications – advantages of digital communication, transmission media, and fundament ales of digital communications, transmission media, modulation techniques and modems. The OSI seven layer network model, LAN technologies – protocols and standards, LAN hardware, TCP/IP and the Internet, Internet Architecture, Internet protocol and datagram., Routing protocols, UDP, Internet standard services, DNS. Networking Technologies, ISDN, Cable Modem System, DSL, SMDS, Frame relay, fast Ethernet, 100VG-anyLAN and Gigabit Ethernet, FDDI and CDDI, Asynchronous Transfer, SONET, DWDM Switching and Virtual LAN, Non-ATM Virtual LANs, IEEE 802.1Q VLAN standard, Network Performance, Analytical approaches, simulation, traffic monitoring. Network Management – SNMP, RMON and RMNv2, TMN, Directory services and network management. Issues related to network reliability and security, SSL and VPN, Introduction only to firewalls and Kerberos, Cyber Laws.

Content

UNIT 1 – Data Communication

- digital communication, advantages of digital communication
- communication, communication system
- Twisted pairs cable ,Advantages, disadvantages, uses ,types
- Coaxial cable, Advantages, disadvantages ,uses ,types
- Optical fiber cable, Advantages, disadvantages, uses, types
- transmission media, Advantages, disadvantages ,uses ,types
- modem, types of modems ,modulation
- data communication ,advantages ,disadvantages
- transmission mode, refraction

UNIT 2 – Network Protocol (OSI Model)

UNIT 3 – Networking Technologies

UNIT 4 -- Network Switching

UNIT 5 – Network Management

UNIT 6 – Network Security

Unit – 1

Data Communication

Q. 1 What is communication?

Ans. Communication is a layman language means to convey a message ,an idea, a picture or a speech that is received and understood clearly and correctly by the person for whom it is conveyed .There could be several methods of conveying the message.

Communication is sharing information have to be local or remote .Between individuals, local communication usually occurs face to face, while remote communication takes place or distance. the turn telecommunication ,which includes telephony, telegraphy and television, means communication at distance.

Telephonic communication is popular because it is cheap and instantaneous. We can talk to a person and convey a lot message on telephone, but picture cannot be sent on telephone . It is in this content ,that data communication containing messages, pictures and voices has taken the importance.

Definition : Data communication is the exchange of data (in the form of 0s and 1s)between two devices via some form of transmission medium(such as wire cable).Data communication is considered local if the communicating devices are in the same building or a similarly restricted geographical area, and is considered remote if the devices are farther apart.

Q. 2 What is communication system?

Ans. **Definition**--- Communication system is the combination of hardware, software and data transfer links that make up a communication facility for transferring data in a cost effective manner.

In the case of sending and receiving messages or data from one place to another, we have many elements working together All these elements put together to work efficiently is known as a system.

the communication system has the sole purpose of passing data or information in the most effective manner.

A communication system itself can be either analog or digital (or a combination of two). The information can be transmitted in either in analog from or in digital form within the communication networks. The technique by which a digital signal is converted to its analog form is known as modulation. The reverse processes, i.e. the conversation of analog signal to its digital form at the destination devices are called demodulation.

Q. 3 What are the advantages of digital communication?

Ans. Advantages of Digital communication:

(1) The voice data, music and images can be combined to make more efficient use of the same circuit and equipment.

(2) Much higher data transmission rates are possible using existing telephones lines.

(3) Digital communication is much cheaper than analog data transmission and also it is not necessary to accurately reproduce on analogue wave form after it has passed through potentially hundreds if reports a transcontinental call.

(4) Maintenance of a digital system is easier received correctly or not , making it simpler to track document the problems.

(5) A digital signals can pass through an arbitrary number of regenerators with no loss is signals and there travels long distances with no information loss.

Q. 4 Explain the following terms with their advantages and disadvantages ?

(a) Twisted pairs cable

(b) Coaxial cable

(c) Optical fiber cable

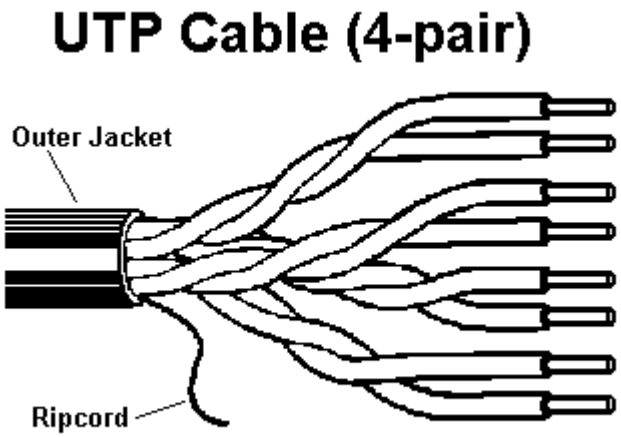
Ans. (a) TWISTED PAIRS:-- It has two types

- Unshielded twisted pair
- Shielded twisted pair

➢ Unshielded twisted pair:--A twisted pair consist of four insulated copper wires, typically about 1mm thick. The wires are twisted together in helical.

The purpose of twisting the curies is to reduce the electric interference from similar pairs close by.

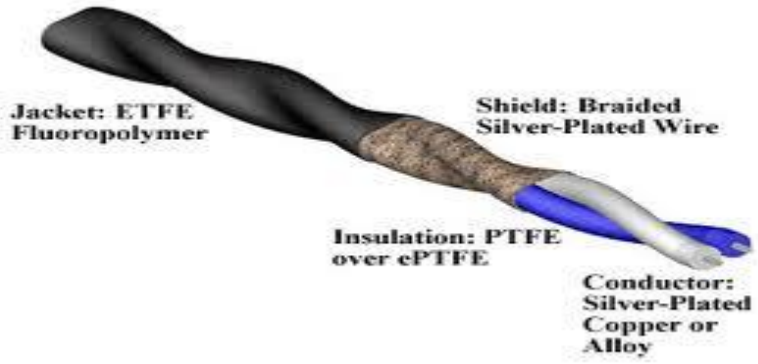
Twisted pair wires are commonly used for digital data transmission over short distances up to 1km.when many twisted pairs run in parallel for a substantial distance, such as all the wires coming from a multistory apartment building to the telephone exchange, they are bundled together and encased in a protective sheath. The pairs in these bundles would interface with one another. it wire not for the twisting.



UNSHEILDED TWISTED PAIR

- Shielded twisted pair:--Shielded wire is typically is used in an electrically noisy environment to limit the effects of noise absorption .unshielded pair commonly referred to as UTP is by far the more common of the two configuration twisted pair wiring is more commonly used for local area network.

  Twisted pair cabling comes in several varieties. Computer network ,true of these are important category-3 twisted pairs consist of two insulated wires gently twisted together .Four such pairs are typically grouped together in a plastic sheath for protection and to keep the eight wires together.



SHIELDED TWISTED PAIR

ADVANTAGES :---

1- Being the coldest method of data transmission trained manpower to repair and service this media of communication are easily available.
2- In a telephone system, signals can travel several kilometers without amplification when twisted pair wires are used.
3- This media can be used for both analog and digital data transmission. The bandwidth depends on the thickness of the wire and the distance travelled but several megabits per second can be achieved for a few kames, in many cases.
4- It is the least expensive media of transmission for short distances.
5- If position of a twisted pair cable is damaged, the entire network is not shut down as it may be case with coaxial cable.

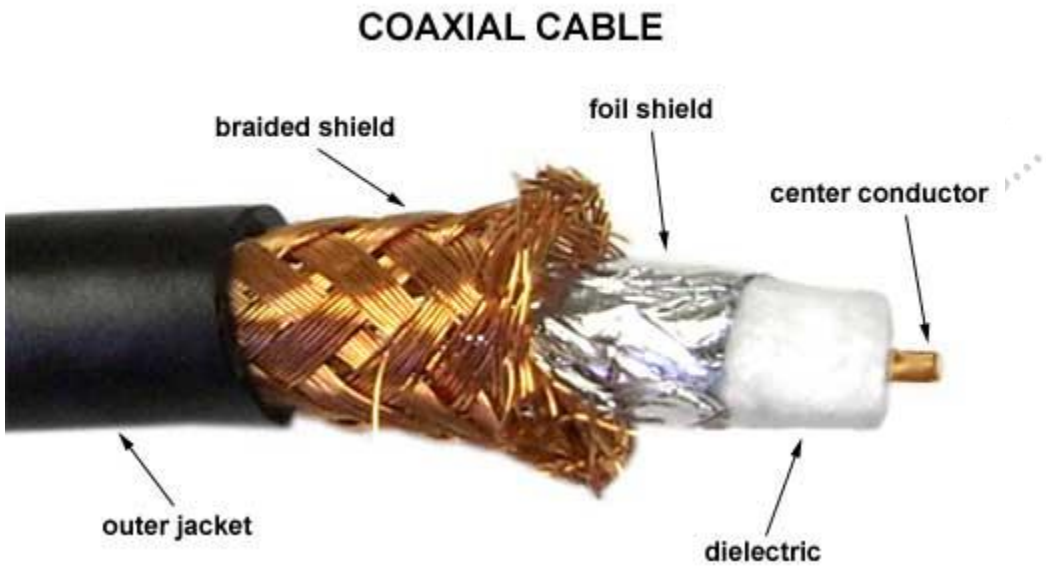
DISADVANTAGES: ---

1-Easily pick up noise signal which results in higher error rates when the line length exceeds 100meters.
2-Being thin in size, It is likely to break easily.

(b)COAXIAL CABLE:-- Coaxial cable consists of a shift copper wire as the core ,surrounded by an in insulating material. The insulator is encased by a cylindrical conductor often as a closely women braided mesh. The ought conductor is covered in an protective plastic sheath. The signal is transmitted by the inner copper wire and is electrically shielded by the outer metal sleeve. Two

kinds of coaxial cable are widely used .one kind 50-ohm cable is commonly used for digital transmission. The other kind, 75-ohm cables, is commonly used for analog transmission in cable TV transmission.

Coaxial cable is difficult to connect to network devices and generally requires more planning than twisted pair system. Many coaxial systems require the connectors on the main cable to be attached directly to the adapter on the PCs. This reduces flexibility in locating workstation and server.



ADVANTAGES:--

(a) It has better shielding than twisted pairs, so it can span longer distances at higher data bps.

(b) It can be used both analog data transmission as well as digital data transmission for analog ,75ohm.broadband coaxial is used and for digital data transmission 50ohm cable, baseband cable is used.

(c) Coaxial cable has higher bandwidth and excellent noise amenity.

(d) It is relatively expensive as ax pared to fiber optic cables and easy to handle.

(e) Coaxial cable has a bandwidth in the range of 300-400MHz,it is capable of carrying over 50 standard 6MHz color TV channels or thousand of channels of voice grade and 1 or low speed data over a single cable.

DISADVANTAGE:--

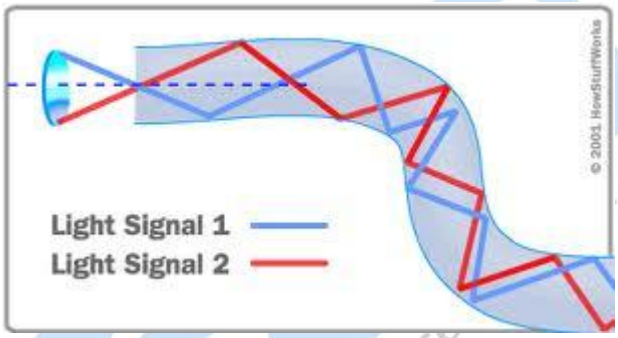
(a) Installation costs, while dropping, are still high.
(b) Special test equipment is often required.
(c) Susceptibility to physical damage.
(d) Wildlife damage to fiber optic cables.

