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INTERNAL ASSESSMENT TEST – I

Sub	COMPUTER COMMUNICATION NETWORKS							Code	21EC53
Date	19/12/2023	Duration	90 mins	Max Marks	50	Sem	V A,B,C,D	Branch	ECE

Answer any 5 full questions

		Marks	CO	RBT
1	What is data communication? Write and explain components of data communication with a neat diagram.	10	CO1	L1
2	Explain different physical structures and network topologies with the help of diagrams.	10	CO1	L2
3	Explain TCP/IP protocol suite	10	CO1	L2
4	Discuss the various services offered by the data link layer	10	CO1	L1
5	With a neat diagram, explain Address Resolution Protocol(ARP) frame format	10	CO1	L2
6	With a neat diagram, explain the encapsulation and decapsulation in the Internet	10	CO1	L2
7	Explain circuit switched and packet switched network with a neat diagram	10	CO1	L2

		Marks	CO	RBT
1	**What is data communication? Write and explain components of data communication with a neat diagram.** ■When we communicate, we are sharing information - local or remote. ■Between individuals, local communication usually occurs face to face, while remote communication takes place over distance. ■The term telecommunication, which includes telephony, telegraphy, and television, means communication at a distance (tele is Greek for "far"). ■The word data refers to information – format of information depends on the people who are communicating. ■Data communications - exchange of data between two devices via transmission medium (wired/ wireless) ■To communicate - communicating devices must be part of a communication system made up of a combination of hardware (physical equipment) and software (programs). ■Effectiveness of a data communications system - depends on four fundamental characteristics: ■delivery, ■accuracy, ■timeliness, ■jitter. 5 components of data communications system. 1.Message:- information (data) to be communicated- text, numbers, pictures, audio, and video. 2.Sender:- device that sends the data message - computer, workstation, telephone handset, video camera, etc. 3.Receiver:- device that receives the message -computer, workstation, telephone handset, television, etc. 4.Transmission medium:- physical path by which a message travels from Tx- Rx - twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves. 5.Protocol:- a set of rules that govern data communications - agreement between the communicating devices.	10	CO1	L1
2	**Explain different physical structures and network topologies with the help of diagrams.** §Defining some network attributes. §Type of Connection: §A network is two or more devices connected through links. §A link is a communications pathway that transfers data from one device to another.	10	CO1	L2

§For visualization purposes, it is simplest to imagine any link as a line drawn between two points.

§For communication to occur, two devices must be connected in some way to the same link at the same time.

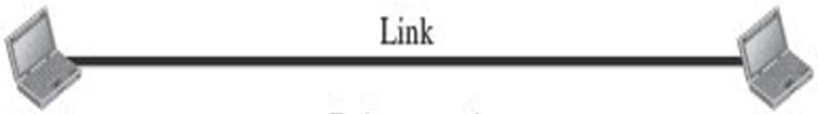
§There are two possible types of connections: point-to-point and Multipoint.

■A point-to-point connection provides a dedicated link between two devices.

■The entire capacity of the link is reserved for transmission between those two devices.

■Point-to-point connections use – wire, cable, microwave channel, satellite links.

■Eg – point to point connection TV-remote



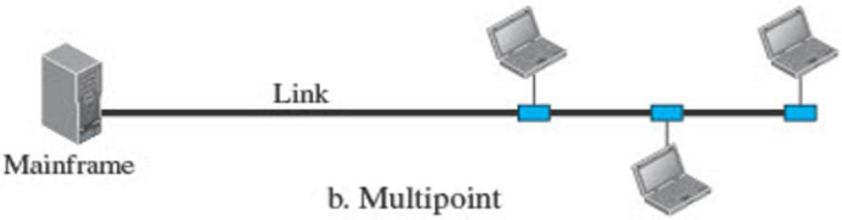
a. Point-to-point

■A multipoint / multidrop connection - more than two specific devices share a single link.

■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 a spatially shared connection.

