



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)
(ISO/IEC - 27001 - 2005 Certified)

WINTER – 2015 EXAMINATION

Subject Code: 17430

Model Answer

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Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.1) a) Attempt any THREE of the following.

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i) Explain any four characteristics of data communication system.

(Each characteristics – 1M)

Ans: Four Characteristics of data Communication systems:

- 1) **Delivery:** The data should be delivered to the correct destination and correct user.
- 2) **Accuracy:** The communication system should deliver the data accurately, without introducing any errors. The data may get corrupted during transmission affecting the accuracy of the delivered data.
- 3) **Timeliness:** Audio and Video data has to be delivered in a timely manner without any delay; such a data delivery is called real time transmission of data.
- 4) **Jitter:** It is the variation in the packet arrival time. Uneven Jitter may affect the timeliness of data being transmitted.

ii) State Distortion and Attenuation.

(Each definition – 2M)

Ans: Attenuation & Distortion

Attenuation: Attenuation means a loss of energy due to resistance of the medium. When a signal, simple or composite, travels through a medium, it loses some of its energy in overcoming the resistance of the medium.



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Distortion: Any change in the signal due to noise, attenuation or other influences. Distortion means that the signal changes its form or shape. Distortion can occur in a composite signal made of different frequencies.

iii) Describe the functions of Hierarchical and Peer to Peer communication.

(Any two function from each communication -2M)

(Note: For hierarchical communication, vertical/through interfaces can be considered)

Ans: Functions of Hierarchical and peer to peer communication

Functions of Hierarchical Communication (Also called *Vertical* communication)

1. To send the data down through the different layers of sending device and back up through the layers of the receiving device.
2. Provides information and services at each layer
3. Provides the procedures for the requesting and receiving services.

Functions of Peer to peer communication (Also called *Horizontal* communication)

1. Provides communication process at a given layer on both sending and receiving end.
2. Provides a set of rules called protocols for each layer to communicate.

iv) Enlist and explain any four advantages of cable modems.

(Any four – 1M each)

Ans: Four advantages of cable modem

1. A cable modem is used to connect a computer to CATV
2. People have cable TV so new wiring is not required.
3. With a single connection, video and data can be accessed simultaneously.
4. Transmission speed for downloads is good in cable modems.
5. Ability to receive live multimedia streams/videos.
6. Provides more bandwidth.

v) Explain TCP/IP Reference Model.

(Diagram - 2M, Description-2M)

[Note: TCP/IP four or Five layer May be considered]

Ans:



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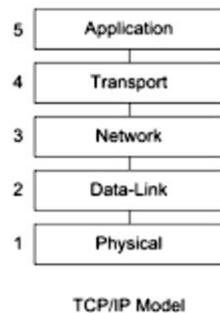


Figure: TCP/IP five layer model

OR

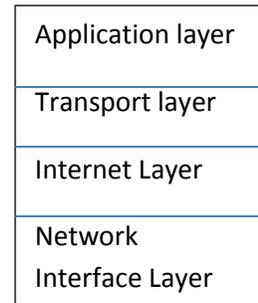


Figure: TCP/IP four layer model

1. Physical Layer:

This deals with hardware level, connections as in other network model

2. Data Link layer/Network Interface Layer

This is similar to the other network models which deal with Media Access and Control (MAC) and also with the frame formats.

3. Network Layer or Internet layer:

This layer is concerned with the format of datagrams as defined in the internet protocol (IP) and also about the mechanism of forwarding datagrams from the source computer to the final destination via one or more routers. The other protocols in this layer include Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP) and Internet Control Message Protocol (ICMP).

4. Transport Layer

This layer is concerned with the transmission of the data. The two main protocols that operate at this layer are Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). TCP is regarded as being the reliable transmission protocol and it guarantees that the proper data transfer will take place. UDP is not as complex as TCP and as such is not designed to be reliable or guarantee data delivery.

5. Application Layer / Process Layer

The application layer is concerned with providing network services to applications. There are many application network processes and protocols that work at this layer, including Hyper Text Transfer Protocol (HTTP), Simple Mail Transport Protocol (SMTP) and File Transfer Protocol (FTP).



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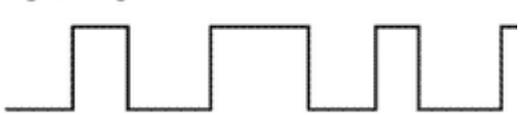
Q.1) b) Attempt any TWO of the following.

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i) Differentiate between analog and digital signal.

(Each difference – 1M, any four points)

Ans:

Analog Signal	Digital Signal
Analog signals are continuous and take continuous values.	Digital signal have discrete states and take discrete values
Analog signals can have an infinite number of values in a range;	Digital signals can have only a limited number of values.
	
Analog hardware is not flexible	Digital hardware is flexible in implementation
Analog instrument draws more power	Digital instrument draws only negligible power
Accuracy is less	Accuracy is more
Analog signal is best suited for audio and video transmission	Digital signal is best suited for computing and digital electronic
Examples like Human voice in air, signals in analog electronic devices.	Examples include Computers and other digital electronic devices.

ii) Enlist and explain any four advantages of fibre optic cable over electrical cable.
(Any four advantages – 1M each)

Ans: Advantages of fibre optic cable:

1. Less signal attenuation: Fiber-optic transmission distance is significantly greater.
2. No EMI (Electro Magnetic Interference): No effect of External environmental condition
3. High Band width up to 2 GBPS
4. Noise resistance: Uses light signal rather than electricity
5. Higher data transfer rate
6. Lesser repeater are required
7. **Resistance to corrosive materials:** Glass is more resistant to corrosive materials than other.
8. **Light weight:** Fiber-optic cables are much lighter than other cables.
9. **Electrical isolation:** - Optical fibers (COF) are fabricated from glass or plastic polymers which are electrical insulators. Hence they do not exhibit earth loop.



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10. **Signal security:** - The light from OF does not radiate significantly & therefore they provide a high degree of signal security.

iii) **Enlist and explain four characteristics of LAN.**

(Any four characteristics – 1M each)

Ans: Characteristics of LAN

- LAN covers Small geographic area (upto10/few kilometers)
- LAN is network within a single building or campus.
- Data rate is very high in Mbps more than WAN
- It is privately owned network.
- Error rate is very less.
- LAN cables are highly reliable.
- Generally lower in cost than a WAN.
- LAN protocols are simple and easy to implement
- It covers the devices upto network layer

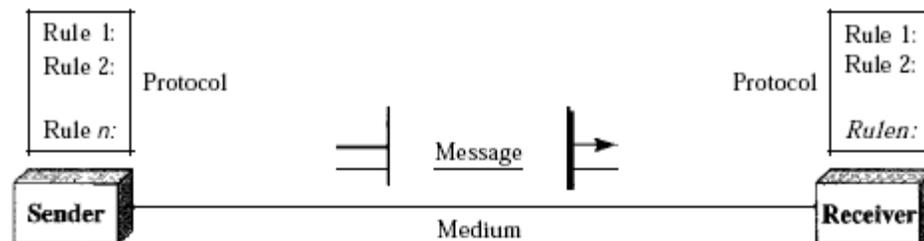
Q.2) Attempt any **FOUR** of the following:

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a) **Explain the components of Data Communication with a neat diagram.**
(Diagram -1M; Description -3M)

Ans: Components of data communication

A data communications system has five components:



1. **Message:** The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.
2. **Sender:** The sender is the device that sends the data message. It can be a computer, Workstation, telephone handset, video camera, and so on.
3. **Receiver:** The receiver is the device that receives the message. It can be a computer, Workstation, telephone handset, television, and so on.
4. **Transmission medium:** The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves.