(b) **OPTICAL FIBER: --** optical fiber is the newest form of bounded media .this media is superior in data handling and security characteristics .the fiber optic cable transmits light signals rather than electrical signals. it is for more efficient than the other network transmission media. Each fiber has an inner core of glass or plastic that conducts light.

There are two types of light sources for which fiber cables are available. These sources of light are:

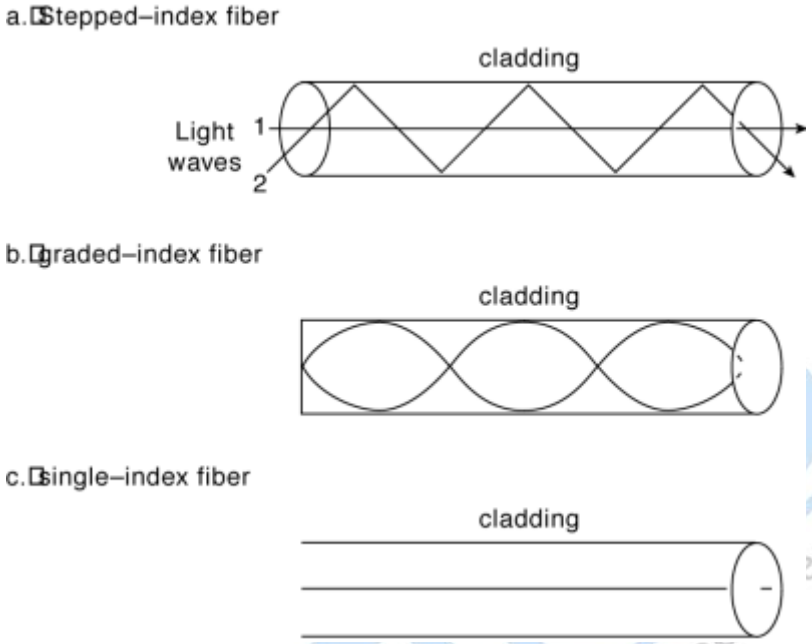
a- Light emitting diodes

b- Light amplification by stimulated emission radiation.

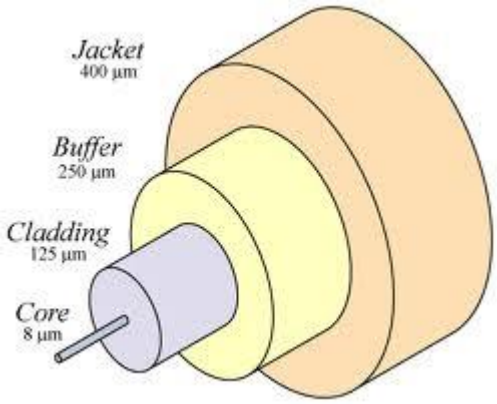


The system basically consists of fiber optic cables that are mode of tine threads of glass or plastic in a single mode fiber, the wire is 8 to 10 microns about the size of hair in multimode fibers, the core is of about 50microns in diameters.

Towards its sources side is a convert that converter that converts electrical signals into light waves. These light waves are transmitted over the fiber. Another converter placed near the sink converts the light waves back to electrical signals are amplified and sent to the receiver each fiber has a inner core of glass or plastic that conducts light. The inner core is surrounded by cladding. Cladding is layer of glass that reflects the light back in to the core.



Single mode fiber allows a single light path and is typically used with laser signaling. Single mode fiber can allow greater bandwidth than multimode but it is more expensive.



ADVANTAGES of fiber optic cable over copper wire:--

(a) It can handle much higher ban width than copper. Due to the low attenuation, repeats are needed only about every 30km on long lines, about every 5km for copper.

(b) Fiber is not being affected by power surges, electromegnatic interference or power failures. Nor it is affected by corrosive chemicals in the air, making it ideal for harsh factory environments.
(c) Fiber is lighter than copper.
(d) Fiber does not wake light and are quit difficult to tap. This gives an excellent security against potential wire tapper.

DISADVANTAGES of fiber optic cable over copper wire:--

(a) Fiber is an unfamiliar technology requiring skills most engineers do not have.
(b) Since optical transmission is inherently unidirectional ,two ways communication requires either two fibers of fours frequency bands on one fiber.
(c) fiber interfaces cost more than electrical interfaces.

Q. 5 Explain transmission media ?

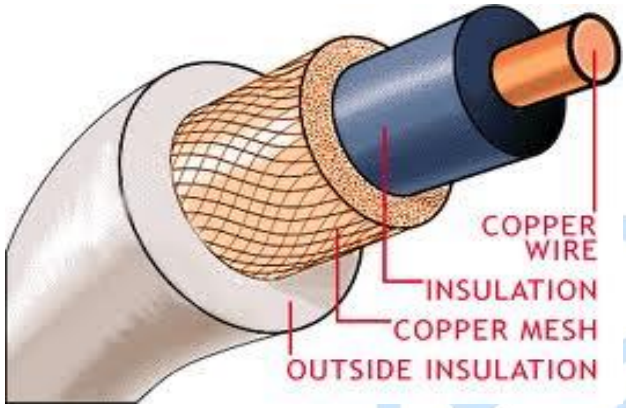
Ans Transmission media :-media is the general term used to describe the data path that forms the physical channel between sender and the receiver.media can be twisted pair wire such as that used for telephone installation ,coaxil cabel of various sizes and electrical characterstics, fiber optics and wireless supporting either light waves or radio waves.
Band width is similar to the concept of frequence response in a stereo amplifier— the greater the frequance response, the higher the band width according to a fundamental princepal of information theory ,higher band width communication channels support higher data rates.

Q.6 Explain the types of transmission media ?

Ans There are several types of physical channels (communication media)through which data can be transmitted from one point to another .some of the most common data transmission media are as follow :--

- Guided media
  - **electrical**
    - Twisted pair cable
    - coaxial cable

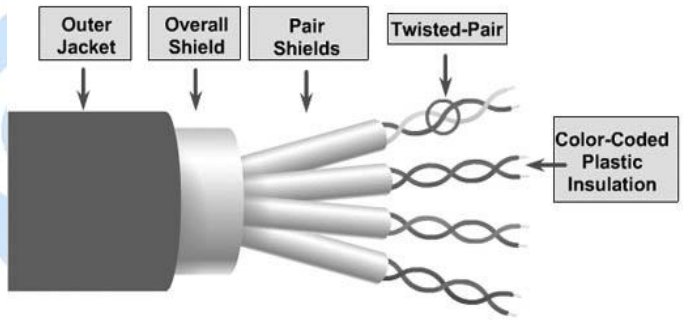
- **optical**
  - single mode and multimode



coaxial cable

➢ **Unguided media**

- electromagnetic waves in air
  - radio
  - microwaves



Twisted Pair

Various forms of data path can be used depend on the type of coputers connected and the data rate.i.e number of bits passed in one second.there are thus main types of communication media.these are bounded and unbounded media.in the case of boundedmedia,the data is transferred in the limited space whereas in the case of unbounded media,there is no restriction on the space.

Q.7 What is modulation?

Ans Modulation is the method of mixing intelligent signal on to the carrier signal so that a weak intelligent signal can be transmitted over long distance over a transmission media such as copper conduct or coaxial cable. Modulation is the process of converting a digital signal from a computer into an analog signal the telephone system will accept .when you pick up the phone while your computer modem is communicating .

Q.8 Explain the concept of modulation ?

Ans Concept of modulation :

Due to the fact that both attenuation and propagation of speed are frequency dependent ,it is undesirable to have a wide range of frequencies in the signal but square waves in digital data have a wide spectrum and are subject of strong attenuation and delay distortion.

Modulation is to mix a data signal onto a carrier and modify its characteristics for transmission in a communication network. A carrier is electromagnetic wave that vibrates at a fixed frequency.

Data modulate by carrier by various methods .and these methods are :

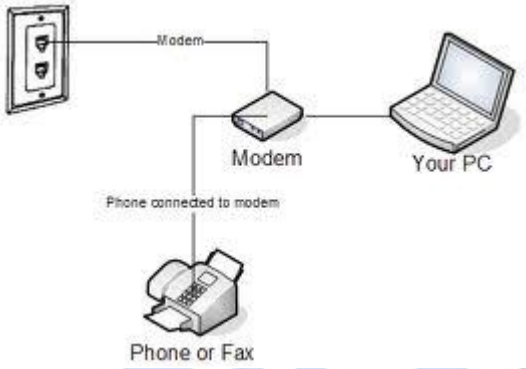
(a) amplitude modulation
(b) frequency modulation
(c) phase modulation

Q.9 What is modem ?

Ans **M**odem stands for modulator demodulator. Modems convert communication signals from a form the computer can understand to aform the telephone system can convey and vice versa.

Modems convert communications signals from a form the computer can understand to a form the phone system can convey and vice versa .modems speed is often discussed in baud rates or bps , which are similar terms but they do not mean exactly the same baud rate refers to the oscillation of a sound wave on which a single bit of data is carried. bits per second is the amount of data transferred in a second.

When a computer wishes to send digital data over a dial up line ,the data must first be converted to analog form by a modem for transmission over the local loop ,then convert to digital form for transmission over the long –haul trunks ,then back to analog over the local loop at the receiving end.



MODE

A modem can be installed internally in the computer in which case it is called an internal modem ,or it can be a external device that is connected to the computer with a serial cable.

Q.10 Explain the types of modems ?

Ans Modems can be of following types :

(a)Landline modems

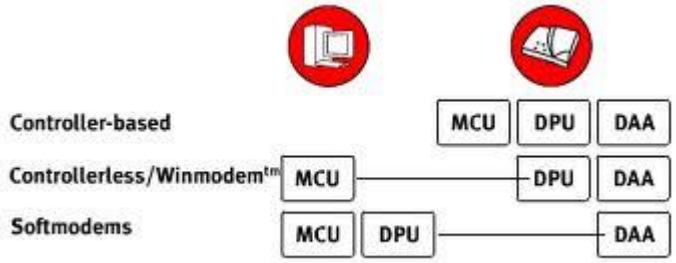
(b)wireless modems

(c)LAN modems

=> Landline modems are modems which connect to the public switched telephone network (PSTN).to connect to PSTN, these modems have have a jack known as RJ-11jack or regular phone jack.
Landline modems can be further classified into the following types :
(a)internal modems
(b)external modems
(c)PCMCIA modems
(d)voice/data/modems

=>wireless modems are redio transmitters/receivers installed into mobile computing devices(i.e.devices that are used while you are moving such as mobile phones,laptops etc)

=>Lan modems allow shared remote access to lan resources.lan modems comes fully preconfigured for asingle particular network architecture such as Ethernet or token ring.



LAN

Q.11 Explain the modem standards ?

Ans There are two modem standards .these are :
(a)**B**ell modems
(b)ITU-T modems
First commercially available modems were developed by Bell telephone company in the early 1970s.Being the first modem manufacturer, they defined the developed of the technology and provided the standard which subsequent manufactures followed. some major Bell modems include the 103/113series,202series,212series,201series.
Many of today's popular modems are based on the standards published by ITU-T.v.21,v.22,v.23,v.32 modems are ITU-T modems.

