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Course Instructor: Mr. Avinash Bhagat	
Student's Roll no: RD2112B56	Student's Reg. no: 12107974
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Ques 1:- Explain four basic network topologies, and write advantages and disadvantages of each type.

For each of the following four networks, discuss the consequences if a connection fails.

a. Five devices arranged in a mesh topology.
b. Five devices arranged in a star topology.
c. Five devices arranged in a bus topology
d. Five devices arranged in a ring topology

Ans: Topology is the arrangement in which various nodes of network are connected through two or more links. Topology determines the path that may be used between any devices of the network.

1. Mesh Topology:- Mesh Topology is also known as fully connected Topology. Mesh Topology is the arrangement of networks in which each node is connected to every other node in a network. The nodes are connected through dedicated links means that link carries traffic only between the two devices it connects. A Mesh Topology use $n(n-1)/2$ links to connect n devices that means each node n is connected to every other node $(n-1)$, node 2 is connected to $(n-1)$, node 3 is connected to $(n-1)$ and so on. Then $n(n-1)$ links are required. If each link allows communication in both directions, then we can divide the number of links by 2. So in mesh topology, we need $n(n-1)/2$.

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Advantages of Mesh Topology:-

1. It is used for long distance communication.
2. If one system fails, it does not affect other systems
3. There is no traffic problem as dedicated links are used
4. It provides faster transmission without delay.

Disadvantages of Mesh Topology:-

1. Cabling cost is high as $n(n-1)/2$ links are required to connect n nodes
2. Installation and reconfiguration are difficult.
3. Huge no. of wirings can used that is greater than available space

2. Star Topology:-

In Star Topology, a central controller is used i.e. Hub. A hub is a device used for transmission between devices. In this, the various nodes or devices are connected to a hub that is in centre. All devices are connected to central hub through dedicated links between hub and a device. There is no any direct communication between devices. The Hub controls all the transmissions among the devices. For example:- If device A wants to send data to device D, then first the data is sent to hub, then hub checks the destination address and pass to every node, then only that node or device accept data that matches the destination address, other nodes will reject data.

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Advantages of Star Topology:-

1. Less cabling is used and less expensive than Mesh Topology.
2. It is easy to install and reconfigure
3. Expansion is easier as new nodes can easily be added.
4. Fault identification and isolation is easier.

Disadvantages of Star Topology:-

1. If the central hub fails, the entire system fails.
2. If one link fails then it cannot be connected with rest of the network
3. Cost of Hub is expensive

3. Bus Topology:- In Bus Topology, there is a single cable to which all the devices are connected. The devices are connected to the cable through drop lines and taps. Drop line is a connection that runs between device and cable and tap is a connector that is used for create a contact with metallic core. There is a terminator that is in the end of network. It absorbs the singal when signal reaches end of line and it bounce back so that single will not lost. For example when one computer send signal to the other computer, then the signal passes through main line. All the computers receive the data but only one computer accept the data whose address is specified in address field of the message, rest of the nodes reject the message.

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Advantages of Bus Topology:-

1. It is easy to add or remove nodes in a network.
2. It is less expensive as only main cable is required.
3. It broadcast the messages to each device that connected to cable.
4. If one node fail, it does not affect other nodes.

Disadvantages of Bus Topology:-

1. If the main cable is fail, the entire network collapses.
2. Difficult reconnection and fault isolation.
3. Signal reflection at taps cause degradation in quality.
4. Higher network traffic slows down the bus speed as only one device can transmit at a time, other devices wait for their turn.

4. Ring Topology:- In this, the various nodes are connected in the form of circle i.e. node 1 is connected to node 2, node 2 to node 3 and so on. There is no beginning or end that needs to be terminate. It has a dedicated point to point link with devices on either side of it. Each device in a Ring Topology is connected to a Repeater. When device receives a signal that is for some other device, then repeater regenerates the the bits and passes them along. In this, each node is connected to its neighbour node. When node 1 want to send data to node 3, first the data is send to node 2, the data is not for node 2, so its repeater regenerates the bits and pass to another node. In this way, communication takes place.

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Advantages of Ring Topology:-

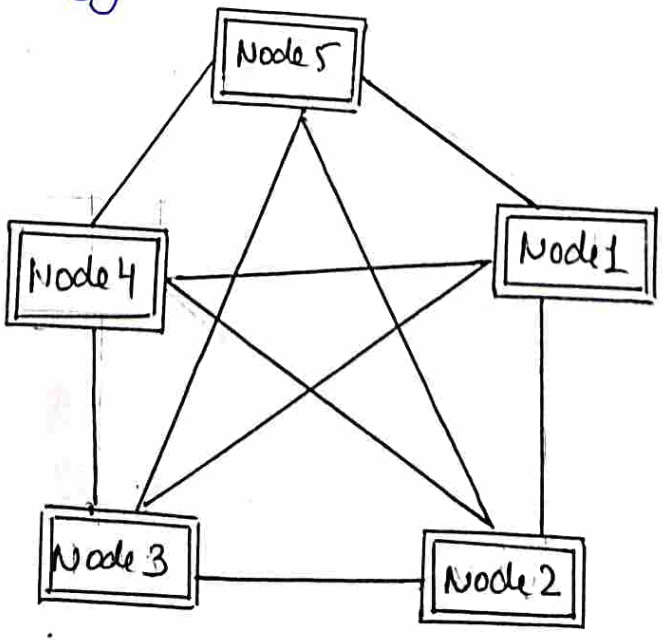
1. Data packets travel fast
2. It is easy to install and reconfigure.
3. To add or delete a node, it requires changing only two connections.
4. If one device does not receive signal within time, it can issue alarm

Disadvantages of Ring Topology:-

1. It requires more cabling.
2. If one node fail, it affects the entire network.
3. Adding or removing nodes leads to disturb the network activity.
4. Increase of new nodes also increases communication delay.