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5. **Protocol:** A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating.

b) **Define Scatternet and explain with a diagram**
(Diagram – 2M; Description- 2M)

Ans: Scatternet with a diagram

Scatternet: Piconets can be combined to form what is called a scatternet. A secondary station in one piconet can be the primary in another piconet. This station can receive messages from the primary in the piconet (as a secondary) and, acting as a primary, deliver them to secondaries in the second piconet. A station can be member of two piconets. The fig. below illustrate the scatternet

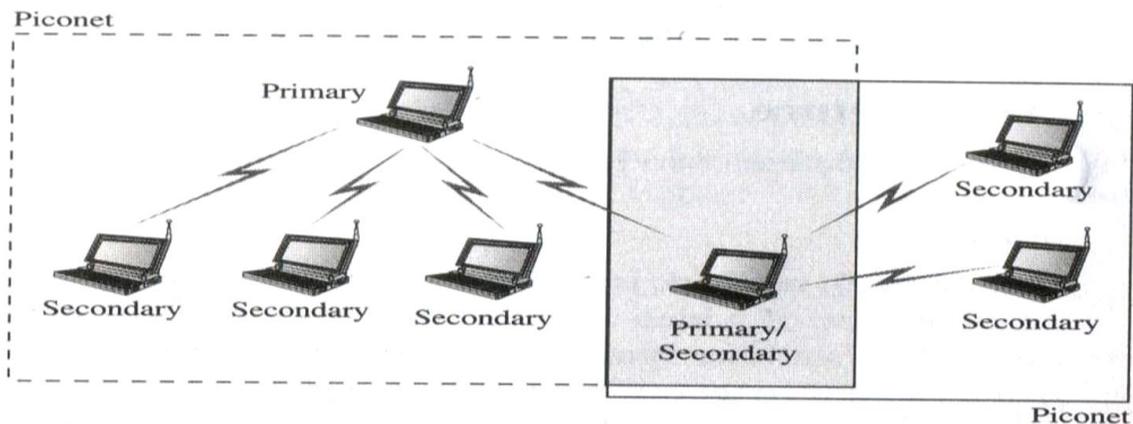


Fig: Scatternet

c) **Explain Distributed Queue Dual Bus with a diagram.**
(Explanation 3M, diagram 1M)

Ans: DQDB

The Distributed Queue Dual Bus (DQDB) protocol is a dual bus configuration. This means that each host in the network connects to two backbone network lines. The hosts get an access to the transmission medium with an approach that is different from LANs. In case of DQDB, a mechanism called distributed queue is used and hence the name Distributed queue Dual Bus (DQDB). Figure shows sample DQDB architecture with two unidirectional buses, called bus A and B. In the fig. five hosts numbered 1 to 5 connect to these buses. Each bus connects to the hosts on their and input and output ports.



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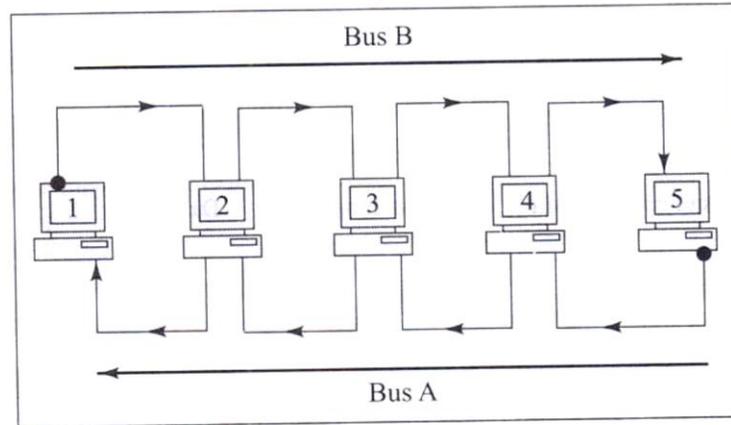


Fig: DQDB architecture (crop)

Distributed Queue Dual Bus (DQDB) is an example of MAN. IT uses the mechanism of a dual queue. There are two buses connecting all the computers on a DQDB network. Each bus allows traffic in a single direction only. To transmit data, the sending host must select one of the two buses. A host reserves the slot before transmitting its data. At any point of time, every host knows how many reservations are pending to be served.

d) State the advantages and disadvantages of Repeater.
(Two advantages – 1M each; Two Disadvantages -1M each)

Ans: Advantages and Disadvantages Repeater

Advantages of Repeater:

- A repeater is used to regenerate the signal.
- It can be used to connect two segments.
- A repeater allows extending the physical length of a network.
- A repeater is used to boost the weak signal when the signal loses the strength as it passes along the cable.
- A repeater does not have filtering capacity; It forwards every frame.
- Repeaters are cheaper when compared to other networking devices.

Disadvantages of Repeater

- Repeater regenerate the signal doesn't amplify the signal
- Repeater is not an intelligent device and it works in physical layer
- Position of repeater in data communication is important; need to place before signal gets weak.
- Traffic cannot be filtered by repeater to ease congestion.



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- e) Define IP Address. Explain three typical formats of IP Address.
(Definition -1M; any three format – 3M)

Ans:

IP address: It is a unique address specified in the TCP/IP used to identify the host in a computer network. It can be a 32 bit address (IPv4) or a 128 bit address (IPv6).

There are five different classes or formats of IP address are as given below:

Class A: Class A type of IP addresses have First byte consisting of Network address with first bit as 0 and the next 3 bytes with host id. Hence, number of hosts are more when compared to number of networks.

Class B: This type has first two bytes specifying network ID with starting two bits as 10 and last two bytes referring to host ID.

Class C: This class has first three bytes referring to network with starting bits as 110 and last byte signifies Host ID. Here, number of networks are more when compared to number of hosts in each network.

