



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

SUMMER – 2016 EXAMINATION
Model Answer

Subject Code: 17430

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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 judgement 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 SIX of the following:

12M

a. Define Multiplexing.

(Correct Definition 2M)

Ans.

Multiplexing:

This is the process of allowing more than one signal to be sent on a single transmission path using different techniques, for efficient use of transmission medium.

Or

Dividing a physical line or medium into different logical segments is called multiplexing.

Or

Multiplexing combines (or multiplexes) the inputs from different sources and load them on different channels of a medium.

b. List two services of IEEE 802.11

(Any Two services, 1M each)

Ans:

Services of IEEE 802.11:

802.11 is a Wireless LAN (WLAN) which covers services of physical and data link layer.

Its specific services are,



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- Basic Service Set (BSS)
- Extended Service Set (ESS)

c. Define error.

(Correct Definition 2M)

Ans:

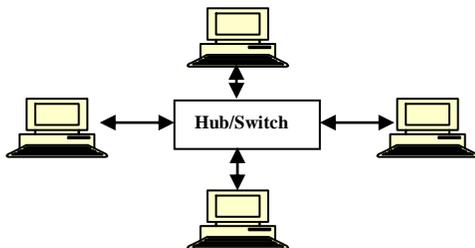
Error:

In Communication Systems, any distortion of transmitted signal before reaching its destination is called error. Errors can be Delay distortion, Attenuation or noise.

d. Draw diagram of star topology.

(Correct diagram 2M)

Ans: Diagram of Star topology:



e. List types of wireless media.

(Any 2 Media- 1M each)

Ans : Types of Wireless Media:

- Air
- Water
- Atmosphere
- Space

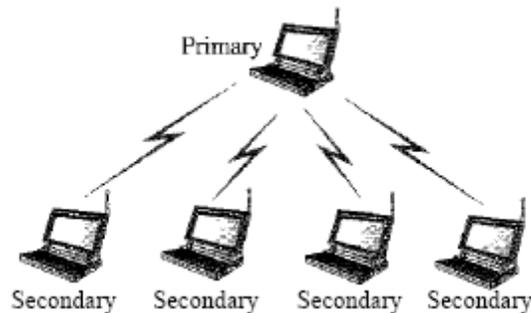
OR

- Radio Waves
- Microwave
- Infrared

f. Draw diagram of piconet.

(Correct Diagram 2M)

Ans:



OR

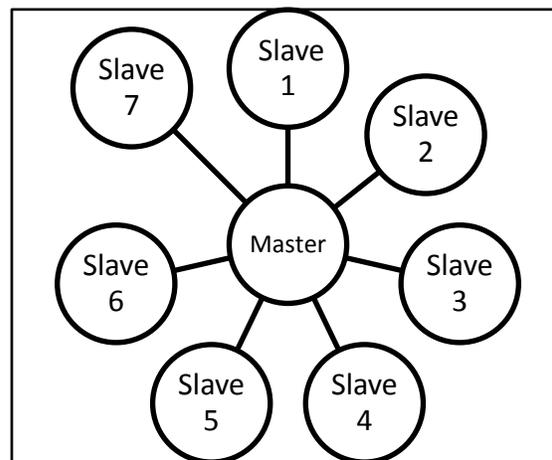


Fig. Piconet showing One Master and up-to 7 active slaves

g. Define packets.

(Correct Definition 2M)

Ans:

Packets:

In data communication, the data to be sent is divided into discrete blocks, which are called as Packets. Each packet has fixed size & length. It contains data to be transferred, along with the sender and receiver address.

h. List four commands of SMTP.

(Any Four commands, each 1/2M)

Ans:

HELO, MAIL FROM, RCPT TO, DATA, RSET, NOOP, QUIT, SEND FROM, SOML FROM, SAML FROM, SAML, VRFY, EXPN, HELP, TURN



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Q. 1) B) Attempt any TWO of the following:

08M

a. Give difference between FDM & TDM (4 points).

(Any Four relevant points, 1M each)

Ans: Difference between FDM & TDM:

Sr. No.	FDM (Frequency Division Multiplexing)	TDM (Time Division Multiplexing)
1	Total frequency bands are divided into several users	Total available time is divided into several slots/user
2	Transmission of two or more signals on the same path, but at different times.	A multiplex system for transmitting two or more signals over a common path by using a different frequency band for each signal.
3	The signals multiplexed come from different sources/transmitters.	TDM imply partitioning the bandwidth of the channel connecting two nodes into finite set of time slots
4	FDM has less flexibility, as it cannot dynamically change the width of the allocated frequency.	TDM provides greater flexibility and efficiency, by dynamically allocating more time periods to the signals that need more of the bandwidth
5	FDM, each signal uses a small portion of the bandwidth all of the time.	In TDM, each signal uses all of the bandwidth some of the time.
6	Channels in FDM can transmit at any time, their latencies would be much lower compared to TDM.	In TDM only one channel can transmit at a given time, and some data would often be delayed, though it's often only in milliseconds.
7	Synchronization is not required	Synchronization is required
8	FDM is simpler to implement than TDM	TDM is complex as compared to FDM.

b. Give difference between SLIP and PPP (4 points).

(Any Four points, each 1M)

Ans: Difference between SLIP and PPP:

Sr. No.	SLIP (Serial Line Internet Protocol)	PPP (Point to Point Protocol)
1	SLIP is not a standard Internet Protocol	PPP is a standard Internet Protocol.
2	SLIP is a connectionless protocol	PPP is a connection-oriented protocol
3	SLIP is not a group of protocols	PPP is a group of protocols
4	It is a simple protocol	It is a complex protocol.
5	It does not perform error detection & correction.	It performs error detection & correction.
6	SLIP transports only IP traffic.	PPP is a multi-protocol transport mechanism
7	IP address is assigned statically.	IP address is assigned dynamically
8	SLIP does not provide any authentication.	PPP provides authentication.



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c. Describe TCP & UDP with respect to their four differences.
(Any Four points, each 1M)

Ans. **Difference between TCP and UDP:**

Sr. No.	TCP (Transmission Control Protocol)	UDP (User Datagram Protocol)
1	TCP is a connection-oriented protocol.	UDP is a connectionless protocol
2	As a message makes its way across the internet from one computer to another. This is connection based.	UDP is also a protocol used in message transport or transfer. This is not connection based which means that one program can send a load of packets to another and that would be the end of the relationship.
3	TCP rearranges data packets in the order specified.	UDP has no inherent order as all packets are independent of each other.
4	The speed for TCP is slower than UDP.	UDP is faster than TCP
5	TCP header size is 20 bytes (bigger)	UDP Header size is 8 bytes (smaller)
6	There is absolute guarantee that the data transferred remains intact and arrives in the same order in which it was sent.	There is no guarantee that the messages or packets sent would reach at all.
7	TCP does Flow Control.	UDP does not have an option for flow control
8	TCP does error checking	UDP does error checking, but no recovery options.
	TCP handles reliability and congestion control.	UDP does not handle reliability and congestion control
9	Its packet contains 1. Sequence Number, 2. ACK number, 3. Data offset, 4. Reserved, 5. Control bit, 6. Window, 7. Urgent Pointer 8. Options, 9. Padding, 10. Check Sum, 11. Source port, 12. Destination port	Its packet contains 1. Length, 2. Source port, 3. Destination port, 4. Check Sum
10	Handshaking is done (SYN, SYN-ACK, ACK)	No handshake (connectionless protocol)
11	Used by protocols like HTTP, FTP, Telnet etc.	Used by DHCP, SNMP, VoIP etc.



