- Broadcast network :- Here, a single source transmitted the massage for every others. That means everyone can received that massage. So, broadcasting means flooding the massage.

- Multicast network :- In multicast a source transmit massages for selected receipient. So, we are not going to flooding the massage. Instead of that using multicast IP address we are transmitting this for selected one.

1) what is point to point / broadcast / multicast network?

→ Point to Point

A point to point line configuration provides a dedicated link between those two devices. Most point-to point line configurations use an actual length of wire or cable to connect the two ends, but other options, such as microwave or satellite links, are also possible.

Multicast network

In a multipoint environment, the capacity of the channel is shared either spatially or temporally. If several devices can use the link simultaneously, it is spatially shared line configuration. If users must take turns, it is a time-shared line configuration.

2) what is Connection less / Connection oriented service?

→ There can be two alternating mode to transmission PDU (Protocol Data unit) between peer entity —

- Connection oriented.
- Connection less.

(1) Connection Oriented :— A layer entity can transfer data to the peer entity using the connection oriented mode of data transfer, if such service is supported by the next lower layer entity. In this mode of data transfer involve 3 phases.

- Connection establishment phase.
- Data transfer phase.
- Connection release phase.

Connection is establishment between Communicating entity.

Negosiation of quality of service parameters, exchange of source and distination address etc. After the data transfer has taken place, there is need to disconnected the connection.

(2) Connection less service :-

Connection less data transfer is a single self Content action without establishmon, maintain, releasing a connection, Connection less service provides transmission of data without any pain nagosiation. There is no assourance of delivery of data unit.

3) Why do telephone company like Connection oriented service ?

→ Telephone company like reliable service so before sending any data in communication. It will first establish a connection with a otherside after that it can send requisite data and finally it close the connection. In this way data communication take place. Connection less service is not a reliable one. So, it's not guranted that data can be transfered to the other side without communicating any error. It may so happend that other side may not ready to receive data at that

robustness

moment. So, ~~robustness~~ and reliability is not there. For this reason, telephone company like connection oriented service.

4) write the different between synchronous and asynchronous data transfer?

→ Synchronous Transmission :- Picture → P 143/6.5

In synchronous transmission the bit stream is combined into longer 'frames' which may contain multiple bytes. Each byte, however, is introduced onto the transmission link without a gap between it and the next one. It is left to the receiver to separate the bit stream into bytes for decoding purpose. In other words, data are transmitted as an unbroken string of 1's and 0's and the receiver separates that string into the bytes, or characters, it needs to reconstruct the information.

Asynchronous Transmission :- Picture → P 142/6.4

Asynchronous transmission is so named because the timing of a signal is unimportant. Instead, information is received and translated by agreed upon patterns. As long as those patterns are followed, the receiving device can retrieve the information with regard to the rhythm in which it is sent.

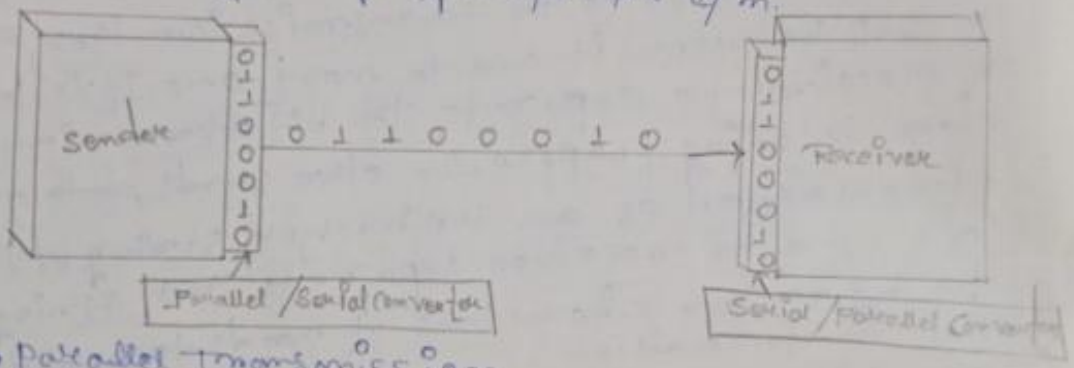
To alert the receiver to the arrival of a new group, therefore, an extra bit is added to the beginning of each byte. This bit, usually a 0, is called the start bit. To let the receiver know that the byte is finished, one or more additional bits are appended to the end of the byte. These bits, usually 1's, are called stop bits.

5) write the difference between serial and parallel transmission?

→ • Serial Transmission

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

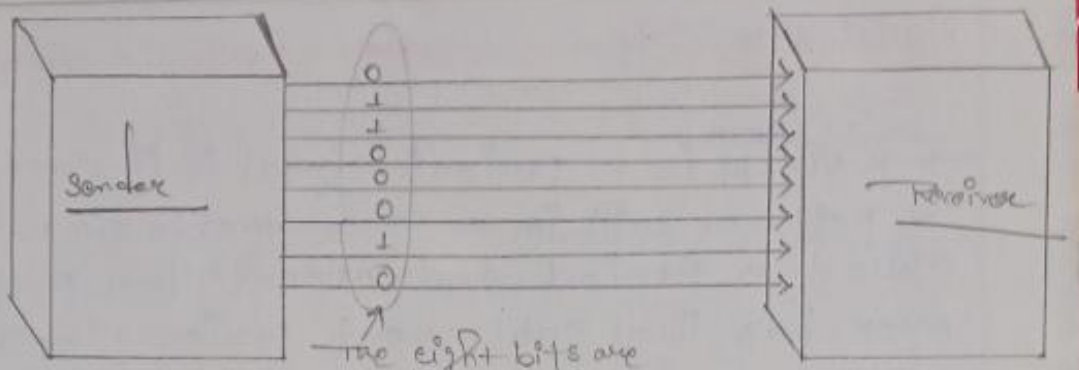
The advantage of serial over parallel transmission is that with only one communication channel serial transmission reduces the cost of transmission over parallel by roughly a factor of n.



• Parallel Transmission

Binary data consisting of 1's and 0's may be organized into group of n bits each. Computers produce and consume data in groups of bits much as we conceive of and use spoken language in the form of words rather than letters. By grouping, we can send data n bits at a time instead of one. This is called parallel transmission.

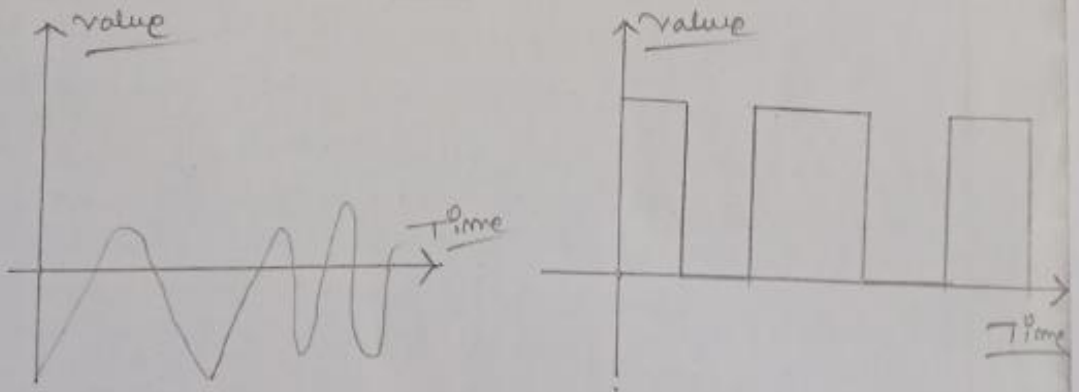
The mechanism for parallel transmission is a conceptually simple one; use n wires to send n bits at one time. That way each bit has its own wire and all n bits of one group can be transmitted with each clock pulse from one device to another.



6)/7) SAME write the difference between analog data and digital data ?

→ Data can be analog or digital. An example of analog data is the human voice. When somebody speaks a continuous wave is created in the air. This can be captured by a microphone and converted to an analog signal.

An example of digital data is data stored in the memory of a computer in the form of 0s and 1s. It is usually converted to a digital signal when it is transferred from one position to another inside or outside the computer.



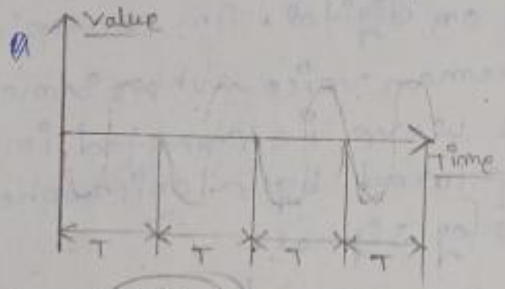
Analog signal

Digital signal

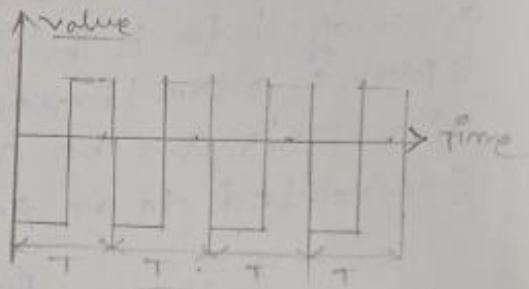
8) write the difference between periodic signal and aperiodic signal?

Periodic signal

→ A signal is a periodic signal if it completes a pattern within a measurable time frame, called a period, and repeats that pattern over identical subsequent periods. The completion of ~~all~~ one full pattern is called a cycle. A period is defined as the amount of time required to complete one full cycle. The duration of a period represented by T.



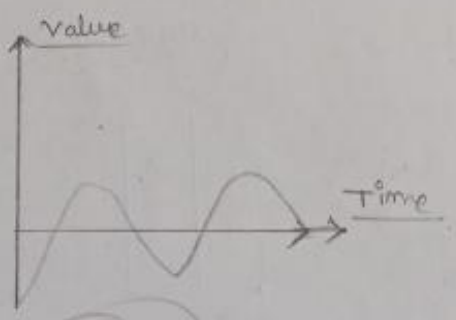
Analog



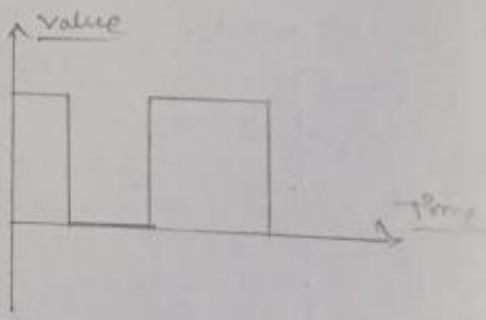
Digital

Aperiodic signal :-

An aperiodic, or non periodic signal changes constantly without exhibiting a pattern or cycle that repeats over time.



Analog



Digital

9) what do you mean by "internet" and "Internet" ? write application of Internet.

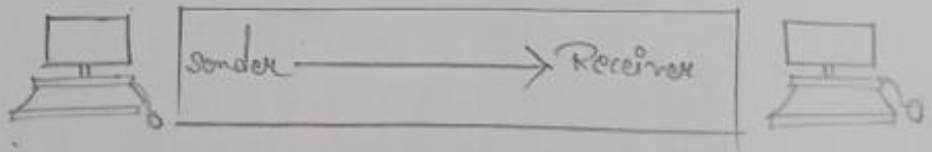
→ Internet :- The internet refers to LAN or MAN that means it can connect some computers with-in a specific geographical boundary such as an office building, a city or more than one building etc. Bacically it denotes network with small span.

Internet designates network of networks, which actually www (world wide web). It can span a country, continant even if a whole of world.

Internet refers to that small network with in a large network that means LAN with in an organisation may be an example of internet. Here machines are not connected with Internet but it connected with some other machines within that network.

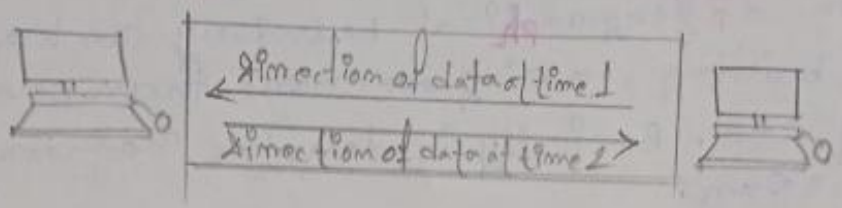
13) Briefly discussed about different transmission modes (simplex, Half duplex and Full duplex) ?

→ Simplex :- In simplex mode, the communication is unidirectional, as on a one-way street. only one of the two stations on a link can transmit, the other can only receive. Key boards and traditional monitors are both example of simplex devices.

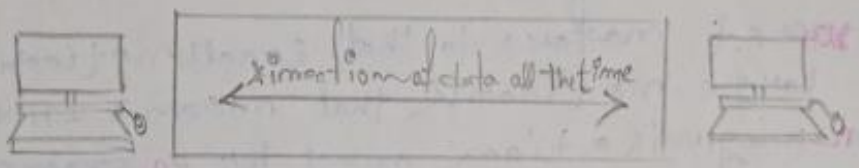


Half-Duplex :-

In half-duplex mode, each station can both transmit and receive, but not at the same time. When one device is sending the other can only receive and vise versa.



Full-Duplex :- In full duplex mode both stations can transmit and receive simultaneously.



One common example of full duplex communication is the telephone network. When two people are communicating by a telephone line, both can talk and listen at the same time.

16) write the difference between LAN, MAN, WAN (Advantage/disadvantage(limitation)).

→ LAN (Local Area Network) :-

A local area network (LAN) is usually privately owned and links the devices in a single office building, on campus. Depending on the needs of an organization and the type of technology used, a LAN can be as simple as two pcs and a printer in someone's home office, on it can extend throughout a company and include voice, sound and media peripherals. Currently, LAN size is limited a few kilometers.

LANS are designed to allow resources to be shared between personal computers on workstations) the resource to be shared can include hardware, software, on data. A common example of a LAN, found in many business environments, links a work group of task-related computers, for example - engineering workstations on accounting pcs.

In addition to size, LANS are distinguished from other types of networks by their transmission media and topology. In general, a given LAN will use only one type of transmission medium. The most common LAN topologies are bus, ring and star.

Metropolitan Area Network (MAN)

A metropolitan area network (MAN) is designed to extend over an entire city. It may be a single network such as a cable television network, or it may be a means of connecting a number of LANs into a larger network so that resources may be shared LAN to LAN as well as device-to-device. For example, a company can use a MAN to connect the LANs in all of its offices throughout a city.

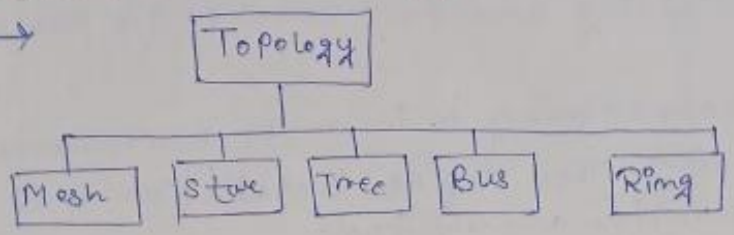
Wide Area Network (WAN)

A wide area network (WAN) provides long-distance transmission of data, voice, image, and radio information over large geographical area that may comprise a country, a continent, or even the whole world.

In contrast to LANs (which depend on their own hardware for transmission), WANs may utilize public, leased, or private communication devices, usually in combinations, and can therefore span an unlimited number of miles.

17) Briefly discussed ~~discussed~~ different topologies with their advantage and disadvantage.

→



■ Mesh topology :—

In a mesh topology every device has dedicated point to point link to every other device. The term dedicated means that the link carries traffic only between the two devices it connects. A fully connected mesh network therefore has $n(n-1)/2$ physical channels to link n devices.

Advantage :—

(1) A mesh offers several advantages over other network topologies. First, the of dedicated links guarantees that each connection can carry it's own data load; thus eliminating the traffic problems that can occur when links must be shared by multiple devices.

(2) Second, a mesh topology is robust. If one link becomes unusable, it does not incapacitate the entire system.

(3) Another advantage is privacy and security. When every message sent travels along a dedicated line, only the intended recipient sees it. Physical boundaries prevent other users from gaining access to messages.

(4) Finally, point to point links make fault identification and fault isolation easy. Traffic can be routed to avoid links with suspected problems.

Disadvantage

The main disadvantages of a mesh are related to the amount of cabling and the number of I/O ports required.

(1) First, because every device must be connected to every other device, installation and reconfiguration are difficult.

(2) Second the sheer bulk of the wiring can be greater than the available space (in walls, ceilings or floors) can accommodate.

(3) And finally, the hardware required to connect each link (I/O ports and cable) can be prohibitively expensive.

■ Star topology :-

In a star topology, each devices has a dedicated point to point link only to a central controller, usually called a hub. The devices are not directly linked to each other. Unlike a mesh topology, a star topology does not allow direct traffic between devices. The controller acts as an exchange: if one device wants to send data to another, it sends the data to the controller, which then relays the data to the other connected device.

Advantage :- other advantages include robustness. If one link fails, only that link is affected. All other links remain active. This factor also lends itself to easy fault identification and fault isolation.

Disadvantage :- However, although a star requires far less cable than a mesh, each node must be linked to a central hub. For this reason more cabling is required in a star than in some other topologies. (such as tree, ring, or bus).

■ Tree topology :- A tree topology is a variation of a star. As in a star, nodes in a tree are linked to a central hub that controls the traffic to the network.

The central hub in the tree is an active hub. An active hub contains a repeater, which is a hardware device that regenerates the received bit patterns before sending them out.

· Advantage :-

The other advantage include robustness. If one link fails only that link is affected. All other links remain active. This factor also lends itself to easy fault identification and fault isolation.

It allows more devices to be attached to a single central hub.

and second, it allows the network to isolate and prioritize communications from different computers.

· Disadvantage :- ~~The central hub in the tree is an active hub contains a~~

However, although a star requires far less cable than a mesh each node must be linked to a central hub. For this reason more cabling is required in a star than in some other topologies (such as tree, ring or bus)

P.TO

Bus topology :—

A bus topology, on the other hand, is multipoint. one long cable acts as a backbone to link all the devices in the network.

nodes are connected to the bus cable by drop lines and taps. A drop line is a connection running between the device and the main cable. A tap is a connector that either splices into the main cable or punctures the sheathing of a cable to create a contact with the metallic core. As a signal travels along the backbone, some of its energy is transformed into heat.

Advantage

Advantages of a bus topology include ease of installation. Backbone cable can be laid along the most efficient path, then connected to the nodes by drop lines of various lengths. In this way, a bus uses less cabling than mesh, star, or tree topologies.