Class D: Class D is used for multicasting and its starting bits are 1110

Class E: Class E is reserved for future use and its starting bits are 1111

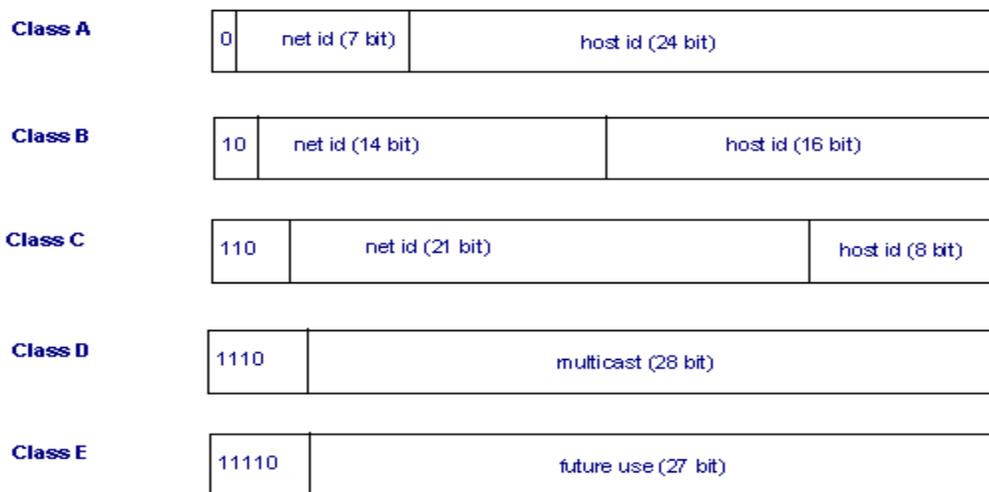


Fig: Formats of classes of IP address

- f) Describe ICMP Datagram.

(Diagram -2M; Description -2M)

Ans: ICMP:

The Internet Control Message Protocol (ICMP) is a mechanism used by hosts and gateways to send notification of datagram problems back to the sender. ICMP sends query and error reporting messages.

The error-reporting messages report problems that a router or a host (destination) may encounter when it processes an IP packet.



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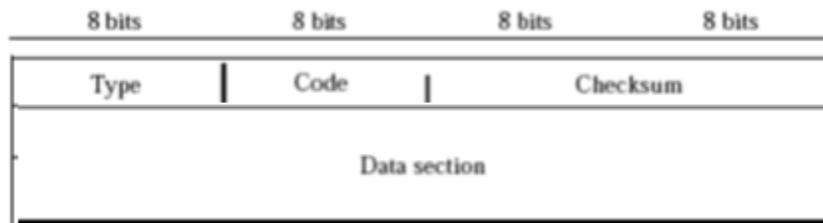
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The query messages, which occur in pairs, help a host or a network manager get specific information from a router or another host. For example, nodes can discover their neighbors. Also, hosts can discover and learn about routers on their network, and routers can help a node redirect its messages.



An ICMP message has an 8-byte header and a variable-size data section. Although the general format of the header is different for each message type, the first 4 bytes are common to all.

As Figure shows,

- First field, ICMP type, defines the type of the message.
- The code field specifies the reason for the particular message type.
- The last common field is the checksum field and it has 2 bytes.
- The data section in error messages carries information for finding the original packet that had the error. In query messages, the data section carries extra information based on the type of the query.

Q.3) Attempt any **FOUR** of the following.

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a) Define Protocol. Explain any three protocols related with Data Communication.
(Definition of protocol 1M, Description of any three protocols 3M)

Ans: Protocol:

A protocol is a set of rules that govern data communications. A protocol defines what is communicated, how it is communicated, and when it is communicated. The key elements of a protocol are syntax, semantics, and timing.

Following are the protocols related to data communication:

TCP: The Transmission Control Protocol (TCP) provides full transport-layer services to applications. TCP is a reliable and connection-oriented stream transport protocol. A connection must be established between both ends of a transmission before either can transmit data.

UDP: User Datagram Protocol is a connectionless, unreliable transport layer protocol with no embedded flow or error control mechanism except the checksum for error



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detection. The UDP packet is called a user datagram. A user datagram is encapsulated in the data field of an IP datagram.

FTP: File Transfer Protocol (FTP) is a standard network protocol is used to transfer files from one host to another host over a TCP based network such as a internet.

TFTP: Trivial File Transfer Protocol (TFTP) is a file transfer protocol notable for simplicity. It is generally used for automated transfer of configuration or boot files between machines.

SMTP: Simple Mail Transfer Protocol (SMTP) is an internet standard for electronic mail (e-mail) transmission across Internet.

IMAP: Internet Message Access Protocol allows and e-mail client to access e-mail on a remote mail server.

Telnet: Telnet is a network protocol used on the Internet or local area networks to provide a bidirectional interactive text-oriented communication facility using a virtual terminal connection.

b) Explain leased line with a neat diagram.

(Description 3M; diagram 1M)

Ans:

A leased line is a dedicated, fixed-bandwidth, symmetric data connection. A permanent telephone connection between two points set up by a telecommunications common carrier. Typically, leased lines are used by businesses to connect geographically distant offices. Unlike normal dial-up connections, a leased line is always active. The fee for the connection is a fixed monthly rate. The primary factors affecting the monthly fee are distance between end points and the speed of the circuit. Because the connection doesn't carry anybody else's communications, the carrier can assure a given level of quality. Telephone companies & ISP's have come up with the option of offering more BW from their premises & let the organizations divide it internally the way they want.

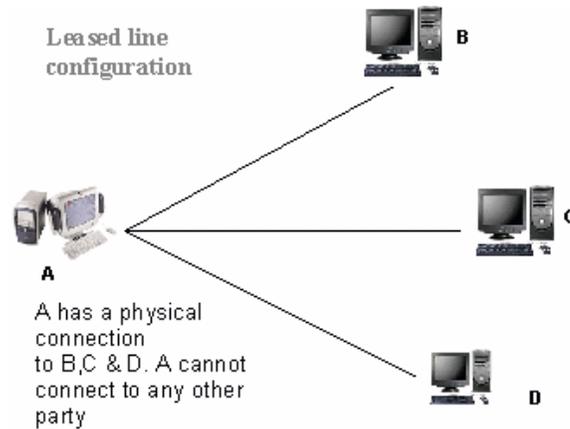


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What is a leased line used for? It is used to link two locations together. The first location is typically a corporate office. The second location is typically another corporate office, a data centre that's connected to the Internet or a data centre that's connected to the company's existing Wide Area Network.

c) Write short note on FTP.

(Appropriate description 4 Marks; any relevant description shall be considered)

Ans:

FTP is a high level application layer protocol that is aimed at providing a very simple interface for any user of the internet to transfer files. FTP presents the user with a prompt and allows entering of various commands for accessing and downloading files that physically exists on a remote compute. The user identifies a remote computer and instructs FTP to establish a connection with it. FTP contacts the remote computer using the TCP/IP software.

Once the connection is established, the user can choose to download a file from the remote computer or the user can send the file from the user end to be stored on remote computer.