■If users must take turns, it is a timeshared connection.



b. Multipoint

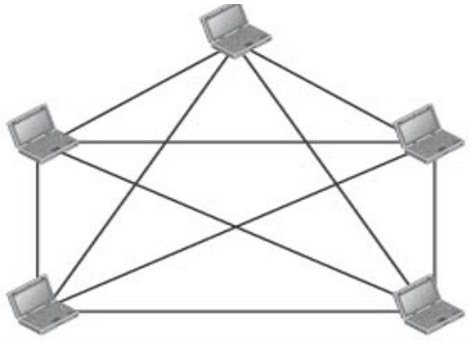
■Mesh topology - every device has a dedicated point-to-point link to every other device.

■Dedicated link - the link carries traffic only between the two devices it connects.

■To find the no. of physical links in a fully connected mesh network with n nodes - each node is connected to every other node.

■Node 1 is connected to (n–1) nodes, node 2 is connected to (n–1) nodes, node n is connected to (n–1) nodes. Total links = n(n–1).

■Duplex links - communication both directions- divide the no. of links by 2 = n(n–1)/2 duplex-mode links.

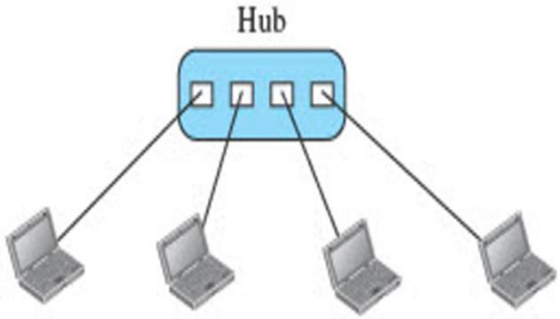


■Star topology - each device has a dedicated point-to-point link only to a central controller - called a hub.

■The devices are not directly linked to one another and do not allow direct traffic between devices.

■Controller/ hub 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.

■Eg – LANs, High-speed LANs



■Bus topology - is multipoint. One long cable acts as a backbone to link all the devices in a network

■Nodes are connected to the bus cable by drop lines and taps.

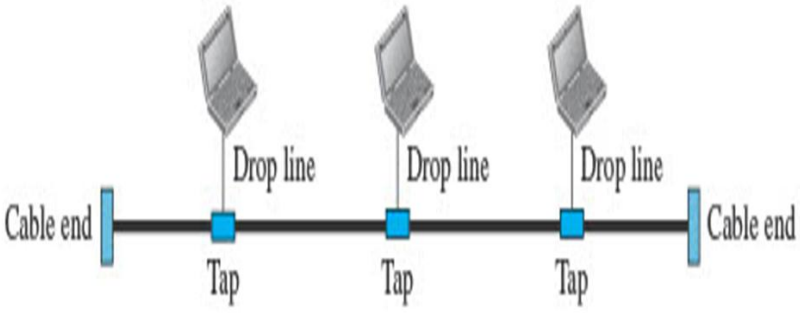
■Drop line - connection running between the device and the main cable.

■Tap - 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 making the signal weaker as it travels farther.

■So there is a limit on the no. of taps a bus can support and on the distance between those taps.