Disadvantage

Disadvantages include difficult reconfiguration and fault isolation. A bus is usually designed to be optimally efficient at installation. It can therefore be difficult to add new devices. ~~As~~ The signal reflection at the taps can cause degradation in quality. This degradation ~~can~~ can be controlled by limiting the number and spacing of devices connected to a given length of cable.

■ Ring topology :- In a ring topology, each device has a dedicated point-to-point line configuration only with the two devices on either side of it. A signal is passed along the ring in one direction, from device to device, until it reaches its destination. Each device in the ring incorporates a repeater.

Advantage

A ring is relatively easy to install and reconfigure. Each device is linked only to its immediate neighbors (either physically or logically). To add or delete a device requires moving only two connections.

Disadvantage

The only constraints are media and traffic considerations (maximum ring length and number of devices). In addition, fault isolation is simplified. Generally in a ring, a signal is circulating at all times. If one device does not receive a signal within a specified period, it can issue an alarm. The alarm alerts the network operator to the problem and its location.

18) Briefly write the advantage and disadvantage of mesh topology over star topology and bus topology.

→ A star topology is less expensive than a mesh topology. In a star, each device needs only one link and one I/O port to connect it to any number of others. This factor also makes it easy to install and reconfigure. Far less cabling needs to be housed, and additions, moves, and deletions involve only one connection, between that device and the hub.

Other advantages include robustness. If one link fails, only that link is affected. All other links remain active. This factor also lends itself to easy fault identification and fault isolation.

However, although a star requires less cable than a mesh, each node must be linked to a central hub. For this reason more cabling is required in a star than in some other topology (such as tree, ring, or bus).

Advantages of a bus topology include ease of installation. Backbone cable can be laid along the most efficient path, then connected to the nodes by drop lines of various lengths. In this way, a bus uses less cabling than mesh, star, or tree topologies.

Disadvantages include difficult reconfiguration and fault isolation. A bus is usually designed to be optimally efficient at installation. It can therefore be difficult to add new devices. As mentioned above, signal reflection at the taps can cause degradation in quality. This degradation can be controlled by limiting the number and spacing of devices connected to a given length of cable.

11) Is an oil pipeline a simplex, half duplex or a full duplex system?

→ An oil pipe is an example of half duplex channel because an oil can flow in one direction at a time. It is not possible to flow both direction at a time, so it is example of half duplex channel.

10) What is socket, port, logical address, physical address and communication protocol?

→ • Socket:- In networking socket is an inbound and point for sending or receiving data with in a node.

• port:- port is generally a specific place for being physically connected to some other device usally, with a socket and a plug. A personal computer is provided with one or more serial or parallel port.

• logical address:- The physical addressing implemented by the data link layer handles the addressing problem locally. If a packet passes the network boundary, we need another addressing system to help distinguish the source and destination systems. 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.

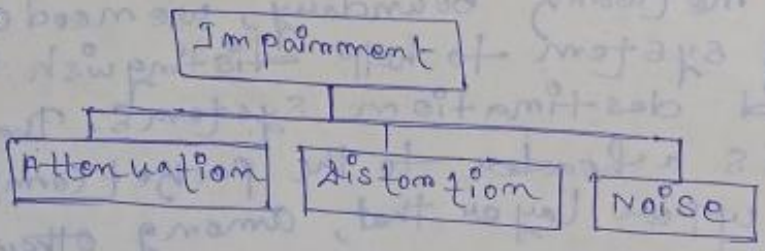
• physical addressing:- If frames are to be distributed to different systems on the network, the data link layer adds a header to the frame to define the physical address of the sender (source address) and/or receiver (destination address) of the frame. If the frame is intended for a system outside the sender's network, the receiver address is the address of the device that connects one network to the next.

• Communication protocol:—

A Protocol in contrast is a set of rules governing the format and meaning of the packets or messages that are exchanged by the peer entities. They are free to change their protocols. But they do not change the service visiable to their users.

15) Briefly discussed about different transmission impairments (Attenuation, Distortion, Noise, Crosstalk).

→



■ Attenuation:- Attenuation means loss of energy. When a signal, simple or complex, travels through a medium, it loses some of it's energy so, that it can overcome the resistance of the medium.

■ Distortion :- Distortion means that the signal changes its form or shape. Distortion occurs in a composite signal; made of different frequencies. Each signal component has its own propagation speed through a medium and, therefore its own delay in arriving at the final destination.

■ Crosstalk :- The noise on a line cast by signal travelling along another line.

■ Noise :- Noise is another problem. several types of noise such as thermal noise, induced noise, crosstalk, and impulse noise may corrupt the signal.

Crosstalk is the effect of one wire on the other. One wire acts as a sending antenna and the other as the receiving antenna. Impulse noise is a spike (a signal with high energy in a very short period of time) that comes from power lines, lightning, and so on.

20) Explain the relationship of services with protocol of a network ?

→ A service is a set of primetives (operation) that layer provides to the layer above it. The service defines what operations the layer is prepared to perform on behalf of it's users. But it's says nothing about how this operation are implimented.

A protocol in contrust is a set of rules governing the format & meaning of the packets or massages.

that are exchange by the peer entities. They are free to change their protocols. But they do not change the service visiable to their users.

22) write the advantage of leased line connectivity over dialup connectivity?

→ In dialup connectivity every time we need to dial to establish the connection. Generally this type of connectivity have low speed. that means data rate is low.

On the other hand in leased line connectivity a dedicated line is maintained between the service provider and the users computer. (point to point link). Here, data rate is very high dialog connectivity but cost is also high than the dialup.

23) what is web browser?

→ • Browser Architecture;—

A variety of vendors offer commercial browsers that interpret and display a web document, and all of them use nearly the same architecture. Each browser usually consists of three parts: a controller, client programs, and interpreters. The controller receives input from the keyboard on the mouse and uses the client programs to access the document.

24) what is DNS ?

→ Domain Name system (DNS) :⇒

DNS is a protocol that can be used in different platforms. In the internet, the domain name space (tree) is divided into three different sections: generic domains, country domains and inverse domain.

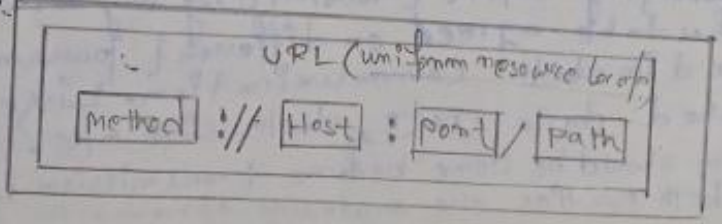
Label	Description
Com	Commercial Organisation
edu	Education Institutions
gov	Government Institutions
int	International Organisation
mil	Military groups
net	Network support centers
org	Nonprofit Organisations

[redacted]

■ what is URL ?

⇒ Uniform Resource Locator (URL)

A client that wants to access a document needs an address. To facilitate the access of documents distributed throughout the world, HTTP uses the concept of locators. The uniform resource locator (URL) is a standard for specifying any kind of information on the internet. The URL defines four things :- method, host computer, port and path.



what is www?

→ The world wide web (www), or the web, is a repository of information spread all over the world and linked together. The www has unique combination of flexibility, portability, and user-friendly features that distinguish it from other services provided by the Internet.

11) what do you mean by value added network?

→ A value added network is a hosted service offering that acts as an intermediary between bissnues partners sharing standart based on proprietary data via a shained bissness processpss. The offer service is refer to as value added network service.

12) write the difference between Computer network (advantage) and distributed system?

→ A computer network is just hudware and softwaare that enables computes to exchange data while still operating independently. Computer network offers different services.

In distibuted system consist of computes that are not only connected but co-ordinate among each other to form a single system. This type of system usally use distibuted processing distibuted data etc. so, here processing depends on different system and resource are distibuted through out the network.

19) what is Jamming signal?

→ A signal that intentionally introduces interference into a (communicat channel either to intentionally prevent error free reception as a means of advising station of some event in CSMA/CD, LAN we often use this Jamming signal.

21) what does negotiation mean when discussing network protocols give an example?

→ In networking before transmitting any data sender and receiver has to be agreed on different parameters that can be used in data communication. Like protocol to be used data rate, data size etc. so, a negosiation should be done before transmission of actual data if both parties are mutualy agreeded then only transmissio take place.

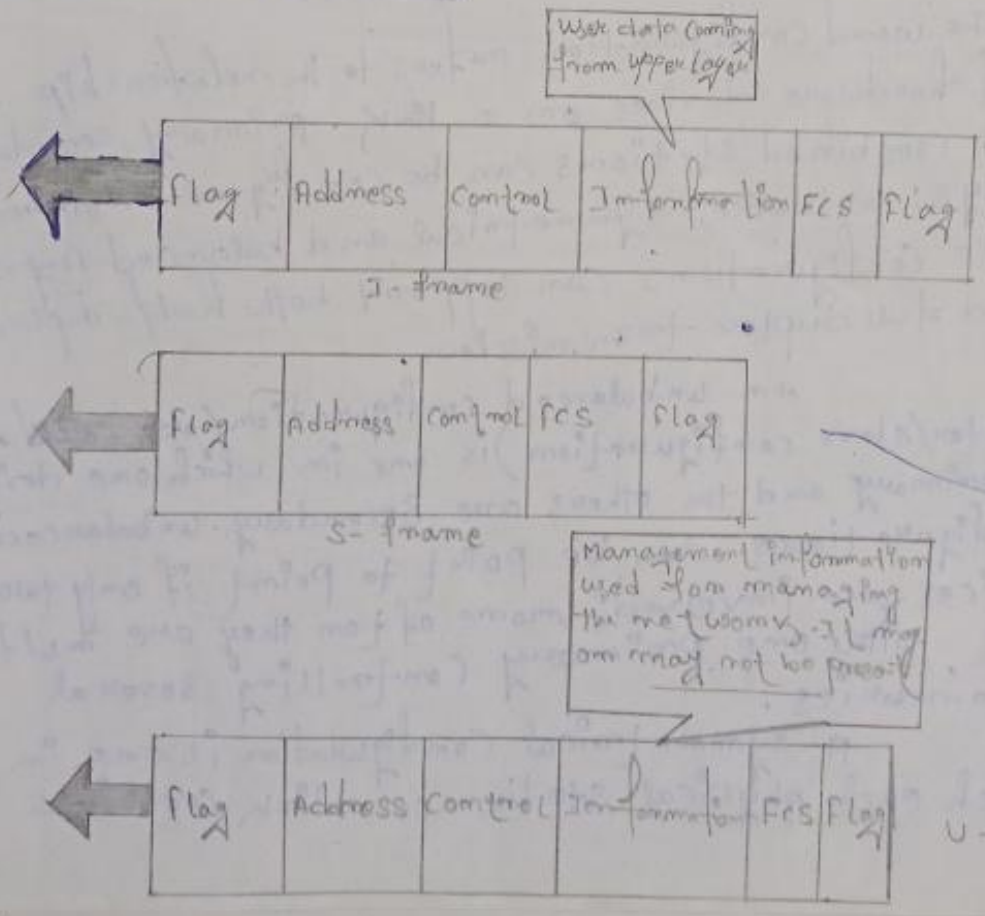
(HDLC)

1) Discuss different types of frame / station type / transmission process / code (data) transparency in HDLC protocol / write different characteristics of bit oriented protocol with example.

→

To provide the flexibility necessary to support all of the options possible in the modes and configurations described HDLC defines three types of frames: Information frames (I-frame), Supervisory frame (S-frame), and unnumbered frames (U-frame). Each type of frame works as an envelope for the transmission of a different type of message. I-frames are used to transport user data and control information relating to user data. S-frames are used only to transport control information, primarily data link layer flow and error controls. U-frames are reserved for system management. Information carried by U-frames is intended for managing the link itself.

Picture – 3/13/11:46



■ Station types

HDLC differentiates between three types of stations: primary, secondary and combined.

A primary station in HDLC functions in the same way as the primary devices in the discussions of flow control. The primary is the device in either a point to point or multipoint line configuration that has complete control of the link. The primary sends commands to the secondary stations. A primary issues commands a secondary issues responses.

A combined station can both command and respond. A combined station is one of a set of connected peer devices programmed to behave either as a primary or as a secondary depending on the nature and direction of the transmission.

■ The word configuration refers to the relationship of hardware devices on a link. primary, secondary and combined stations can be configured in three ways: unbalance, symmetrical and balanced. Any of these configurations can support both half-duplex and full duplex transmission.

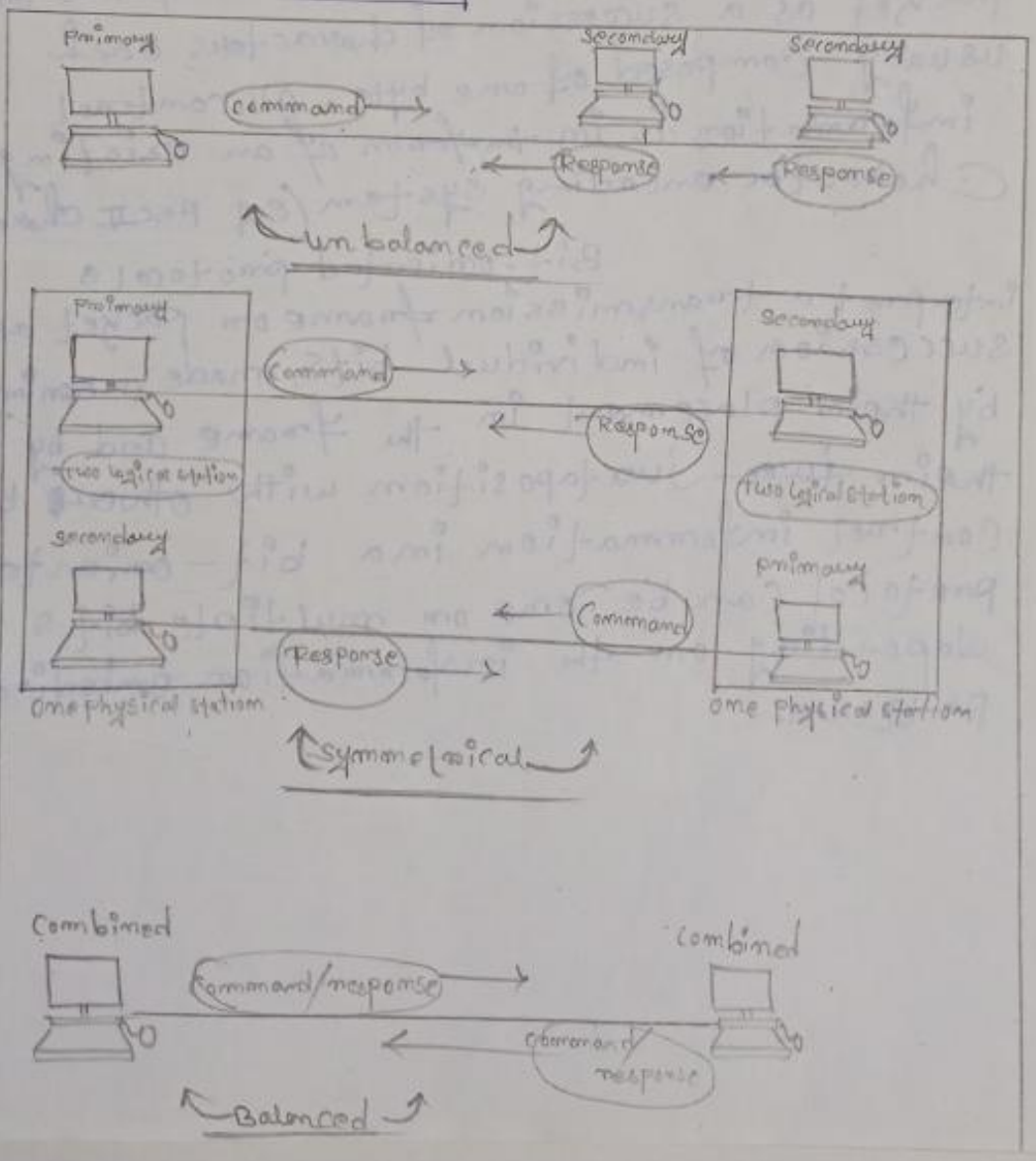
An unbalanced configuration (also called a master/slave configuration) is one in which one device is primary and the others are secondary. unbalanced configurations can be point to point if only two devices are involved; more often they are multi-point, with one primary controlling several secondaries.

A symmetrical configuration is one in which each physical station on a link consists

of two logical stations one a primary and the other a secondary. separate lines link the primary aspect of one physical station to the secondary aspect of another physical station. A symmetrical configuration behaves like an unbalanced configuration except that control of the link can shift between the two stations;

A balanced configuration is one in which both stations in a point to point topology are of the combined type. The stations are linked by a single line that can be controlled by either station.

Picture – 11.14/341 (D)



2) write the use of commands DISC, SNRM, FRMR?

→ DISC ⇒ Disconnect.

SNRM ⇒ Set normal response mode.

FRMR ⇒ frame reject.

3) write the difference between HDLC and SDLC protocol?

→ Character-oriented protocols (also called byte-oriented protocols) interpret a transmission frame or packet as a succession of characters, each usually composed of one byte. All control information is in the form of an existing character encoding system (e.g. ASCII characters).

Bit-oriented protocols interpret a transmission frame or packet as a succession of individual bits, made meaningful by their placement in the frame and by their juxtaposition with other bits. Control information in a bit-oriented protocol can be one or multiple bits depending on the information embodied in the pattern.

4) what do you mean by HDLC subset (X.25)?

5) write the difference between HDLC (Bit oriented) and BSC (character oriented) protocol?

→ (P→ 382)

6) What do you mean by bit stuffing and byte stuffing?

→ HDLC uses a process called bit stuffing. Every time a sender wants to transmit a bit sequence having more than five consecutive 1s, it inserts (stuffs) one redundant 0 after the fifth 1. For example, the sequence 01111111000 becomes 011111011000. This extra 0 is inserted regardless of whether the sixth bit is another 1 or not. Its presence tells the receiver that the current sequence is not a flag. Once the receiver has seen the stuffed 0, it is dropped from the data and the original bit stream is restored.

• Byte stuffing:-

7) If the bit string 01111110011111110/ 01111011111011111110 is bit stuffed, what is the output string after bit stuffing?

→ 01111110011111110

⇒ 0111110100111110110

Byte stuffing

∴ Attached 0 after five 1's.

8) what is piggybacking?