FTP uses two connections between a client and server.

- Data transfer
- Control information – for commands and responses

This makes FTP more efficient

The client has three components

- User interface
- Client control process



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- Client data transfer process

FTP uses two well-known TCP ports: port 21 is used for the control connection and port 20 is used for the data connection.

d) Enlist and explain functions of application layer.

(List 1 Mark; Description of any three functions; 1 mark each)

Ans: Functions of Application Layer

- Network Virtual Terminal
- File Transfer
- Mail services
- Directory services

Description:

- 1. Network Virtual Terminal:** It allows user to log on to a remote host
- 2. File Transfer:** It allows a user to access, retrieve and manage files in a remote computer.
- 3. Mail services:** It provides the basis for email forwarding and storage facilities.
- 4. Directory services:** It provides distributes database sources and access for global information about various objects and services.

e) Explain the incompatibility issues of internet working.

(Hardware issues: 2M, software issues: 2M)

Ans: Incompatibility issues are address in two respects:

- 1) **Hardware Issue:** Some additional hardware is used to connect physically distinct computer networks. This hardware component is most commonly a router. A router is a special-purpose computer that is used specifically for internet working purposes. A router has a processor (CPU) & memory like any other computer. However, it has more than one I/O interface that allows it to connect to multiple computer networks. A network connects to a router in the same way as it connects to any other computer. A router connects two or more computer networks.

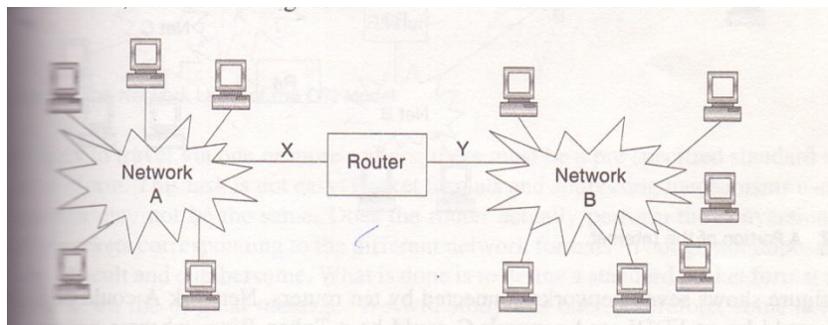


Fig: A router connects two or more computer networks together



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The router is a special computer that has two networks which connect to these two networks. These two networks correspond to the two physical addresses that the router has.

A router can connect incompatible networks. That is, networks 'A' & 'B'.

2) Software Issue: At the software level, routers must agree about the way in which information from the source computer on one network would be transmitted to the destination computer on a different network. Since this information is likely to travel via one or more router, there must be a pre specified standard to which all routers must confirm. Packet formats and addressing mechanisms used by the underlying networks may not be the same. Does the router actually perform the conversion and reconversion of the packets corresponding to the different networks formats?

Though not impossible, this approach is very difficult and cumbersome. Therefore, some networking protocols are required that can standardize common between incompatible networks. Only then can the concept of universal service be truly realized. In the case of all Internet communication, the TCP/IP suite of protocols makes this possible.

The basic idea is that TCP/IP defines a packet size, routing algorithms, error control method etc universally.

TCP/IP solves the problem of connecting heterogeneous networks seamlessly.

f) Define ARP. Explain its functions.

(Definition 1 mark; Functions 3 marks)

Ans:

Anytime a host or a router has an IP datagram to send to another host or router, it has the logical (IP) address of the receiver. The logical (IP) address is obtained from the DNS if the sender is the host or it is found in a routing table if the sender is a router. But the IP datagram must be encapsulated in a frame to be able to pass through the physical network. This means that the sender needs the physical address of the receiver. The host or the router sends an ARP query packet. The packet includes the physical and IP addresses of the sender and the IP address of the receiver. Because the sender does not know the physical address of the receiver, the query is broadcast over the network.

Every host or router on the network receives and processes the ARP query packet, but only the intended recipient recognizes its IP address and sends back an ARP response packet. The response packet contains the recipient's IP and physical addresses. The packet is unicast directly to the inquirer by using the physical address received in the query packet.



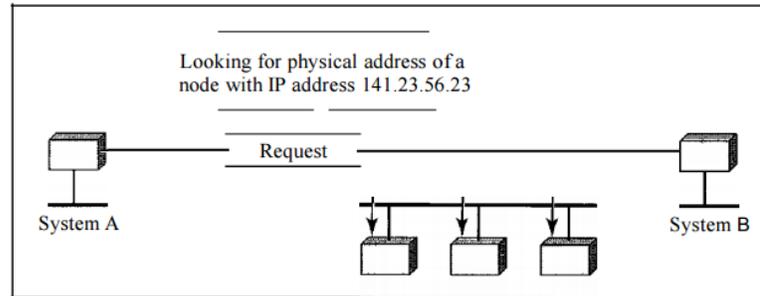
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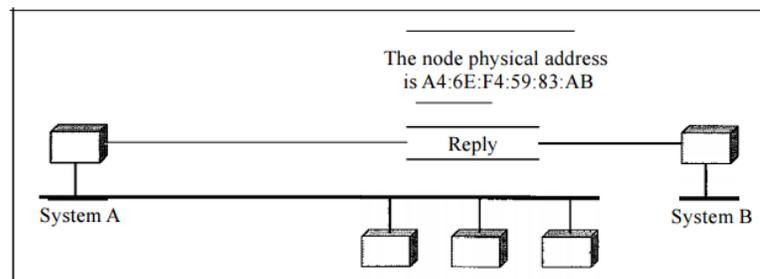
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a. ARP request is broadcast



b. ARP reply is unicast

In Figure a, the system on the left (A) has a packet that needs to be delivered to another system (B) with IP address 141.23.56.23. System A needs to pass the packet to its data link layer for the actual delivery, but it does not know the physical address of the recipient. It uses the services of ARP by asking the ARP protocol to send a broadcast ARP request packet to ask for the physical address of a system with an IP address of 141.23.56.23. This packet is received by every system on the physical network, but only system B will answer it, as shown in fig. b. System B sends an ARP reply packet that includes its physical address. Now system A can send all the packets it has for this destination by using the physical address it received.

Q.4) Attempt any FOUR of the following.

16

a) Define Data communication. Enlist various standard organizations for Data Communication.

(Definition 2 marks; Standards 2 marks)

Ans:

Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable. For data communications to occur, the communicating devices must be part of a communication system made up of a combination of hardware (physical equipment) and software (programs).