Q.12 What are the advantages of data communication ?

Ans **D**ata communication has a following advantages :

(a) Pictures sound and written data can be sent within minutes and a confirmation about it reaching at the destination can be obtained indirectly.

(b) Message can be coded so that it is not understood by anybody else except the person who is sending and the person who is receiving the message. even if the message is intercepted on the way, it can not be decoded.

(c) Message can be sent in any language including hindi, regional language or european language from any part of the world to any other part of the world.

(d) Users need not take highly specialized training for sending or receiving messages.

(e) In addition waying to conveying a message ,the same pc can also be used as an instrument to get information from varied sources such as railways ,stock exchange. even goods can be purchased using computers and is return the payments can be sent electronically.

(e) PCs connected with modem can also be used for education,entertainment,etc.

(f) Telephonics calls can be made to any part of the world with the same expenses as a local telephone call made within the city.

Q.13 What are the main components of data communication ?

Ans Components of the data communication :

1- **Messages:--** the messages is the information (data)to be communicated.it can consist of text,numbers,pictures,sound on video or any combination of these.

2- **Sender**:-- the sender is the device that sends the data message.it can be a computer workstation,telephone handset video camera and so on.

3- **Receiver:--** the receiver is the device that recevices the messages .it can be a computer,workstation,handset
Telephone and so on.

4- **Medium:--** the transmission medium is the physical path by which a message travels from sender to receiver.it can consist of twisted pair wire,cables,fiber,optic cable,laser or radio weaves.

5- **Protocol:--** a protocol is a set of rules that govern data communication devices.without a protocol ,two devices may be connected but not communicating,just as a person speaking french can not be understand by a person who speaks only japanese.

Q.14 Define data communication network ?

Ans Data Communication network :--the task of network designers is to selected and coordinate the network components is that the necessarydata are module to the right place,at the right time,with minimum of errors and at the lowest possible cost.a number of communication processor are used by network designers to achieve this goal.

Communication system is the combination of hardware,software and data transfer units that make up a communication facility for transferring data in an efficient manner.

Q.15 What are the characteristics of data communication system ?

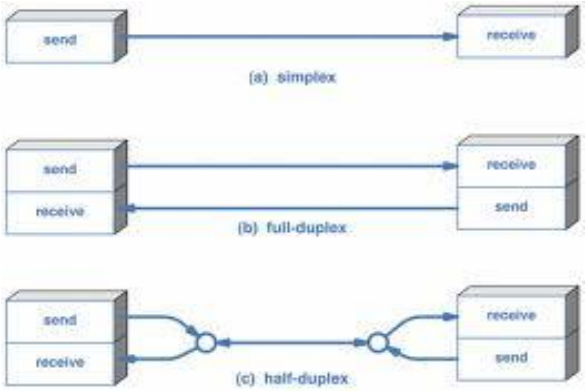
Ans Fundamentals characteristics of data communication system :

1- **Delivery**: the system must deliver data to the correct destination.data must be received by the intended devices or user and only by that device or user.
2- **Accuracy**: the system must deliver data accuratly. data that have been altered in transmission and left uncorrected are unusable.
3- **Timeliness**: the system must deliver data in a timely manner data delivered late are useless. in the case of videos, audios, and voice data. timly deliverly means delivering data as they are produced in the same order that they are produced and without significant delay. this kind of delivery is called real time transmission.

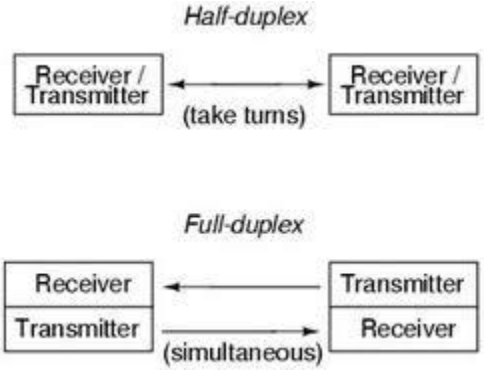
Q.16 Write down the transmission mode ?

Ans The term transmission mode is used to define the direction of signal flow between two linked devices.there are three types of transmission modes :

1- Simplex
2- Half-duplex
3- Full-duplex



1- **SIMPLEX** :--in this mode,the communication is undirectional,as on a one-way communication transmission.television transmission is avery good example of simplex communication.the main transmitter sends out a signal(broadcast),but it does not expect a reply as the receving units can not issue reply back to the transmitter.exam: include a data collection terminal one a factory floor or a line printer.
2- **HALF-DUPLEX** :-- in half-duplex mode,both units communicate our same medium,but only one unit can send at a time.while one is in send mode,the other unit is in receiving mode.it is like true polite people talking to each other-one talk the other listen,but both of them could not talk at the same time –thus a half duplex line can alternately sen and receive data.it requires two wires it is used to connect a terminal with computer.the terminal might transmit data and them the computer responds with an acknowledgement.the transmission of data to and from a hard disk is also done in half duplex mode.
3- **FULL-DUPLEX**:-- a half-duplex system,the line must be "turned around "each time the direction is requires. This involves a special switching circuit and requires a small amount of time with high speed capabilities of the computer this turn around time is unacceptable in many instances. also,some application requires simultaneously transmission in both direction in such cases a full duplex system is used that allows information to flow simultaneously in both direction on the transmission path. use of full-duplex line improves efficiency as the line turnaround time required in a half-duplex arrangement is eliminated also requires four wires for full-duple.



Q.17 What is REFRACTION ?

Ans Refraction:--light travel in a straight line as long as it is moving through a single uniform substance. If ray of light travelling through one substance suddenly enters another substance, its speed changes abruptly, causing the ray to change direction. This change is called refraction.

The two angles mode by the beam refraction in relation to the vertical axis are called I for incident and R for refracted the beam travels from a less dense medium into a more sense medium. In the case angle angle R is smaller than angle I.

When a beam travels from a more dense, medium into a less dense medium. in this case the value of I is smaller than the value of R, when light travels into denser medium, the angle of incidence is grater than the angle of refraction.

Unit– 2

Network Protocol (OSI Model)

Q.1 What is OSI model ?

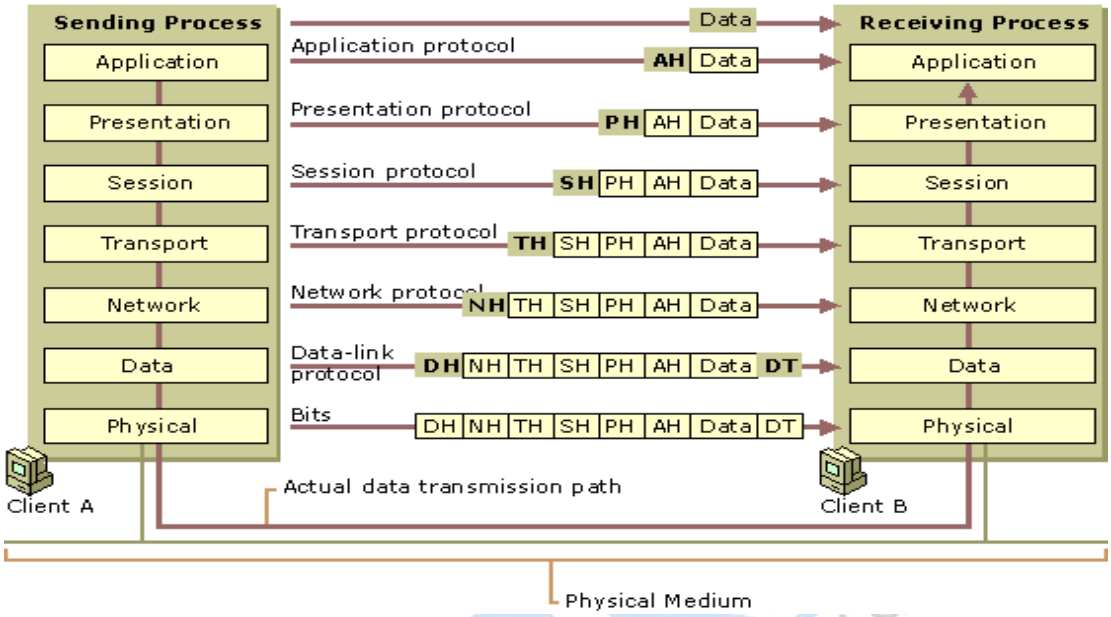
Ans Model :-- The OSI model is layered framework for the design of network system that allows for communication across all types of computer system .it consist of separate but related layers, each of which defines a segment of the process of moving information across a network.

Q. 2 Explain the architecture of OSI seven layer network model ?

Ans LAYER Architecture :--The OSI model is built of seven ordered layer :

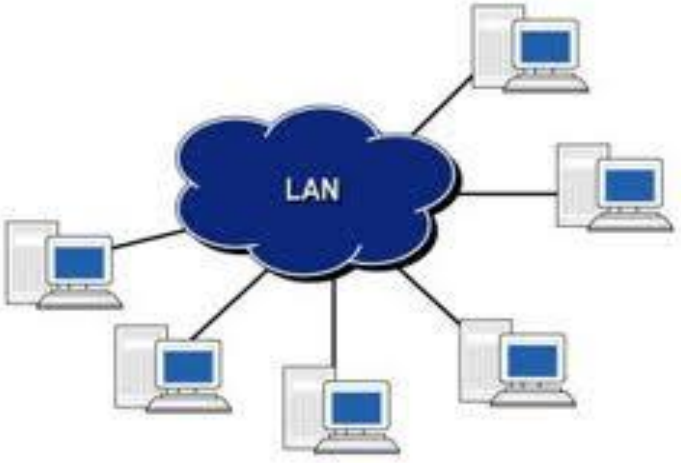
1- Physical layer
2- Datalink layer
3- Network layer
4- Transport layer
5- Session layer
6- Presentation layer
7- Application layer

The message is passed into many intermediate nodes(a to b mod)



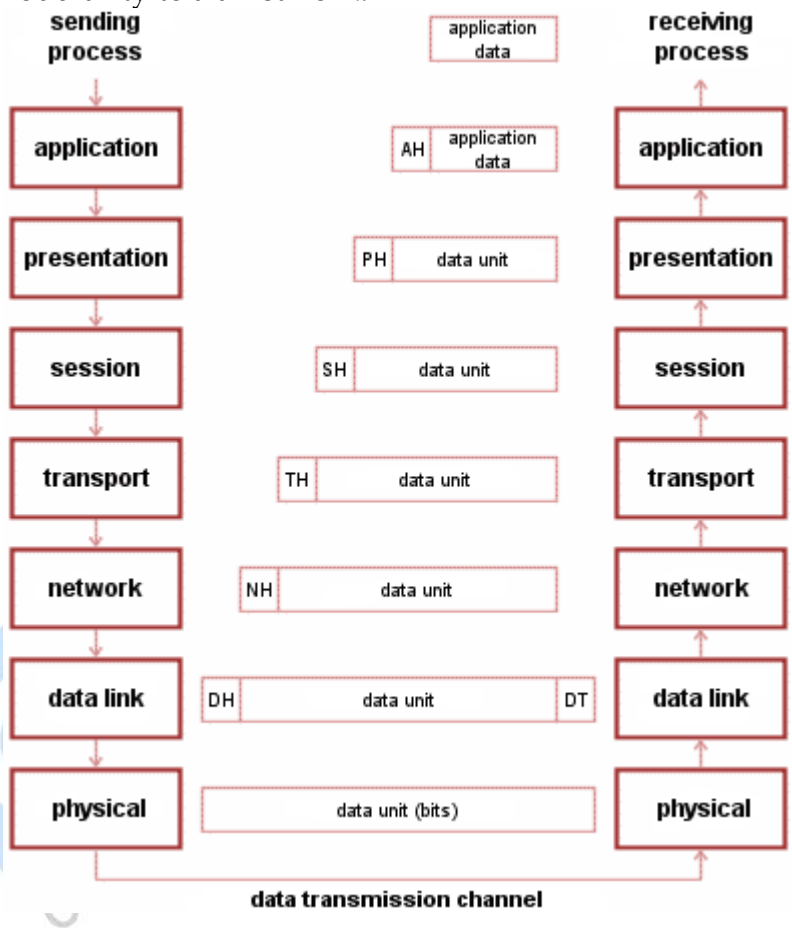
Q.3 What is LAN ?