Consequences if a connection fails:

(a) Mesh Topology:-



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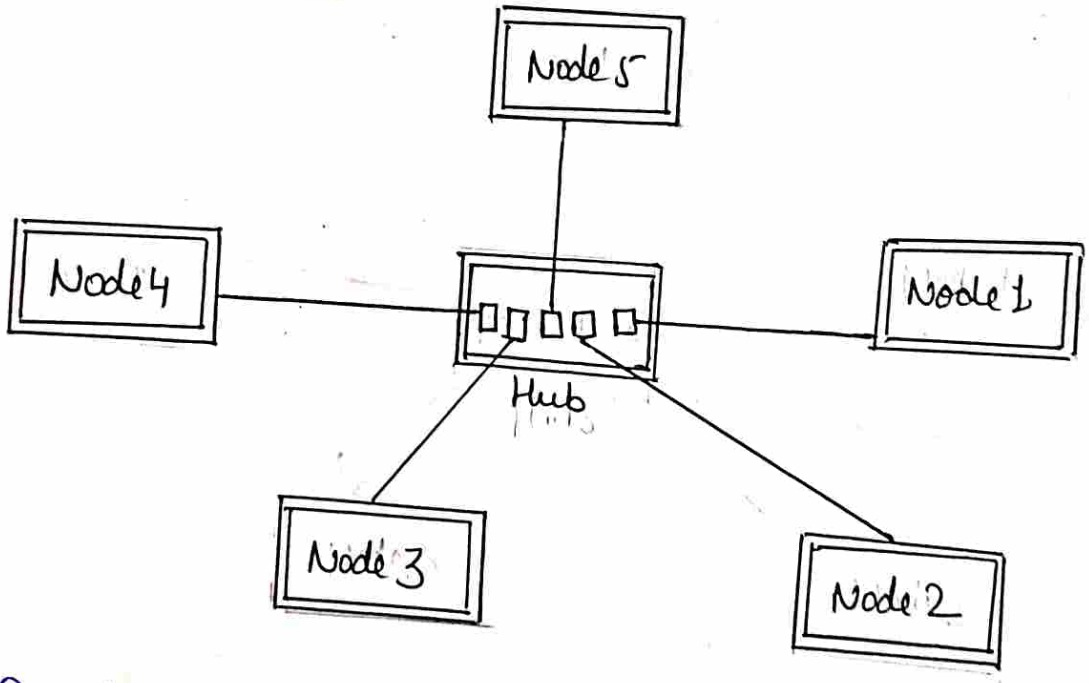
In Mesh Topology, there are five devices arranged. In this, if one link is failed, it does not affect entire system because the dedicated links to every node eliminate traffic problem that occur when link is shared by multiple sources. So if connection.
If five devices are there, we have 10 links and four I/O ports. If any link fails, it's easy to find which link goes fail and doesn't affect other links

(b) Star Topology:-



In Star Topology, if five devices are connected to a hub, any link fails, the other devices won't affected. There is dedicated point-to-point link between a hub and a device. So if any link breaks down or fail, it does not affect the entire system.