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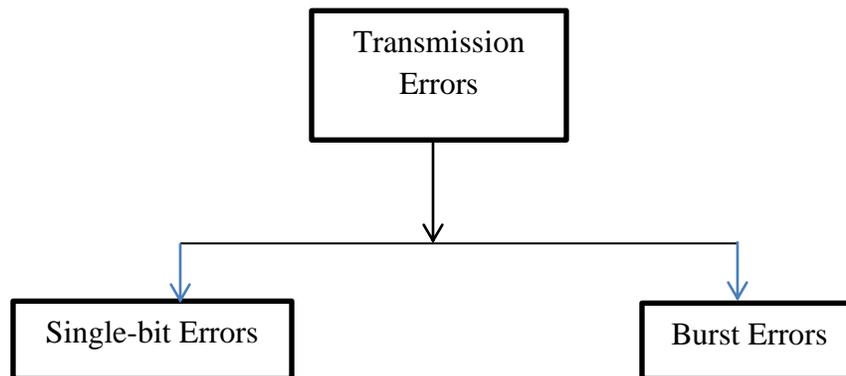
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- International Organization for Standardization (ISO).
- International Telecommunication Union-Telecommunication Standards Sector (ITU-T)
- American National Standards Institute (ANSI)
- Institute of Electrical and Electronics Engineers (IEEE).
- Electronic Industries Association (EIA).

b) Explain different types of transmission errors.

(Explanation of Single bit errors 2M, Burst errors 2M)

Ans:



There are two types of errors:

1. Single bit errors
2. Burst errors

If the signal is carrying binary data, and if a value of 0 changes to 1 or vice versa then it is known as single bit error. In burst error multiple bits of binary value are changed.

Single bit errors

In single bit of the data unit changes. Thus effectively, either a 0 bit changes to 1 or a 1 bit changes to 0. Single bit errors are more likely in the case of parallel transmission because it is likely that one of the eight wires carrying the bits has become noisy, resulting in corruption of a single bit of each byte. This can be a case of parallel transmission between the CPU and the memory inside a computer.

Burst errors

In case of serial transmission, the duration of noise is usually longer than that of a single bit; hence the chances of corrupting only a single bit are less.

In contrast, a burst changes at least two bits during data transmission because of errors. Note that burst errors can change any two or more bits in a transmission. These bits need



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not necessarily be adjacent bits. Burst errors are more likely in serial transmission, because the duration of noise is longer, which causes multiple bits to be corrupted.

c) Define LAN. Explain its advantages.

(Definition 1 marks; Advantage 3 Marks; any three advantages shall be considered)

Ans:-

A LAN is confined to a small area, usually within a single building. A local area network (LAN) is usually privately owned and links the devices in a single office, building, or 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; or it can extend throughout a company and include audio and video peripherals. A line (bus) topology is the cheapest in terms of cabling costs.

ADVANTAGES OF LAN

- Can connect existing machines together e.g. connect machines of different departments for better interoperability.
- Price to performance ratio is very good. Mainframes and mini computers are much costlier as compared to performances.
- Incremental growth: you can add machines to existing network as and when needed.
- Files can be stored on a central computer (the file server) allowing data to be shared throughout an organization.
- Files can be backed up more easily when they are all on a central fileserver rather than when they are scattered across a number of independent workstations.
- Networks also allow security to be established, ensuring that the network users may only have access to certain files and applications.
- Software and resources can be centrally managed.
- Network versions of software often allow for their speedy installation on workstations from the file server.
- Expensive devices such as laser printers or scanners can be shared.
- Users can access their files from any workstation

d) Enlist different types of bridges. Explain any two.

(List 1 mark; 1½ Marks for each type's description)

Ans:

- 1.Transparent Bridges
- 2.Source Routing Bridges
- 3.Two-Layer Switches



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- 4. Simple Bridges
- 5. Multiport Bridges

1. Transparent Bridges

A transparent bridge is a bridge in which the stations are completely unaware of the bridge's existence. If a bridge is added or deleted from the system, reconfiguration of the stations is unnecessary. According to the IEEE 802.1 d specification, a system equipped with transparent bridges must meet three criteria:

Forwarding: Frames must be forwarded from one station to another.

Learning The forwarding table is automatically made by learning frame movements in the network.

Loops Problems: Loops in system must be prevented.

2. Source Routing Bridges

Another way to prevent loops in a system with redundant bridges is to use source routing bridges. A transparent bridge's duties include filtering frames, forwarding, and blocking. In a system that has source routing bridges, these duties are performed by the source station and, to some extent, the destination station.

In source routing, a sending station defines the bridges that the frame must visit. The addresses of these bridges are included in the frame. In other words, the frame contains not only the source and destination addresses, but also the addresses of all bridges to be visited.

The source gets these bridge addresses through the exchange of special frames with the destination prior to sending the data frame.

Source routing bridges were designed by IEEE to be used with Token Ring LANs. These LANs are not very common today.

3. Two-Layer Switches

A two-layer switch is a bridge, a bridge with many ports and a design that allows better (faster) performance. A bridge with a few ports can connect a few LANs together. A bridge with many ports may be able to allocate a unique port to each station, with each station on its own independent entity. This means no competing traffic (no collision, as we saw in Ethernet).



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A two-layer switch, as a bridge does, makes a filtering decision based on the MAC address of the frame it received. However, a two-layer switch can be more sophisticated. It can have a buffer to hold the frames for processing. It can have a switching factor that forwards the frames faster. Some new two-layer switches, called cut-through switches, have been designed to forward the frame as soon as they check the MAC addresses in the header of the frame

e) Explain DNS.

(Appropriate description 4 Marks; any relevant description shall be considered)

Ans:

A domain name server is simply a computer that contains the database and the software of mapping between domain names and IP addresses. Every domain has a domain name server. It handles request coming to computers owned by it and also maintains the various domain entries. The DNS is completely distributed throughout the world on millions of computers.

Table : Generic Domain Name

<i>Label</i>	<i>Description</i>
aero	Airlines and aerospace companies
biz	Businesses or firms (similar to "com")
com	Commercial organizations
coop	Cooperative business organizations
edu	Educational institutions
gov	Government institutions
info	Information service providers
int	International organizations
mil	Military groups
museum	Museums and other nonprofit organizations
name	Personal names (individuals)
net	Network support centers
org	Nonprofit organizations
pro	Professional individual organizations

The DNS works very similar to a telephone directory inquiry service.