→ Piggybacking means combining data to be sent and acknowledgement of the frame received in one single frame.

(BSC)

1) Discuss the BSC protocol of datalink layer/ write different characteristics of character oriented protocol with example.

2) The following data fragment occours in a middle of a data stream for which character stuffing is used DLE, STX, A, DLE, B, DLE, ETX. what is the output after stuffing?

→ DLE, STX, A, DLE, B, DLE, ETX

⇒ ESC DLE, ESC STX, A, ESC DLE, B, ESC DLE, ESC ETX

1) Discuss the BSC protocol of datalink layer/write different characteristics of character oriented protocol with example.

⇒ • **character-oriented protocol :-**

character oriented protocol (also called byte-oriented protocols) interpret a transmission frame or packet as a succession of characters each usually composed of one byte. All control information is in the form of an existing character encoding system.

• **Binary synchronous Communication (Bsc) :-**

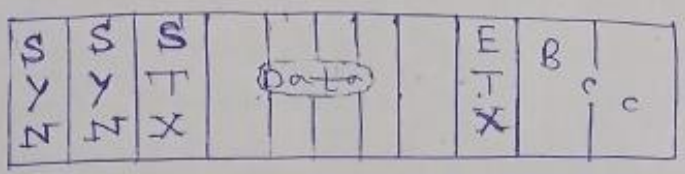
Binary synchronous Communication (Bsc) is a popular character-oriented data link protocol. ~~developed by IBM~~ usable in both point to point and multipoint configurations it supports half duplex transmission using stop and wait ARQ flow control and

error connection. BSC does not support full duplex transmission on sliding window protocol.

- **BSC frames :-** The BSC protocol divides a transmission into frames. If a frame is used strictly for control purpose, it is called a control frame. control frames are used to exchange information between communication devices, for example, to establish the initial connection, to control the flow of the transmission, to request error connections, and to disconnect the devices at the close of a session. If a frame contains part or all of the message data itself, it is called a data frame. Data frames are used to transmit information, but may also contain control information applicable to that information.

- BSC Frames
  - Control frames
  - Data frames

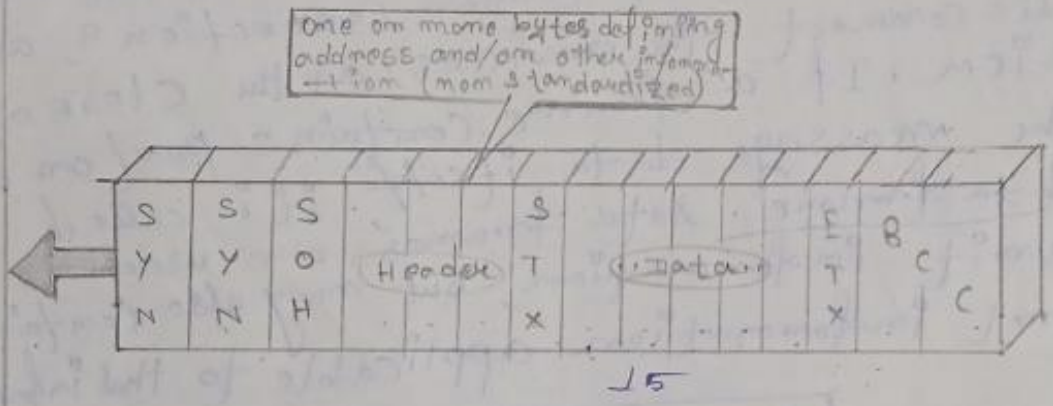
- Picture 11.6 / (P) - 334

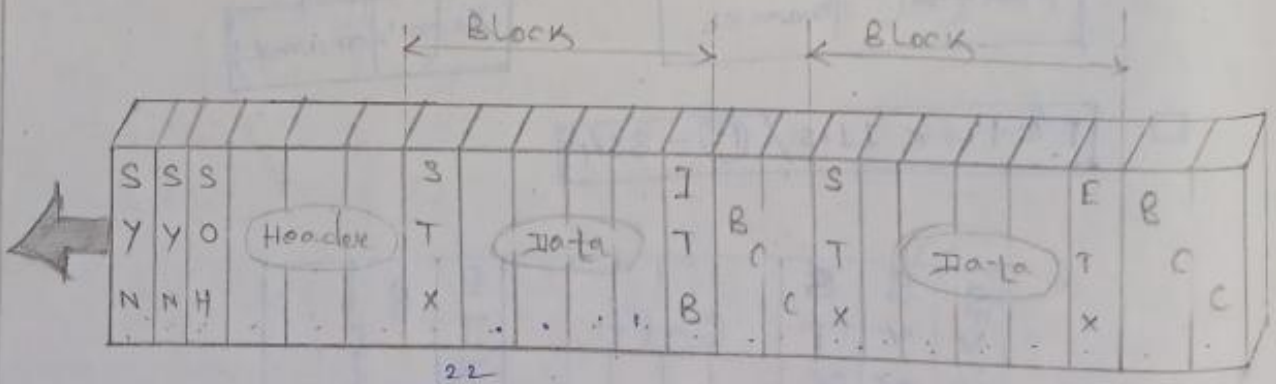


The ASCII code for SYN is 0010110. The leading bit of the byte is usually filled out by an additional 0. A start of text (STX) character.

This character signals to the receiver that the control information is ending and the next byte will be data. Finally, one or two characters called the block check count (BCC) are included for error detection. A BCC field can be a one-character longitudinal redundancy check (LRC) or a two character cyclic redundancy check (CRC).

- Picture 11.7 / (P) - 335
- Picture 11.8 / (P) - 336

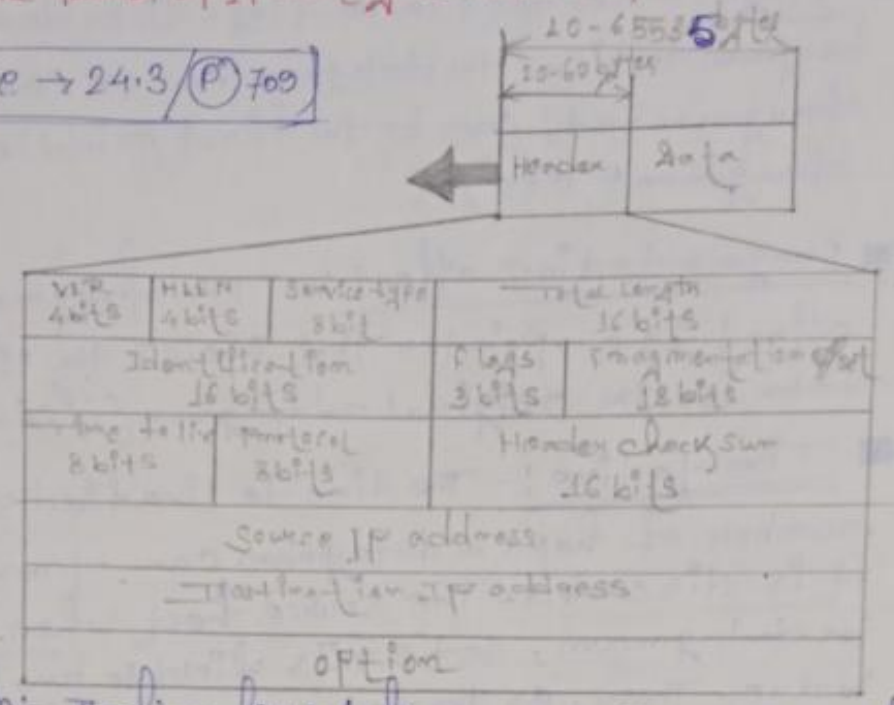




TCP/IP

1) Discuss the format of IP Datagram header?

→ Picture → 24.3 / (P) 709



- Version:- The first field defines the version number of the IP. The current version is 4 (IPv4), with a binary value of 0100.
- Header length (HLEN):- The HLEN field defines the length of the header in multiples of four bytes. The four bits can represent a number between 0 and 15, which when multiplied by 4, gives a maximum of 60 bytes.
- Service type:- The service type field defines how the datagram should be handled. It includes bits that define the priority of the datagram. It also contains bits that specify the type of service the sender desires such as the level of throughput, reliability and delay.
- Total Length:- The total length field defines the total length of the IP datagram. It is a two-byte field (16 bits) and can define up to 65,535 bytes.
- Identification:- The identification field is used in fragmentation. A datagram, when passing through different networks may be divided into fragments to match the network frame size. When this happens, each fragment is identified with a

sequence number in this field.

- Flags:- The bits in the flags field deal with fragmentation (the datagram can or can not fragmented; can be the first, middle, or last fragment, etc).
- Fragmentation offset:- The fragmentation offset is a pointer that shows the offset of the data in the original datagram (if it is fragmented)
- Time to live:- The time to live field defines the number of hops a datagram can travel before it is discarded. The source host, when it creates the datagram, sets this field to an initial value. Then, as the datagram travels through the internet, router by router, each router decrements this value by 1. If this value becomes 0 before the datagram reaches its final destination, the datagram is discarded. This prevents a datagram from going back and forth forever between routers.
- Protocol:- The protocol field defines which upper-layer protocol data are encapsulated in the datagram (TCP, UDP, ICMP, etc).
- Header checksum:- This is a 16 bit field used to check the integrity of the header, not the rest of the packet.
- Source address:- The source address field is a four byte (32 bit) internet address. It identifies the original source of the datagram.
- Destination address:- The destination address field is a four byte (32 bit) internet address. It identifies the final destination of the datagram.

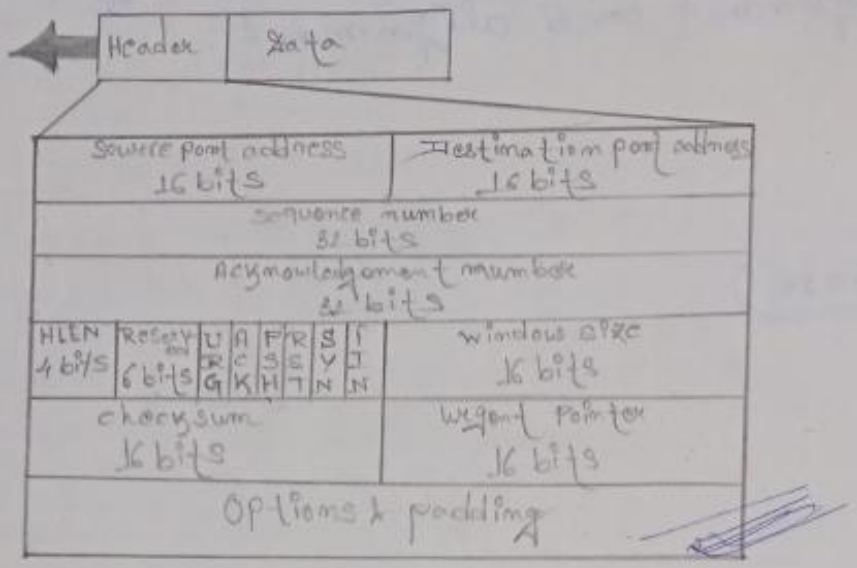
- Options:- The options field gives more functionality to the IP-datagram. It can carry fields that control routing, timing, management and alignment.

3) Discuss different classes of IP (IP classful address / IP addressing)?

→ (P→71e)

(2) Discuss the format of TCP header?

picture:- 24.16 / (P) 724



- Source port address:- The source port address defines the application program in the source computer.
- Destination port address:- The destination port address defines the application program in the destination computer.
- Sequence number:- A stream of data from the application program may be divided into two or more TCP segments. The sequence number field shows the position of data in the original data stream.
- Acknowledgement number:- The 32-bit acknowledgement number is used to acknowledge the receipt of data from the other communicating device. This number is valid only if the ACK bit in the control field is set.) In this case, it defines the byte

sequence number that is next expected.

- **Header Length (HLEN)**:- The size of the header can be a maximum of 60 bytes (4×15), since the minimum required size of the header is 20 bytes, 40 bytes are thus available for the options section.
- **Reserved**:- A six-bit field is reserved for future use.
- **Control**:- The urgent bit, when set, validates the urgent pointer field. Both this bit and the pointer indicate that the data in the segment are urgent. The ASK bit, when set, validates the acknowledgement number field. Both are used together and have different functions, depending on the segment type. The PSH bit is used to inform the sender that a higher throughput is needed. The reset bit is used to reset the connection when there is confusion in the sequence numbers. The SYN bit is used for sequence number synchronization in three types of segments: connection request, connection confirmation and confirmation acknowledgement. The FIN bit is used in connection termination.
- **window size**:- The window is a 16 bit field that defines the size of the sliding window.
- **checksum**:- The checksum is a 16 bit field used in error detection.
- **urgent point**:- This is the last required field in the header. Its value is valid only if the URG bit in the control field is set.
- **option & padding**:- The remainder of the TCP header defines the optional fields. They used to convey additional information to the receiver or for alignment purpose.

(4) Routing algorithm? (P-620-630) Distance vector / Link state system

(Conversion)

1) Write the different between Manchester and differential Manchester Encoding?

→ In manchester encoding the transition at the middle of the bit is used for both synchonization and bit representation.

Example:-

In differential manchester encoding the transition at the middle of the bit is used only for synchronization. The bit representation is shown by the inversion or non inversion at the beginning of the bit.

Example:-

2) what do you mean by modulation/modulation rate/ demodulation/modem/codec/line encoding? what is the function of modem and codec?

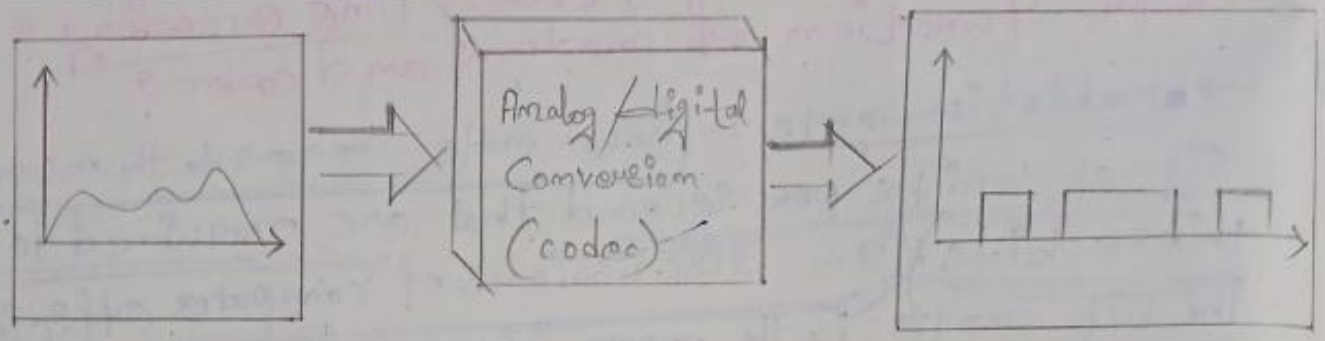
→ ■ Modulation rate :- Baud rate refers to the number of signal units per second that are required to represent those bits. In discussions of computer efficiency, the bit rate is the more important - we want to know how long it takes to process each piece of information. In data transmission, however, we are more concerned with how efficiently we can move those data from place to place, whether in pieces or blocks. The fewer signals units required, the more efficient the system and the less bandwidth required to transmit more bits, so we are more concerned with baud rate. The baud rate determines the bandwidth required to send the signal.

■ Demodulation :- A modulator converts a digital signal into an analog signal using ASK, FSK, PSK, or QAM. A demodulator converts an analog signal into a digital signal. While a demodulator resembles an analog-to-digital converter, it is not in fact a converter of any kind. It does not sample a signal to create a digital facsimile; it merely reverses the process of modulation - that is, it performs demodulation.

■ Modem :- Modem stands for modulator/demodulator.

■ Codec :- The lower figure shows the analog-to-digital converter called a Codec (coder-decoder)

[Picture :- 5.15/(P) 102]



■ Line encoding :- Digital to digital encoding or conversion is the representation of digital information by a digital signal. For example, when you transmit data from your computer to your printer, both the original data and the transmitted data are digital. In this type of encoding, the binary 1s and 0s generated by a computer are translated into a sequence of voltage pulses that can be propagated over a wire.

3) state Nyquist theorem / shannon Capacity.

→

- According to the Nyquist theorem, the sampling rate must be at least two times the highest frequency.

- Engineers are often interested in the maximum data rate of a channel. In 1944, Claude shannon introduced a formula to determine the theoretical highest data rate for a channel

$$C = B \log_2 \left(1 + \frac{S}{N}\right)$$

In this formula, B is the bandwidth of the channel, S/N is the signal to noise ratio and C is the capacity (called the shannon capacity) of the channel in bps.

4) Explain ASK, FSK, PSK (Binary or 8-PSK) QPSK/4PSK, differential PSK, QAM. (difference).

→ • ASK (Amplitude shift keying) :- In amplitude shift keying (ASK), the strength of the carrier signal is varied to represent binary 1 or 0. Both frequency and phase remain constant while the amplitude changes. which voltage represents 1 and which represents 0 is left to the system designers.