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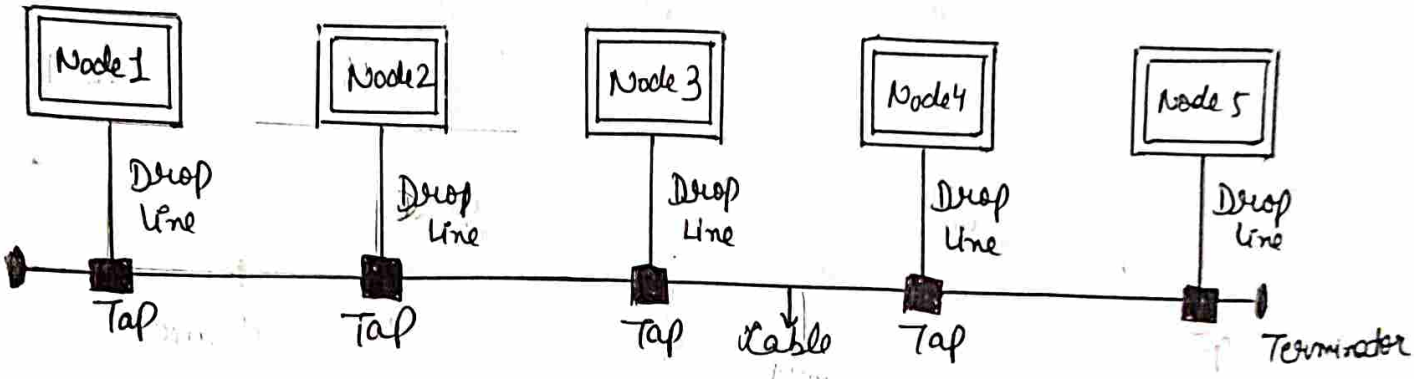
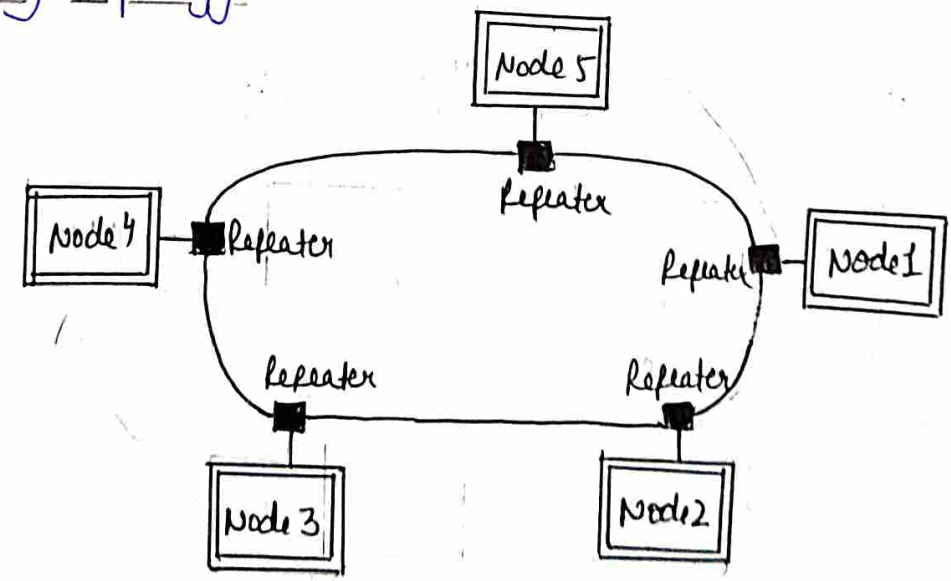
(c) Bus Topology:-



In Bus Topology, a wire is connected through which all devices are connected. If there is fault or break in the cable, then it will stop all transmission. The signals will not pass and get back to origin. If backbone cable is broken, the whole communication fail.

(d) Ring Topology:-



In this, five nodes are connected in a network. If a singal connection break between two devices, that the whole network will be disabled because single goes from one node to another node. If any point break down, the network will be alarmed.

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Ques 2: How does information get passed from one layer to the next in the Internet model? What are headers and trailers, and how do they get added and removed? With the help of examples explain the concerns of the physical layer, data link layer, network layer, transport layer and application layers in the Internet model?

Ans: Information get passed from one layer to the next layer in the Internet model. Information passes from various layers and then further pass to the destination. At the sender side, the data is at Application Layer, then data is passed to the layer below it i.e. Presentation layer. Presentation layer makes the data presentable. Then the data is further passes to the layer below it i.e. Session Layer. Session Layer is responsible for creating session, managing session with receiver to send packets. Then the packets are further moved to the layer Transport Layer. It contains the port number of receiving end. Then the resultant information passed to the Network Layer. Logical Layer is responsible for sending packets to the particular route. Then, information passes to Data Link Layer. Data Link Layer, error correction and detection techniques are applied. Then information passed to the Physical Layer. Then data is converted into Bits and Bytes through Transmission medium. Again the process goes in reverse at the receiver side. At Receiver end, the bits and bytes and passed to Data Link Layer. Data Link Layer checks the Trailer, if it satisfy

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relationship between Data and destination, trailer is dropped. Now frame is converted into packets. At Network Layer, it sees the IP Address and if it matches, then it will accept otherwise forward data to Transport Layer. Transport Layer checks Port Address and forward to the layer above it i.e. Session Layer. Then Session layer disconnected, header is removed and information Passed to Presentation Layer. Then finally, the information passes through Application Layer. Finally it receives to the receiver. This is how the information get passed in the Internet Model.

A Header is used in different Layers. Header contains information about the particular layer's function that it performs. Header is added to the beginning of data. Trailers is the information that is added to the end of data. The Header is added to the layers 6, 5, 4, 3 and 2 and Trailers are added only at layer 2. At the sender side, User interact with machine at Application Layer. Information is passed to the Presentation Layer. At Presentation Layer, a Header is added (H6). This Header contains information about the data. It has compression, decryption techniques. It contains information about data that is received from upper Layer and sends it to the Session Layer.