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Q.2. Attempt any FOUR of the following:

16M

a. Draw the components of data communication system and state the function of each component.

(Diagram: 2M, Functions: 2M)

Ans: Data Communication System:

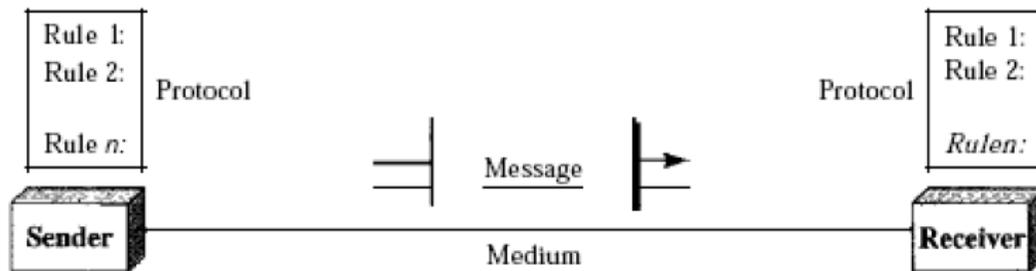


Fig. Data Communication

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.
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. Give difference between twisted pair cable and co-axial cable. (4 points)

(Any four points, each 1M)

Ans:



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Difference between Twisted pair cable and co-axial cable:

Sr. No.	Twisted Pair Cable	Co-axial cable
1	Pairs of wires are twisted.	It has two conductors, inner and outer which share the same axis.
2	Twisting is done to reduce noise	It has insulator between two conductors
3	Flexible, Cheap and easy to install	Less flexible, Expensive, and difficult to Install
4	Less reliable and data rate depends on various categories.	More reliable and it has higher data rate.
5	Different types of cables such as STP and UTP with categories CAT-1, CAT2, CAT-3, CAT-4 and CAT-5 etc.	Various standards like thinnet (10base 2) and thicknet (10 base 5)
7	Used in Computer Networks.	Commonly used by cable companies to carry television transmissions.
8	E.g.: Star topology	Eg.: bus topology

c. State two applications of Bluetooth network.

(Any 2 applications, each 2M; any other relevant applications may be considered)

Ans: **Bluetooth Applications:**

- Peripheral devices such as a wireless mouse or keyboard can communicate with the computer through this technology.
- Monitoring devices can communicate with sensor devices in a small health care center.
- Home security devices can use this technology to connect different sensors to the main security controller.
- Conference attendees can synchronize their laptop computers at a conference.
- It also allows hands-free voice communication with headset
- It also enables a mobile computers (laptop) to connect to a fixed LAN.
- It can also be used for file transfer operation from one mobile phone to another.

d. Give the name of layer from OSI model where following networking devices are operating (i) Router, (ii) Bridge, (iii) Hub, (iv) Gateway.

(Each layer, 1M)

Ans :

	Networking Device	OSI layer
(i)	Router	Network Layer
(ii)	Bridge	Data Link Layer
(iii)	Hub	Physical Layer
(iv)	Gateway	Application Layer or All Layers



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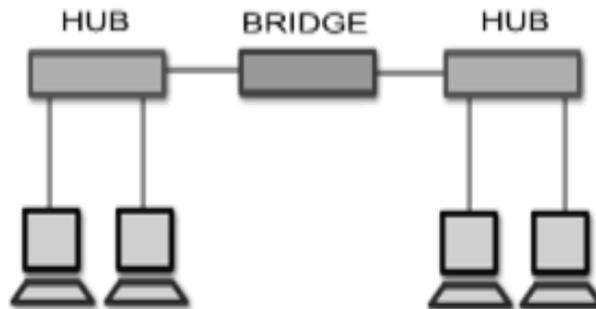
e. What is filtering in bridge?

(Correct Explanation- 4M)

Ans.

Bridges: A bridge is a device which connects two different portions of a computer network. It facilitates host-to-host communications within a network. This divided a big network into smaller networks, called segments. Bridge can send the data frames only to the concerned segment, thus preventing excess traffic.

A bridge maintains a table of host addresses versus the segment numbers to which they belong. When a bridge receives a frame from a host, it examines its tables to check if the address of the destination host is available in the table. If available, it delivers the frame to that segment which is called forwarding. However, if the destination address is not available, the bridge discards it. This is called filtering. If any noise on network occurs because of collision or disturbance in electrical signal, the bridge will consider it as an incorrectly formed frame and will not forward to the segment connected to other port of the bridge. Thus filtering of the unwanted signals to a particular segment of the network takes place by the Bridges.



f. Define FTP. Describe working of FTP.

(Definition & Explanation-3M; Diagram: 1M)

Ans: **FTP:**

Definition: FTP (File Transfer Protocol) is a high-level (application layer) protocol is an interface for any user of the internet to transfer files. The user requests the FTP to either retrieve from or upload a file to a remote server.

Working: FTP presents the user with a prompt and allows entering of various commands for accessing and downloading files that are physically exist on a remote computer. After invoking an FTP application, the user identifies a remote computer and instructs FTP to establish a connection with it. FTP contacts the remote computer using TCP/IP software.



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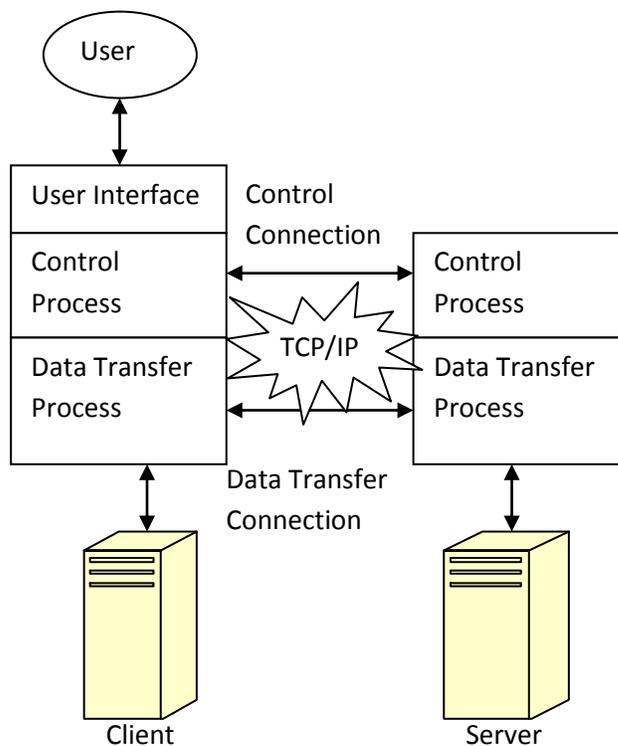
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Once the connection is established, the user can choose to download a file from the remote computer, or can send file to be stored on the remote computer.

FTP uses two connections between a client and a server. One connection is used for the actual file's **data** transfer and the other is used for **control** information (commands and responses).

These two connections and components of FTP are as shown in the diagram



The client has three components namely, User interface, Client control process and client data transfer process. The server has two components namely, the server control process and server data transfer process.