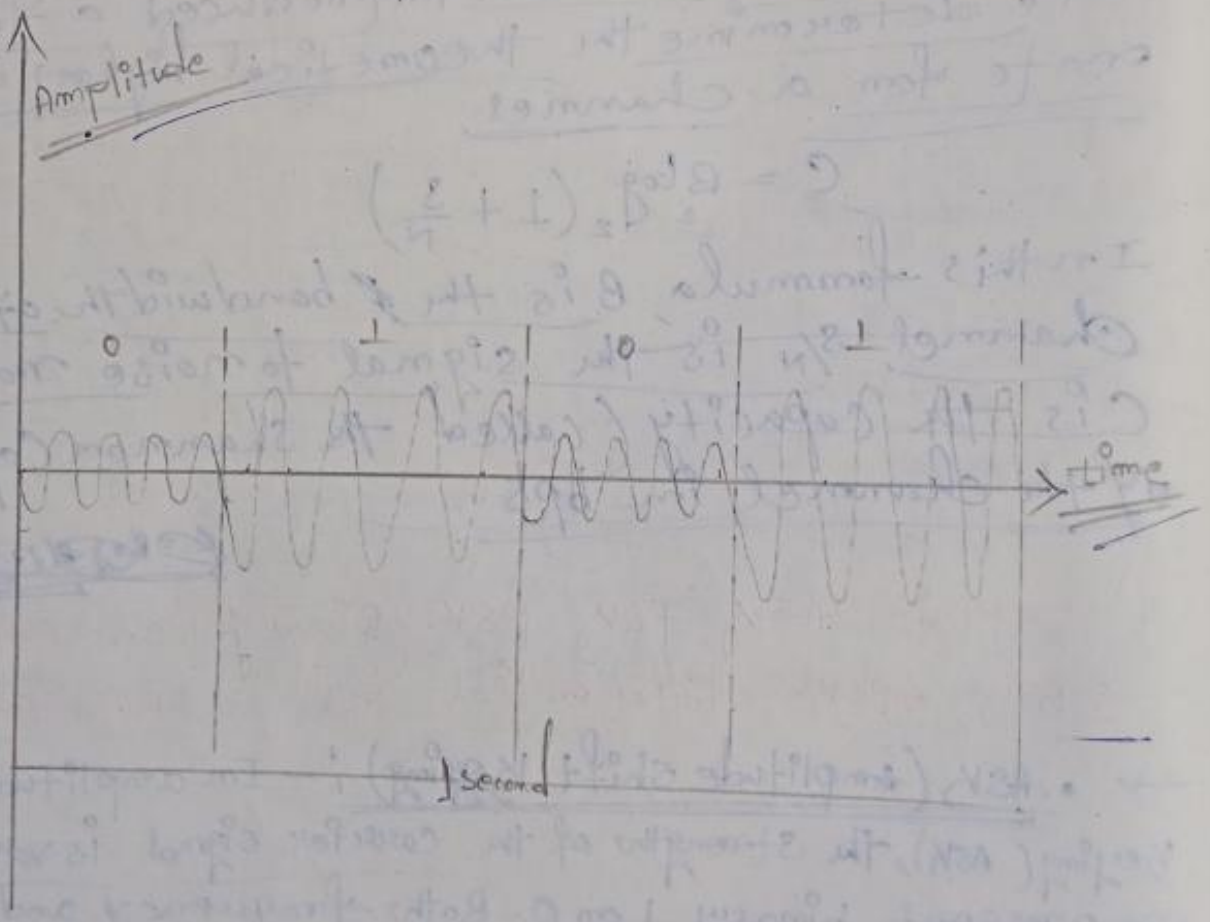
unfortunately, ASK transmission is highly susceptible to noise interference. The term noise refers to unintentional voltages introduced onto a line by various phenomena such as heat or electromagnetic induction created by other sources. These unintentional voltages combine with the signal to change the amplitude. A 0 can be change to 1 and a 1 to 0.

- Bandwidth requirements for ASK are calculated using the formula,

$$BW = (1 + d) \times N_{baud}$$

BW is the bandwidth.
N_{baud} is the baud rate.
And (d) is the factor related to the condition.

- Picture :- 5.24 / (P) 110



• Frequency shift keying (FSK) :-

In frequency shift keying (FSK), the frequency of the carrier signal is varied to represent ~~by~~ binary 1 or 0. The frequency of the signal during each bit duration is constant and its value depends on the bit (0 to 1): both peak amplitude and phase remain constant.

FSK avoids most of the noise problems of ASK. Because the receiving devices is looking for specific frequency changes over a given number of periods it can ignore voltage spikes. The limiting factors of FSK are the physical capabilities of the carrier.

• In FSK, if f_{c_1} & f_{c_0} are the carrier frequencies then,

$$BW = \text{Baud rate} + (f_{c_1} - f_{c_0})$$

• Picture :- 5.27/(P) - 112

• phase shift Keying (PSK) :- In phase shift keying (PSK), the phase of the carrier is varied to represent binary 1 or 0. Both peak amplitude and frequency remain constant as the phase changes, for example if we start with a phase of 0 degrees to represent binary 0, then we can change the phase to 180 degree to send binary 1.

• Picture :- 5.29 / (P) - 114

• 4-PSK :-

Picture :- 5.31 / P-115

Picture :- 5.32 / P-115

00 0
10 90
180
270
360 360

• Differential PSK :- The problem of generating coherent carrier with at the receiving end can be circumvented by encoding the digital information as the ~~shift~~ Phase change rather then ~~the as~~ as the absulate phase. This modulation scheme is called differential PSK.

$$\Delta\phi = \phi_t - \phi_{t-1}$$

• 8-PSK :-

Picture :- 5.33 / P-116

• QAM (Quadrature Amplitude modulation) :-

Quadrature amplitude modulation (QAM) means combining ASK and PSK in such a way that we have maximum contrast between each bit, dibit, tribit, quadbit, and so on.

5) Explain AM, FM, PM. which one more superior between AM and FM.

→ • AM (Amplitude Modulation) :- In AM transmission, the carrier signal modulated so that its amplitude varies with the changing amplitudes of the modulating signal. The frequency and phase of the carrier remain the same; only the amplitude changes to follow variations in the information

• The total bandwidth required for (AM) can be determined from the bandwidth of the audio signal.

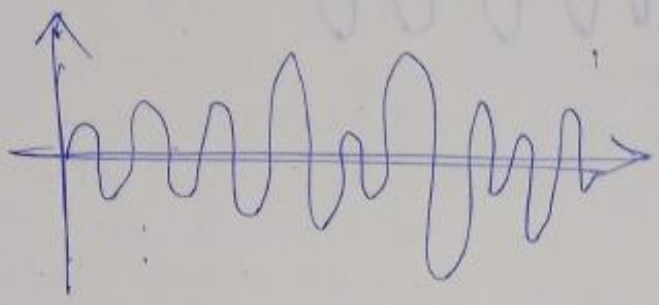
$$BW_t = 2 \times BW_m$$

BW_t = total bandwidth.

BW_m = Bandwidth of the modulating signal.

f_c = frequency of the carrier.

Picture :- 5.41/(F)-101



- FM (Frequency modulation) :-

In FM transmission, the frequency of the carrier signal is modulated to follow the changing voltage level (amplitude) of the modulating signal. The peak amplitude and phase of the carrier signal remain constant, but as the amplitude of the information signal changes, the frequency of the carrier changes correspondingly.

- The total bandwidth required for (FM) can be determine from the bandwidth of the audio signal.

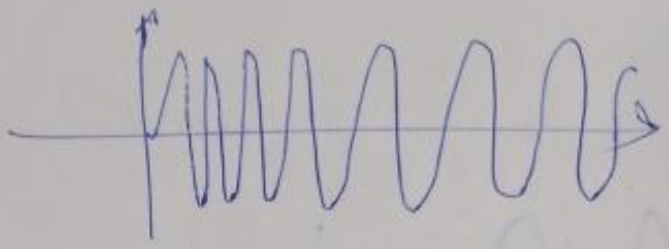
$$BW_t = 10 \times BW_m$$

$\therefore BW_t$ = total bandwidth

BW_m - Bandwidth of the modulating signal.

$\therefore f_c$ = frequency of the carrier.

Picture:- 5.44 / (P) - 123



- phase modulation:-

(PM) is used as an alternative of frequency modulation (FM). In (PM) the phase of the carrier signal is modulated to follow the changing voltage level of the modulating signal.

6) Explain PAM, PCM method?

→ The first step in analog-to-digital conversion is called pulse amplitude modulation (PAM). This technique takes an analog signal, samples it, and generates a series of pulses based on the results of the sampling. The term sampling means measuring the amplitude of the signal at equal intervals.

(PCM):- The method of sampling used in PAM is more useful to other areas of engineering than it is to data communication. However, PAM is the foundation of an important analog-to-digital conversion method called pulse code modulation (PCM).

7) Discuss different analog to digital conversion technique.

→ Same as Q.NO. (6)

8) Discuss different digital to analog conversion technique?

→ Same as Q.NO. (4)

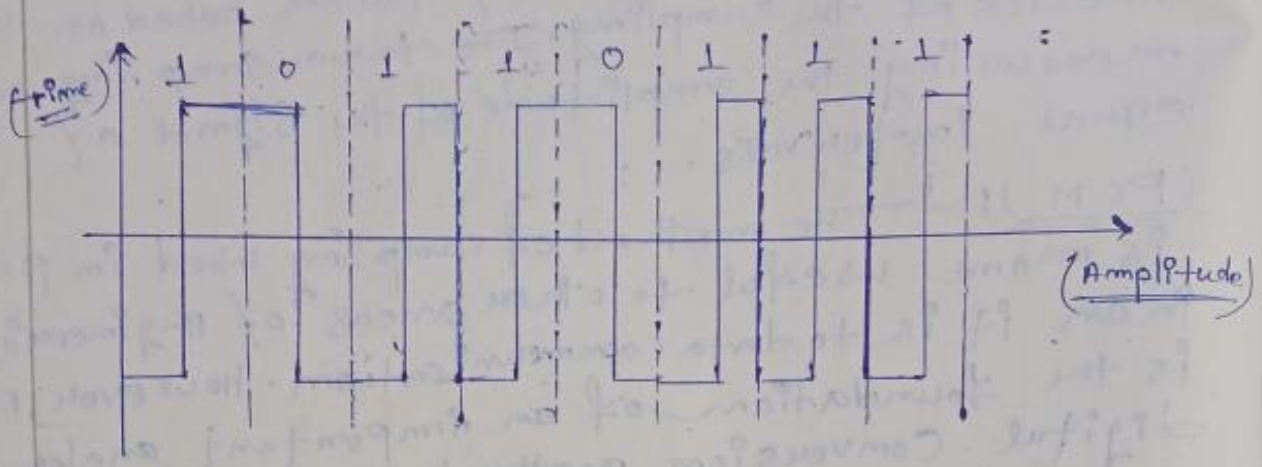
9) write the advantage of PSK over ASK and FSK.

→ By using only half of those possibilities the measurable differences between shifts are increased and greater signal readability is ensured. In addition, several QAM designs link specific amplitudes with specific phases. This means that even with the noise problems associated with amplitude shifting the meaning of a shift can be recovered from phase information. In general therefore a second advantage of QAM over ASK is its lower susceptibility to noise.

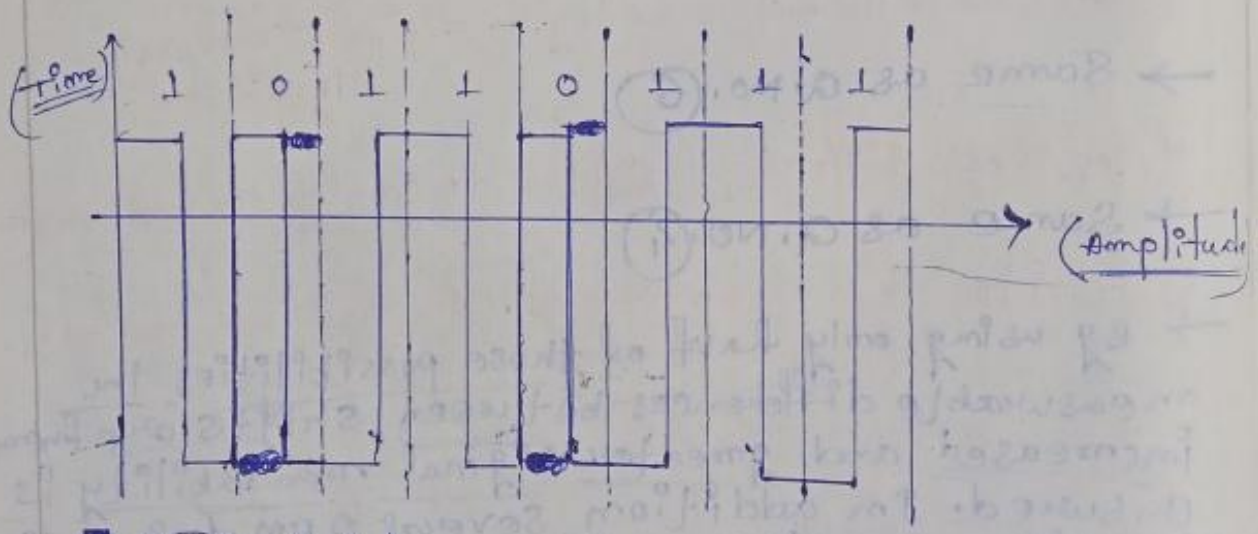
10) Represent 10110111 in Manchester/differential Manchester/NRZ-I/NRZ-L scheme.

→

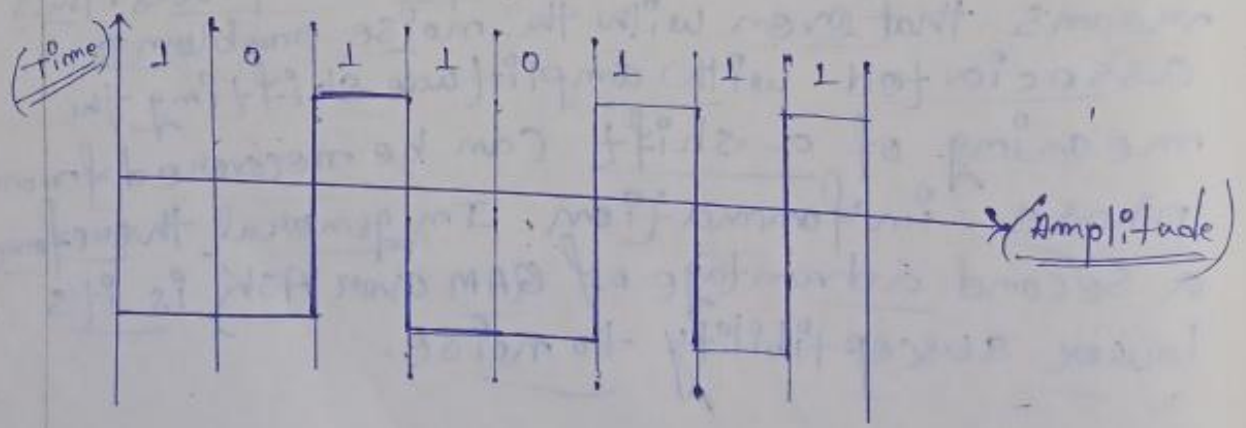
- Manchester :⇒



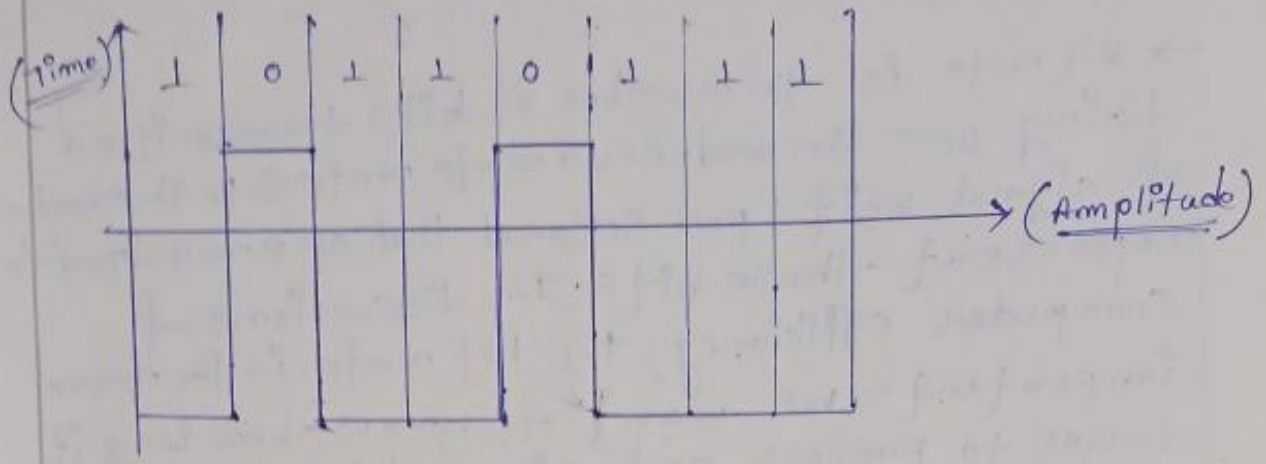
- Differential Manchester :⇒



- NRZ-I :⇒



■ NRZ-L :→



11) what is subnet or subnet mask ?

→ • Subnetting :- As we previously discussed, an IP address is 32 bits long; one portion of the address indicates a network (net id), and the other portion indicates the host (or router) on the network (host id). This means that there is a sense of hierarchy in IP addressing. To reach a host on the internet we must first reach the network using the first portion of the address (net id).

• Masking :- Masking is a process that extracts the address of the physical network from an IP address. Masking can be done whether we have subnetting or not. If we have not subnetted the network, masking extracts the network address from an IP address.

12) what is bit rate and baud rate, write the difference?

→ Bit rate is the number of bits transmitted during one second. Baud rate refers to the number of signal unit per second that are required to represent those bits. In discussions of computer efficiency, the bit rate is the more important. we want to know how long it takes to process each piece of information. In data transmission, however, we are more concerned with how efficiently we can move those data from place to place, whether in pieces or in blocks. The fewer signal unit required the more efficient the system and the less bandwidth required to transmit more bits; So we are more concerned with baud rate. The baud rate determines the bandwidth required to send the signal.

13) A binary signal send over a 6/5/3 KHz channel whose signal to noise ratio is 20/30/20 DB. What is the maximum data rate?

→ $dB = 10 \log_{10}\left(\frac{P_2}{P_1}\right)$

Here, $\left(\frac{S}{N}\right)$ = signal to noise ratio, 20 dB

or, $10 \log_{10}\left(\frac{P_2}{P_1}\right) = 20$

or, $\frac{P_2}{P_1} = 100$

∴ According to shannon capacity,

$C = B \log_2\left(1 + \frac{S}{N}\right)$

$= B \log_2(1+100)$

$= B \log_2(101)$

$= 19.975$ KBPS

∴ we know according to nyquist theorem
Sampling rate = 2 x highest frequency.

= 2 X 3

= 6 KBPS.

14) A noiseless 4KHz channel is sampled in every 1/2 msec. what is the maximum data rate?

→ A noiseless channel can carry an arbitary large amount of information. No matter how often it is sampled. For the 4KHz channel according to Nyquist theorem,

∴ Sampling rate = 2 x highest frequency.

= 2 X 4000

= 8000 Samples/sec.

Let each sample transmitting 16 bit then channel can said

16 X 8000 = 128 KBPS.

15) A noise channel has a bandwidth with 3000 Hz and channel capacity is 34860 bps. Calculate the signal to noise ratio of the channel?

→ ∴ The bandwidth (B) = 3000 Hz.

∴ Channel Capacity (C) = 34860 bps.

∴ Now, we appling the shanon capacity.

$$C = B \log_2 \left(1 + \frac{S}{N}\right)$$

∴ $34860 = 3000 \log_2 \left(1 + \frac{S}{N}\right)$

∴ $\frac{S}{N}$ = feasible.