At Session Layer, sessions are created, maintained session with receiver. H5 is header added to the Session Layer that is responsible for storing information about source and destination address of packets. Now, Data is in Transport Layer

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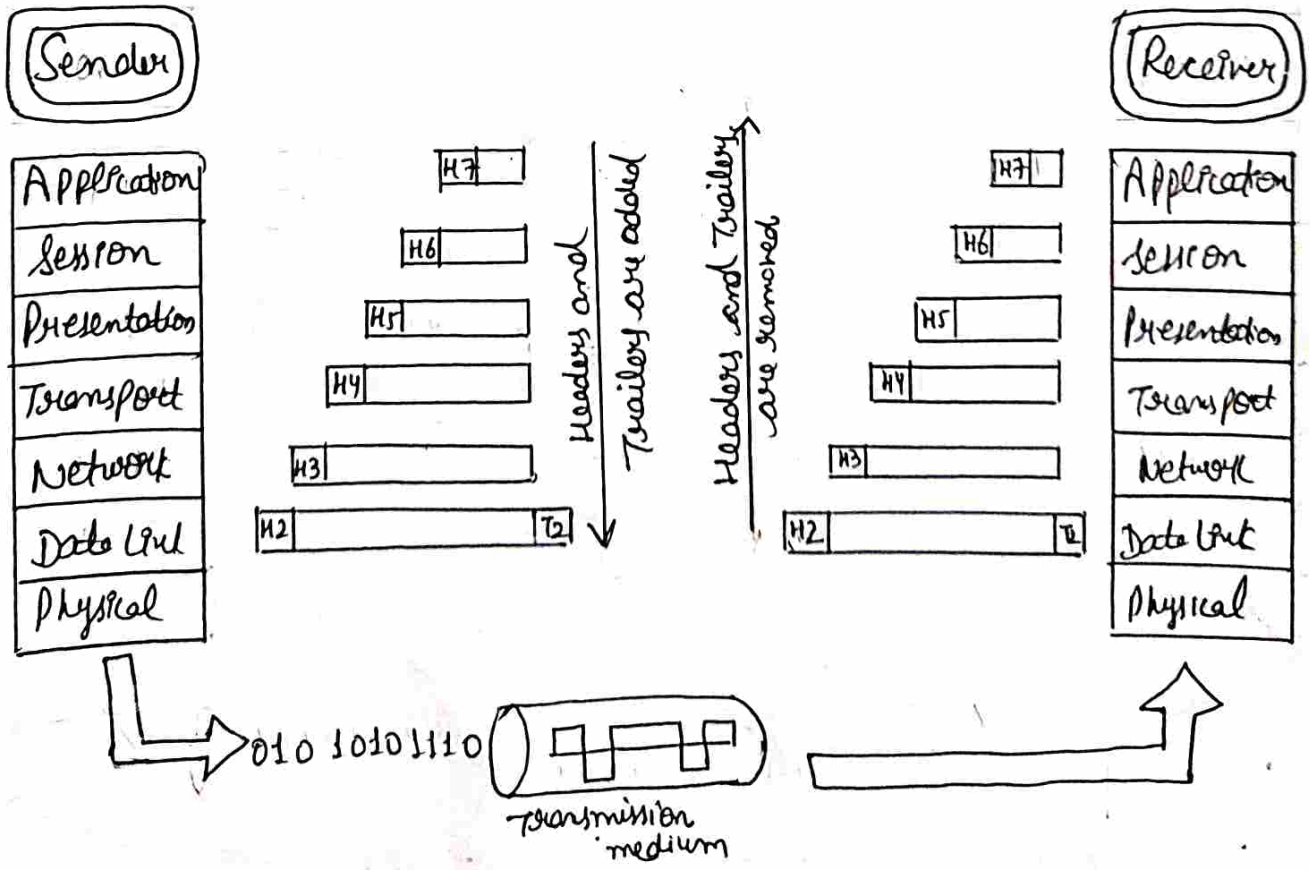
We put one header H4 at the beginning. It contains information about the port address of source and destination and other information about data. Then it send to Network Layer. Network Layer writes the logical address of sender and receiver, finds out route and then put information into segment and now called as packet. This information is stored in header H3. In Data Link Layer, error and detection techniques are applied. In this, Header H2 is added that contains information about the address of source machine and destination machine. In this layer, Trailer is added. It contains the error correction and detection techniques and packets are converted into frames. Now, we send data to the Physical Layer in the form of bits and bytes.



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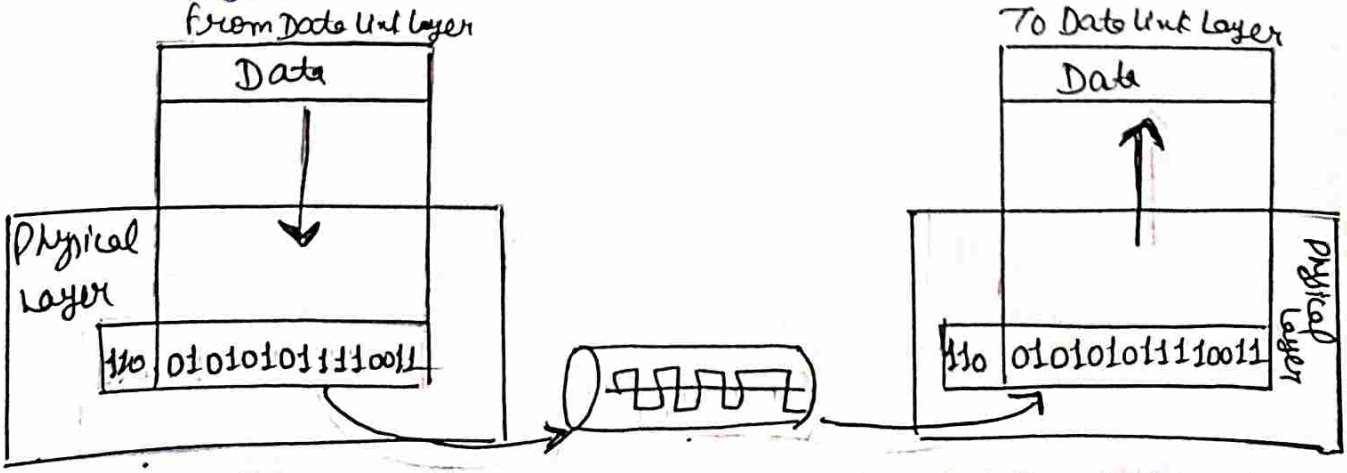
At the Receiver end,
Now the bits and bytes are converted into frames, now the Header (H2) is removed by Data Link Layer. It then checks Trailer T2, if it is satisfied the relationships, then trailer T2 is dropped. Now the frame is converted to packets. Network Layer check the header H3, it sees source IP Address if it matches with the particular source, then it will accept otherwise foward to Transport layer and H3 is removed. Transport Layer checks the port address from H3, if it stisfy, then foward to Session Layer and dropped H4. Then session layer is disconnected, Header is removed. It removes header H6 and data or information is passed to the Application layer. Hence, the information reaches to the receiver end.