The TCP control connection is made between the control processes of the client and the server. While the data is sent (IP packets) from the server to the client, the server keeps track of the progress of the file: how much data has been sent, the number of bytes sent, the percentage of total file size in bytes and how much remains to be sent. It sends this information simultaneously on the second connection, i.e., control connection. This is used for the successful upload and download of the files. If multiple files are to be transferred, control connection will remain active throughout the entire FTP session, whereas data transfer connection is opened and closed for each file that is to be transferred.



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

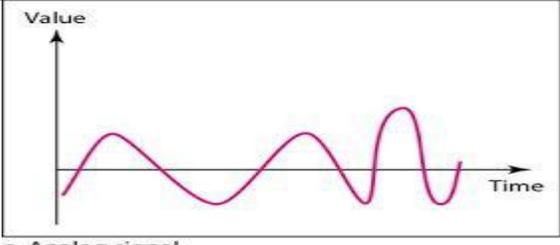
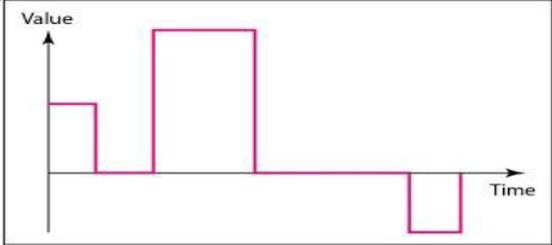
Q.3 .Attempt any FOUR of the following:

16M

a. Give difference between digital signal and analog signal. (4 points)

(Any Four Relevant Points of comparison 1M each)

Ans:

Analog signal	Digital signal
An analog signal has infinitely many levels of intensity over a period of time.	A digital signal has only a limited number of values along its value.
As the wave moves from value A to value B. it passes through and includes an infinite number of values along its path.	Although each value can be any number, it is often as simple as 1 and 0.
Analog signals are continuous in nature.	Digital signals are discrete in nature.
	
Analog signals are higher density.	Digital signals are lower density.
Loss and Distortion is high.	Loss and Distortion is low.
Analog signals are less secure as compare with Digital signal.	Digital signals are more secure
Less bandwidth is require for transmission	High bandwidth is requiring for transmission.
Synchronization not present	Synchronization present.
Examples like Human voice in air, signals in analog electronic devices.	Examples include Computers and other digital electronic devices.
Analog signal is best suited for audio and video transmission.	Digital signal is best suited for computing and digital electronic



Accuracy is less	Accuracy is more
------------------	------------------

b. Explain transmitting/Receiving Handoff operations.
(1M-Definition, 1M-Relevant Diagram & 2M-Procedure)

Ans:

During the conversation, if the mobile phone crosses the cell, the signal can become weak. The MTSO constantly checks the signal level, and if it finds it low, it immediately seeks a new cell that can look after the communication better. The MTSO then changes the cell-carrying channel so smoothly that the user hardly notices. This process of handing the signal off from the old channel to the new one is called handoff. This process is described below.

Step 1: Cell A senses that the user of cell 50 is moving to cell B, and that its signal is becoming weaker. So it alerts the MTSO. This is shown in Fig a.

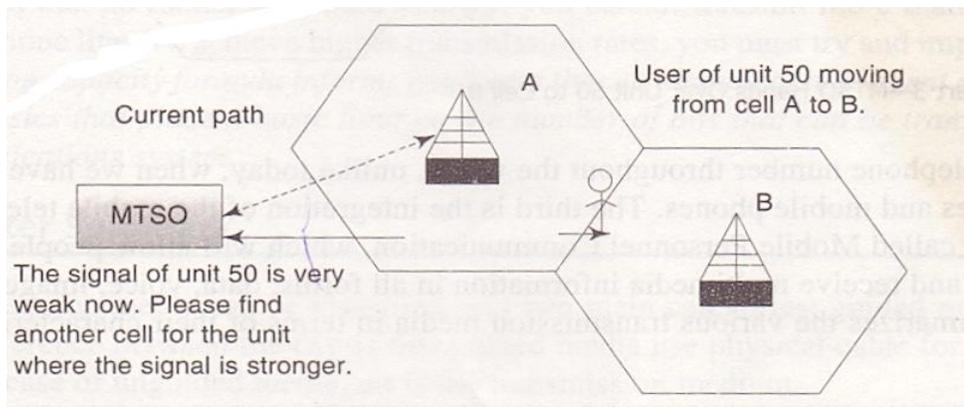


Fig a. : Handoff part a – A unit Becomes Weak in Cell A

Step 2: The MTSO wants to check if any of the adjacent units (B,C, etc.) can take up the responsibility of unit 50. Cell C responds by saying that it cannot do so, as unit 50 is weak in cell C, too. However, cell B says that it is ready to take up the responsibility of unit 50 as it is receiving a strong signal from unit 50. This is shown in Fig. b

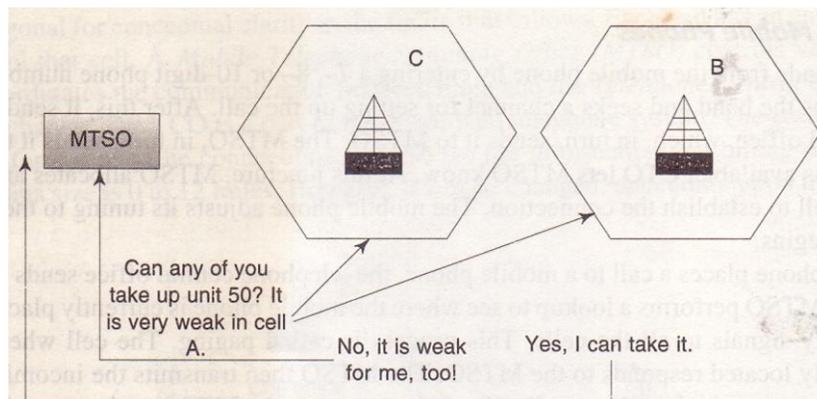




Fig. b : Handoff part b – MTSO Enquires to see if Anybody Can Take up Unit 50

Step 3: The MTSO redirects unit 50 from cell A to cell B. This is shown in Fig c.

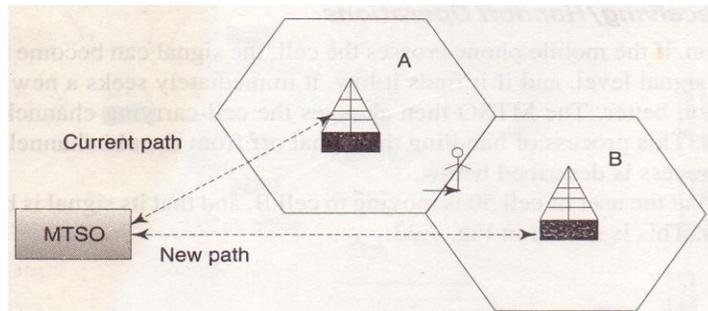


Fig. c : Handoff part c – MTSO Hands Over Unit 50 to Cell B

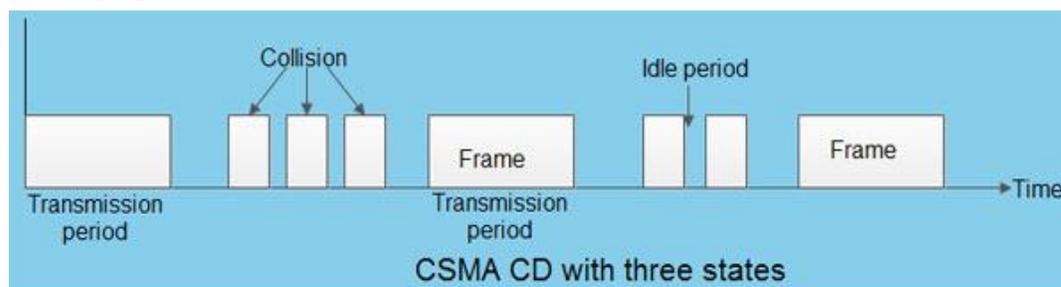
c. Explain working of CSMA/CD.