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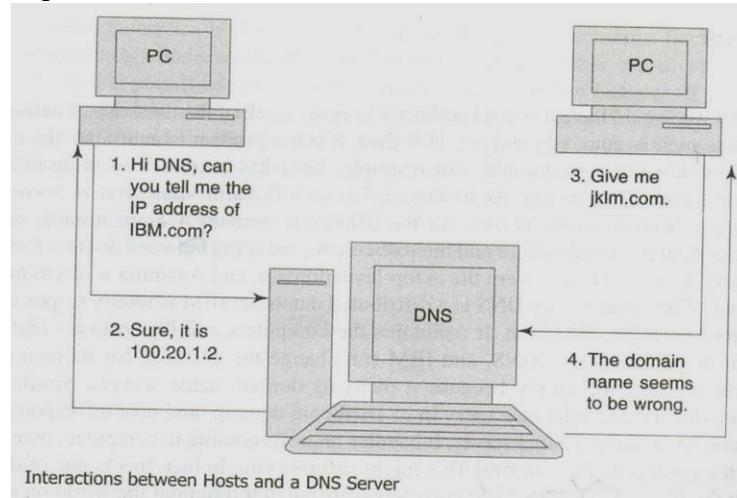
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Basically, DNS server does two things tirelessly:

- Accept request from programs for converting domain names into IP addresses.
- Accept request from other DNS servers to convert domain names into IP addresses



When such request comes in, a DNS server has the following options:

It can supply the IP address because it already knows the IP address for the domain. It can contact another DNS server and try to locate the IP address for the name requested. It may have to do this more than once. Every DNS server has an entry called alternate DNS server, which is the DNS server it should get in touch with for unresolved domains. The DNS hierarchy specifies how the chains between the various DNS servers should be established for this purpose.

It can simply say, “I do not know the IP addresses for the domains name you have requested, but here is the IP addresses for a name server that knows more than I do”. In other words, it suggests the name of another DNS server. It can return an error message because the requested domain name is invalid or does not exist.

f) Differentiate between TDM and FDM.

(Any 4 points of differentiation shall be considered; 1 mark each)

Ans:

TDM	FDM
Total available time is divided into several slots/user	Total frequency bands are divided into several users
A multiplex system for transmitting two or more signals over a common path by using a different frequency band for each signal.	Transmission of two or more signals on the same path, but at different times



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TDM imply partitioning the bandwidth of the channel connecting two nodes into finite set of time slots	The signals multiplexed come from different sources/transmitters.
TDM provides greater flexibility and efficiency, by dynamically allocating more time periods to the signals that need more of the bandwidth	FDM lacks this type of flexibility, as it cannot dynamically change the width of the allocated frequency.
In TDM, each signal uses all of the bandwidth some of the time.	FDM, each signal uses a small portion of the bandwidth all of the time.
Latency in TDM is TDM allocates time periods, only one channel can transmit at a given time, and some data would often be delayed, though it's often only in milliseconds.	Channels in FDM can transmit at any time, their latencies would be much lower compared to TDM.
With technological advancements, the cost of TDM is dropping.	In FDM, This is not true.
TDM is complex as compared to FDM.	FDM is simpler to implement than TDM.

Q.5) Attempt any FOUR of the following:

16

- a) State advantages and disadvantages of Network standards
(Any two advantages: 2M, Any Two Disadvantages: 2M)**

Ans:

Advantages:

1. Many computers from all the world can connect together for communicating, because they are using the international standard.
2. Easier maintenance and installation because you get used on the standard.
3. Up gradation and Adoptions of standard becomes easy.

Disadvantages:

1. Problems Occur in Standards, it takes time to solve as it involves all international regulating bodies.
2. All companies and manufactures must compulsorily follow standards to communicate.
3. The standards cannot be modified or customized as per the need by individuals.



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b) Compare circuit switching with packet switching.

(Any Four difference 4M)

(Note: Circuit switching and any one of the packet (packet) switching should be considered)

Ans:

Circuit Switching	Packet Switching (Datagram)	Packet Switching (Virtual Circuit)
Dedicated path	No Dedicated path	No Dedicated path
Path is established for entire conversation	Route is established for each Packet	Route is established for entire conversation
Call setup delay	Packet transmission delay	call setup delay as well as packet transmission delay
Overload may block call setup	Overload increases packet delay	Overload may block call setup and increases packet delay
Fixed bandwidth	Dynamic bandwidth	Dynamic bandwidth
No overhead bits after call setup	overhead bits in each packet	overhead bits in each packet

c) Explain the Architecture of WAN.

(Explanation: 2M, Diagram: 2M)

Ans:

When numbers of packet switches are connected together a WAN is formed. A packet switch has multiple I/O ports. Thus it can connect too many different computers or other switches to form a variety of topologies.

A figure given below shows a WAN formed by four Switches and 15 computers connected together. From figure we can say that WAN need not need to be a symmetric network. There can be any number of packet switches, and the packet switches connect to each other and the host. For instance, packet switch 1 connects to only three hosts, whereas packet switch 3 connects to 5 hosts. The packet switches are connected to each other using very high speed lines, such as T1. The hosts local to a particular packet switch connect to that packet switch.

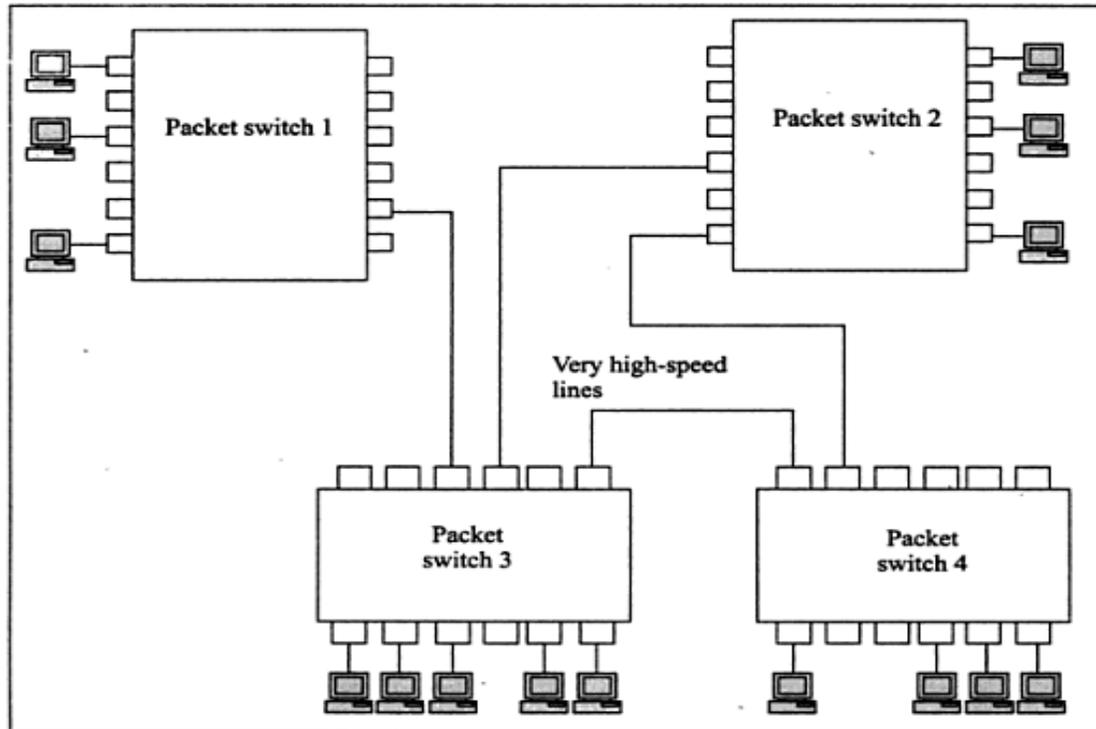


Fig: Packet switches and computers forming a WAN.