Concerns:-

1. Physical Layer:- Physical Layer is the botton layer of OSI model. It is responsible for the physical connection between the devices



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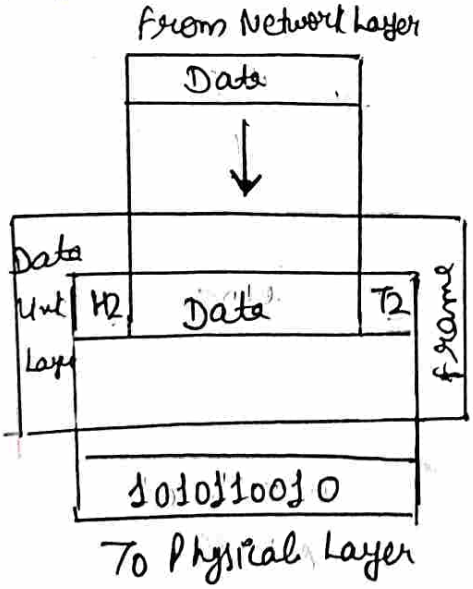
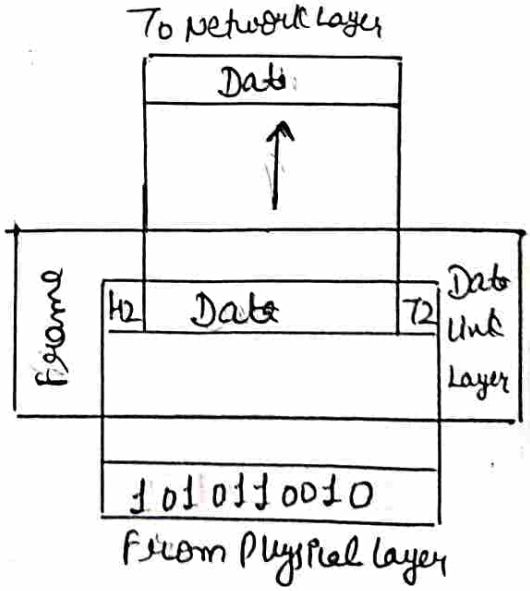
1. Physical Layer is responsible for transmitting raw bits over a communication channel. It transforms bits into signals using various encoding schemes to transmit data across medium.
2. Provides the synchronization of bits by providing clock and provides synchronization at bit level
3. Physical layer defines the duration of bit i.e no. of bits sent in one second.
4. Physical connection is made by using twisted-pair, coaxial cables.

2. **Data Link Layer:-** Data link layer is the second layer of OSI model. It is responsible for node to node delivery of data. Data link layer receives data from the Network Layer and creates frames, add physical address to these frames and pass to Physical layer





It is responsible for dividing the bits into small data units called frames.