Ans Local area network(LAN) is a group of computer located in the same room, on the same floor, or in the same building that are connected to form a single computer network .local area network allows users to share storage devices, printers , applications, data and other network resources.



Q 4 What is interfaces between layer ?

Ans Interfaces between layers:--the passing of the data and network information down through the layers of the sending machine and back up through the layers of the receiving machine is made possible by an interface between each pair of adjacent layers .each interfaces defines what information and services a layer must provided for the layer above it well defined interfaces and layer function provide modularity to a a network.



Q5 Explain pair to pair process ?

Ans Pair to pair process:--between machines , layers x on one machine communicates with layer x on another machine. This communication is governed by an agreed upon series of rules and convention called protocols. The processes on each machine that communicates at a given layer are called pair-to-pair process. Each layer in the sending machine adds its even information to the message it receives

from information is added in the form of header or trilers, headers are added to the message at layer 6,5,4,3,2 a trailor is added at layer 2.

Q6 Explain the organization and function of the OSI layers ?

Ans Organization of the layer :--

The seven layer can be thought of as belonging to three subgroups, layers 1,2and 3-physical, datalink layer and network –are the network support layers ,they deal with the physical aspects of moving data from one devices to another.layer5,6,7-session , presentation and application can be thought of as the user support layers; they allow interoperability among unrelated software system. layer 4,the transport layer, ensure end to end reliable data transmission while layer 2 ensures reliable transmissions on a single link, the upper OSI layer are almost always implemented in software.

Function of the layers :--

- PHYSICAL Layer :
  1- The physical layer coordinates the functions required to transmit a bit stream over a physical medium.
  2- It deals with the mechanical and electrical specification of the interfaces and transmission medium.
  3- It also defines the procedures and function that physical devices and interfaces have to perform for transmission to occur.

4- It defines the actual set of wires,plugs and electrical signals that connect the sending and receiving devices to the network.

FEATURES :

1- Physical characteristics of interfaces and media : the physical layer defines the characteristics of the interface between the devices and the transmission medium.

2- Representation of bits : the physical layer data consist of a stream of bits without any interpretation.

3- Data rate : the transmission rate—the no of bits sent each second is also defined by the physical layer.

4- Synchronization of bits :the sender and receiver must be synchronized at the bit level.

5- Line configuration : in a point to point configuration,two devices are connected to gether through a dedicated link.

6- Physical topology : the physical topology defines how devices are connected to make a network.

7- Transmission mode : the physical layer also defines the direction of transmissions between four devices.

- **DATA LINK LAYER**

1- The data link layer transform the physical layer ,a row transmission facility,to a reliable link and is responsible for node to node delivery.

2- It makes the physical layer appear error free to the upper layer(network).

- Responsibilities:

1- Framing :-- the data link layer divides the steam of bits received from the network layer into manageable data units called frames.

2- Physical addressing :-- if frames are used to be distributed to different system on the network,the data link layer adds a header to the frame to define the physical address of the sender (source add.)and or receiver destination address of the frame.

3- Flow-control :--if the rate at which data are absorbed by the receiver is less than the rate produced in the sender ,the data link

layer impose a how control mechanism to prevent overhelming the receiver.

4- Error control :--the data link layer adds reliability to the physical layerby adding mechanism to detect and retransmit damaged or lost frames.

5- Access control :--when four or more devices are connected to the same link ,data link layerprotocols are necessary to determine which devices has control our the link at any given time.

- **Network layer :--**

1- This is responsible for the source to destination delivery of a packet possibly across multiple networks.

2- The network layer ensures that each packets get from its point of origin to its final destination.

3- If thus system are connected to the same link there is usually were need for a network layers.

4- The two systems are attached to different networks (links)with connecting devices between the network ,there is often a need for the network layer to accomplish source-to-destination delivery.

- Responsibilities:

1- Logical addressing :--the network layer adds a header to the packet coming from the upper layer that ,among other things,includes the logical addresses of the sender and receiver.

2- Routing :-- when independent networks or links are connected together to create an internetwork ,the connecting devices called router or gateways,route the packets to their final destination.

- **TRANSPORT Layer :--**

The transport layer breaks large messages from the session layer into packets to be sent to the destination computer and ressembles packets into messages to be presented to the session layer.the transport layer typically sends an acknowledgement to the originator for the messages received.

- **Responsibilities:**

1- Service –point addressing:-- the transport layer header therefore must include a type of address called a service point address. The network layer gets each packet to the correct computer .the transport layer gets the entire messages to the correct process on that computer.
2- Segmentation and reassembly:--a message is divided into transmittable segments each segment containing a sequence number. This number enables the transport layer to reassemble.
3- Connection control:--the transport layer can be either connectionless or connection oriented.
4- Flow control:--flow control at this layer is performed end to end rather than across a single link.
5- Error control: -- error control at this layer is performed end to end rather than across a single link. The sending transport layer without error (damaged, loss, duplication).

- **SESSION layer**:-- the session layer is the network dialog controller .it establishes, maintains and synchronizes the interaction between communicating systems.
  - **Responsibilities:**
    1- Dialog control:- the session layer allows two systems to enter into a dialog. It allows the communication between two processes to take places either in half duplex or full duplex.
    2- Synchronization:--the session layer allows a process to add checkpoints into a stream of data.
- **PRESENTATION layer**:--It is concerned with the syntax and semantics of the information exchanged between two systems. The presentation layer translates data between the formats the network requires and the formats the translations.

Note: The presentation layer adapts information to the local environment.

- Responsibilities:
  1- Translation:--the process in two system are usually exchanging information in the form of character strings, numbers and so on

.the information should be changed to bit stream before being transmitted.

2- Encryption:--it means that the sender transform the original information to another form and sends the resulting message out over the network.

3- Compression:--data compression reduces the number of bits to be transmitted. It is important for multimedia searches text,audio,or video.

- **APPLICATION layer :--**it is the top most layer of the OSI model.It enables the user whether human or software, to access the network .it provides the user interfaces and support for services such as electronic mail, remote file access and transfer shared database management and other types of distributed information services.
  - **Responsibilities:**
    1- Network virtual terminal:--it is a software version of a physical terminal and allows a user to log on to a remote host. The remote host believes it is communicating with one of its own terminal and allows you to log on.
    2- File transfer, access and management :--this application allows a user to access files in a remote computer, to retrieve files from a remot computer and to manage and control files in a remote computer .
    3- Mail service:--this application provides the basis for e-mail forwarding and storage.
    4- Directory service:--this application provides distributed database sources and access for global information about various objects and services.

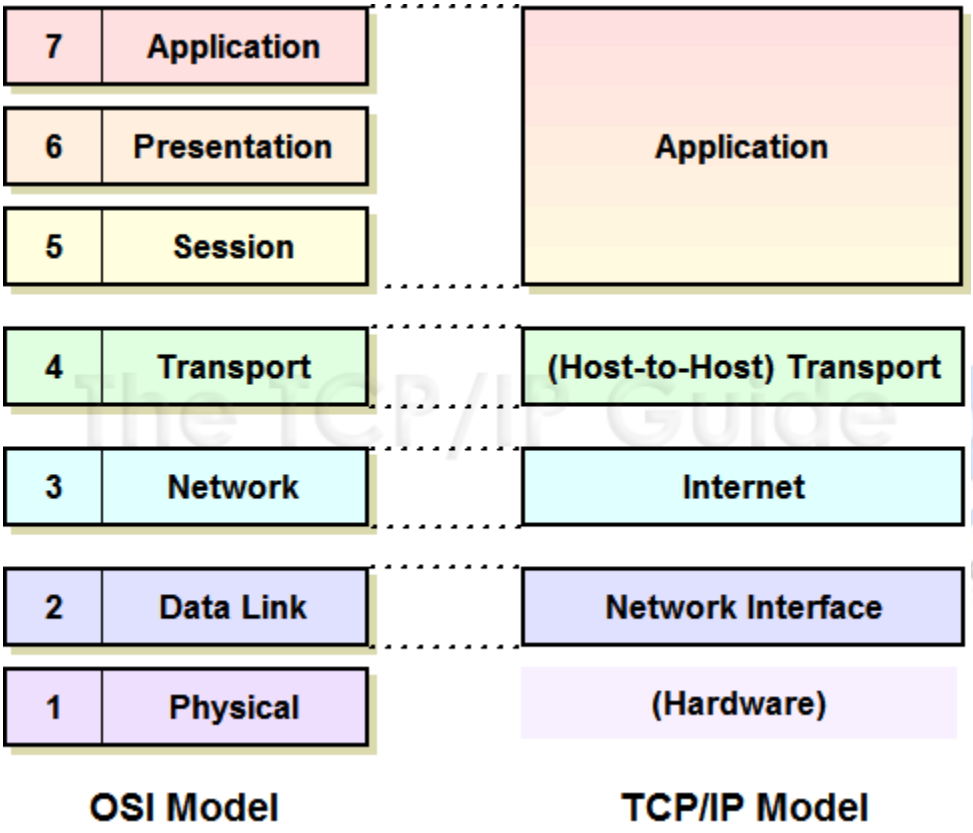
Q 7 Explain TCP/IP ?

Ans TCO/IP:-- The Internet protocol suite is the set of communications protocols used for the Internet and similar networks, and generally the most popular protocol stack for wide area networks. It is commonly known as TCP/IP, because of its most important protocols: Transmission Control Protocol (TCP)

and Internet Protocol (IP), which were the first networking protocols defined in this standard. It is occasionally known as the DoD model due to the foundational influence of the ARPANET in the 1970s (operated by DARPA, an agency of the United States Department of Defense).

TCP/IP provides end-to-end connectivity specifying how data should be formatted, addressed, transmitted, routed and received at the destination. It has four abstraction layers, each with its own protocols. From lowest to highest, the layers are:

1. The link layer (commonly Ethernet) contains communication technologies for a local network.
2. The internet layer (IP) connects local networks, thus establishing internetworking.
3. The transport layer (TCP) handles host-to-host communication.
4. The application layer (for example HTTP) contains all protocols for specific data communications services on a process-to-process level (for example how a web browser communicates with a web server).



Q 8 What is internet protocol ?

Ans INTERNET PROTOCOL :--(ip)works at the network layer .the Functions it handle and methods it uses are as follows:

(a) For addressing, it uses the logical network address.
(b) For switching purpose, it uses the packet switching method.
(c) For route selection, it uses the dynamic method.
(d) For connection services, it provides error control.