(Working – 3M, Any Relevant Diagram 1M)

Ans:

To reduce the impact of collisions on the network performance, Ethernet uses an algorithm called CSMA with Collision Detection (CSMA / CD): CSMA/CD is a protocol in which the station senses the carrier or channel before transmitting frame just as in persistent and non-persistent CSMA. If the channel is busy, the station waits. It listens at the same time on communication media to ensure that there is no collision with a packet sent by another station. In a collision, the issuer immediately cancels the sending of the package. This allows to limit the duration of collisions: it do not waste time to send a packet complete if it detects a collision. After a collision, the transmitter waits again silence and again, it continued his hold for a random number; but this time the random number is nearly double the previous one. From a packet is transmitted successfully, the window will return to its original size.

Again, this is what we do naturally in a meeting room if many people speak exactly the same time, they are realizing account immediately (as they listen at the same time they speak), and they interrupt without completing their sentence. After a while, one of them speaks again. If a new collision occurs, the two are interrupted again and tend to wait a little longer before speaking again.





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d. What is internetworking? Why is it required?

(Definition 1M; 3M for Requirement)

Ans:

An internetworking is collection of individual networks, connected by intermediate Networking devices, that functions as a single large network.

The main reason for having an internet is that each computer network is designed with a specific task in mind. For example, a LAN is typically used to connect computers in a smaller area (such as an office) and it provides fast communication between these computers. On the other hand, WAN technologies are used for communication over longer distances. As a result, networks become specialized entities. Moreover, a large organization having diversifying needs has multiple networks. In many cases, these networks do not use the same technology in terms of the hardware or communication protocols.

Consequently, a computer can only communicate with other computers attached to the same Network. As more and more organizations had multiple computer networks in the 1970s, this Became a major issue. Computer networks became small islands! In many cases, an employee had to physically move for using computers connected to different networks. For example, to print a document, the employee would need to use a computer that connected to a print server. Similarly for accessing a file on another network, the employee had to use a computer on that network, and so on. Clearly, this was a nuisance. This affected productivity, as people did not like to move around for performing trivial tasks.

As a result, the concept of universal service came into being. In simple terms, it means that there is no dependence on the underlying physical technology, or on the fact that were many separate physical networks. Like a telephone network, people wanted a single computer network in their organization. A user should be able to print a document or send a message to any other user from his computer, without needing to use a separate computer on another network for each such task. For this to be possible, all computer networks should be connected together. This means that there should be a network of physically separate networks. This forms the basis of internetworking.

e. Explain leased line connection

(Description 4M; Any relevant description shall be considered)

Ans:

Many medium and large organizations generally need a high bandwidth for connecting to the Internet, because the number of users is very high. Suppose 100 users in an office need Internet access at the same time. In such situations, the simplest option of obtaining 100 dial-up accounts from an ISP is not very attractive. This is because; having 100 ISP accounts is not good enough. To connect these 100 users to the ISP, the organization would also need



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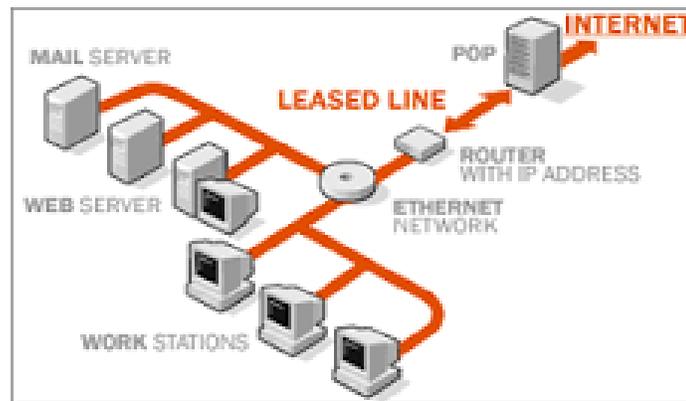
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100 telephone lines! Clearly, this is not acceptable for reasons of cost and maintenance. Also, the moment a new user is added, a new Internet connection and telephone line would be required for the user. Telephone companies and ISPs have come up with the option of offering more bandwidth from their premises, and then let the organization divide it internally the way it wants. For this, an ISP provides an option of leasing lines to these kinds of organizations. In simple terms, a leased line can be thought of as a very thick pipe connecting the office of an organization with the internet via the ISP. A medium-to-big organization obtains a digital line from an ISP for a fixed charge per month, regardless of its actual use. That is organization may or may not use the complete bandwidth of the leased line, but it would still pay a fixed charge. In return, the organization gets larger bandwidth from the ISP, shared by multiple users mostly through a LAN.



f. Explain working of ICMP.

(Description 4M; Any relevant description shall be considered)

Ans:

ICMP is a protocol which performs network administration task and reports the errors of different types. ICMP is a connectionless protocol.

It functions as a monitor of Internet layer communication enabling intermediate or end systems to return error message to the sender. For example, when a router has problem, processing a datagram during the journey to its destination, it generates an ICMP message and transmits it back to the source system. The source system may take action to alleviate the problem in response to the ICMP message. The data field in a ICMP error message contains entire 20 byte IP header of the datagram that caused the problem, plus the first 8 bytes of the datagrams own data field. Following are the most important types of ICMP error messages:

Message Type	Description
Destination unreachable	Packet could not be delivered
Time exceeded	Time to Live (TTL) field hit 0.
parameter problems	Invalid header field



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Source quench	Choke packet
Redirect	Teach a router about geography
Echo request	Ask a machine if it is alive
Echo reply	Yes, I am alive
Timestamp Request	Same as Echo Request, but with timestamp
Timestamp reply	Same as Echo reply, but with timestamp

The message format of ICMP is as given below.

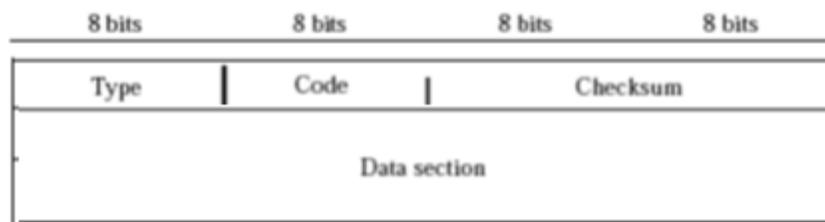


Fig. ICMP message format

Q.4 Attempt any FOUR of the following:

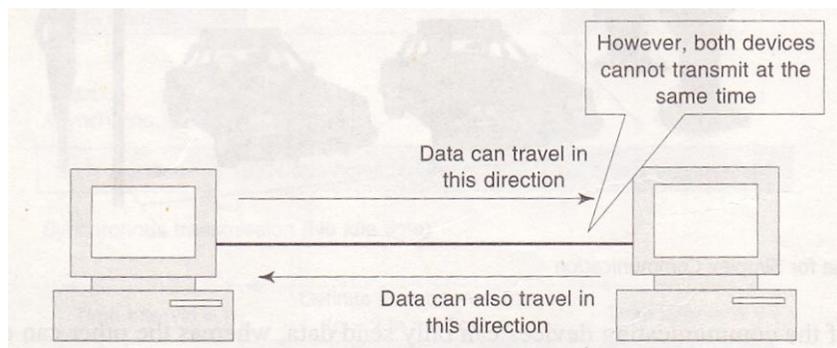
16M

a. Explain Half duplex system and full duplex system with diagram.
(Half duplex system 2M & Full duplex system 2M)

Ans:

Half duplex: In the half-duplex mode, both devices can transmit data, though not at the same time. When one device is sending data, the other must only receive it, and vice versa. This is conceptually similar to a street that has a single lane for vehicle traffic. When vehicles from one side are coming, the vehicles from the other side must wait.