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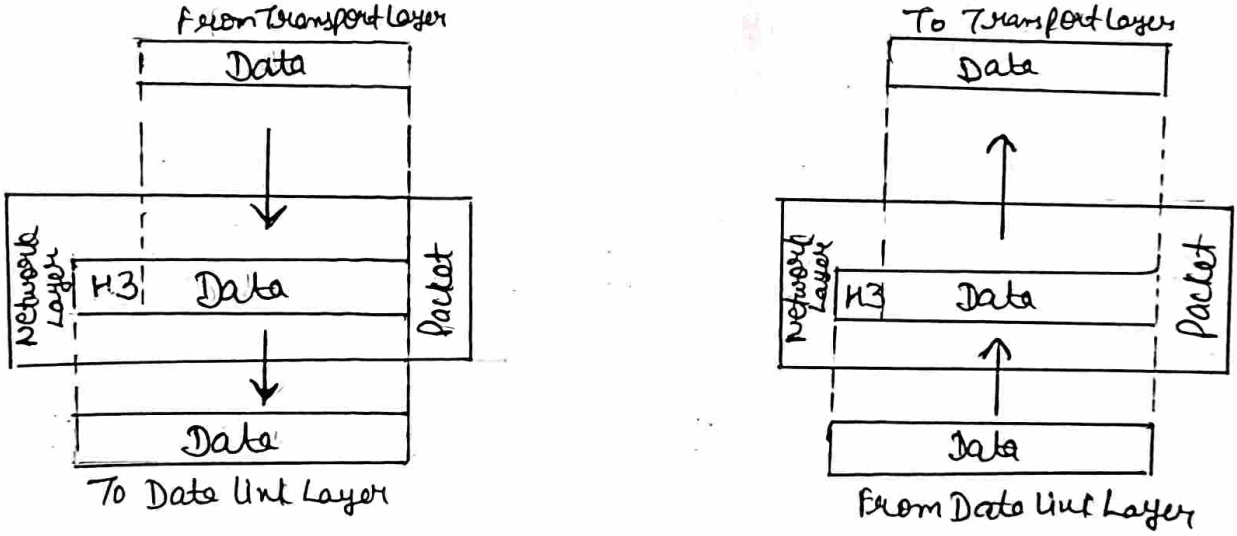
3. **Network Layer:-** Network Layer is the third layer of OSI Model. Network layer is concerned with the source-to-destination delivery of a packet across the network. The Network Layer carries the packet from source all the way to its destination. It ensures that data or packet gets from its point of origin to destination. In this, Routers or Gateways are used to route packet to destination.



4. **Transport Layer:-** Transport Layer is the fourth Layer of OSI Model. It is responsible for source to destination delivery of entire message. It looks after the delivery of the entire message whether it arrives accurately or not. There are two types of services in this layer.

1. Connection oriented:- The receiving device send acknowledgement to the source after packet is received.
2. Connectionless:- The receiver does not acknowledge receipt of packet. It assumes that packet is reached fine.

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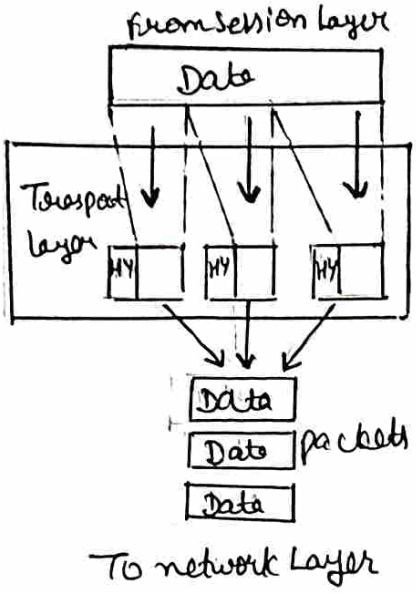
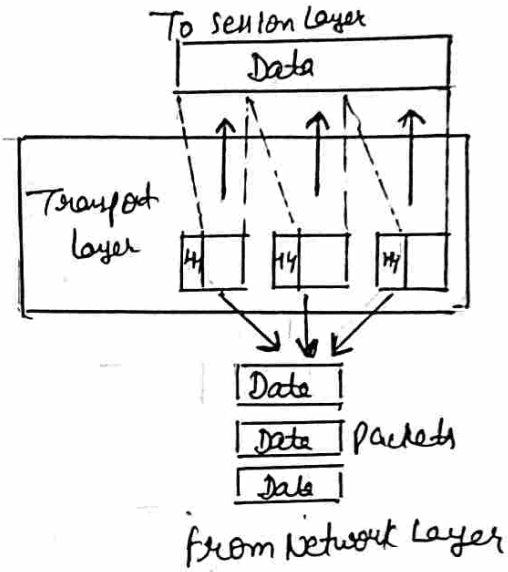
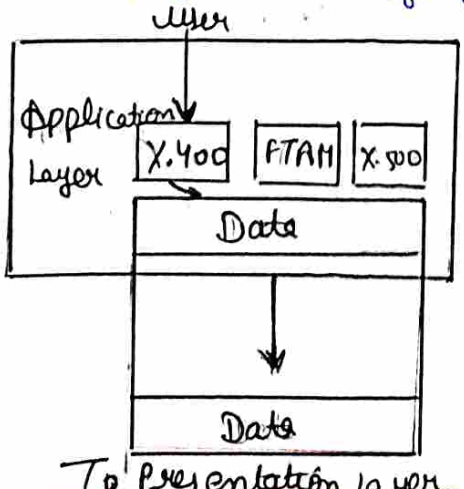
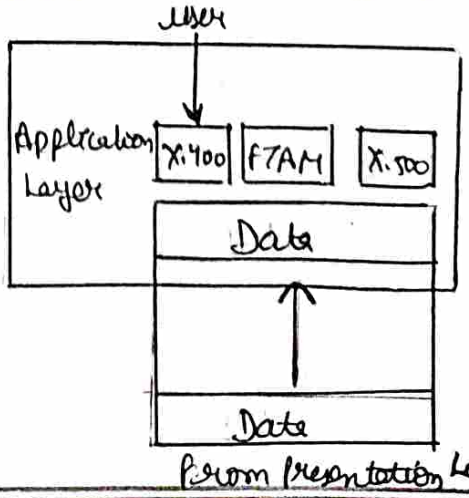