IP is connectionless, datagram protocol (ip packets are also reffered to as ip datagram)ip uses packet switching and perform route selection by using dynamic routing tables that a referenced at each hop. The packets making up a message could be routed differently through the internetwork depending on the

state of the network at each hop. For example, if a link were to go down or become congested, packet will be sent through a different route.

Appended to each packet is an ip header, which includes sources and destination information. ip uses sequence numbering if it is necessary to fragment a packet into smaller parts and reassembles it at its destination or at an intermediate point. ip performs error checking on the header information by way of a checksum.

IP addresses are unique, 4byte addresses that must be assigned to every addressable device or node on the internetwork .a big message is divided into smaller packets by the TCP. These are given a header and then enveloped by the ip to be sent to the addresses by various routes using the router at the receiving end each envelop is placed in order and the message is reassembled by the TCP and forwarded to the addresses.

Q9 What is DNS ?

Ans DNS stands for Domain Name System. Sun Microsystems developed the domain Name System

(DNS) in the early 1980s as an easier way to keep track of Internet addresses .The DNS establishes a hierarchy of domains, which are groups of computers on the Internet.

The DNS gives each computer on the net an Internet address or domain name, using easily recognizable letters and words instead of numbers.

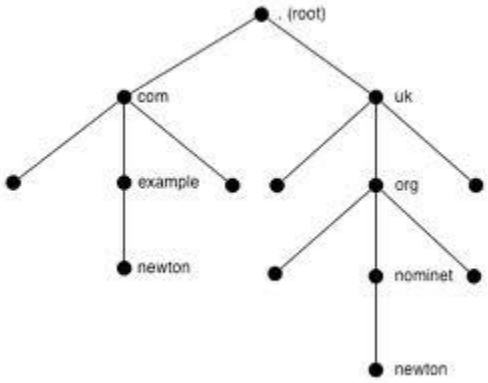
Domain Nmae System (DNS) is the standard for resolving names to Internet addresses. However, the hosts file still plays a role in name resolution during LAN resolution when DNS is down. In a nutshell, DNS is a distributed database whose structure looks system in which like the UNIX file system. DNS is a client/server system in which the resolvers query the named servers to find an address record for a domain name. The query process begins with the root name servers. If the root name server does not know the answer, it returns the address of a name server, This iterative process continues until a name server respond with the address for the domain name.

Q.10 Explain the types of DNS?

Ans The root of DNS database on the Internet is managed by the INTERNET Network Information Center(http://www.internic.com).

The top-level domains were assigned organization wise, and by country. DNS is a protocol that can be used in different platforms . In the Internet, the domain name space(tree) is divided into the three different sections:

(a) Generic domains
(b) Country domains
(c) Inverse domains



DNS ZONES

Generic Domains:

The generic domains define registered hosts according to their generic behavior. Each node in the tree defines a domain, which is an index to the domain name space database. The first level in the generic domain section allows seven possible three character labels. These labels describe the organization types as listed in Table:

Generic domain names

Label	Description
Edu	Educational Organizations
Com	Commercial Organizations

Country Domains:

The country domains section follows the same format as the generic domains but uses two-character country abbreviations (e.g., "us" for United States) in palce of the three- character organizational abbreviations at the first level. Second level labels can be organizational, or they can be more specific, national destinations.

The United states for example, uses state abbreviations as a subdivision of "us" (e.g., ca.us.).

Inverse Domain : The inverse domain is used to map an address to a name . This may happen, for example, when a server has received a request from a client to do a task. Whereas the server has a file that contains a list of authorized clients(extracted from the received IP packet). To determine if the the client is on the authorized list, it can send a query to the DNS server and ask for a mapping of address to name.

Q.11 What is UDP ?

Ans UDP(user datagram protocol)is a connectionless protocol that works at the transport layer.UDP transports datagram's but does not acknowledge their receipt .UDP also uses a port address to achieve datagram delivery ,but this port address is simply a pointer to a process ,not a connection identifier ,as it is with TCP. The lack of overhead makes UDP faster than TCP .hence a sender whishing to send a small message and does not care much about reliability can use UDP.

UDP provides no flow control or acknowledgements for received packets. If UDP detects some error while transmitting a datagram, it simply drops the datagram and does not inform the sender about the same.

Q.12 Explain UDP applications?

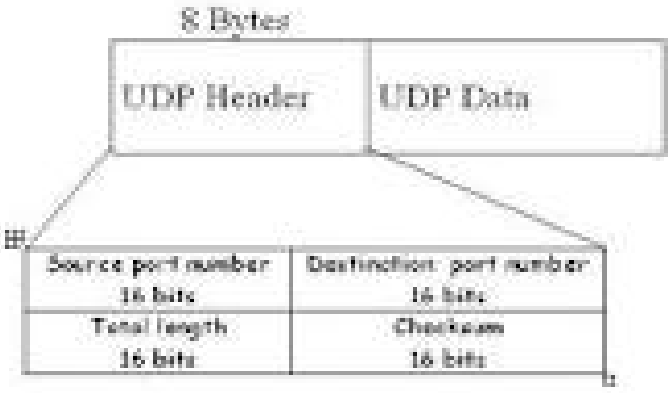
Ans UDP applications : The following are some applications of UDP Protocols-

(a) UDP is used for simple request response communication.

(b) UDP is only suitable for a process having internal flow and error control mechanisms such as TFTP(trivial file transfer protocol).

(c) UDP is suitable transport protocol for multicasting and broadcasting.

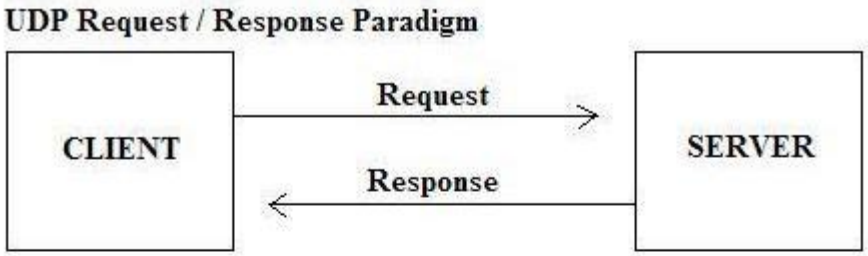
(d) UDP is applied for route updating protocols namely, routing information protocol.

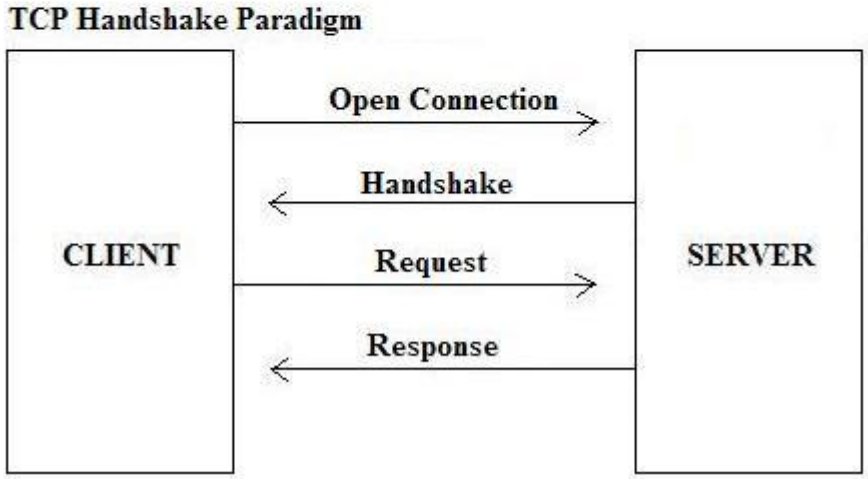


Q.13 How UDP works ?

Ans UDP gives a connectionless services each user datagram's sent by udp is an independent datagram. There is no relationship between the various user datagram's even when they are coming from the same source process and going to the same destination program .the user datagram's are not numbered moreover , each user datagram can travel a different path.

Each request must be small enough to fit into one user datagram .only some processor sending short message need to use UDP because it cannot cut messages into small segments.





Encapsulation and decapsulation of messages

Following are the steps for sending messages using UDP:

(a) If processor has a message to send through udp,it passes the message to udp along with a pair of socket addresses giving the length of data.

(b) Udp receives the data .it adds the udp header.
Udp then passes the user datagrams to the ip with the socket addresses.

(c) Ip adds its own header indicating that the data has come from the udp protocol.the ip datagram is then passed to the data link layer .

(d) The data link layer receives the ip datagram.it adds its own header and passes it to the physical layer.

(e) The physical layer encodes the bits into electrical or optical signals and sends it to the remote machine.

(f) When the message arrives at the destination host ,the physical layer decodes the signals into and passes it to the data link layer.

(g) The data link layer uses the header and the trailer to check the correctness of data. if there is no error ,the header and the trailer are dropped and the datagram is passed to the ip.

(h) The ip software does its own checking .if there is no error ,the header is dropped and the user datagram passed to the udp with the sender and receive ip addresses

(i) Udp uses the checksum to check the entire user datagram .if there is no error, the header is dropped and the application data along with the sender socket address is passed to the process.

(j) The sender socket address is passed to the message received.

At the server site ,the mechanism of creating queues is as follows :

(a) A server asks for incoming and outing queues using its well known port when it starts running the queues remain open as long as the server is running.

(b) When a message arrives for a server , udp checks to see if an incoming queue has been created for the port number specified in the destination port number field of the user datagram.

(c) If there is a queue , udp sends the received user datagram to the end of the queue.

(d) If there is no such queue , udp discards the user datagram and ask the ICMP protocol to send a port unreachable message to the client.

(e) If queue is overflows then udp drops the user datagram .it asks for a port unreachable message to the client .

(f) When a servant wants to respond to a client it sends messages to the outgoing queue using the source port number specified in the request.

(g) Udp removes the messages one by one ,and after adding the udp header ,delivers them to ip.

(h) In case ,an outgoing queue overflows then operating system asks the server to wait before sending any more messages.

Q. 14 What is Datagram?

Ans A datagram is a packet that is sent over a network using a connectionless service ,i.i. a network where the delivery of data does not depend on the maintenance of connections between the communicating computers. Such service do not

guarantee that the datagrams will be delivered without error, without duplication or loss and in the same serial order in which they were sent. They only guarantee a "best effort" delivery of datagram.
Packets in the ip layer are called datagram.a datagram is a variable length packet (up to 65,536bytes) consisting of two parts
(a) Header
(b) data

Q.16 What is internet ?

Ans The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (often called TCP/IP, although not all applications use TCP) to serve billions of users worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies. The Internet carries an extensive range of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support email.

Most traditional communications media including telephone, music, film, and television are reshaped or redefined by the Internet, giving birth to new services such as Voice over Internet Protocol (VoIP) and Internet Protocol Television (IPTV). Newspaper, book and other print publishing are adapting to Web site technology, or are reshaped into blogging and web feeds. The Internet has enabled and accelerated new forms of human interactions through instant messaging, Internet forums, and social networking. Online shopping has boomed both for major retail outlets and small artisans and traders. Business-to-business and financial services on the Internet affect supply chains across entire industries.