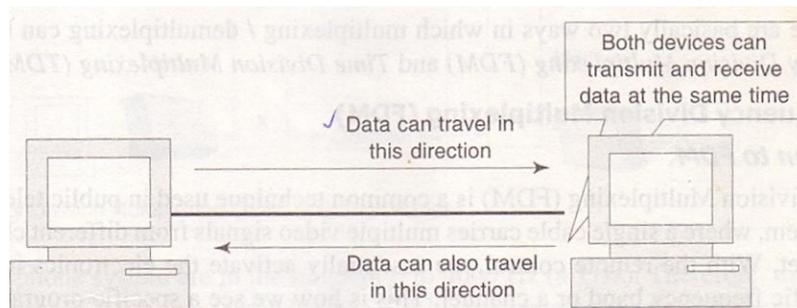
Thus, both sides take turns to send data as shown in diagram. This requires a definite turn around time during which the device changes from the receiving mode to the transmitting mode. Due to this delay, half-duplex communication is slower than simplex communication. However, it is more convenient than simplex communication, as both the devices can send and receive the data.





Examples of half-duplex communication are conversations over walkie-talkie.

Full duplex: In full duplex (or simply duplex) communication mode, both the devices can transmit data at the same time. It means that both devices are capable of sending as well as receiving data at the same time. This is like a two-way street with traffic flowing in both directions at the same time. It is also similar to a telephone conversation, where both parties can talk to each other simultaneously.

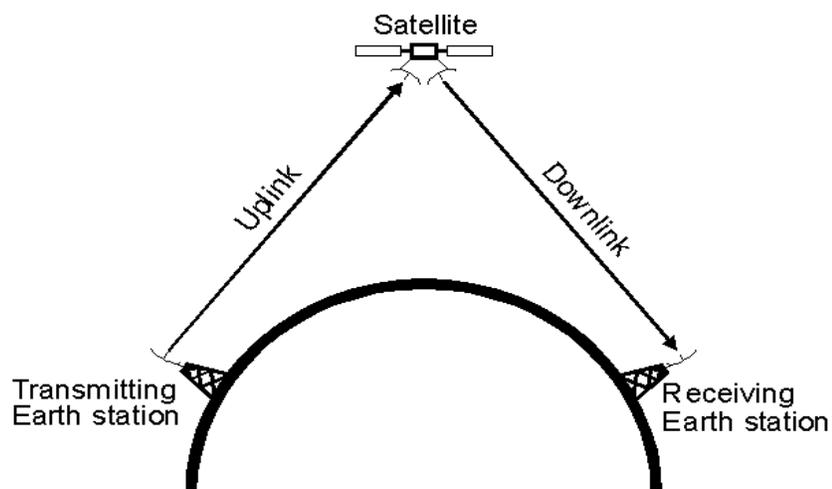


b. Explain satellite communication with diagram.

(Description 2M; Diagram 2M)

Ans:

Satellite communication is similar to terrestrial microwave communication except that satellite acts as one of the station. Satellite performs the functions of an antenna and the repeater together. Ground station A sends information to ground station B via the satellite.



Two frequency bands are used for signals from earth to satellite (uplink) and from satellite to earth (down link). Satellite takes uplink signal coming from sender process it & converts to



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downlink frequency & transmits it towards earth. The coverage area over which the signal of satellite is available is called as footprint of satellite.

Three Categories of Satellites based on the altitude are

1. Geostationary Earth orbit (GEO)
2. Middle-Earth-orbit (MEO)
3. Low-Earth-orbit (LEO)

c. What is connection- oriented service and connectionless service?
(*Connection oriented service 2M & Connection less services – 2M*)

Ans:

Connection Oriented Service:

There is a sequence of operation to be followed by the users of connection oriented service. These are:

1. Connection is established
2. Information is sent
3. Connection is released

In connection oriented service we have to establish a connection before starting the communication. When connection is established we send the message or the information and then we release the connection.

Connection oriented service is more reliable than connectionless service. We can send the message in connection oriented service if there is an error at the receivers end.

Example of connection oriented is TCP (Transmission Control Protocol) protocol.

Connectionless Services:

It is similar to the postal services, as it carries the full address where the message (letter) is to be carried. Each message is routed independently from source to destination. The order of message sent can be different from the order received.

In connectionless the data is transferred in one direction from source to destination without checking that destination is still there or not or if it prepared to accept the message. Authentication is not needed in this.

Example of Connectionless service is UDP (User Datagram Protocol) protocol.

d. Explain with neat labeled diagram TCP/IP reference model.
(*Diagram – 1M & Description – 3M*)

Ans:

The TCP/IP reference model is the network model used in the current Internet architecture. The reference model was named after two of its main protocols, TCP (Transmission control Protocol) and IP (Internet Protocol).



There are versions of this model with four layers and with five layers.

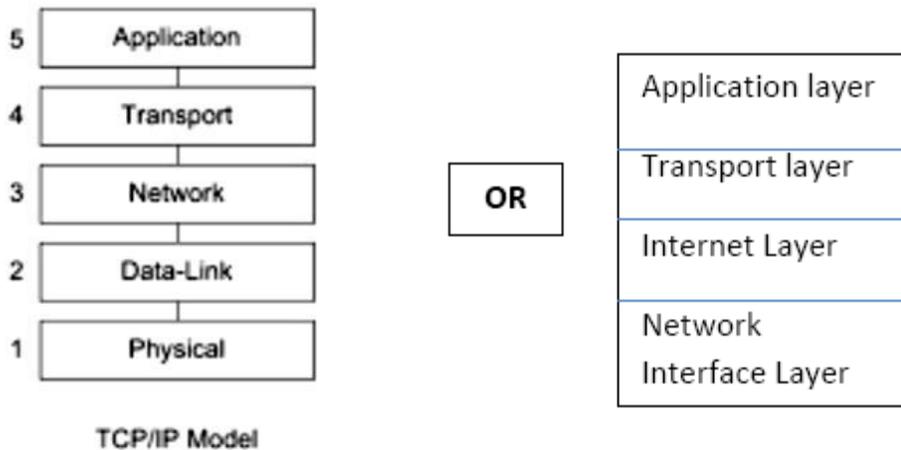


Figure: TCP/IP five layer model

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.



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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).

e. What is multicast routing?