16) Compute the bit rate for a 1000 baud 16QAM signal?

→ Each signal can carry 4 bits in 16QAM because $2^4 = 16$.

Thus, the total bit rate = $4 \times 1000 = 4000$ bps

17) A TV channel has 6 MHz wide. How many bit per second can be send if 8 levels digital signal is used? Assumed noiseless channel.

→ Sampling rate,

As per nyquist theorem sampling rate,

= 2 × 6 MHz

= 12 milian samples/sec.

4/8 level signals provide 2/3 bit per sample.

data rate = Sampling rate × no. of bits per sample.

= 12 × 2

= 24 Megabit/sec.

18) Given a bandwidth of 4000 Hz of 8 PSK signal. What are the bit rate and baud rate?

OSI Model

1) What is massage, frame, datagram segment bit?

→

- **Massage** :- In application, presentation and section layer unit of data is known as massage So these 3 layers performs different operation on a massage.
- **Datagram on segment** :- In transport layer unit of data is known as segment of datagram, here massage received from the higher layer gets devided into several segment.
- **Datagram** :- In networks layer unit of data unit is known as datagram on packet. Here segment received from the upper layer & some extra header connected together to form a datagram.
- **Frame** :- In datalink layer data unit is known as frame where datagram are receive from networks layer & some extra header connected together to form a frame.
- **Bits** :- finally in physical layer each frames are converted in binary representation cosisting of several 1 & 0 bits. so bit is the least significant unit of data for Physical layer.

2) what is layered protocol? write 2 advantage of it.

→ A protocol in contrust is a set of rules governing the format & meaning of the packets on massages, That are exchange by the peer entities. They are free to change their protocols. But they do not change the service visiable to their users.

• Advantages:- A service is a set of preme tives (operation) that layer provides to the layer above it. (The service defines what operations the layer is prepared to perform on behalf of it's users. But it's says nothing about how this operation are implimented)

A protocol in contrust is a set of rules governing the format & meaning of the packets on massages. That are exchanged by the peer entities. They are free to change their protocol's. But they donot change the service visiable to their users.

3) Compare (similarity and dissimilarity) between OSI model and TCP/IP reference model.

• Transmission Control protocol (TCP) was developed before the OSI model. Therefore, the layers in the TCP/IP protocol do not match exactly with those in the OSI model. The TCP/IP protocol is made of five layers: physical, datalink, network, transport, and application. The application layer in TCP/IP can be equated with the combination of session, presentation and application layers of the OSI model.

At the transport layer, TCP/IP defines two protocols: TCP and user datagram protocol (UDP). At the network layer, the main protocol defined by TCP/IP is internetworking protocol (IP), although there are some other protocols that support data movement in this layer.

4) write advantage (reason of using/principle applied) and disadvantage of OSI model (layered architecture or protocol).

→ Same as Q.NO. (2) Advantages point only.

5) write the function layers in OSI model.

→ 7 layers & their works,
(Page NO.— 47 - 56)

6) Explain the concept of service access point entity (SAP), peer entities, protocol data unit (PDU) in OSI.

→ • Protocol data unit (PDU) :-

The data unit in the LLC level is called the protocol data unit (PDU). The PDU contains four fields familiar from HDLC : a destination service access point (DSAP), a source service access point (SSAP), a control field, and an information field.

• Service access point (SAP) :-

7) Which of the OSI layer handles (i) Token management, (ii) Framing (iii) Data encoding (iv) Routing ?

→ (i) Token management → Network layer.
(ii) Framing → Data link layer.
(iii) Data encoding → presentation layer.
(iv) Routing → Network layer.

8) write different service primitives applicable in network?

⇒ There are 3 types of services —

(i) Confirm service:- After providing the service(n+1) - entity confirms this to the (n+1) - Entity using confirm primitive all the 4 service primitives request, indication, response & confirm services are require for confirm service.

(ii) Non Confirm Service:- The service requested by the (n+1) entity is prided by the (n) but confirmation of having provided the service is not given to the request (y (n+1) entity. The service primitive used in non confirm service are request & indication.

(iii) Provider Initiated service:- For this case the (n) entity initiated and provides the service without any request. The only service primitive required is indication. For example, the network layer may disconnect a network connection on its own and report the disconnection using such service to the transport layer.

9) A system has n/7/15 layer protocol hierarchy. Application generated massage of m/10 bytes. At each of the layer h/8 byte header is added. what fraction of the network bandwidth is filled with header?

→ Here, massage size is (m) bytes and total number of layers is (n), each layer added (h) byte. so total number of header byte per massage is (nh).

∴ Total massage size will be (m+nh)
∴ So, the fraction of bandwidth wastage is = $\left(\frac{nh}{m+nh}\right)$.

10) How peer to peer communications is achieved through layered architecture?

→ There can be two alternating mode to transferring PDU (protocol data unit) between peer entity
- Connection oriented.
- Connection less.

— ① Connection Oriented:- A layer entity can transfer data to the peer entity using the connection Oriented mode of data transfer, If such service is supported by the next lower layer entity. In this mode of data transfer involve 3 phases.
- Connection establishment phase.
- Data transfer phase.
- Connection release phase.

Connection is establishment between Communicating entity. Establishment of a connection. Negosiation of quality of

service primitives, exchange of source and destination address etc. After the data transfer has taken place, there is need to disconnected the connection.

11) Explain the (i) confirmed service (ii) non-confirmed service (iii) provider Initiated service?

→ Same as Q. NO. — (8).

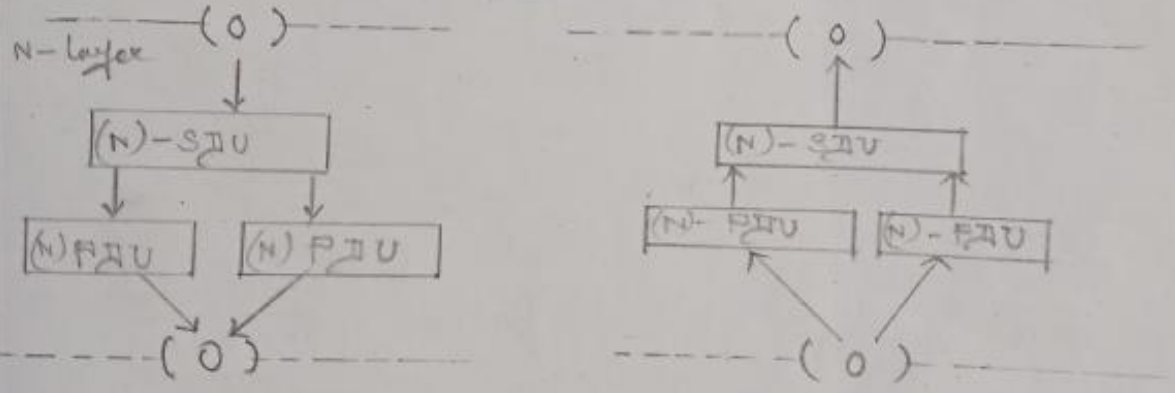
12) ~~Using suitable diagram, explain the~~ (i) SAP (ii) PDU (iii) SDU (iv) IDU (v) ICI (vi) PCI

18) Explain with suitable diagram the following functions of an OSI layer (i) Segmentation, (ii) Blocking (iii) Concatenation.

• Segment: ⇒

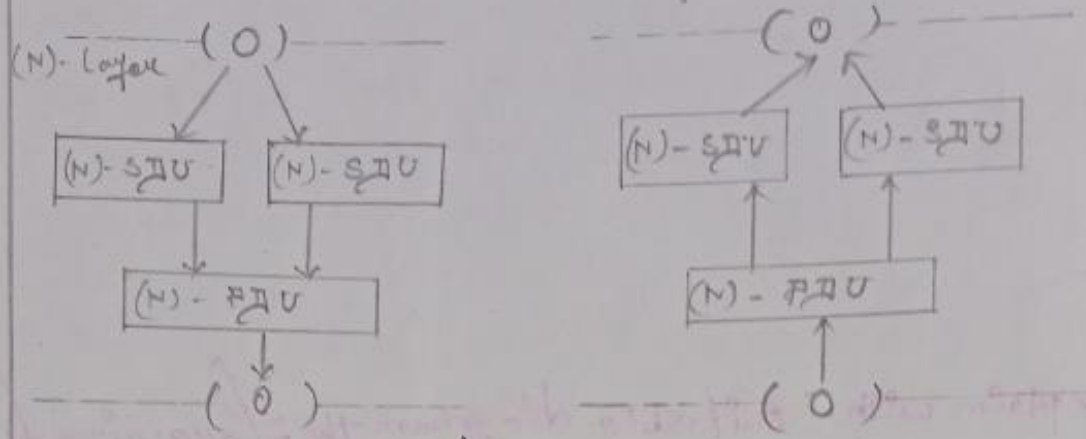
→ (N)- entity may segment and (N)- SDU into several (N)- PDU within an (N)- connection. At the other end of the connection, (N)- PDUs are reassembles into one (N)- SDU.

SDU: (Source Data unit)



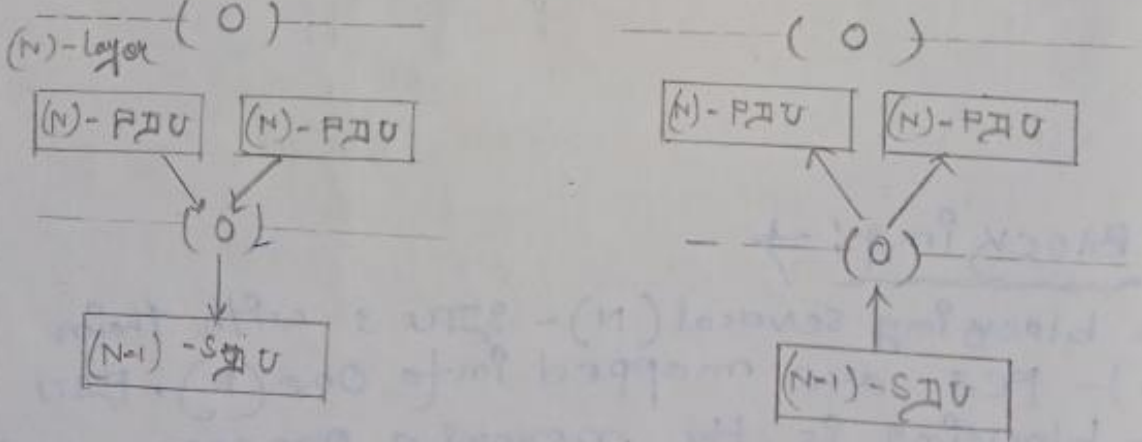
• Blocking: ⇒

In blocking several (N)- SDUs with their (N)- PCI are mapped into one (N)- PDU. de blocking is the reverse process carried out at the other end of the connection to set get back the (N)- SDU.



- Concatenation :-

It's involves mappings of several (N)-PDUs into a single (n-1) SDU. The concatenated PDU are separated by the receiving peer entity. Enough control information must be conveyed to enable the individual PDUs to be separated.



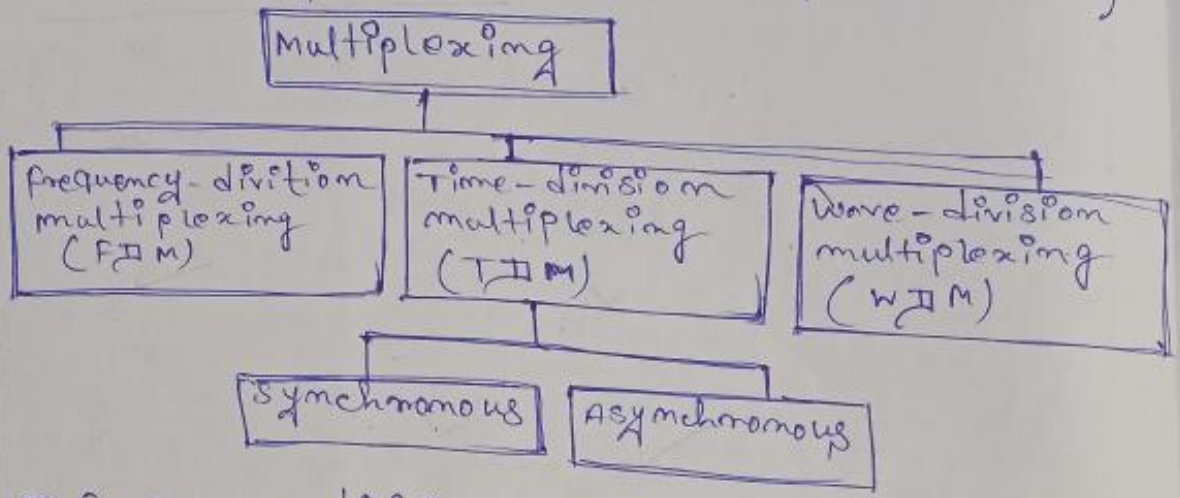
14) Explain the concept of layer, interface and quality of service of a network.

→ Same as Q. NO (8).

* Multiplexing *

1) What is multiplexing? Briefly discussed about FDM, WDM and TDM (synchronous and asynchronous) with e.g. (difference on Compare).

→ ■ Multiplexing is the set of techniques that allows the simultaneous transmission of multiple signals across a single data link.



■ Frequency-division multiplexing :-

Frequency-division multiplexing (FDM) is an analog technique that can be applied when the bandwidth of a link is greater than the combined bandwidths of the signals to be transmitted. In FDM, signals generated by each sending device modulate different carrier frequencies. These modulated signals are then combined into a single composite signal that can be transported by the link. carrier frequencies are separated by enough bandwidth to accommodate the modulated signal. These bandwidth ranges are the channels through which the various signal travel. channel must be separated by strips of unused bandwidth (guard bands) to

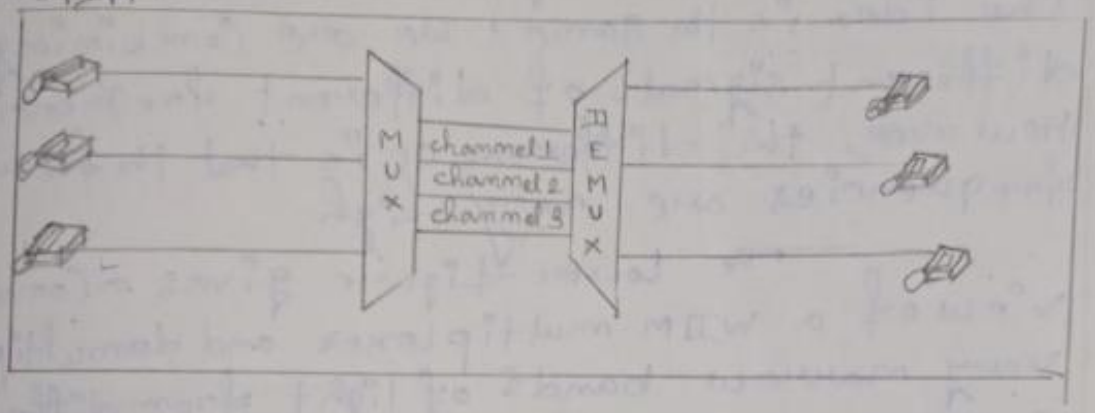
to prevent signals from overlapping.

Picture 8.3/Ⓟ – 233

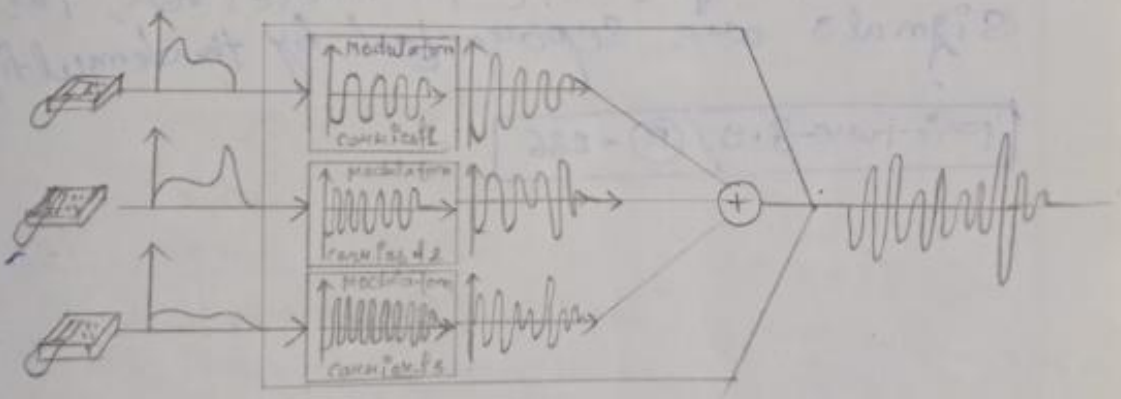
Picture 8.4/Ⓟ – 234

Picture 8.6/Ⓟ – 235

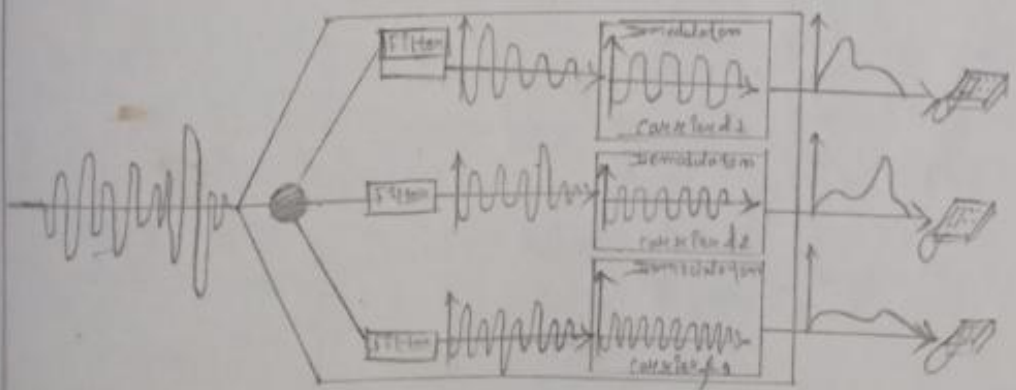
* FDM *



FDM multiplexing process - time domain.



FDM demultiplexing process - time domain.