The origins of the Internet reach back to research of the 1960s, commissioned by the United States government in collaboration with private commercial interests to build robust, fault-tolerant, and distributed computer networks. The funding of a new U.S. backbone by the National Science Foundation in the 1980s, as well as private funding for other commercial backbones, led to worldwide participation in the development of new

networking technologies, and the merger of many networks. The commercialization of what was by the 1990s an international network resulted in its popularization and incorporation into virtually every aspect of modern human life. As of 2011, more than 2.2 billion people – nearly a third of Earth's population — use the services of the Internet.

The Internet has no centralized governance in either technological implementation or policies for access and usage; each constituent network sets its own standards. Only the overreaching definitions of the two principal name spaces in the Internet, the Internet Protocol address space and the Domain Name System, are directed by a maintainer organization, the Internet Corporation for Assigned Names and Numbers (ICANN). The technical underpinning and standardization of the core protocols (IPv4 and IPv6) is an activity of the Internet Engineering Task Force (IETF), a non-profit organization of loosely affiliated international participants that anyone may associate with by contributing technical expertise.

Q.17 Explain internet standard and internet architecture ?

Ans A specification for which at least two independent and interoperable implementations and successful operational experience has been obtained may be elevated to the Internet Standard level. An Internet Standard is characterized by a high degree of technical maturity and by a generally held belief that the specified protocol or service provides significant benefit to the Internet community.

Generally Internet Standards cover interoperability of systems on the Internet through defining protocols, messages formats, schemas, and languages. The most fundamental of the Internet Standards are the ones defining the Internet Protocol.

All Internet Standards are given a number in the STD series - The first document in this series, STD 1, describes the remaining documents in the series, and has a list of Proposed Standards.

Each RFC is static; if the document is changed, it is submitted again and assigned a new RFC number. If an RFC becomes an Internet Standard (STD), it is assigned an STD number but retains its RFC number. When an Internet Standard is updated, its number stays the same and it simply refers to a different RFC or set of RFCs. A given Internet Standard, STD n, may be RFCs x and y at a given

time, but later the same standard may be updated to be RFC z instead. When STD 1 is updated again, it will simply refer to a newer RFC, but it will still be STD 1. Note that not all RFCs are standards-track documents, but all Internet Standards and other standards-track documents are RFCs.

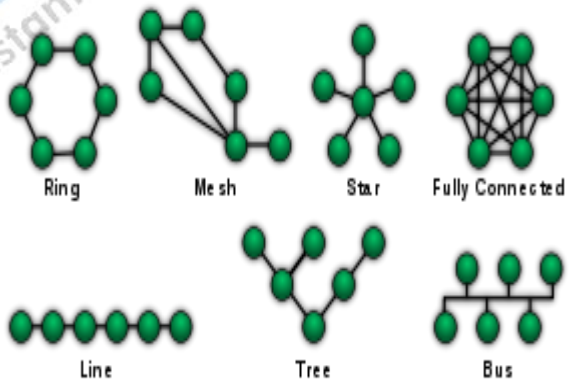
Q.18 Explain network topologies and their types ?

Ans **Network topology** is the arrangement of the various elements (links, nodes, etc.) of a computer or biological network. Essentially, it is the topological structure of a network, and may be depicted physically or logically. *Physical* topology refers to the placement of the network's various components, including device location and cable installation, while *logical* topology shows how data flows within a network, regardless of its physical design. Distances between nodes, physical interconnections, transmission rates, and/or signal types may differ between two networks, yet their topologies may be identical.

Logical topologies are often closely associated with Media Access Control methods and protocols. Logical topologies are able to be dynamically reconfigured by special types of equipment such as routers and switches.

The study of network topology recognizes eight basic topologies:

- Bus
- Point to point
- Star
- Ring or circular
- Mesh
- Tree
- Hybrid
- Daisy chain



DIFFERENT TYPES OF TOPOLOGIES

Unit – 3

Networking Technologies

Q.1 What is computer networking ?

Ans A computer network, often simply referred to as a network, is a collection of computers and other hardware components interconnected by communication channels that allow sharing of resources and information. Where at least one process in one device is able to send/receive data to/from at least one process residing in a remote device, then the two devices are said to be in a network. Simply, more than one computer interconnected through a communication medium for information interchange is called a computer network.

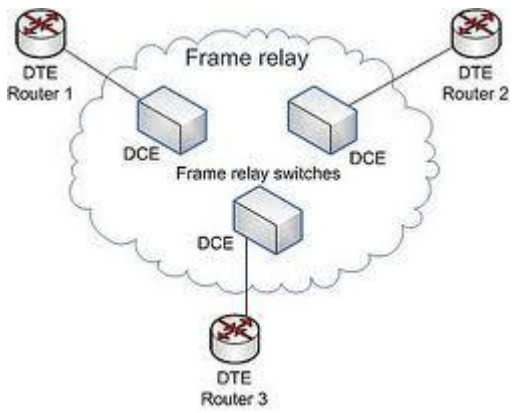
Networks may be classified according to a wide variety of characteristics, such as the medium used to transport the data, communications protocol used, scale, topology, and organizational scope.

Communications protocols define the rules and data formats for exchanging information in a computer network, and provide the basis for network programming. Well-known communications protocols include Ethernet, a hardware and link layer standard that is ubiquitous in local area networks, and the Internet protocol suite, which defines a set of protocols for internetworking, i.e. for data communication between multiple networks, as well as host-to-host data transfer, and application-specific data transmission formats.

Computer networking is sometimes considered a sub-discipline of electrical engineering, telecommunications, computer science, information technology or computer engineering, since it relies upon the theoretical and practical application of these disciplines.

Q.2 What is frame relay ?

Ans FRAM RELAY:--frame relay is a virtual circuit in wan that was designed in 1990.industry standard ,switched data link layer protocol that handles multiple virtual circuits between connected devices frame relay is more efficient than x.25the protocol for which is generally considered a replacement.



FRAME RELAY

- Frame relay operates at a high speed (recently 44.376mbps).
- Frame relay operates in physical and DLL. This means that it can be used as a back bone network.
- Frame relay allows a frame size of 9000bytes which can handles all local area network frame size.
- Frame relay has no error detection at the DLL or no error control .there is not even the retransmission facility a frame is damage or drop.
- Frame relay designed in this way to provide fast transmission data capability for more reliable media and for those protocol that have error control at the higher layer.

Q.3 What is asynchronous transmission mode ?

Ans Asynchronous transmission mode networking is the newst topology available at this time .unlike others it can carry both voice and data over network wire or fiber ATM transmits all packets as 53byte cells, that have a variety of identifires on them to determine such things as quality of service.

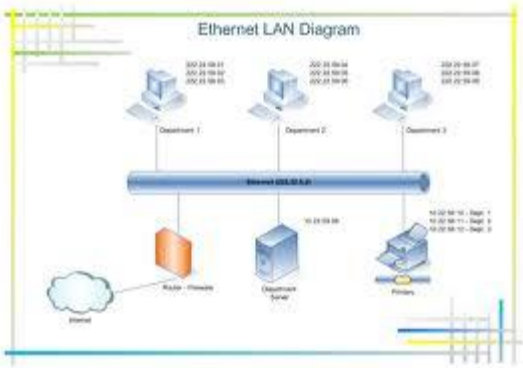
- Quality of service in packet data is similar to quality of sevice in regular mail. in regular mail you have a choice of service namely speed post air mail ect. when you send a speed post ,it receives priority over other types of mail so its gets to its destination first.

A few bits of data of data in a packet of data indicate the quality of services required for that data .when the quality of service feature is implemented you can send packet based on their need for band width

- ATM can provide for simultaneous data,video and voice transmission .it can be used for WAN,LAN and MAN. It can reach speeds of up to 2.488gigabits per second.

Q.4 What is Ethernet?

Ans ETHERNET:--Ethernet invented in 1973 by Bob Metcalf(who later formed a new company called 3 com, one of the most successful networking companies),was way to circumvent the limitation of earlier networks. It was based on an IEEE standard called 802.3CSMA/CD, and it provided for ways to manage the crazy situation that occurred when many computers tried to transmit on one wire simultaneously.



In terms of networking , collisn happiness when two computers attempt to transmit data on the same network wire at the same time .this creates a conflict both computers sense the collision ,stop transmitting ,and wait a random amount of time before retransmitting. Each computer can transmit data only when no other computer is currently transmitting .the larger the collision domain the more likely it is that collision will occur ,that is why ethernet designer try to keep the number of computers in a segment as low as possible.

Q.5 Explain the term fast Ethernet and gigabit Ethernet ?

Ans Gigabit Ethernet and Fast Ethernet :-- In computer networking , gigabit ethernet is a term describing various technologies for transmitting Ethernet frames at a rate of a gigabit per second (1,000,000,000 bits per second), as defined by the IEEE 802.3-2008 standard. It came into use beginning in 1999, gradually supplanting Fast Ethernet in wired local networks where it performed

considerably faster. The cables and equipment are very similar to previous standards, and by the year 2010, were very common and economical.

Half-duplex gigabit links connected through hubs are allowed by the specification, but full-duplex usage with switches is much more common.

There are five physical layer standards for gigabit Ethernet using optical fiber (1000BASE-X), twisted pair cable (1000BASE-T), or balanced copper cable (1000BASE-CX).

The IEEE 802.3z standard includes 1000BASE-SX for transmission over multi-mode fiber, 1000BASE-LX for transmission over single-mode fiber, and the nearly obsolete 1000BASE-CX for transmission over balanced copper cabling. These standards use 8b/10b encoding, which inflates the line rate by 25%, from 1000 Mbit/s to 1250 Mbit/s, to ensure a DC balanced signal. The symbols are then sent using NRZ.

IEEE 802.3ab, which defines the widely used 1000BASE-T interface type, uses a different encoding scheme in order to keep the symbol rate as low as possible, allowing transmission over twisted pair.

Q.6 What is ISDN ? explain.

Ans **I**ntegrated Services Digital Network (ISDN) is a set of communications standards for simultaneous digital transmission of voice, video, data, and other network services over the traditional circuits of the public switched telephone network. It was first defined in 1988 in the CCITT red book. Prior to ISDN, the telephone system was viewed as a way to transport voice, with some special services available for data. The key feature of ISDN is that it integrates speech and data on the same lines, adding features that were not available in the classic telephone system. There are several kinds of access interfaces to ISDN defined as Basic Rate Interface (BRI), Primary Rate Interface (PRI) and Broadband ISDN (B-ISDN).

ISDN is a circuit-switched telephone network system, which also provides access to packet switched networks, designed to allow digital transmission of voice and data over ordinary telephone copper wires, resulting in potentially better voice quality than an analog phone can provide. It offers circuit-switched connections (for either voice or data), and packet-switched connections (for data), in increments of 64 kilobit/s. A major market application for ISDN in some countries is Internet access, where ISDN typically provides a maximum of 128 kbit/s in both upstream and downstream directions. Channel bonding can

achieve a greater data rate; typically the ISDN B-channels of 3 or 4 BRIs (6 to 8 64 kbit/s channels) are bonded.

ISDN should not be mistaken for its use with a specific protocol, such as Q.931 whereby ISDN is employed as the network, data-link and physical layers in the context of the OSI model. In a broad sense ISDN can be considered a suite of digital services existing on layers 1, 2, and 3 of the OSI model. ISDN is designed to provide access to voice and data services simultaneously.

However, common use reduced ISDN to be limited to Q.931 and related protocols, which are a set of protocols for establishing and breaking circuit switched connections, and for advanced calling features for the user. They were introduced in 1986.