(Any Relevant Description – 4M)

Ans:

- Multicast IP Routing protocols are used to distribute data (for example, audio/video streaming broadcasts) to multiple recipients. Using multicast, a source can send a single copy of data to a single multicast address, which is then distributed to an entire group of recipients.
- A multicast group identifies a set of recipients that are interested in a particular data stream, and is represented by an IP address from a well-defined range. Data sent to this IP address is forwarded to all members of the multicast group.
- Routers between the source and recipients duplicate data packets and forward multiple copies wherever the path to recipients diverges. Group membership information is used to calculate the best routers at which to duplicate the packets in the data stream to optimize the use of the network.
- A source host sends data to a multicast group by simply setting the destination IP address of the datagram to be the multicast group address. Any host can become a source and send data to a multicast group. Sources do not need to register in any way before they can begin sending data to a group, and do not need to be members of the group themselves.
- A **Multicast Routing Protocol** is used to communicate between multicast routers and enables them to calculate the multicast distribution tree of receiving hosts. Protocol Independent Multicast (PIM) is the most important Multicast Routing Protocol.

f. Explain RARP with neat diagram.

(Description – 2M & Diagram – 2M)

Ans.

RARP (Reverse Address Resolution Protocol):

Reverse Address Resolution Protocol (RARP) finds the logical address for a machine that knows only its physical address. Each host or router is assigned one or more logical (IP) addresses, which are unique and independent of the physical (hardware) address of the machine. To create an IP datagram, a host or a router needs to know its own IP address or addresses. The IP address of a machine is usually read from its configuration file stored on a disk file. However, a diskless machine is usually booted from ROM, which has minimum booting information. The ROM is installed by the manufacturer. It cannot include the IP



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address because the IP addresses on a network are assigned by the network administrator. It is the RARP which designed for diskless workstations that have no means of permanently storing their TCP/IP configuration information or TCP/ IP settings. While ARP broadcasts an IP address in an effort to discover its equivalent hardware address, RARP broadcasts the systems hardware address. RARP server responds by transmitting the IP address assigned to that client computer. RARP can supply IP address to all the systems on a network segment. The machine can get its physical address (by reading its NIC), which is unique locally. It can then use the physical address to get the logical address by using the RARP protocol.

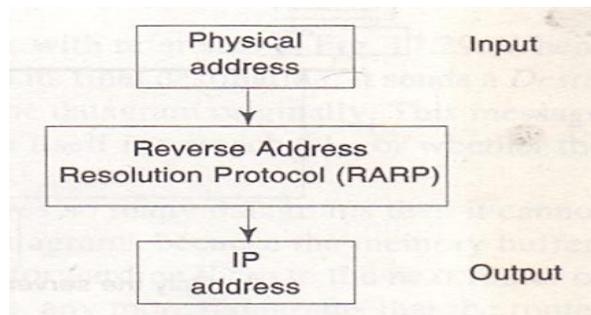


Fig: Reverse Address Resolution Protocol

Q.5 Attempt any FOUR of the following:

16M

a. Explain two types of communication system. Give suitable examples.

(Any two types -2M; examples- 2M)

Ans:

Real life data communication process involves many hardware devices and software techniques, which makes it an extremely complex process. The real-life data communication process (Far simplified) is shown below.

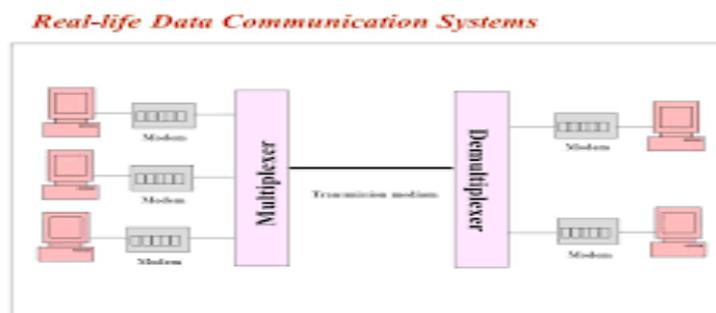


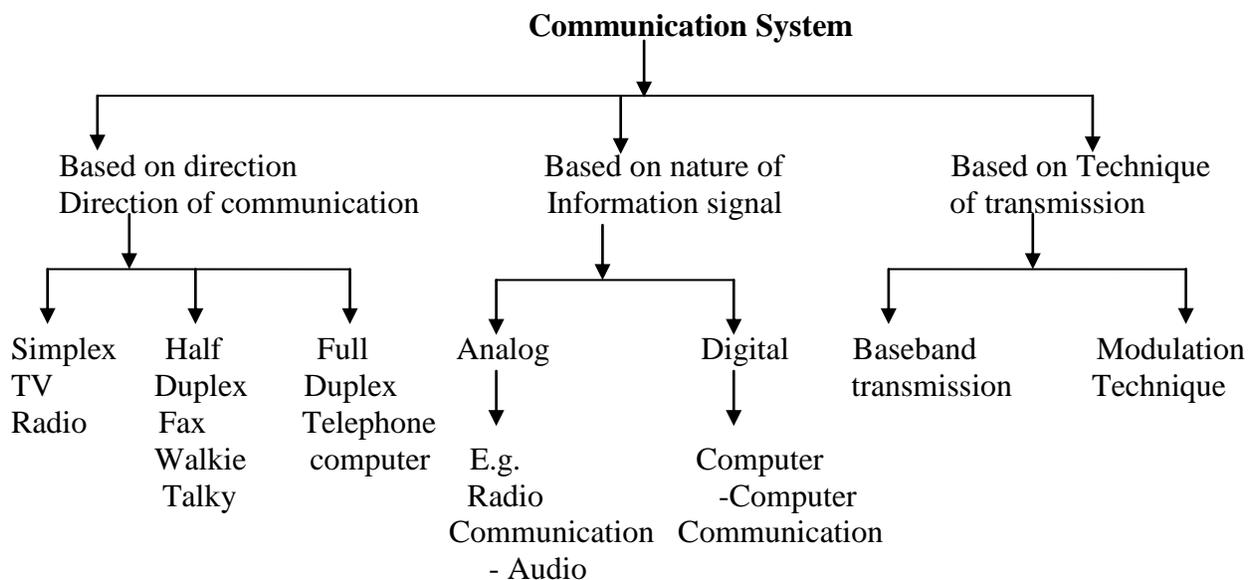
Fig. Real-life Communication system



Data communication are the exchange of data between two devices/computer.

The communication systems can be basically categorized into three types based on-

- 1) Whether, the system is based on direction
- 2) Whether, the input signal is analog or digital
- 3) Whether, the system uses baseband transmission or modulation technique.



b. What are routers? Explain with diagram.

(Definition 1M, Diagram-1M, Explanation-2M)

Ans.

A router is a device that connects two or more computer networks together. This allows two or more disparate computer networks to send data to each other.

Router is a device which works in the network layer of OSI Model. It comprises hardware and software. In software it has operating system and routing protocol. Routers are of 2 types, Static and dynamic router.