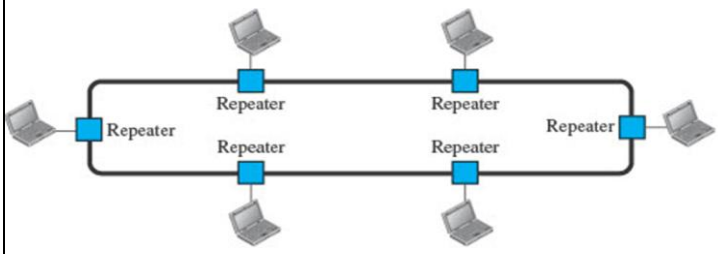
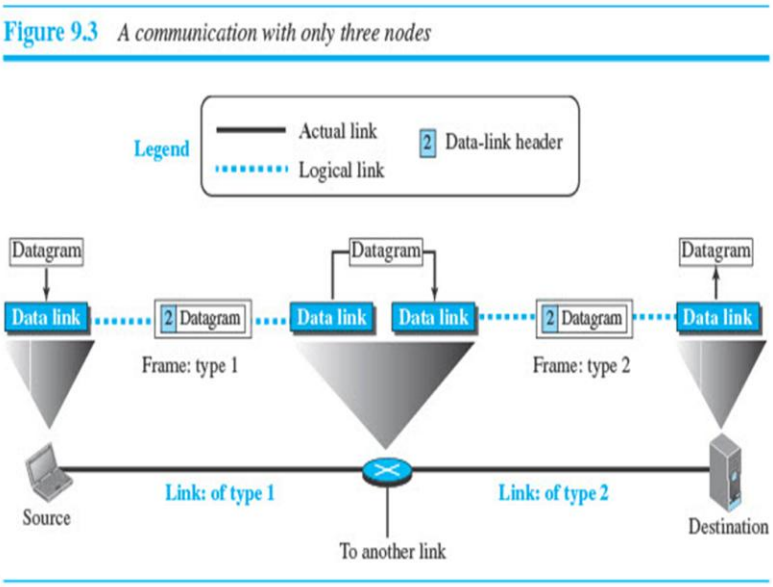
■Eg - early LAN networks



■Ring topology - each device has a dedicated point-to-point connection with only 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 has a repeater.

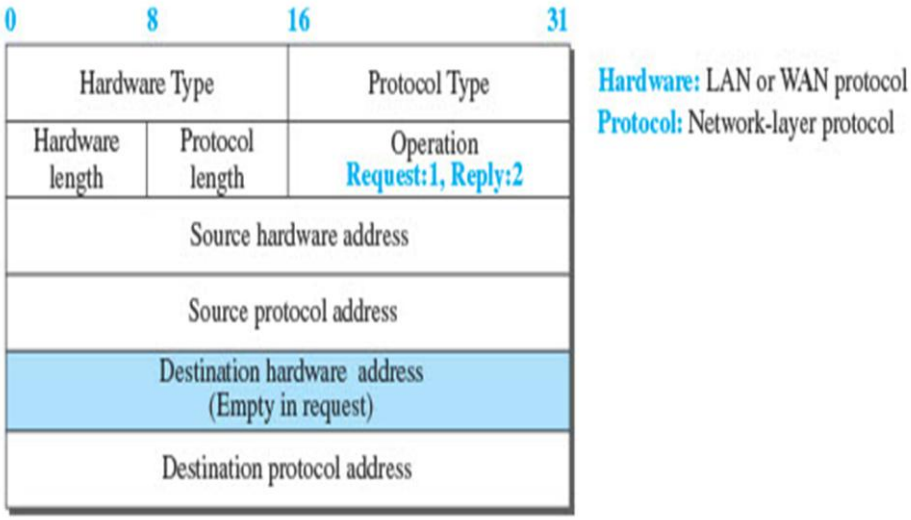
■When a device receives a signal intended for another device, its repeater regenerates the bits and passes them along.

	■Eg- IBM LAN, Token Ring.  			
3	**Explain TCP/IP protocol suite**	10	CO1	L2
4	**Discuss the various services offered by the data link layer** •The datagram received by the data-link layer of the source host is encapsulated in a frame. •The frame is logically transported from the source host to the router. •The frame is decapsulated at the data-link layer of the router and encapsulated at another frame. •The new frame is logically transported from the router to the destination host. •Note that, although we have shown only two data-link layers at the router, the router actually has three data-link layers because it is connected to three physical links.  •Definitely, the first service provided by the data-link layer is **framing**. •The data-link layer at each node needs to encapsulate the datagram (packet received from the network layer) in a **frame** before sending it to the next node. •The node also needs to decapsulate the datagram from the frame received on the logical channel. •Different data-link layers have different formats for framing. •**A packet at the data-link layer is normally called a frame.** •If the producer produces items that cannot be consumed, accumulation of items occurs. •The sending data-link layer at the end of a link is a producer of frames; the receiving data-link layer at the other end of a link is a consumer. •If the rate of produced frames is higher than the rate of consumed frames, frames at the	10	CO1	L1