In a videoconference, ISDN provides simultaneous voice, video, and text transmission between individual desktop videoconferencing systems and group (room) videoconferencing systems.

Q.7 What is FDDI and CDDI ?explain

Ans Fiber Distributed Data Interface (FDDI) provides a 100 Mbit/s optical standard for data transmission in a local area network that can extend in range up to 200 kilometers (120 mi). Although FDDI logical topology is a ring-based token network, it does not use the IEEE 802.5 token ring protocol as its basis; instead, its protocol is derived from the IEEE 802.4 token bus timed token protocol. In addition to covering large geographical areas, FDDI local area networks can support thousands of users. As a standard underlying medium it uses optical fiber, although it can use copper cable, in which case it may be referred to as CDDI (Copper Distributed Data Interface). FDDI offers both a Dual-Attached Station (DAS), counter-rotating token ring topology and a Single-Attached Station (SAS), token bus passing ring topology.

FDDI was considered an attractive campus backbone technology in the early to mid 1990s since existing Ethernet networks only offered 10 Mbit/s transfer speeds and Token Ring networks only offered 4 Mbit/s or 16 Mbit/s speeds. Thus it was the preferred choice of that era for a high-speed backbone, but FDDI has since been effectively obsolesced by fast Ethernet which offered the same 100 Mbit/s speeds, but at a much lower cost and, since 1998, by Gigabit Ethernet due to its speed, and even lower cost, and ubiquity.

FDDI, as a product of American National Standards Institute X3T9.5 (now X3T12), conforms to the Open Systems Interconnection (OSI) model of functional layering of LANs using other protocols. FDDI-II, a version of FDDI, adds the

capability to add circuit-switched service to the network so that it can also handle voice and video signals. Work has started to connect FDDI networks to the developing Synchronou Optical Network (SONET).

A FDDI network contains two rings, one as a secondary backup in case the primary ring fails. The primary ring offers up to 100 Mbit/s capacity. When a network has no requirement for the secondary ring to do backup, it can also carry data, extending capacity to 200 Mbit/s. The single ring can extend the maximum distance; a dual ring can extend 100 km (62 mi). FDDI has a larger maximum-frame size (4,352 bytes) than standard 100 Mbit/s Ethernet which only supports a maximum-frame size of 1,500 bytes, allowing better throughput.

Designers normally construct FDDI rings in the form of a "dual ring of trees" (see network topology). A small number of devices (typically infrastructure devices such as routers and concentrators rather than host computers) connect to both rings - hence the term "dual-attached". Host computers then connect as single-attached devices to the routers or concentrators. The dual ring in its most degenerate form simply collapses into a single device. Typically, a computer-room contains the whole dual ring, although some implementations have deployed FDDI as a Metropolitan area network.

Qus8 What is SMDS ? explain.

Ans Switched Multi-megabit Data Service (SMDS) was a connectionless service used to connect LANs, MANs and WANs to exchange data, in early 1990s. In Europe, the service was known as Connectionless Broadband Data Service (CBDS).

SMDS was specified by Bellcore, and was based on the IEEE 802.6 metropolitan area network (MAN) standard, as implemented by Bellcore, and used cell relay transport, Distributed Queue Dual Bus layer-2 switching arbitrator, and standard SONET or G.703 as access interfaces.

Its a switching service that provides data transmission in the range between 1.544 Mbit/s (T1 or DS1) to 45 Mbit/s (T3 or DS3). SDMS was developed by Bellcore as an interim service until Asynchronous Transfer Mode matured. In the mid-1990s, SMDS was replaced, largely by Frame Relay.

SMDS was notable for its initial introduction of the 53-byte cell and cell switching approaches, as well as the method of inserting 53-byte cells onto G.703 and SONET.

Qus9 What is SONET ? explain.

Ans Synchronous Optical Networking (SONET) and Synchronous Digital Hierarchy (SDH) are standardized multiplexing protocols that transfer multiple digital bit streams over optical fiber using lasers or highly coherent light from light-emitting diodes (LEDs). At low transmission rates data can also be transferred via an electrical interface. The method was developed to replace the Plesiochronous Digital Hierarchy (PDH) system for transporting large amounts of telephone calls and data traffic over the same fiber without synchronization problems. SONET generic criteria are detailed in Telcordi Technologies Generic Requirements document GR-253-CORE. Generic criteria applicable to SONET and other transmission systems (e.g., asynchronous fiber optic systems or digital radio systems) are found in Telcordia GR-499-CORE.

SONET and SDH, which are essentially the same, were originally designed to transport circuit mode communications (e.g., DS1, DS3) from a variety of different sources, but they were primarily designed to support real-time, uncompressed, circuit-switched voice encoded in PCM format. The primary difficulty in doing this prior to SONET/SDH was that the synchronization sources of these various circuits were different. This meant that each circuit was actually operating at a slightly different rate and with different phase. SONET/SDH allowed for the simultaneous transport of many different circuits of differing origin within a single framing protocol. SONET/SDH is not itself a communications protocol per se, but a transport protocol.

Due to SONET/SDH's essential protocol neutrality and transport-oriented features, SONET/SDH was the obvious choice for transporting the fixed length Asynchronous Transfer Mode (ATM) frames also known as cells. It quickly evolved mapping structures and concatenated payload containers to transport ATM connections. In other words, for ATM (and eventually other protocols such as Ethernet), the internal complex structure previously used to transport circuit-oriented connections was removed and replaced with a large and concatenated frame (such as OC-3c) into which ATM cells, IP packets, or Ethernet frames are placed.

Racks of Alcatel STM-16 SDH add-drop multiplexers

Both SDH and SONET are widely used today: SONET in the United States and Canada, and SDH in the rest of the world. Although the SONET standards were developed before SDH, it is considered a variation of SDH because of SDH's greater worldwide market penetration.

The SDH standard was originally defined by the European Telecommunications Standards Institute (ETSI), and is formalized as International Telecommunication Union (ITU) standards G.707, G.783, G.784,and G.803.The SONET standard was defined by Telcordia and American National Standards Institute(ANSI) standard T1.105.

Q.10 What is DWDM ? explain.

Ans DWDM (Dense Wavelength devision Multiplexing):-- it refers originally to optical signals multiplexed within the 1550 nm band so as to leverage the capabilities (and cost) of erbium doped fiber amplifiers (EDFAs), which are effective for wavelengths between approximately 1525–1565 nm (C band), or 1570–1610 nm (L band). EDFAs were originally developed to replace SONET/SDH optical-electrical-optical (OEO) regenerators, which they have made practically obsolete. EDFAs can amplify any optical signal in their operating range, regardless of the modulated bit rate.

DWDM Systems :- At this stage, a basic DWDM system contains several main components:

1. A DWDM terminal multiplexer. The terminal multiplexer actually contains one wavelength converting transponder for each wavelength signal it will carry. The wavelength converting transponders receive the input optical signal (i.e., from a client-layer SONET/SDH or other signal), convert that signal into the electrical domain, and retransmit the signal using a 1550 nm band laser. (Early DWDM systems contained 4 or 8 wavelength converting transponders in the mid 1990s. By 2000 or so, commercial systems capable of carrying 128 signals were available.) The terminal mux also contains an optical multiplexer, which takes the various 1550 nm band signals and places them onto a single fiber (e.g. SMF-28 fiber). The terminal multiplexer may or may not also support a local EDFA for power amplification of the multi-wavelength optical signal.
2. An intermediate line repeater is placed approx. every 80 – 100 km for compensating the loss in optical power, while the signal travels along the fiber. The signal is amplified by an EDFA, which usually consists of several amplifier stages.
3. An intermediate optical terminal, or optical add-drop multiplexer. This is a remote amplification site that amplifies the multi-wavelength signal that may have traversed up to 140 km or more before reaching the remote site. Optical diagnostics and telemetry are often extracted or inserted at such a site, to allow for localization of any fiber breaks or signal impairments. In more sophisticated

systems (which are no longer point-to-point), several signals out of the multiwavelength signal may be removed and dropped locally.

4. A DWDM terminal demultiplexer. The terminal demultiplexer breaks the multi-wavelength signal back into individual signals and outputs them on separate fibers for client-layer systems (such as SONET/SDH) to detect. Originally, this demultiplexing was performed entirely passively, except for some telemetry, as most SONET systems can receive 1550-nm signals. However, in order to allow for transmission to remote client-layer systems (and to allow for digital domain signal integrity determination) such demultiplexed signals are usually sent to O/E/O output transponders prior to being relayed to their client-layer systems. Often, the functionality of output transponder has been integrated into that of input transponder, so that most commercial systems have transponders that support bi-directional interfaces on both their 1550-nm (i.e., internal) side, and external (i.e., client-facing) side. Transponders in some systems supporting 40 GHz nominal operation may also perform forward error correction (FEC) via 'digital wrapper' technology, as described in the ITU-T G.709 standard.
5. Optical Supervisory Channel (OSC). This is an additional wavelength usually outside the EDFA amplification band (at 1510 nm, 1620 nm, 1310 nm or another proprietary wavelength). The OSC carries information about the multi-wavelength optical signal as well as remote conditions at the optical terminal or EDFA site. It is also normally used for remote software upgrades and user (i.e., network operator) Network Management information. It is the multi-wavelength analogue to SONET's DCC (or supervisory channel). ITU standards suggest that the OSC should utilize an OC-3 signal structure, though some vendors have opted to use 100 megabit Ethernet or another signal format. Unlike the 1550 nm band client signal-carrying wavelengths, the OSC is always terminated at intermediate amplifier sites, where it receives local information before retransmission.

Unit – 4

Network Switching

Q.1 What is switching ?

Ans **S**witches are hardware or software devices capable of creating temporary connection between two or more devices link.link to the switch but not to each other .

There are three methods of switching :-

(1) circuit switching

(2) message switching

(3) packet switching

Q.2 What is circuit switching ?

Ans Circuit switching creates a direct physical connection between two devices such as phone .in this transmission line is open between two parties until their communication is finished circuit switching is efficient for connection that carry a large amount of data.

Circuit switching is appropriate for voice data .it is a method of networking in which communicating machines have exclusive view of the circuit linking the, even during passes, when the circuit is idel.

Q.3 What is message switching ?

Ans **I**n a message switching the central switch station accepts the traffic sent to it by the station connected to it.

The message are stored in the switch stations buffer memory and a line is available, Tthe data are forwarded to the appropriate station. Thus the message switching is also known as stored and forward method.

The benefit whit message switching is that when the sending station has finished sending .it's traffic, it can send data to another.

Q.4 What is packet switching ?

Ans **P**acket switching is an allocation technique that uses bandwidth only when there is data to be transmitted the packet header identifies the source of the data and destination and it can also identify the nature of data.
The problem with message switching is the main difficulty with implementing system using message switching is the need to allocate the large data buffer to hold incoming message and the time it takes for a message to reach its destination complicated software programs are required to manage the routing and storage of these messages.

Long messages are broken into smaller units in packet switching and the units are called "packet".

Q.5 What is virtual LAN ?