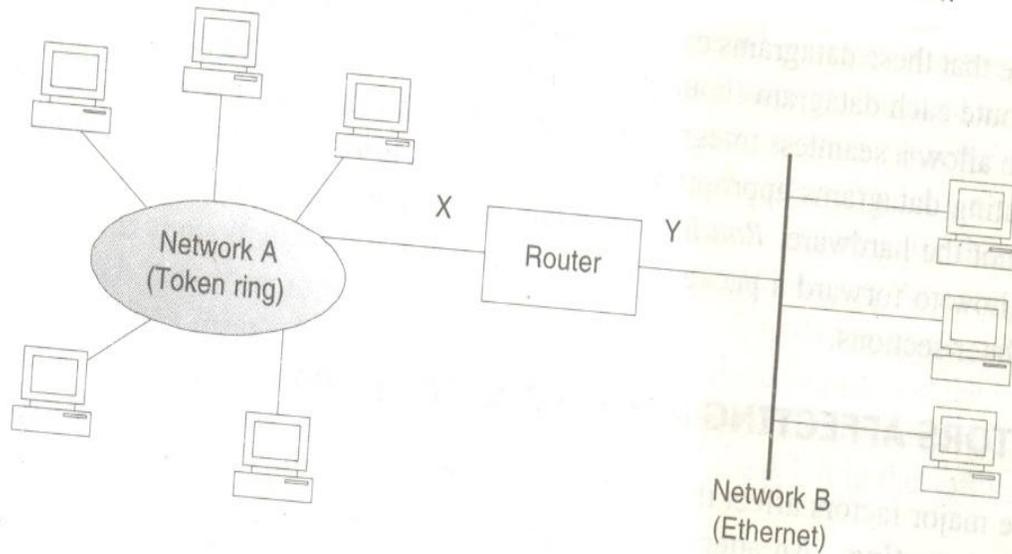
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The figure shows a router connecting to two networks A and B at points X & Y. Router will have two interface and two Network Interface Cards (NIC)- One to internet with n/w A at point X and other to interact with n/w B at pt Y.

This enables the routers to send data between the two networks A & B. A router can connect more than two networks also. Then it will have many interfaces.

c. Name four standard organization. Give its functions each.

(Listing Any 4- 2M; function - 1/2M each)

Ans:

Four Standard organizations are:-

- 1) The International Standard s Organization (ISO)
- 2) The International Telecommunication Standards Union- Telecommunication Standards Sector (ITU-T)
- 3) The American National Standards Institute (ANSI)
- 4) The Institute of Electrical & Electronic Engineers (IEEE)
- 5) The Electronic Industries Association (EIA)

Functions:

ISO: - Standard Creation Organization. ISO is a non profitable organization. OSI model as a networking protocol is contribution of ISO.

ITU-T: - Created to resolve issues related to incompatibility of individual nations standard for data communication. V-series for modems, ISDN, are contribution of ITU-T



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ANSI: - A private non-profit organization undertaking projects for social benefits of the US citizens. Professional groups, Industry representatives, government regulatory bodies and consumer groups represent ANSI.

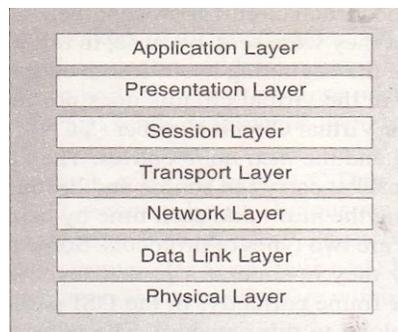
IEEE: - Focuses on development in Electric & Electronic Engineering & radio services. Also oversees the development and adoption of International computer and communication standards.

EIA: - Non- profitable organization focuses on public awareness & lobbying for standards. Main contribution is development of Interfaces for physical connections and electronic signal specifications for data communications.

d. Explain ISO-OSI reference model with diagram.

(Diagram 2M- explanation- 2M)

Ans.



OR

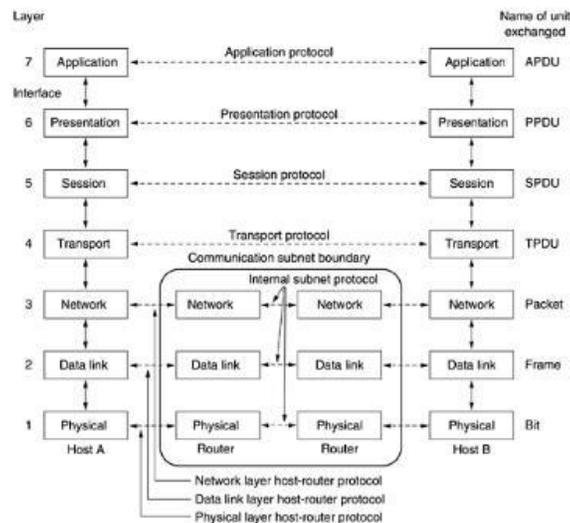


Fig. ISO-OSI reference model



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Physical layer is concerned with sending raw bits between the source and destination nodes. It takes the following factors into account signal Encoding, Medium, Bit Synchronization, Transmission type, Topology, Bandwidth, etc.

Data link layer is responsible for transmitting frame or packet between adjacent nodes. It handles addressing, Flow control, Media Access Control, Synchronization, Error Control etc.

Network layer is responsible for routing the packet within the subnet. It handles Congestion control, Logical addressing, Accounting & billing, Error free delivery between source destination.

Transport Layer is responsible for Host-Host message delivery, Application to Application. Communication, Segmentation & Reassembly, Connection.

Session Layer: Main function is to establish, maintain and synchronize the interaction between two communicating hosts.

Presentation Layer deals translation, Encryption, Compression, etc.

Application layer is the top most layer providing various services like network virtual terminal(NVT), directory services, File Access and transfer, Mail services, remote login etc.

e. Explain Internal Architecture of ISP.

(Diagram 2M, Description 2M)

Ans.

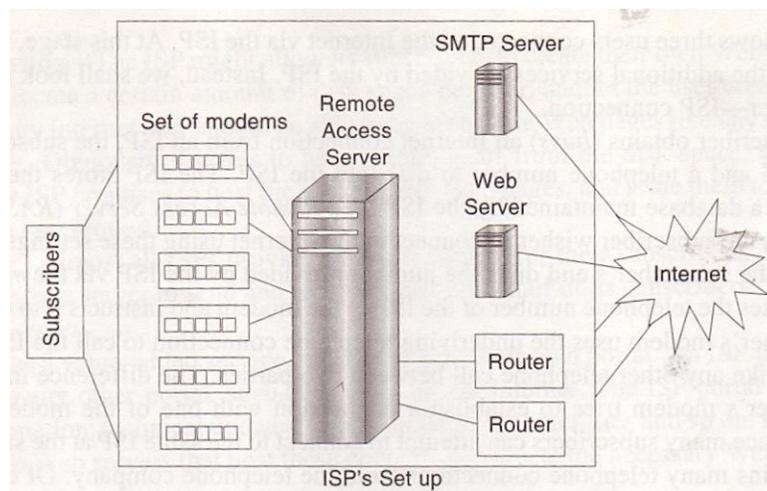


Fig. Internal Architecture of ISP



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At fundamental level an ISP has to essentially provide an Internet access to its subscriber. It is compulsory feature of an ISP. Optionally, it may also provide some other services for its subscribers such as

- Web page hosting
- Email- Access (SMTP Server)
- ISP portal (Web Server).

Each of these services necessitates hardware/software in the ISP premises as shown in the figure.