	receiving end need to be buffered while waiting to be consumed (processed). •Case 1 - to let the receiving data-link layer drop the frames if its buffer is full. •Case 2- to let the receiving data-link layer send a feedback to the sending data-link layer to ask it to stop or slow down. •Different data-link-layer protocols use different strategies for flow control. •At the sending node, a frame in a data-link layer needs to be changed to bits, transformed to electromagnetic signals, and transmitted through the transmission media. •At the receiving node, electromagnetic signals are received, transformed to bits, and put together to create a frame. •Since electromagnetic signals are susceptible to error, a frame is susceptible to error, so the error needs first to be detected. •After detection, it needs to be either corrected at the receiver node or discarded and retransmitted by the sending node. •Error detection and correction is an issue in every layer (node-to node or host-to-host). •Although a link may be congested with frames, which may result in frame loss, most data-link-layer protocols do not directly use a congestion control to alleviate congestion, although some wide-area networks do. •In general, congestion control is considered an issue in the network layer or the transport layer because of its end-to-end nature. •We will discuss congestion control in the network layer and the transport layer in later chapters.			

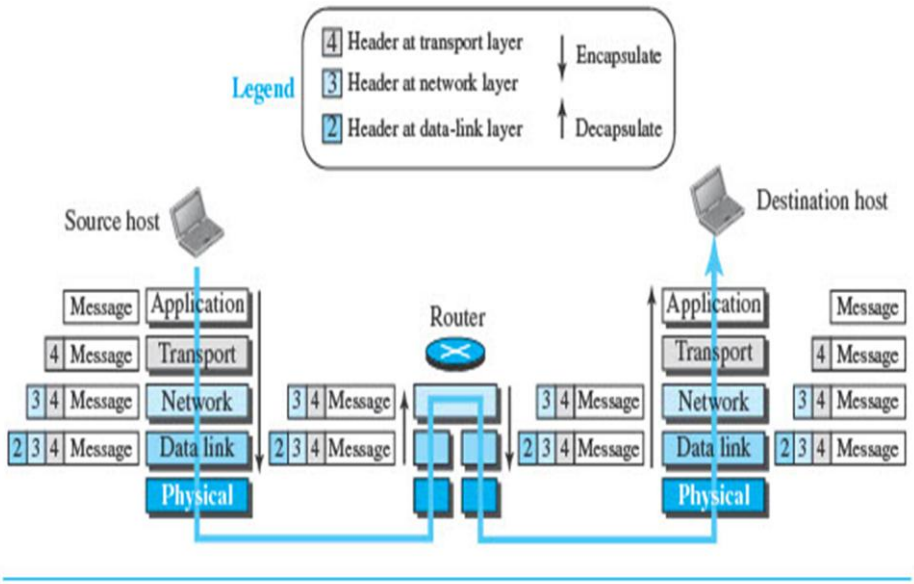
5	**With a neat diagram, explain Address Resolution Protocol(ARP) frame format** •**Hardware type - d**efines the type of the link-layer protocol; Ethernet is given the type 1. •**Protocol type -** defines the network-layer protocol: IPv4 protocol is $(0800)_{16}$. •**Source hardware & source protocol addresses -** variable-length fields defining the Tx link-layer & network-layer addresses. •**Destination hardware address & destination protocol address -** fields define the Rx link-layer & network-layer addresses. •An ARP packet is encapsulated directly into a data-link frame. •The frame needs to have a field to show that the payload belongs to the ARP and not to the network-layer datagram. •**Example 9.4**: - A host with IP address N1 and MAC address L1 has a packet to send to another host with IP address N2 and physical address L2. The two hosts are on the same network.	10	CO1	L2

Figure 9.8 *ARP packet*



6	**With a neat diagram, explain the encapsulation and decapsulation in the Internet**	10	CO1	L2

Figure 2.8 *Encapsulation/Decapsulation*



At the source, we have only encapsulation.

1.At the application layer, the data to be exchanged is referred to as a message. A message normally does not contain any header or trailer, but if it does, we refer to the whole as the message. The message is passed to the transport layer.