Ans. VIRTUAL LAN is a networking technology that allows networks to be segmented logically without having to be physically rewired.
Rationally each department in a building used to have its own local area network .these LAN were created using hubs and these hubs were connected to a main Ethernet switch in the main room of the building .how ever broadcast sent by any hosts on the network ,even if all the hosts do not need to receive them. Also, if the location of the department changes, the hubs must be rewired to reflect the new topology of the network.
To overcome these problems, many Ethernet switches nowadays

Support virtual LAN (VLAN) technologies .all hubs are replaced by van switches the network administrator creates virtual network segments whose logical topology is independent of the physical topology of the wiring. Each station is assigned a VLAN identification number (id) ,and station with the same VLAN ID can act and function as though they are all on the same physical network segment.

Broadcast sent by one host are received only by hosts with the same VLAN ID. The assignment if VLAN ID is done at the port level on the switches themselves and can be managed remotely using network management software.

Advantage of VLAN: the main advantage of using VLAN technologies is that users can be grouped together according to their need for network communication, regardless of their actual physical location.

Disadvantage of VLAN: the only disadvantage is that additional equipment is required to set up and establish the VLANs.

Q.6 Explain non ATM?

Ans. Asynchronous Transfer Mode (ATM) is, according to the ATM Forum, "a telecommunications concept defined by ANSI and ITU (formally CCITT) standards for carriage of a complete range of user traffic, including voice, data, and video signals, "and is designed to unify telecommunication and computer networks. It uses asynchronous time-division multiplexing, and it encodes data into small, fixed-sized cells. This differs from approaches such as the Internet Protocol or Ethernet that use variable sized packets or frames. ATM provides data link layer services that run over a wide range of OSI physical Layer links. ATM has functional similarity with both circuit switched networking and small packet switched networking. It was designed for a network that must handle both traditional high-throughput data traffic (e.g., file transfers), and real-time, low-latency content such as voice and video. ATM uses a connection-oriented model in which a virtual circuit must be established between two endpoints before the actual data exchange begins. ATM is a core protocol used over the SONET/SDH backbone of the public switched telephone network (PSTN) and Integrated Services Digital Network (ISDN), but its use is declining in favor of All IP

.

Q.7 What is IEEE802.1Q VLAN standards?

Ans. IEEE 802.1Q is the networking standard that supports Virtual LANs (VLANs) on an Ethernet network. The standard defines a system of VLAN tagging for Ethernet frames and the accompanying procedures to be used by bridges and switches in handling such frames. The standard also contains provisions for a quality of service prioritization scheme commonly known as IEEE 802.1p and defines the Generic Attribute Registration Protocol.

Portions of the network which are VLAN-aware (i.e., IEEE 802.1Q conformant) can include VLAN tags. Traffic on a VLAN-unaware (i.e., IEEE 802.1D conformant) portion of the network will not contain VLAN tags. When a frame enters the VLAN-aware portion of the network, a tag is added to represent the VLAN membership of the frame's port or the port/protocol combination, depending on whether port-based or port-and-protocol-based VLAN classification is being used. Each frame must be distinguishable as being within exactly one VLAN. A frame in the VLAN-aware portion of the network that does

not contain a VLAN tag is assumed to be flowing on the native (or default) VLAN.

The standard was developed by IEEE 802.1, a working group of the IEEE 802 standards committee and continues to be actively revised with notable revisions including IEEE 802.1ak, IEEE 802.1Qat and IEEE 802.1Qay.

Q.8 what is simulation?

Ans. In computer science, simulation has some specialized meanings: Alan Turing used the term "simulation" to refer to what happens when a universal machine executes a state transition table (in modern terminology, a computer runs a program) that describes the state transitions, inputs and outputs of a subject discrete-state machine. The computer simulates the subject machine. Accordingly, in theoretical computer science the term *simulation* is a relation between state transition systems, useful in the study of operational semantics.

Less theoretically, an interesting application of computer simulation is to simulate computers using computers. In computer architecture, a type of simulator, typically called an *emulator*, is often used to execute a program that has to run on some inconvenient type of computer (for example, a newly designed computer that has not yet been built or an obsolete computer that is no longer available), or in a tightly controlled testing environment (see *Computer architecture simulator* and *Platform virtualization*). For example, simulators have been used to debug a micro program or sometimes commercial application programs, before the program is downloaded to the target machine. Since the operation of the computer is simulated, all of the information about the computer's operation is directly available to the programmer, and the speed and execution of the simulation can be varied at will.

Simulators may also be used to interpret fault trees, or test VLSI logic designs before they are constructed. Symbolic simulation uses variables to stand for unknown values.

In the field of optimization, simulations of physical processes are often used in conjunction with evolutionary computation to optimize control strategies.

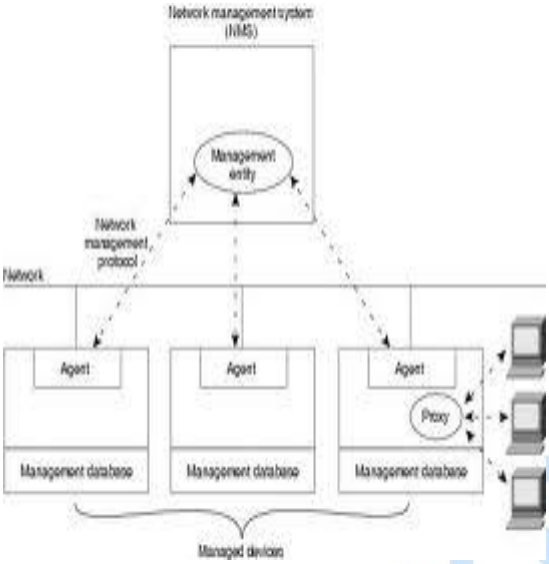
Unit– 5

Network Management

Q.1 What is network management?

Ans. Network management refers to the activities, methods, procedures, and tools that pertain to the operation, administration, maintenance, and provisioning of networked systems.

- Operation deals with keeping the network (and the services that the network provides) up and running smoothly. It includes monitoring the network to spot problems as soon as possible, ideally before users are affected.
- Administration deals with keeping track of resources in the network and how they are assigned. It includes all the "housekeeping" that is necessary to keep the network under control.
- Maintenance is concerned with performing repairs and upgrades—for example, when equipment must be replaced, when a router needs a patch for an operating system image, when a new switch is added to a network. Maintenance also involves corrective and preventive measures to make the managed network run "better", such as adjusting device configuration parameters.
- Provisioning is concerned with configuring resources in the network to support a given service. For example, this might include setting up the network so that a new customer can receive voice service.



NETWORK MANAGEMENT

Functions that are performed as part of network management accordingly include controlling, planning, allocating, deploying, coordinating, and monitoring the resources of a network, network planning, frequency allocation, predetermined traffic routing to support load balancing, cryptographic key distribution authorization, configuration management, fault management, security management, performance management, bandwidth management, Route analytics and accounting management.

Q.2 What is directory services?

Ans. A directory service is the software system that stores, organizes and provides access to information in a directory. In software engineering, a directory is a map between names and values. It allows the lookup of values given a name, similar to a dictionary. As a word in a dictionary may have multiple definitions, in a directory, a name may be associated with multiple, different pieces of information. Likewise, as a word may have different parts of speech and different definitions, a name in a directory may have many different types of data.

Directories may be very narrow in scope, supporting only a small set of node types and data types, or they may be very broad, supporting an arbitrary or extensible set of types. In a telephone directory, the nodes are names and the data items are telephone numbers. In the DNS the nodes are domain names and the data items are IP addresses (and alias, mail server names, etc.). In a directory

used by a network operating system, the nodes represent resources that are managed by the OS, including users, computers, printers and other shared resources. Many different directory services have been used since the advent of the Internet but this article focuses mainly on those that have descended from the X.500 directory service.

Q.3 What is SNMP?

Ans. SNMP it stands for simple network management protocol .SNMP is an internet standard application layer (layer 7) protocol for exchanging device management information between network devices on a TCP/IP network .simple network management protocol (SNMP)is most often used for collecting statically and configuration information about network devices such as computer ,hubs,switches,routers and even network printers. the statistical information includes the number of packets or frames sent or received per second the number of error per second etc.the configuration information include the IP address of an interface on the device, the version of the operating system running of the device etc. management systems are used to monitor network health, trap errors perform diagnostic and generate reports .SNMP is the most popular network management protocol in use.

Q.4 Explain the network management technology?

Ans. A small number of accessories methods exist to support network and network device management. Access methods include the SNMP, command-line interface (CLIs), custom XML, CMIP, Windows Management Instrumentation (WMI), Transaction Language 1, CORBA, NETCONF, and the Java Management Extensions (JMX). Internet service providers (ISP) use a technology known as deep packet inspection in order to regulate network congestion and lessen Internet bottlenecks.

Schemas include the WBEM, the Common Information Model, and MTOSI amongst others.

Medical Service Providers provide a niche marketing utility for managed service providers; as HIPAA legislation consistently increases demands for knowledgeable providers. Medical Service Providers are liable for the protection of their client's confidential information, including in an electronic realm. This liability creates a significant need for managed service providers who can provide secure infrastructure for transportation of medical data.

Q.5 What is TMN?

Ans. The Telecommunications Management Network is a protocol model defined by ITU-T for managing open systems in a communications network. It is part of the ITU-T Recommendation series M.3000 and is based on the OSI management specifications in ITU-T Recommendation series X.700.

TMN provides a framework for achieving interconnectivity and communication across heterogeneous operations system and telecommunication networks. To achieve this, TMN defines a set of *interface points* for elements which perform the actual communications processing (such as a call processing switch) to be accessed by elements, such as management workstations, to monitor and control them. The standard interface allows elements from different manufacturers to be incorporated into a network under a single management control.

For communication between Operations Systems and NEs (Network Elements), it uses the Common management information protocol (CMIP) or Mediation devices when it uses Q3 interface.

TMN can be used in the management of ISDN, B-ISDN, ATM, and GSM networks. It is not as commonly used for purely packet-switched data networks.

Modern telecom networks are automated, and are run by OSS software or operational support systems. These manage modern telecom networks and provide the data that is needed in the day-to-day running of a telecom network. OSS software is also responsible for issuing commands to the network infrastructure to activate new service offerings, commence services for new customers, and detect and correct network faults.

Q.6 Explain RMON?

Ans. The Remote Network Monitoring (RMON) MIB was developed by the IETF to support monitoring and protocol analysis of LANs. The original version (sometimes referred to as RMON1) focused on OSI Layer 1 and Layer 2 information in Ethernet and Token Ring networks. It has been extended by RMON2 which adds support for Network- and Application-layer monitoring and by SMON which adds support for switched networks. It is an industry standard specification that provides much of the functionality offered by

proprietary network analyzers. RMON agents are built into many high-end switches and routers.

An RMON implementation typically operates in a client/server model. Monitoring devices (commonly called "probes" in this context) contain RMON software agents that collect information and analyze packets. These probes act as servers and the Network Management applications that communicate with them act as clients. While both agent configuration and data collection use SNMP, RMON is designed to operate differently than other SNMP-based systems:

- Probes have more responsibility for data collection and processing, which reduces SNMP traffic and the processing load of the clients.
- Information is only transmitted to the management application when required, instead of continuous polling.

In short, RMON is designed for "flow-based" monitoring, while SNMP is often used for "device-based" management. RMON is similar to other flow-based monitoring technologies such as Net Flow and Slow because the data collected deals mainly with traffic patterns rather than the status of individual devices. One disadvantage of this system is that remote devices shoulder more of the management burden, and require more resources to do so. Some devices balance this trade-off by implementing only a subset of the RMON MIB groups (see below). A minimal RMON agent implementation could support only statistics, history, alarm, and event