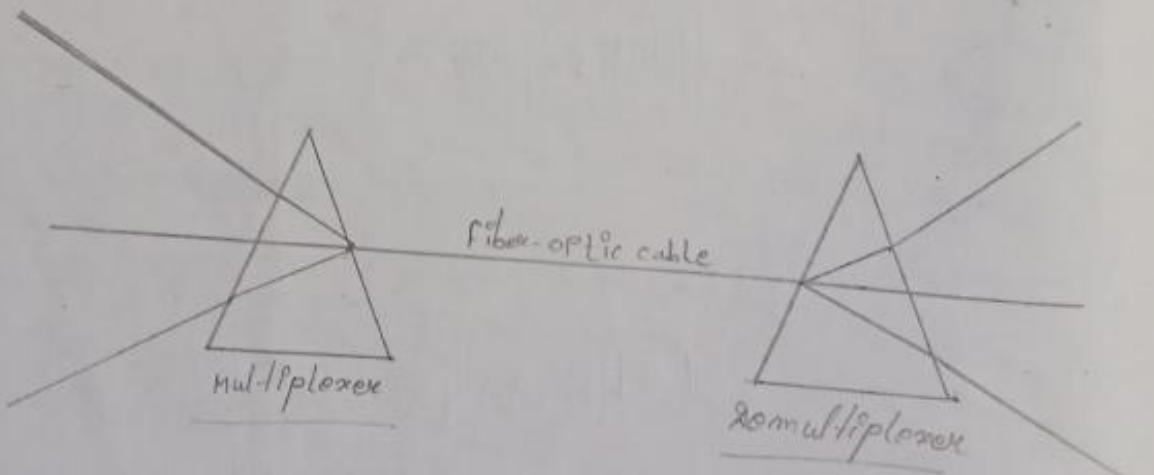


Wave division multiplexing (WDM) :—

Wave-division multiplexing (WDM) is conceptually the same as FDM, except that the multiplexing and demultiplexing involve light signals transmitted through fiber-optic channels. The idea is the same: we are combining different signals of different frequencies. However, the difference is that the ~~frequen~~ frequencies are very high.

The lower figure gives a conceptual view of a WDM multiplexer and demultiplexer. Very narrow bands of light from different sources are combined to make a wider band of light. At the receiver, the signals are separated by the demultiplexer.

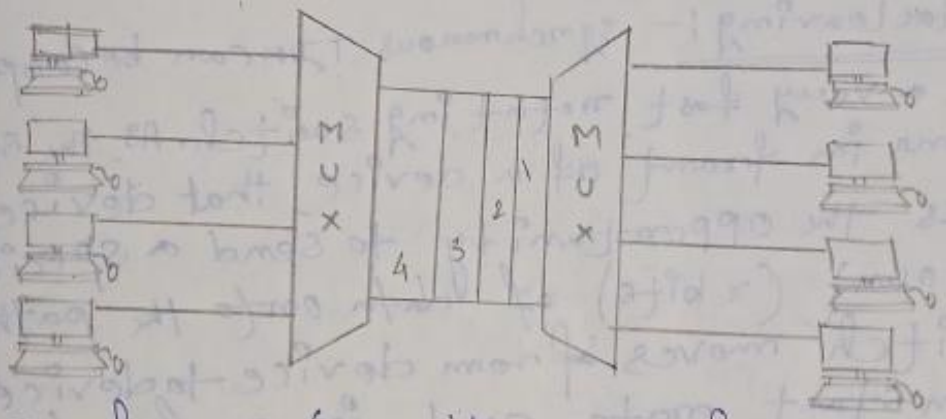
Picture-8.9/(F)-236



Time-division multiplexing (TDM)

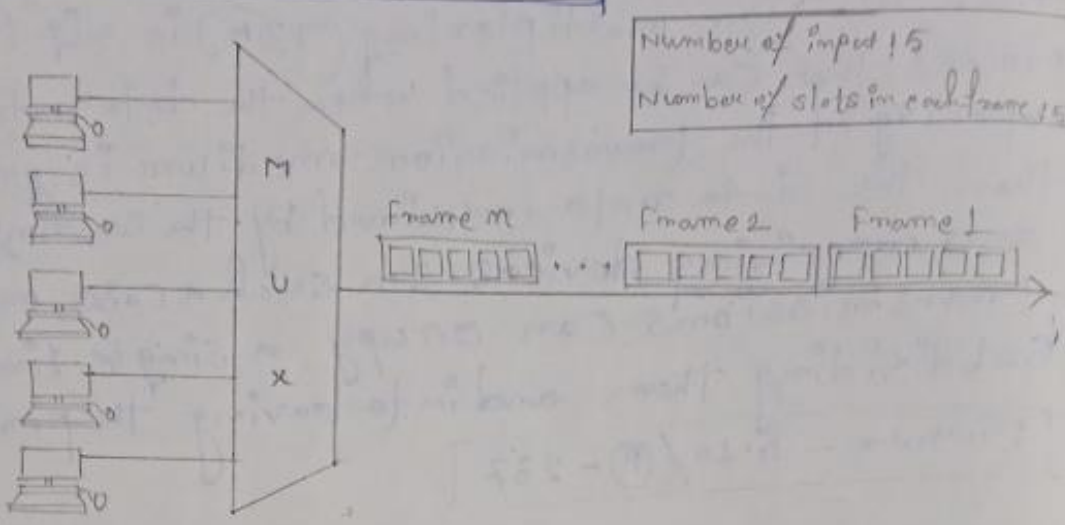
time-division multiplexing (TDM) is digital process that can be applied when the data rate capacity of the transmission medium is greater than the data rate required by the sending and receiving devices. In such a case, multiple transmissions can occupy a single link by subdividing them and interleaving the portions.

Picture - 8.10 / (P) - 287



• synchronous (TDM) :- In synchronous time-division multiplexing, the term synchronous has a different meaning from that used in other areas of telecommunications. Here synchronous means that the multiplexer allocates exactly the same time slot to each device at all times whether or not a device has anything to transmit. Time slot A, for example, is assigned to device a alone and cannot be used by any other device. Each time it allocated time slot comes up, a device has the opportunity to send a portion of it is data.

Picture – 8.11 / (P) – 287

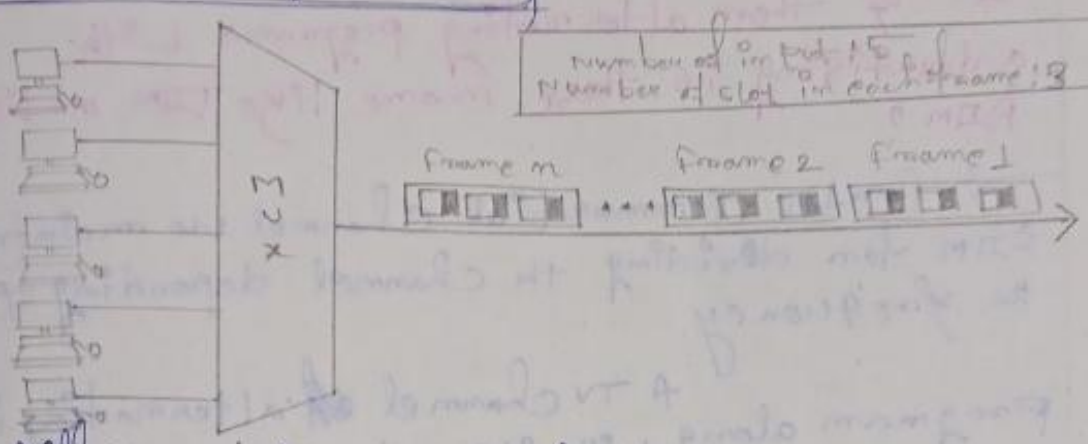


• Interleaving :– synchronous TDM can be compared to a very fast rotating switch. As the switch opens in front of a device, that device has the opportunity to send a specified amount (x bits) of data onto the path. The switch moves from device to device at a constant rate and in a fixed order. This process is called interleaving

■ Asynchronous TDM :–

Asynchronous time-division multiplexing, or statistical time-division multiplexing, is designed to avoid this type of waste. As with the term synchronous, the term asynchronous means something different in multiplexing than it means in other areas of data communications. Here it means flexible or not fixed.

Picture - 8.16/(P)-241



- Difference between Asynchronous/synchronous

Like synchronous TDM, asynchronous TDM allows a number of lower speed input lines to be multiplexed to a single higher-speed line. unlike synchronous TDM however, in asynchronous TDM the total speed of the input lines can be greater than the capacity of the path. In a synchronous system, if we have n input lines, the frame contains a fixed number of at least n time slots. In an asynchronous system, if we have n input lines, the frame contains so more than m slots, with m less than n.

m < n

(3) A cable TV system has 100 commercial channel all of them alternating programs with advertising is these mome like TDM or like FDM?

→ for 100 commercial channel we maintain FDM for deviding the channel depending upon the frequency.

A TV channel alternating it's program along with its advertisement is an example of time devition multiplexing (TDM) because here TV channel maintains different time slot for programming on advertisement.

(2) A TV channel is alternating its program along with advertisement. Is it TDM or FDM - justify?

→ A TV channel alternating it's programalong with it's advertisement is an example of time devition multiplexing (TDM) because here TV channel maintains different time slot for programming on advertisement.

(4) what is TDMA?

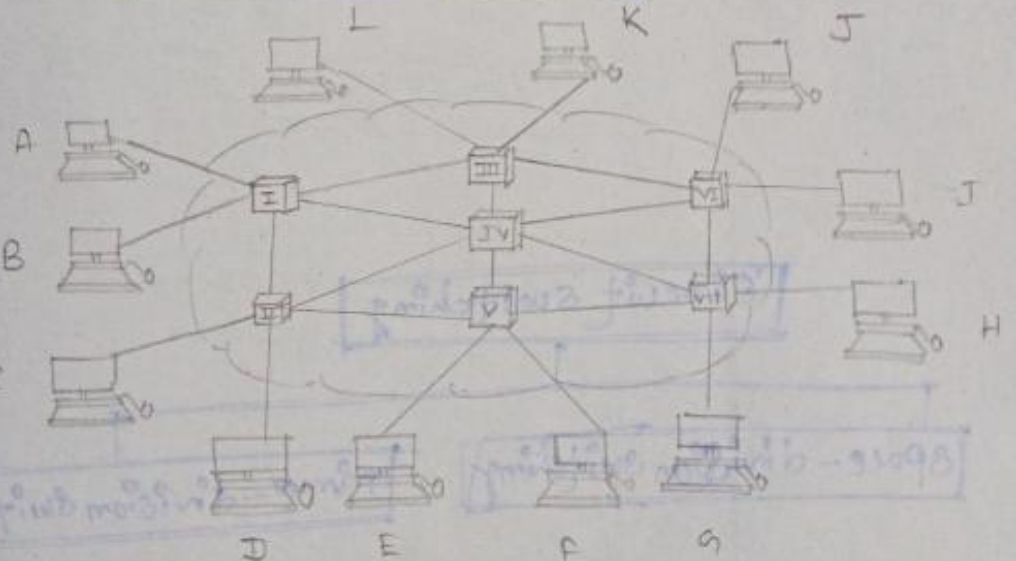
→ (Time divition multiple access). It is a channel access method for sheared medium it allows several users to share the same frequency channel by diving the signal into different time slot. The user transmit signals one after another using it's own time slot.

Switching

(1) what is switching? Briefly discuss about packet switching (datagram, virtual circuit (SVC & PVC), circuit switching (space division (crossbar, multistage), Time division (TDM Bus)) massage switching (disadvantage). Advantage & disadvantage of each switching

→ A switched network consists of a series of interlinked nodes, called switches. Switches are hardware and/or software devices capable of creating temporary connections between two or more devices linked to the switch but not to each other. In a switched network, some of these nodes are connected to the communicating devices.

picture-14.1/P-432



Switched Network

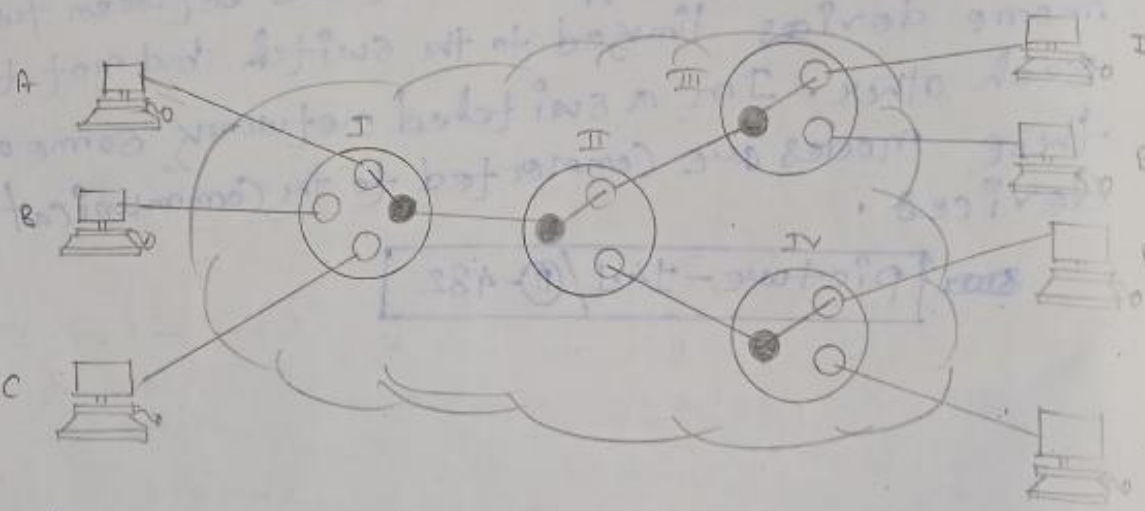
Switching methods

- Circuit switching
- Packet switching
- Message switching

Circuit switching :-

Circuit switching creates a direct physical connection between 2 devices such as phones or computers.

Picture :- 14.8 / Ⓟ - 483



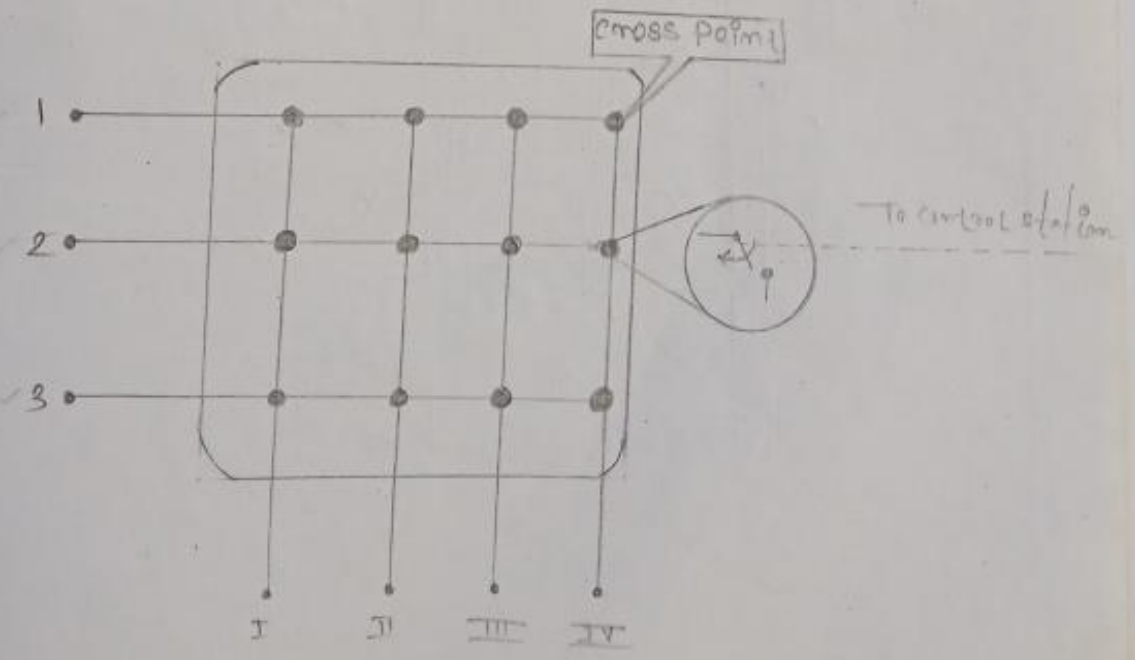
- Circuit switching
  - space-division switching
  - time-division switching

Space-Division Switches

In space-division switching, the paths in the circuit are separated from each other, spatially. This technology was originally designed for use in analog networks but is used currently in both analog and digital networks. It has evolved through a long history of many designs.

- **Crossbar switches :-** A crossbar switch connects n inputs to m outputs in a grid, using electronic microswitches at each crosspoint. The major limitation of this design is the number of crosspoints required. Connecting n inputs to m outputs using a crossbar switch requires n x m crosspoints.

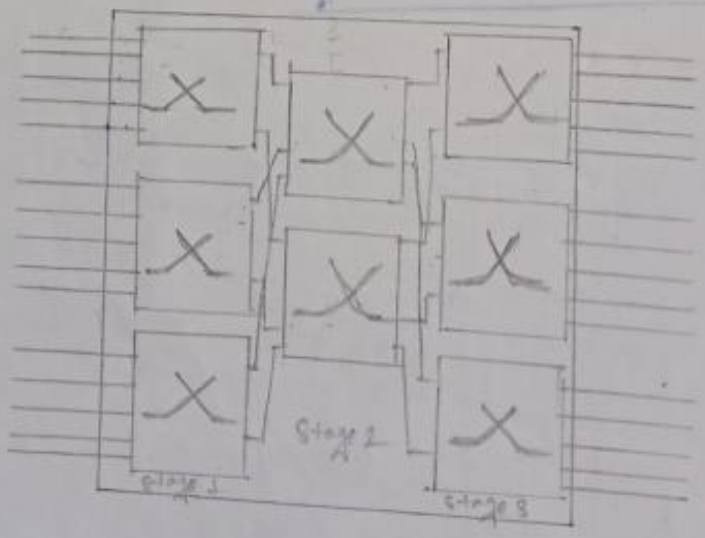
Picture :- 14.7 / (P) 434



Multistage switches :-

The solution to the limitation of the crossbar switch is to use multistage switches, which combine crossbar switches in several stages. In multistage switching, devices are linked to switches that, in turn are linked to a hierarchy of other switches. The design of a multistage switch depends on the number of stages and the number of switches required in each stage. Normally the middle stages have fewer switches than do the first and last stage. ~~Normally, the middle stages have~~ For example, imagine that we want a multistage switch as in the lower figure to do the job of a single 15 by 15 Crossbar switch.