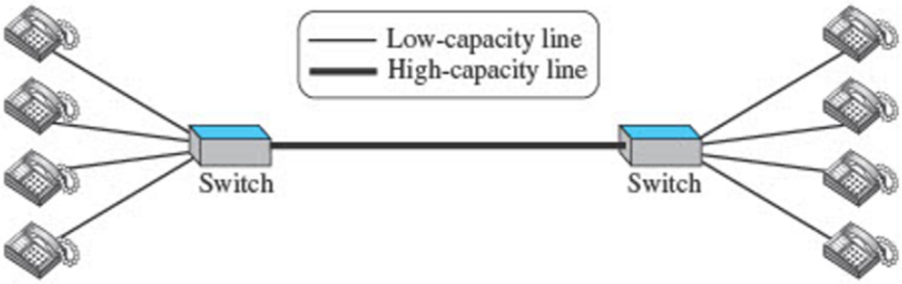
2.The transport layer takes the message as the payload, the load that the transport layer should take care of.

3.It adds the transport layer header to the payload, which contains the identifiers of the source and destination application programs that want to communicate plus some more

	information that is needed for the end-to end delivery of the message, such as information needed for flow, error control, or congestion control. 4.The result is the transport-layer packet, which is called the segment (in TCP) and the user datagram (in UDP). The transport layer then passes the packet to the network layer. 3.The network layer takes the transport-layer packet as data or payload and adds its own header to the payload. 4.The header contains the addresses of the source and destination hosts and some more information used for error checking of the header, fragmentation information, and so on. 5.The result is the network-layer packet, called a datagram. The network layer then passes the packet to the data-link layer. 6.The data-link layer takes the network-layer packet as data or payload and adds its own header, which contains the link-layer addresses of the host or the next hop (the router). 7.The result is the link-layer packet, which is called a frame. The frame is passed to the physical layer for transmission. ■At the router, we have both decapsulation and encapsulation because the router is connected to two or more links. 1.After the set of bits are delivered to the data-link layer, this layer decapsulates the datagram from the frame and passes it to the network layer. 2.The network layer only inspects the source and destination addresses in the datagram header and consults its forwarding table to find the next hop to which the datagram is to be delivered. The contents of the datagram should not be changed by the network layer in the router unless there is a need to fragment the datagram if it is too big to be passed through the next link. The datagram is then passed to the data-link layer of the next link. 3.The data-link layer of the next link encapsulates the datagram in a frame and passes it to the physical layer for transmission. ■At the destination host, each layer only decapsulates the packet received, removes the payload, and delivers the payload to the next-higher layer protocol until the message reaches the application layer. ■It is necessary to say that decapsulation in the host involves error checking.			
7	**Explain circuit switched and packet switched network with a neat diagram** ■An **internet** is a **switched network -** a switch connects at least two links together. ■Switch can forward data from a network to another network when required. ■The two most common types of switched networks: ■**circuit-switched** networks. ■**packet-switched** networks. ■Circuit-switched network - dedicated connection, called a **circuit**, is always available between the two end systems; the switch can only make it active or inactive.	10	CO1	L2

■Eg - Circuit switching used in telephone networks in the past, Today - packet- switched telephone network.

■High-capacity communication line connects the 2 switches, where the channel capacity can be shared between all pairs of telephone sets.



■Switches used in this example have forwarding tasks but no storing capability.

■When all telephone sets are busy; 4 people at one site are talking with 4 people at the other site- channel/ link capacity is fully used.

■When only 1 telephone set at 1 side is connected to a telephone set at the other side- 1/4th of the link capacity is used.

■Circuit-switched network is efficient only when it is working at its full capacity and is inefficient when it is working at partial capacity.

■Link capacity should be 4 times the capacity of each voice line -communication should not fail, all telephones communicates simultaneously.

■Communication between the two ends is done in blocks of data - **packets.**

■Continuous communication between 2 telephone sets – occurs with flow of individual data packets between the two computers.

■This allows us to make the switches function for both storing and forwarding- packet can be stored and sent later.

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