- d) Explain different types of Routers.
(Static Router: 2M, Dynamic Router: 2M)

Ans: Router: Router is an interconnectivity device used to interconnect more than one networks together it specifically works at network layer of OSI reference model called as layer 3 device.

Routers are of two types:

1. Static routers: A router with **manually configured** routing tables is known as a static router. A network administrator, with knowledge of the internetwork topology, manually builds and updates the routing table, programming all routes in the routing table.



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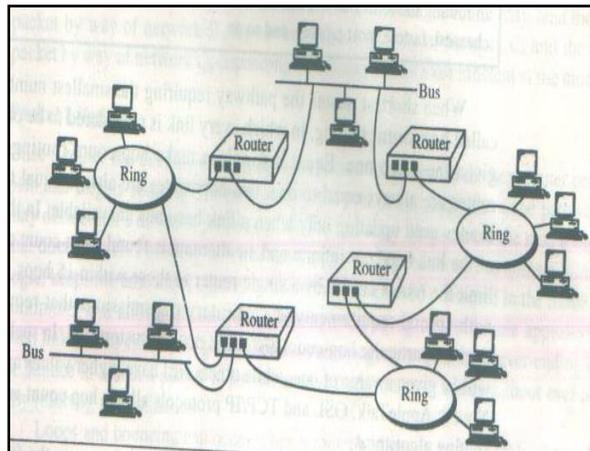
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Static routers are **not fault tolerant**. The lifetime of a manually configured static route is infinite and, therefore, static routers do not sense and recover from downed routers or downed links. Static routers are more secure.

2. Dynamic routers: A router with **dynamically configured** routing tables is known as a dynamic router. Dynamic routing consists of routing tables that are built and maintained automatically through an ongoing communication between routers. This communication is facilitated by a routing protocol, a series of periodic or on-demand messages containing routing information that is exchanged between routers. Except for their initial configuration, dynamic routers require little ongoing maintenance, and therefore can scale to larger internetworks. Dynamic routing is **fault tolerant**.



e) **Define Topology. Enlist various topologies.**

(Definition: 2M, Enlisting of topologies (Any 4): 2M)

Ans: Topology:

Topology refers to layout of a network. How different nodes in a network are connected to each other and how they communicate is determined by the network's topology.

Types of Topologies are

1. Mesh Topology
2. Bus Topology
3. Star Topology
4. Ring Topology



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5. Tree Topology
6. Hybrid Topology

f) Mention the advantages of IEEE standards.

(Any 4 Advantages: 1M each)

(Advantages of a particular IEEE standard may also be considered.)

Ans:

Standards are necessary in every walk of life.

- In absence of standards, every manufacturer can theoretically manufacture a set of goods or services that are incompatible with other manufacturers.
- To avoid such anomalies a set of standards is established which governs the rules that manufacturers must obey.
- IEEE focuses developments in the areas of electrical and electronics engineering and Radio sciences.
- IEEE also oversees the developments and adoptions of international computer and communications standards.

Advantages of IEEE 802.11:

1. It provides increased bandwidth per access point
2. Most of the features of the earlier standards like Radio Management, Wireless Multi Media, WPA2 encryption, Intrusion Detection etc.
3. 802.11n is totally backward compatible. It can support 802.11a, b and g standards for connecting the legacy clients too.

Advantages of IEEE 802.16:

- 1) Single station can serve hundreds of users.
- 2) Much faster deployment of new users comparing to wired networks.
- 3) Speed of 10Mbps at 10 kilometers with line-of-sight.
- 4) It is standardized, and the same frequency equipment should work together.



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Q. 6) Attempt any FOUR of the following:

16

a) Define bandwidth and data transmission rate.

(Definition and unit of bandwidth 2M, data transmission rate 2M)

Ans:

Bandwidth: The information carrying capacity of a signal or a medium, calculated using the difference between the highest and lowest frequencies.

In digital transmission (such as of data from one computer to another) bandwidth is measured in bits per second (bps).

Data Transmission rate: The speed with which data can be transmitted from one device to another. Data rates are often measured in megabits (million bits) or megabytes (million bytes) per second. These are usually abbreviated as Mbps and MBPS, respectively. Another term for data transfer rate is throughput.

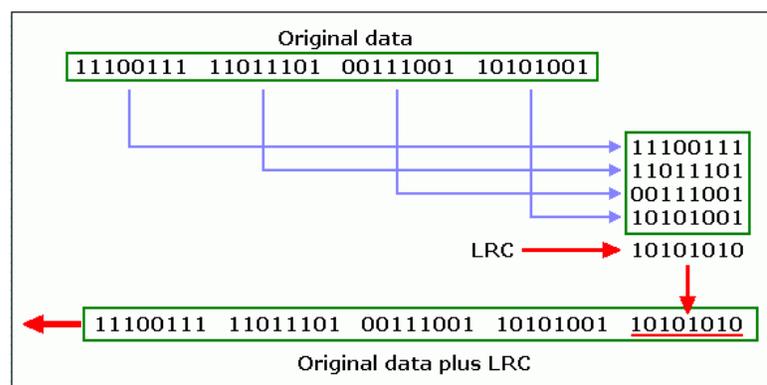
b) LRC with an example

(LRC Explanation 2M, Example 2 M)

Ans:

LRC: In this error detection method, a block of bits is organized in a table with rows and columns. Then the parity bit for each column is calculated and a new row of eight bits, which are the parity bits for the whole block, is created. After that the new calculated parity bits are attached to the original data and sends to the receiver.

Example:





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LRC increases the likelihood of detecting burst error. An LRC of n bits can easily detect a burst error of n bits.

However, if two bits in one data unit are damaged and two bits in exactly the same positions in another data unit are also damaged, the LRC checker will not detect an error.

```
10100011 00110011 11011101 11100111
      10101010 (LRC)
Calculate the LRC for Data Received
      10100011
      00110011
      11011101
      11100111
→ LRC Calculated by Receiver      10101010
→ Compare with LRC Received      10101010
```

Note that although the 5th bit and the 7th bit for 1st and 2nd data unit have been changed but the LRC calculated by receiver is still the same as the LRC received. Thus the receiver checker cannot detect this burst error.

c) Explain various gateways in OSI Reference model

(Diagram: 2M, Explanation: 2M)

(Note: Explanation of Gateways in general may also be considered.)