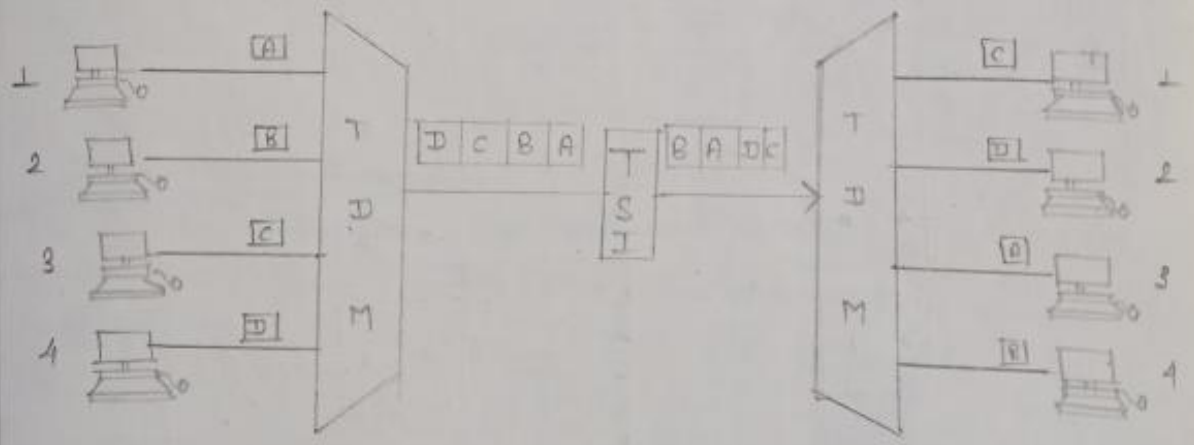
Picture - 14.8 / (P) - 435



Time-Division Switches :-

Time division switching uses time-division multiplexing to achieve switching. There are 2 popular methods used in time-division multiplexing : the time-slot interchange and the TDM bus.

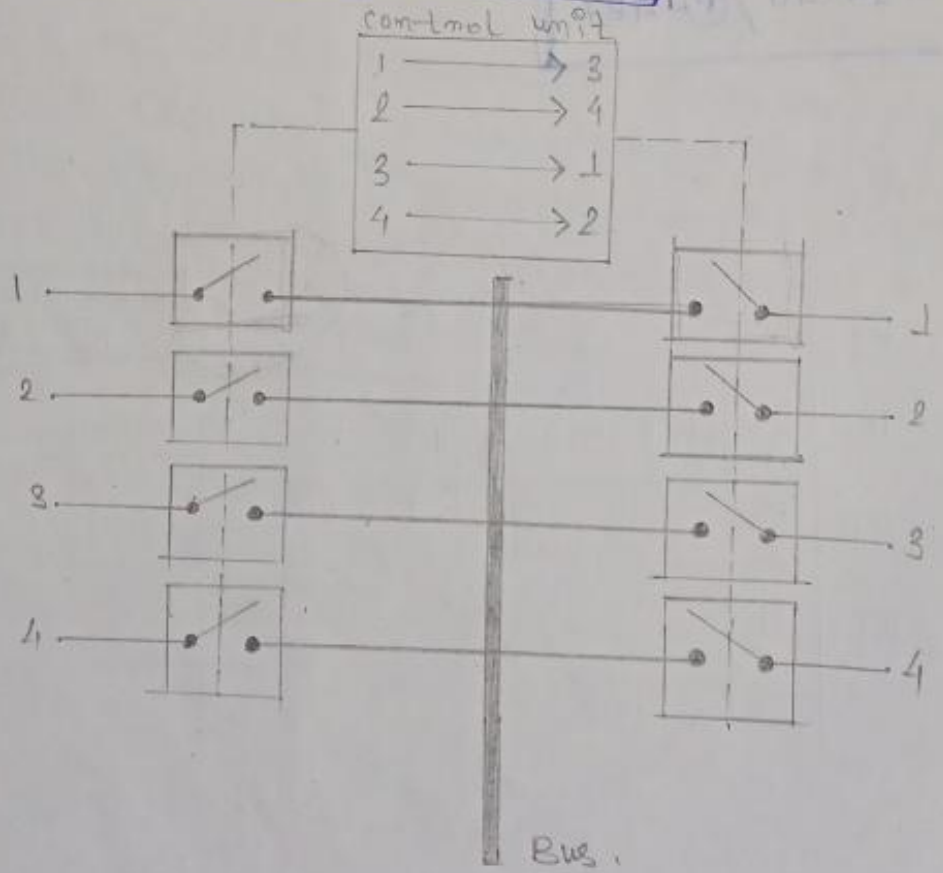
picture - 14.10 / (P) 437 (2nd ed)



TSI → Timeslot interchange.

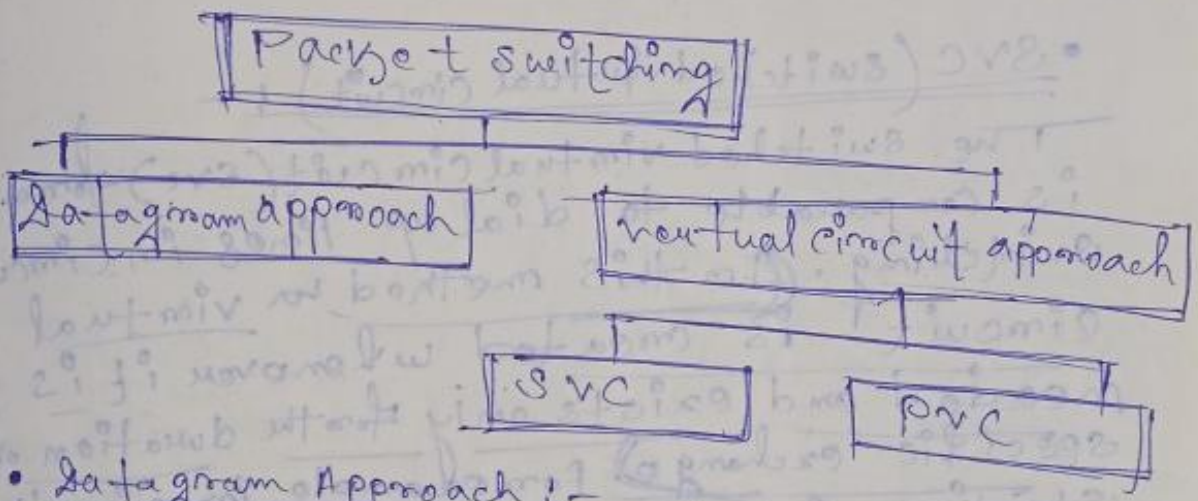
TDM Bus :- The lower figure shows a very simplified version of TDM bus. The input and output lines are connected to a high-speed bus through input and output gates. Each input gate is closed during one of the four time slots ~~during~~ during the same time slot, only one output gate is also closed. This pair of gates allows a burst of data to be transferred from one specific input to one specific output line using the bus.

Picture - 14.12 (P) - 438



Packet switching :-

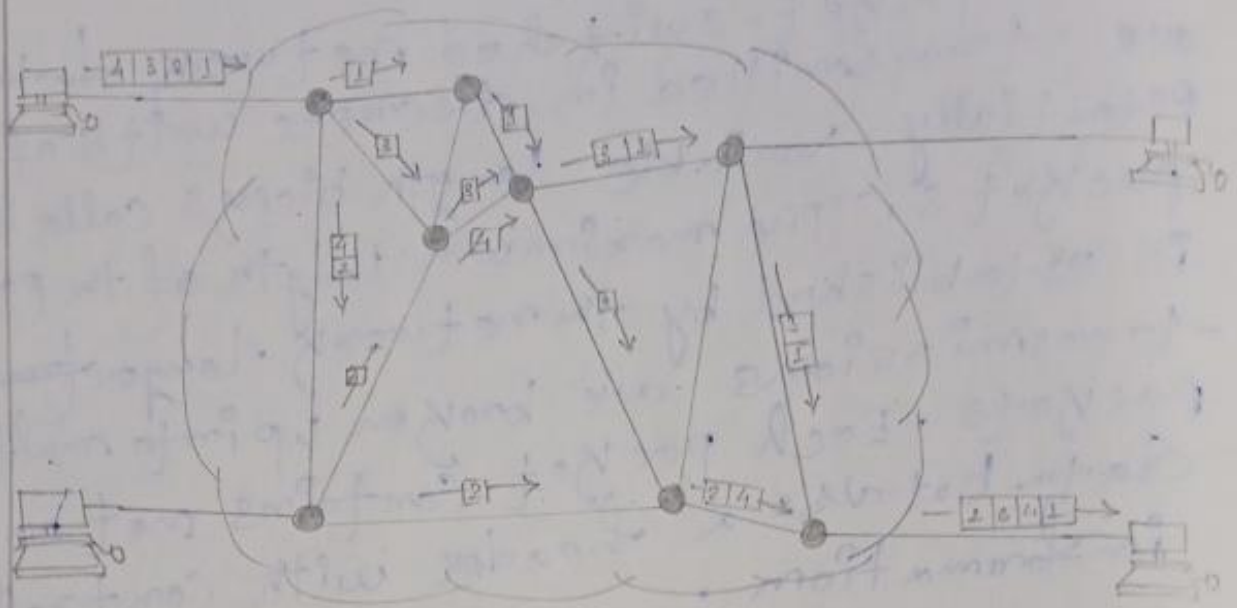
In a packet-switched network, data are transmitted in discrete units of potentially variable length blocks called packets. The maximum length of the packet is established by the network. Longer transmissions are broken up into multiple packets. Each packet contains not only data but also a header with control information.



- Datagram Approach :-

In the datagram approach to packet switching, each packet is treated independently from all others. Even when one packet represents just a piece of a multipacket transmission the network treats it as though it existed alone. packets in this technology are referred to as datagrams.

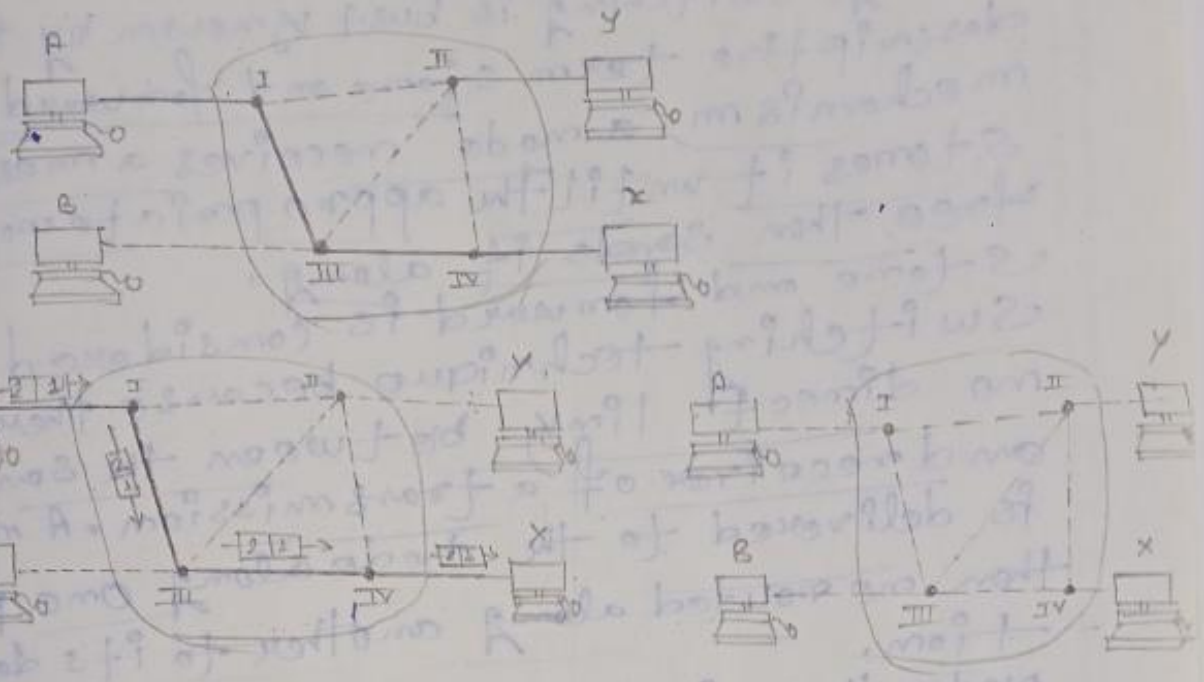
Picture - 14.17 (P) - 443



- SVC (switched virtual circuit) :-

The switched virtual circuit (SVC) format is comparable to dial up lines in circuit switching. In this method a virtual circuit is created whenever it is needed and exists only for the duration of the specific exchange. For example, imagine that station A wants to send four packets to station x. First, A requests the establishment of a connection to x. Once the connection is in place, the packets are sent one after another and in sequential order, when the last packet has been received and, if necessary, acknowledged the connection is released and that virtual circuit ceases to exist.

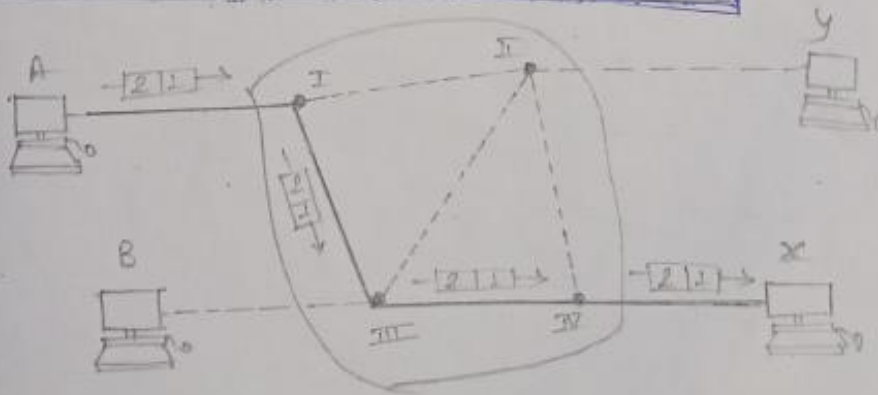
picture - 14.19 / (P) - 444



• PVC (permanent virtual circuit):—

Permanent virtual circuit (PVC) are comparable to leased lines in circuit switching. In this method, the same virtual circuit is provided between two users on a continuous basis. The circuit is dedicated to the specific users. No one else can use it and because it is always in place, it can be used without connection establishment and connection termination.

picture — 14.20 / (P) - 445



Message switching :-

Message switching is best known by the descriptive term store and forward. In this mechanism, a node receives a message stores it until the appropriate route is free, then sends it along.
Store and forward is considered a switching technique because there is no direct link between the sender and receiver of a transmission. A message is delivered to the node along one path then re routed along another to its destination.
Note that in message switching, the messages are stored and relayed from secondary storage (disk), while in packet switching the packets are stored and forwarded from primary storage (RAM).

Error Detection & Correction

1) What do you mean by error detection and correction? write the difference between them.

→ • Error detection :-
Even if we know what type of error can occur, will we recognize one when we see it? If we have a copy of the intended transmission for comparison, of course we will. But what if we don't have a copy of the original? Then we will have no way of knowing we have received an error until we have decoded the transmission and failed to make sense of it. For a machine to check for error this way would be slow, costly and of questionable value.

• Error Correction :- Error correction can be handled in two ways. In one, when an error is discovered, the receiver can have the sender retransmit the entire data unit. In the other, a receiver can use an error-correcting code, which automatically corrects certain errors.

2) what is CRC ? write CRC checksum algorithm and flowchart. what will be the checksum value for the message 101011 and polynomial 1001 ?

→ CRC (cyclic redundancy check) :→

unlike VRC and LRC, which are based on addition, CRC is based on binary division. In CRC, instead of adding bits together to achieve a desired parity, a sequence of redundant bits, called the CRC or the CRC remainder, is appended to the end of a data unit so that the resulting data unit becomes exactly divisible by a second predetermined binary number. At its destination, the incoming data unit is divided by the same number. If at this step there is no remainder, the data unit is assumed to be intact and therefore accepted.

CRC checksum algorithm

First, a string of n 0s is appended to the data unit. The number n is one less than the number of bits in the predetermined divisor, which is (n+1) bits.

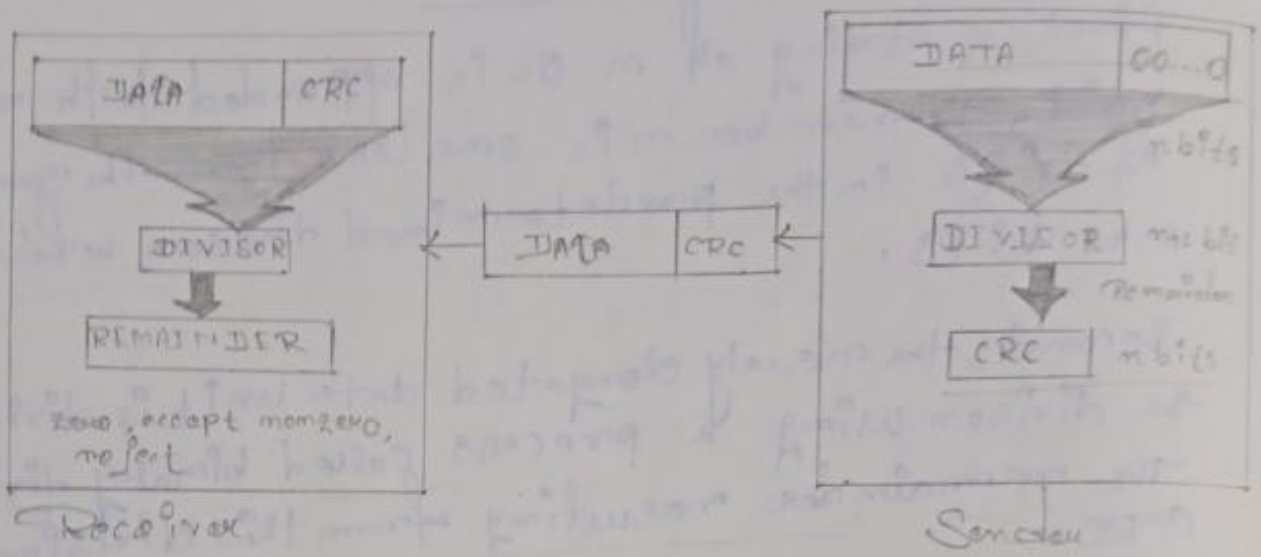
Second, the newly elongated data unit is divided by the divisor using a process called binary division. The remainder resulting from this division is the CRC.