A subscriber of the ISP connects to one of the telephone lines of the ISP via a modem. The ISP's modem then routes the subscriber to the Remote Access server (RAS) to authenticated him. Once the user is authenticated, the user can send requests for web pages, send/receive emails or files etc. The user's interaction with the Internet is coordinated by the RAS. ISP needs the SMTP server for storing the subscriber's email. Till the subscriber connects to the Internet Web server is used by ISP to set up a portal and also to store web pages created by the subscribers. Routers route the user's request for web pages to the internet.

f. Give the name of layer where following protocols are related / belong to

- SMTP**
 - TCP-UDP**
 - IP**
 - ARPANET**
- (1M each)*

Ans:

- SMTP – APPLICATION LAYER
- TCP-UDP – TRANSPORT LAYER
- IP – NETWORK LAYER / INTERNET LAYER
- ARPANET – DATA LINK LAYER/ LINK LAYER

Q.6 Attempt any FOUR of the following:

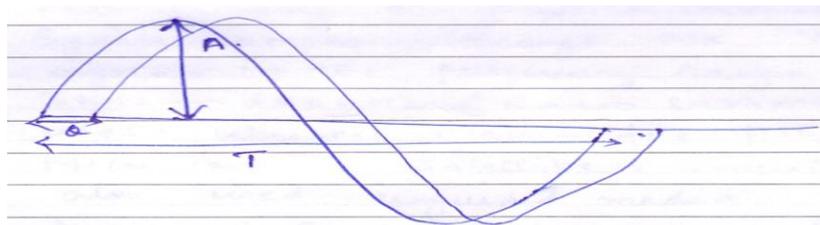
16M

a. State the meaning of

- Phase**
- Frequency**
- Amplitude**
- Time period**

(Each definition – 1 M)

Ans:





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- i. Phase of a signal is the position of a waveform relative to time zero (unit-radians or degrees)
- ii. $F = \frac{1}{T}$ Frequency is the number cycles completed in one second (unit-Hertz)
- iii. A- Amplitude is the strength of the signal (unit -Volts)
- iv. T- Time period the time taken for completion of one cycle (unit-Seconds)

b. Explain unguided (wireless) media.

(Explanation of wireless – 4M)

Ans.

Unguided media transport Electro Magnetic waves without using a physical conductor. Signals propagate through air, space and water. Signals are normally broadcast through free space and thus are available to anyone who has a device capable of receiving them. It is broadly classified into following types:

- Radio waves
- Microwaves
- Infrared waves

Wireless media uses upper end of Electromagnetic spectrum. Unguided media is used when cable installation is difficult or troublesome. The signals in the frequency range 3KHz-300GHz (Radio communication) uses wireless media for propagation. Microwave & Satellite communication also used as unguided media. Microwave communication is a line of sight propagation. Cellular communication also uses an unguided media.

Wireless LAN (WLAN), Bluetooth etc are also examples of Wireless Communication.

c. State two advantages and two disadvantages of Bus topology.

(Any 2 Advantages- 2M, any two Disadvantages -2M)

Ans.

Advantages of Bus topology –

- 1) Easy to install
- 2) Uses less cable
- 3) Cost efficient
- 4) Easy to understand and layout the network
- 5) Can extend bus by using BNC connector.

Disadvantages of Bus topology:-

- 1) Difficult to add new nodes
- 2) Fault isolation is difficult
- 3) If the main bus breaks down, the whole network cannot function
- 4) Terminator is required at the end of the bus, otherwise ringing will happen.
- 5) Only one node can transmit data at a time.



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d. Draw and explain TCP segment header format.

(Diagram 2M, Explanation 2M)

Ans.

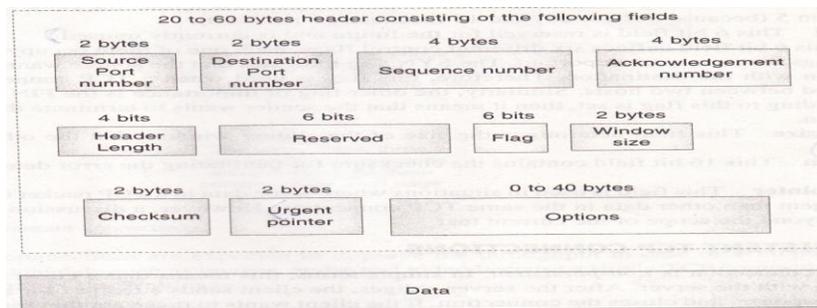


Fig. TCP Header format

Source port number (2 bytes) : This signifies the port number of the source computer corresponding to the application or process.

Destination port number (2 bytes) : This signifies the port number of the destination computer corresponding to the application or process.

Sequence number (4 bytes) : This field identifies the location of the data in this segment in relation to the entire sequence.

Acknowledgement number (4 bytes): If the destination host receives a packet with sequence number X correctly, it sends $X + 1$ as the acknowledgement number back to the source. Thus, it defines the sequence number that the destination is expecting to receive next from the source.

Header length (4 bits): This field specifies the number of four-byte words in the TCP header.

Reserved (6 bits) : This field is unused.

Flag (6 bits) : This field defines six different control flags, each one of them occupying one bit.

Window size (2 bytes): This field determines the size of the sliding window that the other party must maintain.

Checksum (2 bytes) : This field contains the checksum for facilitating the error detection and correction.



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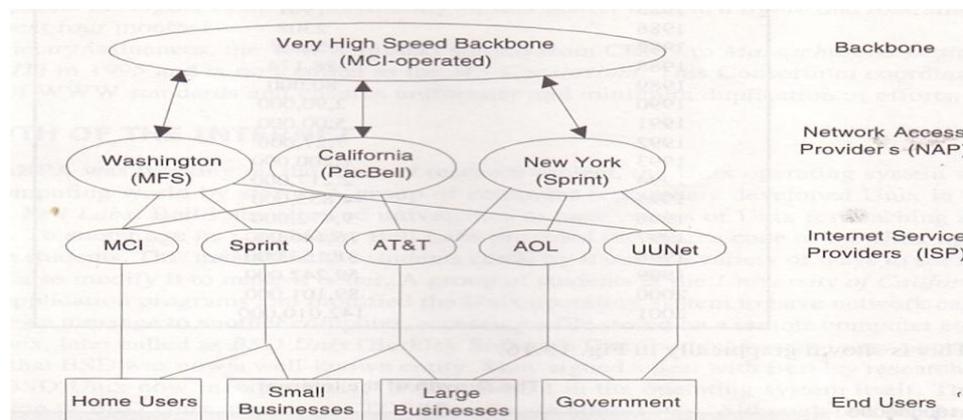
Urgent pointer (2 bytes): This field is used in situations where some data in a TCP packet is more important or urgent than order data in the same TCP connection.

e . Explain the internet topology.

(Diagram 2M, Explanation 2M)

Ans.

Internet is the world wide network of computer networks. It is organized to form a hierarchy that makes it very simple to understand and operate. The following figure shows different parts of the hierarchy.



At the very top, there is a very high speed backbone and at the other end there are the users and businesses. There are intermediate layers of network access provider (NAC) and Internet Service Providers (ISPs)

A home user dials into an ISP using a telephone connection with a modem. The ISP routes the call to a Network Access Provider (NAP) which in turn connects to a high speed back bone at a convenient network access point. This completes the circuit. Now, the user can send/ receive any message to anyone else connected to the Internet.

f. Explain IP addressing procedure in detail.

(Explanation of IP addressing – 2M, Classes -2M)

Ans.

IP address: It is a unique logical 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). The IPv4 address include two parts namely, Network Identification number (net id) and Host identification number (host id). The network id is given globally and host id can be given locally.

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.



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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

Class A	0	net id (7 bit)	host id (24 bit)
Class B	10	net id (14 bit)	host id (16 bit)
Class C	110	net id (21 bit)	host id (8 bit)
Class D	1110	multicast (28 bit)	
Class E	1111	future use (28 bit)	

Fig. Classes of IP addressing