4. Application Layer:- Application Layer is the seventh layer of OSI model. It provides user interface to the user such as e-mail, database access. It seems like user can work on remote compute, it seems that user work on his own computer. It provides access to network by providing user interfaces. X.400 is for message handling, X.500 for directory and FTAM for file transfer. As depicted in the diagram:





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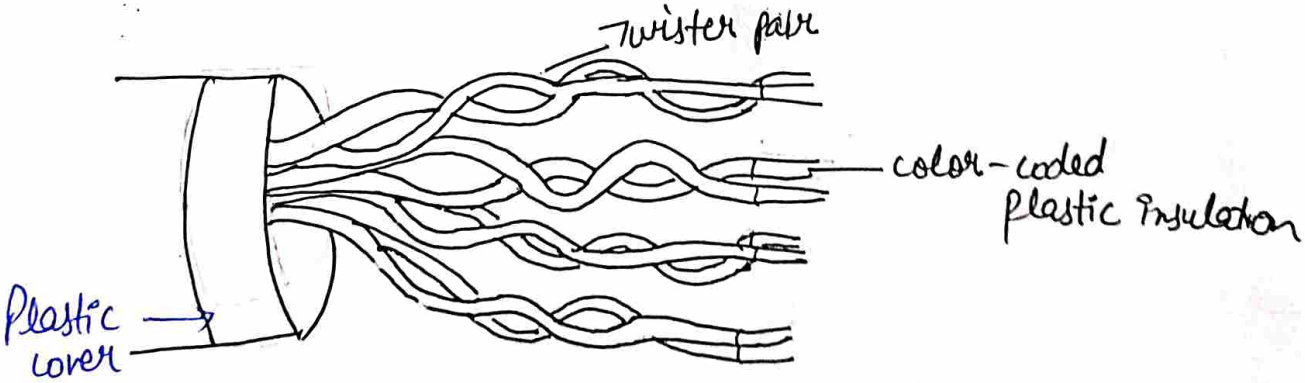
Ques3:- Explain working of the following medium/devices with the help of supporting diagrams.

a. UTP Cable

b. Router

Ans:- (a) UTP Cable:- Unshielded Twisted pair come the Guided Media. UTP Cable is used for telephone wiring and local Area Networks. It consists of color-coded copper wires that are twisted. UTP cables does not have any braiding as insulator to protect against interference. It is twisted wire because if the wires are not twisted then noise trouble occurs but if it is properly wired, then there will not any trouble, no interference is there.



Plastic-cover protects the wires from damage

Twisted-pair protects the signal for electromagnetic interference

color-coded plastic insulation identifies each pair and protect from interference

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It consists of four pairs of wairs :-

1. Orange - White of orange
2. Green - White of Green
3. Broom - White of Broun
4. Blue - White of Blue

Two pairs are used for sending and another is used for receiving. The two wires in a pair are twisted to reduce crosstalk and electromagnetic interferenc. There are different categories of UTP :-

CAT3 :- CAT3 is implemented in phone lines. It supports transmission rate 10 Mbps to 100 metres. It is used very less.

CAT4 :- In this, there are 4 pair of wires. It supports transmission rate of 16 Mbps upto 100 metres. It requires 3 twists per foot. It is used for 10 Base T networks and in Token Ring Networks.

CAT5 :- CAT 5 used in Ethernet and 100 Base-X networks. It contains two twisted pairs. It supports transmission rate from 100 Mbps for upto 100 metres.

CAT5e :- CAT5e use four twisted pairs of wires. The transmission rate of CAT5e is from 1 Gbps for 100 metres. It is used in Ethernet and 1000 Base-X networks.

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CAT6:- CAT6 is used in Ethernet and 1000 Base-X networks. It contains four tightly wound twisted pairs. The transmission rate of CAT6 is 1 Gbps for upto 100 metres and 10 Gbps for upto 50 metres.

RJ45:- RJ is Register Jack-45. It is a connector which is used to connect computers to LAN. In this, 8 pins are there. The cable is put in RJ-45 connector. In RJ-45, eight pins are there. 1, 2, 3, 4, 5, 6, 7 and 8. Pin 1, 2 are used for transmission, pin 3, 6 pair are used for receiving data and Pin 4, 5 and Pin 7 8 are used for POE. POE is Power over Ethernet. We send power through POE. Ethernet Cable don't carry power, they only carry signals. So where data corruption is more, POE is used. RJ45 connector pins are given below:-

Pin 1 is for Orange
Pin 2 is white of orange
Pin 3 White Green
Pin 4 White of blue
Pin 5 Blue
Pin 6 White of Green
Pin 7 Brown
Pin 8 White of Brown