Third, the CRC of n bits derived in step 2 replaces the appended 0s at the end of the data unit. Note that the CRC may consist of all 0s.

The data unit arrives at the receiver data first, followed by the CRC. The receiver treats the whole string as a unit and divides it by the same divisor that was used to find the CRC remainder.

If the string arrives without errors, the CRC checker yields a remainder of zero and the data unit passes. If the string has been changed in transit, the division yields a non-zero remainder and the data unit does not pass.

Picture - 9.8 / (P) - 280

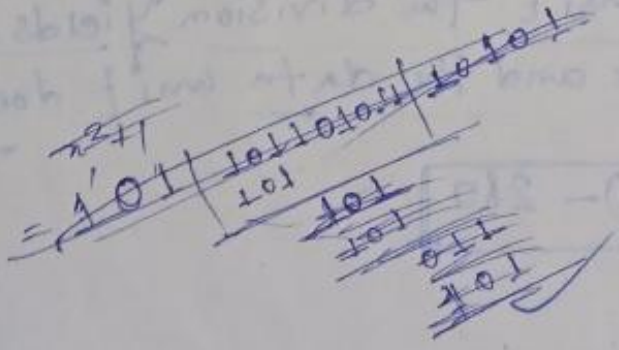


5) Datalink Layer always put the CRC in header, why?

⇒ Same as Q. NO-(2).

3) what is the remainder ~~obtain~~ obtain by dividing $x^7+x^5+1 / x^7+x^6+x^5+1$ by generated polynomial x^3+1 ?

⇒



$x^7 + x^5 + 1$ → 10100001

$x^3 + 1$ → 1001

```
1001 ) 10100001 000 ( 10110 1
       1001
        1100
        1001
         1010
         1001
          1110
          1001
           111   ← remainder
```

Transmit data is

10100001 | 111 → (Data | CRC)

```
1001 ) 10100001 111 ( 10110111
       1001
        1100
        1001
         1010
         1001
          1111
          1001
           1101
           1001
            1001
            1001
               0
```

Transmission Media

1) write advantage of Coaxial cable over twisted pair.

→ Twisted pair cable

Twisted-pair cable comes in two forms: unshielded and shielded.

unshielded twisted-pair (UTP) cable is the most common type of telecommunication medium in use today. Although most familiar from its use in telephone system, it's frequency range is suitable for transmitting both data and voice. A twisted pair consists of two conductors (usually copper), each with its own colored plastic insulation. The plastic insulation is colour banded for identification.

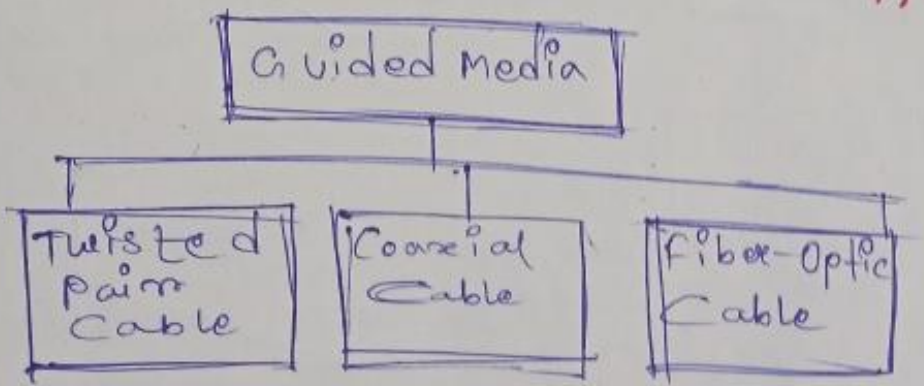
2) write the advantage of fiber cable over Coaxial cable (Copper wire).

→ Coaxial cable carries signals of higher frequency ranges than twisted-pair cable, in part because the two media are constructed quite differently. Instead of having two wires, coax has a central core conductor of solid or stranded wire enclosed in an insulating sheath, which is, in turn, encased in an outer conductor of metal foil, braid, or a combination of two (also usually copper).

3) write advantage of satellite communication over radio wave communication.

→ Microwave signals propagate in one direction at a time, which means that two frequencies are necessary for two-way communication such as a telephone conversation. One frequency is reserved for microwave transmission in one direction and the other for transmission in the other. Each frequency requires its own transmitter and receiver. Today, both pieces of equipment usually are combined in a single piece of equipment called a transceiver, which allows a single antenna to serve both frequencies and functions.

4) Explain the transmission characteristics of twisted pair / coaxial cable / fiber optics (optical fiber) / radio wave / micro wave / satellite communication. (difference / advantage / disadvantage)



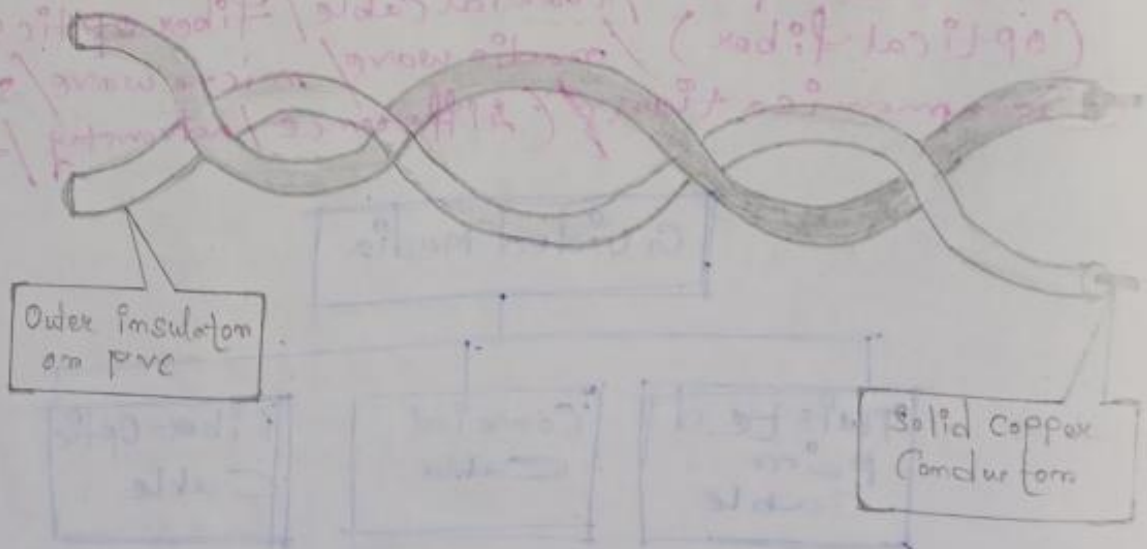
Twisted-pair Cable

The twisted pair Cable comes in two forms: unshielded and shielded.

unshielded Twisted-Pair Cable (UTP)

unshielded twisted-pair (UTP) cable is the most Common type of telecommunication medium in use today. Although most familiar from its use in telephone Systems, its frequency range is suitable for transmitting both data and voice. A twisted pair consists of two conductors, each with its own colored plastic insulation. The plastic insulation is color-banded for identification

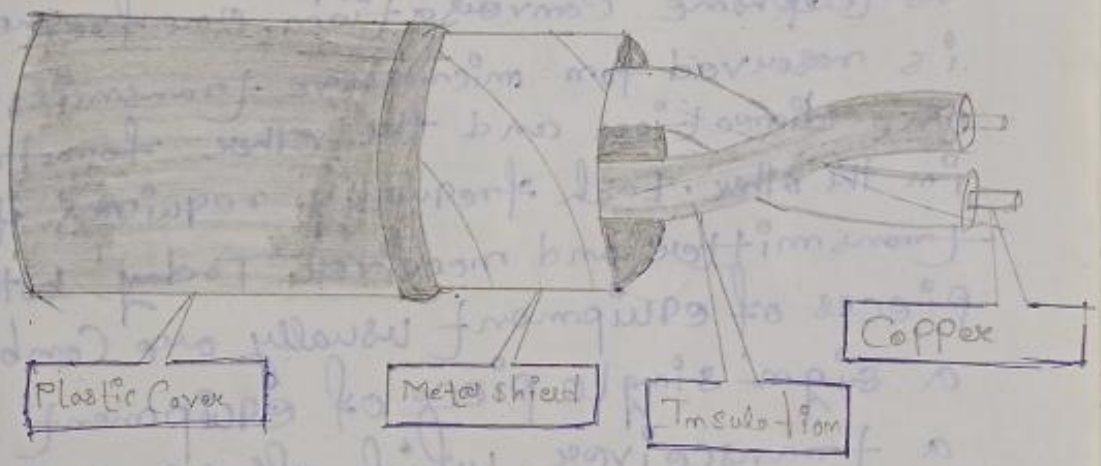
Picture - 7.5 / (P) 189



shielded twisted-pair (STP) cable

shielded twisted-pair (STP) cable has metal foil or braided-mesh covering that encases each pair of insulated conductors. The metal casing prevents the penetration of electromagnetic noise. It also can eliminate a phenomenon called crosstalk, which is the undesired effect of one circuit on another circuit. It occurs when one line picks up some of the signals traveling down another line).

~~Coaxial Cab~~ Picture - 7.10 / (P) 192



Coaxial cable : Coaxial cable carries signals of higher frequency ranges than twisted-pair cable in part because the two media are constructed quite differently. Instead of having two wires, coax has a central core conductor of solid or stranded wire enclosed in an insulating sheath, which is, in turn, encased in an outer conductor of metal foil, braid, or a combination

of the two.

- RG-8. used in thick Ethernet.
- RG-9. used in thick Ethernet.
- RG-11. used in thick Ethernet.
- RG-58. used in thin Ethernet.
- RG-59. used for TV

• Terrestrial Microwave

Microwave signals propagate in one direction at a time, which means that ~~two~~ two frequencies are necessary for two-way communication such as telephone conversation. One frequency is reserved for microwave transmission in one direction and the other for transmission in the other. Each frequency requires its own transmitter and receiver. Today, both pieces of equipment usually are combined in a ~~sign~~ single piece of equipment called a transceiver, which allows a single antenna to serve both frequencies and functions.

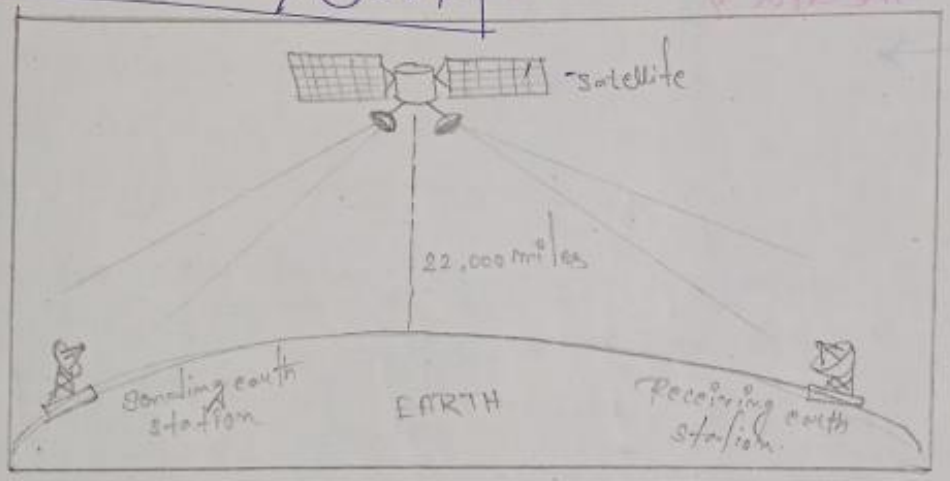
• Infrared and millimeter wave :→

unguided infrared and millimeter wave are widely used for short range communication. Major drawback: they do not pass through solid objects. An infrared system ~~in~~ in one room of a building will not interface with a similar system in adjacent rooms or building.

• Satellite Communication:-

Satellite microwave can provide transmission capability to and from any location on earth, no matter how remote. This advantage makes high quality communication available to underveloped parts of the world without requiring a huge investment in ground-based infrastructure.

Picture:- 7.34/ (P) 207



5) what is Geostationary satellite? write the downlink and uplink frequency of any two ~~Ku~~ satellite band?

→ The frequencies reserved for satellite microwave communication are in the gigahertz (GHz) range. Each satellite sends and receives over two different bands. Transmission from the earth to the satellite is called uplink. Transmission from the satellite to the earth is called downlink.

Satellite frequency bands

Band	downlink	uplink
C	3.7 to 4.2 GHz	5.925 to 6.425 GHz
Ku	11.7 to 12.2 GHz	14 to 14.5 GHz
Ka	17.7 to 21 GHz	27.5 to 31 GHz

7) Compare between guided media and unguided media ?

→

8) 9) Is the Nyquist theorem true for optical fiber (SAME) or only copper wire?

→ Nyquist theorem is the property of mathematic and has nothing to do with technology. It says that if you have a function whose 'Fourier spectrum' does not extended since and cosince above f(t) then by sampling the function at a frequency of (2f). we capture all information. Thus, the Nyquist theorem is true for all media.

According to the Nyquist theorem, the Sampling rate must be at least two times the highest frequency.

4) Radio wave / Transmission :-

Radio waves are easy to generate, can travel along distances, and can penetrate buildings easily, so they are widely used for communication both indoors and outdoors. Radio waves also are omnidirectional, meaning that they travel in all directions from the source, so the transmitter and receiver do not have to be carefully aligned physically.

Geosynchronous satellites :- Line-of-sight propagation requires that the sending and receiving antennas be locked onto each other's location at all times. For this reason, a satellite that moves faster or slower than the earth's rotation is useful only for short periods of time. To ensure constant communication, the satellite must move at the same speed as the earth so that it seems to remain fixed above a certain spot. such satellites are called geosynchronous.

Sheet

1) what is the baud rate of the standard 10 MbPS Ethernet?

⇒ The Ethernet uses Manchester encoding, which means it has two signals periods per bit sent. The data rate of the standard Ethernet is 10 Mbps, So the baud rate is ~~twise~~ twice that, on 20 megabaud.

Sheet

2) A 1-Km-long, 10-Mbps CSMA/CD LAN (not 802.3) has a propagation speed of 200m/μsec. Repeaters are not allowed in this system. Data frames are 256 bits long, including 32 bits of header, checksum, and other overhead. The first bit slot after a successful transmission is reserved for the receiver to capture the channel in order to send a 32-bit acknowledgement frame. what is the ~~effective~~ effective data rate, excluding overhead, assuming that there are no collisions?

⇒ The round-trip propagation time of the cable is 10 μ sec. A Complete ~~transmission~~ has six phases:

~~transmitter~~ transmitter seizes cable (10 μ sec)
transmit data (25.6 μ sec)
Delay for last bit ~~to~~ to get to the end (5.0 μ sec)
Receiver seizes cable (10 μ sec)
acknowledgement send (3.2 μ sec)
Delay for last bit to get to the end (5.0 μ sec)

The sum of these is 58.8 μsec. In this period, 224 bit data bits are sent, for a rate of about 3.8 Mbps.

~~1 Ms~~ (22.4 M sec) — (224 bit)
(58.8 M sec) — 3.8 Mbps

$\frac{1}{20}$ ... $\frac{1}{200000}$

3) Consider building a CSMA/CD network running at 1 Gbps over a 1-KM cable with no repeaters. The signal speed in the cable is 200,000 Km/sec. What is the minimum frame size?

⟹ For a 1-Km cable, the one-way propagation time is 5 μsec, so $2\tau = 10$ μsec. To make CSMA/CD work, it must be impossible to transmit an entire frame in this interval. At 1 Gbps, all frames shorter than 10,000 bits can be completely transmitted in under 10 μsec, so the minimum frame is 10,000 bits or 1250 bytes.

4) A group of N stations share a 56-Kbps pure ALOHA channel. Each station outputs a 1000-bit frame on an average of once every 100 sec, even if the previous one has not yet been sent (e.g. the stations can buffer outgoing frames). What is the maximum value of N?

⟹ With pure ALOHA the usable bandwidth is 0.184×56 Kbps $= 10.3$ Kbps.

Each station requires 10 bps, so, $N = \frac{10300}{10}$

$N = 1030$ stations

Transmission media

(6) Multipath fading occurs when signal reach a receiver via many paths and their relative strengths and phases change. It affects most forms of radio communication links in one form or another. It can affect signals on frequencies. It may also cost distortion of the radio signal. As the various paths that can be taken by the signals vary in length.

LAN

(1) Binary exponential Backoff or truncated binary exponential backoff algorithm used - Space out repeated transmission of the same block of data often to avoid network Conjuction.

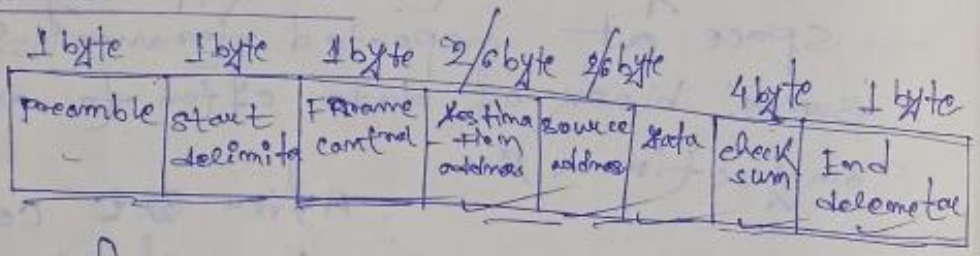
After C collisions a random number of slot time between 0 and $(2^C - 1)$ is choosen. After the first collisions each sender is wait. 0 or 1 slot time.

+

CSMA/CD (P→ 373)

(10) Token is used in token bus and token ring protocol for token passing mechanism, different frame are managed by claim token and successor token. claim token mean when one the machine wants to reserve the token and ~~sucss~~. successor token means address of the successor of the currently served machine. successor token helps to denote the successor of the current machine. using claim token we can find out the list of machine which reserve the token for their use.

(6) 802.4 (Token Bus) :-



The preamble field is use to synchonised the ~~rec~~ receiver clock. The start delimiter and end delemeter fields are use to mark the start and end of the frame. The frame Control field identifies the frame as either a data frame or control frame. For data frame it includes the priority level of the frame and may also include an ~~ind~~ indicator to requiring the destination station to acknowledge Correct or incorrect receipt of the frames.

For control frame, the field specifies the frame type. The destination and source address fields contains a hard. -ware address. Data field can be upto 0 to 30182 bits. checksum is use to detected the transmission errors,

30182 bits
< 4500