Ans:

Gateways operates at all the seven layers of the OSI model



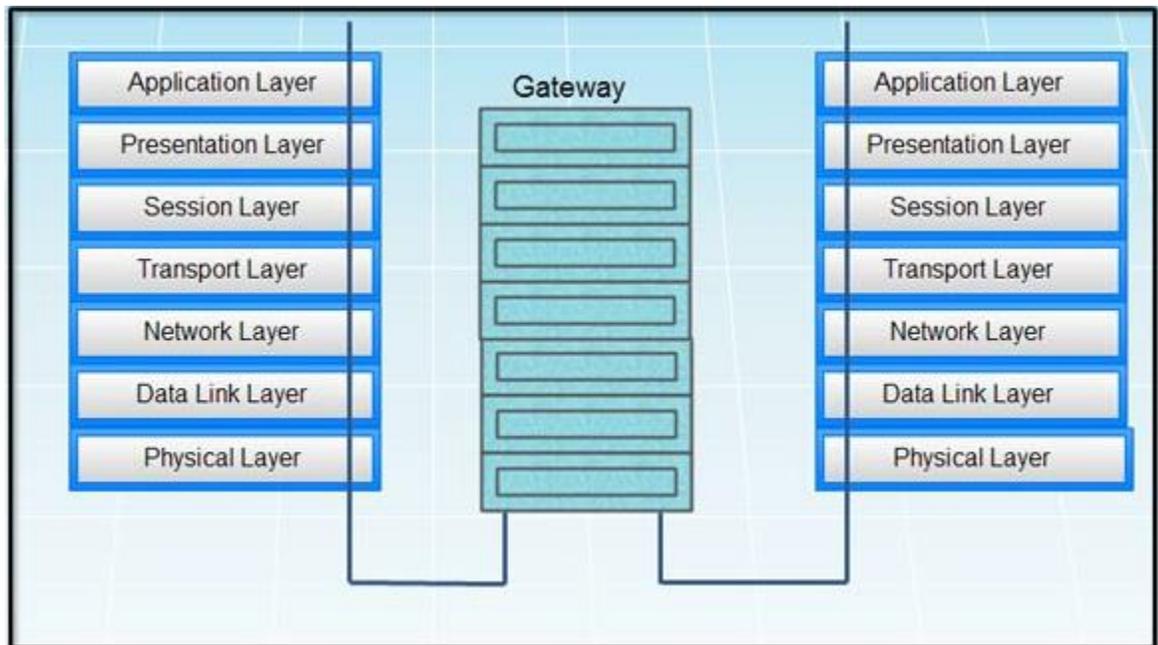
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1. Gateways provide full protocol conversion from one proprietary LAN technology to another, i.e. Ethernet to token ring or FDDI or any other standard or protocol rather than encapsulation
2. It uses higher layers of the OSI model, perhaps through layer 7, the application layer. IBM SNA, DECnet, Internet TCP/IP and other protocols can be converted from network-to-network
3. Unlike bridges and routers, gateways operate slowly because of protocol conversion. Consequently, they may create bottlenecks of congestion during periods of peak usage.

d) Functions of data link layer
(Any 4 Functions: 1M each)

Ans: Functions of Data-link Layer

Data link layer does many tasks on behalf of upper layer. These are:

- **Framing**

Data-link layer takes packets from Network Layer and encapsulates them into Frames. Then, it sends each frame bit-by-bit on the hardware. At receiver' end, data link layer picks up signals from hardware and assembles them into frames.



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- **Addressing**

Data-link layer provides layer-2 hardware addressing mechanism. Hardware address is assumed to be unique on the link. It is encoded into hardware at the time of manufacturing.

- **Synchronization**

When data frames are sent on the link, both machines must be synchronized in order to transfer to take place.

- **Error Control**

Sometimes signals may have encountered problem in transition and the bits are flipped. These errors are detected and attempted to recover actual data bits. It also provides error reporting mechanism to the sender.

- **Flow Control**

Stations on same link may have different speed or capacity. Data-link layer ensures flow control that enables both machines to exchange data on same speed.

- **Multi-Access**

When host on the shared link tries to transfer the data, it has a high probability of collision. Data-link layer provides mechanism such as CSMA/CD to equip capability of accessing a shared media among multiple Systems.

e) What is data fragmentation?

(Explanation: 4M)

(IP fragmentation description can be considered)

Ans:

Data fragmentation occurs when a piece of data in memory is broken up into many pieces that are not close together. This is typically the result of attempting to insert a large object into storage that has already suffered external fragmentation.

Fragmentation is the process of chopping larger chunks of data into smaller chunks. Fragmentation is usually performed at the hardware level, and when data is chopped into fragments, it is referred to as a frame. Fragmentation occurs so that data can be



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transmitted across a connection without overwhelming the memory buffers on either side of the connection. Fragmentation allows for the coordination of data transmission amongst devices connected to a common transmission medium.

A datagram can travel through different networks. Each router decapsulates the IPv4 datagram from the frame it receives, processes it, and then encapsulates it in another frame. If an incoming frame's size is too large for the destination LAN, the data must be fragmented into several frames. The data then need to be reassembled at the destination. However, no protocol at the data link layer allows the fragmentation and reassembly of frames.

The format and size of the received frame depend on the protocol used by the physical network through which the frame has just traveled. The format and size of the sent frame depend on the protocol used by the physical network through which the frame is going to travel. For example, if a router connects a LAN to a WAN, it receives a frame in the LAN format and sends a frame in the WAN format.

- f) Describe the construction of fiber optic cable with a neat diagram.
(Diagram: 2M, Construction of Cable: 2M)**

Ans:

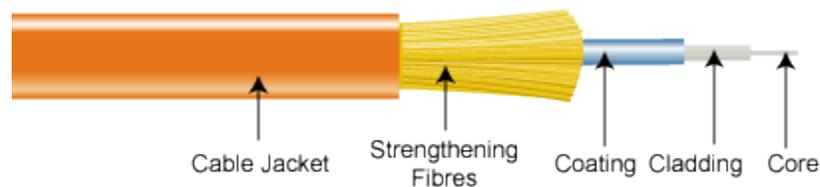


Fig: Construction of Fiber Optic Cable

Core: This is the physical medium that transports optical data signals from an attached light source to a receiving device. The core is a single continuous strand of glass or plastic that's measured in microns (μ) by the size of its outer diameter. The larger the core, the more light the cable can carry. All fiber optic cable is sized according to its



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core's outer diameter. The three multimode sizes most commonly available are 50, 62.5, and 100 microns. Single-mode cores are generally less than 9 microns.

Cladding: This is the thin layer that surrounds the fiber core and serves as a boundary that contains the light waves and causes the refraction, enabling data to travel throughout the length of the fiber segment.

Coating: This is a layer of plastic that surrounds the core and cladding to reinforce and protect the fiber core. Coatings are measured in microns and can range from 250 to 900 microns.

Strengthening fibers: These components help protect the core against crushing forces and exercise tension during installation..

Cable jacket: This is the outer layer of any cable. Most fiber optic cables have an orange jacket, although some types can have black or yellow jacket.