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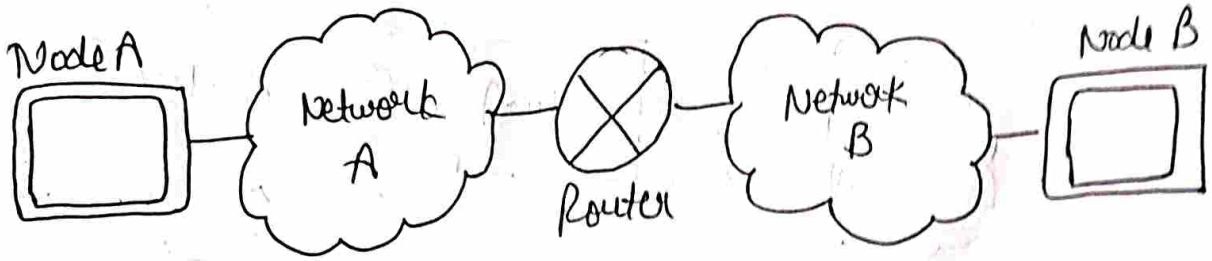
(b) **Router**:- Router is a networking device. Routers are used to connect different networks. A Router connect LAN's and WAN's in the network and pass packets among them. Router works on three layers i.e. Physical, Data-Link and Network Layer. Router checks MAC Address at Data Link Layer but also check the IP Address of the device. To access a particular network, then IP Addresses are used. Routers can connect many networks and have many kinds of networks



Router has link of more than one network and contains the address and contains the address of the nodes on all the networks.

If Network A's packet is going to Network B, then the packet first goes to Router. Router forward the packet to other network using Routing Table. Routing Table contains information about the networks that to which networks the router is connected and then router decide that where to forward the packet. Routers has multiple ports, it can connect to multiple networks. If Router can't

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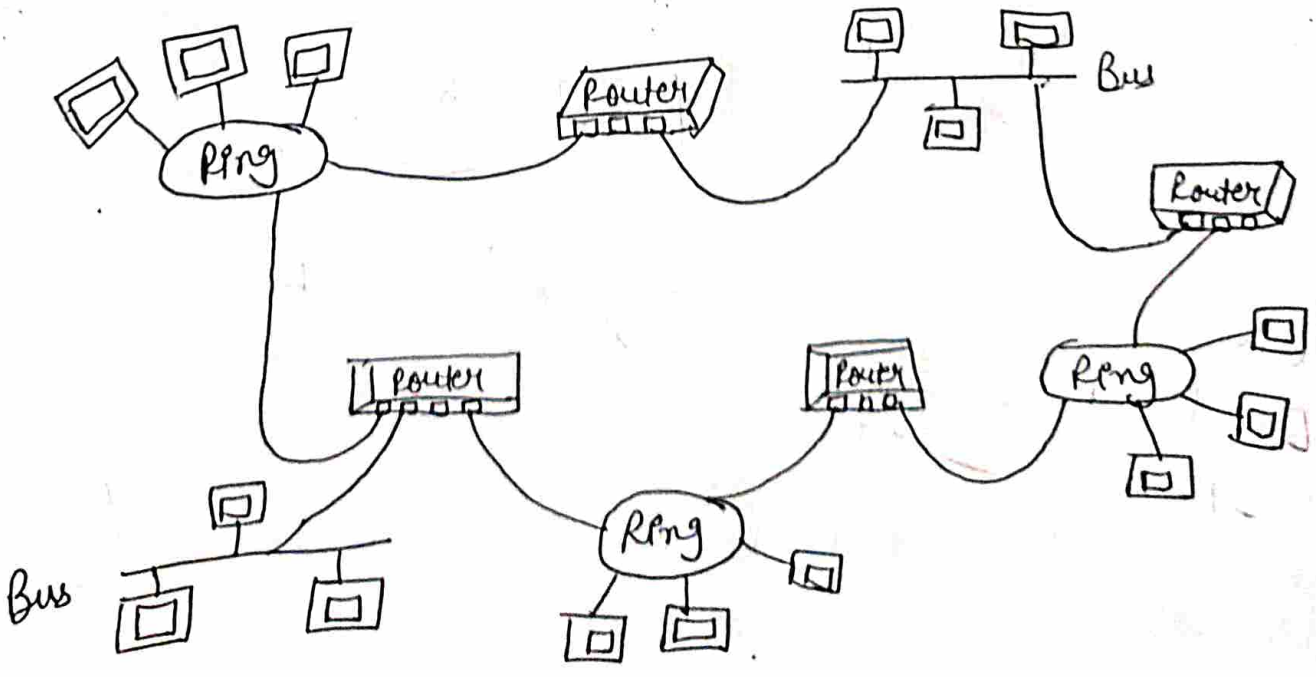
decide whether, where to forward the packet, then it use flooding. Flooding means router send packets to all the directions or to all the devices. Routers can use filtering to stop the packet from forwarding through ARP Request. When ARP request arrives at router, then router stops forwarding of packets using Routing Table. Router use Store and forward Method that means Router stores the packet in memory, process the packet and then decide to where packet should send. If another packet comes, it do not collide and goes into memory. Suppose if two networks are connected to a router, then the router has IP adress of one of the devices in Network A and one of the device in Network B. So Router contains IP Address of one device of Network A and Network B.



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In this diagram, four routers are used. These routers are used to connect networks. The router is connected to various topologies. If the router receives packet from one of the connected packets, router pass the packet to the appropriate network. If the received packet contains the address of a node that is on another network, the router determines the best path of sending the packet. Once the router has identified best route, then router passes the packet to another router to which destination network belongs. That router checks the destination address and forward the packets to the appropriate network.