



**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:**

**12**

**a) State any two advantages of FDM.**

**(Any two, 2M)**

- 1) A large number of signal (channels) can be transmitted simultaneously.
- 2) FDM does not require synchronization between transmitter and receiver for proper operation
- 3) Demodulation of FDM is easy.
- 4) Due to slow narrow band fading, only a single channels gets affected.

**b) Compare guided media and unguided media(any two points)**

**(Any two points 2M)**

<b>Guided media</b>	<b>Unguided media</b>
The signal energy propagates within the guided media i.e. through wires	The signal energy propagates through air
It is mainly suited for point to point line configurations.	It is mainly used for broadcasting purpose.
The signal propagates in the form of voltage, current or photons.	The signal propagates in the form of electromagnetic waves.
Examples of guided media are:- Twisted Pair Cable, Co-axial Cable, Optical Fiber Cable	Examples are:- Microwave or Radio Links Infrared



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c) **List different types of satellites.**

(Any Four 2M)

- 1) Geostationary earth orbit (GEO)
- 2) Low earth Orbit (LEO)
- 3) Middle Earth Orbit(MEO)
- 4) Communication satellites
- 5) Navigation satellites
- 6) Astronomy satellites
- 7) Remote sensing satellites
- 8) Space exploration satellites
- 9) Search and rescue satellites
- 10) Atmospheric studies satellites

d) **What is a SMDS?**

(SMDS - 2M)

- 1) Switched Multimegabit Data Services (SMDS) is a high speed MAN technology.
- 2) It is a packet switched datagram service for high speed MAN data transmission.

e) **What is repeater? Give its use.**

(Repeater 1M; Uses 1M)

A **repeater** is an electronic device that receives a signal and retransmits it at a higher level or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances.

**Uses (any one)**

A *telephone repeater* is an amplifier in a telephone line,

An *optical repeater* is an optoelectronic circuit that amplifies the light beam in a optical fiber cable;

A *radio repeater* is a radio receiver and transmitter that retransmit a radio signal.

f) **List the classes of IP address.**

( $\frac{1}{2}$  mark for each class, Any four class)

Different classes of IP address.

- Class A
- Class B
- Class C
- Class D
- Class E

g) **List different types of network connecting devices.**

(List 2M)

Types of network connecting devices

- 1) Networking Devices
  - a) Repeaters
  - b) Bridges
- 2) Inter-networking Devices
  - a) Routers
  - b) Gateways

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c) What is encapsulation?

(Definition – 2M)

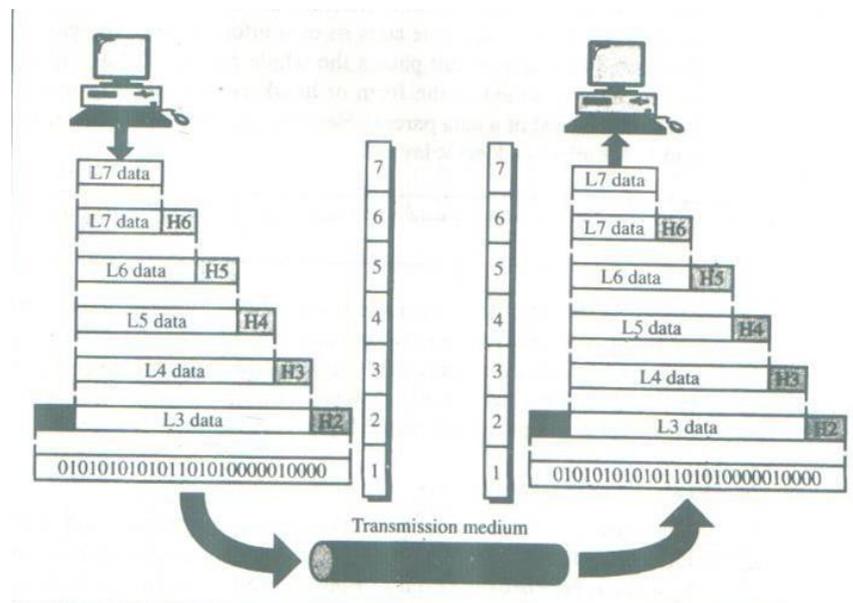
**Note: Any relevant explanation or diagram may also be considered.**

The protocols operating at the various layers work together to supply a unified quality of service. Each protocol layer provides a service to the layers directly above and below it. The process of adding the **headers and trailers** to the data is called as **data encapsulation**.

OR

A packet(header and data ) at level 7 is encapsulated in a packet at level 6.The whole packet at level 6 is encapsulated in a packet at level 5, and so on. In other words, the data portion of a packet at level N-1 carries the whole packet (data and header and maybe trailer) from level N. The concept is called **encapsulation**.

OR



**B. Attempt any TWO of the following:**

**8**

a) Describe characteristics of data communication systems.

(1 mark each)

The effectiveness of any data communications system depends upon the following four fundamental characteristics:

- 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.

**b) Describe following:**

- i. **Wi-Fi**
- ii. **Wi-Max**  
(2 Marks Each)
- i. **Wi-Fi**

Wi-Fi is the name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections. Wi-Fi is simply a trademarked phrase that means *IEEE 802.11*.

**IEEE 802.11 wireless LAN:** The 802.11 architecture defines two types of services and three different types of stations.

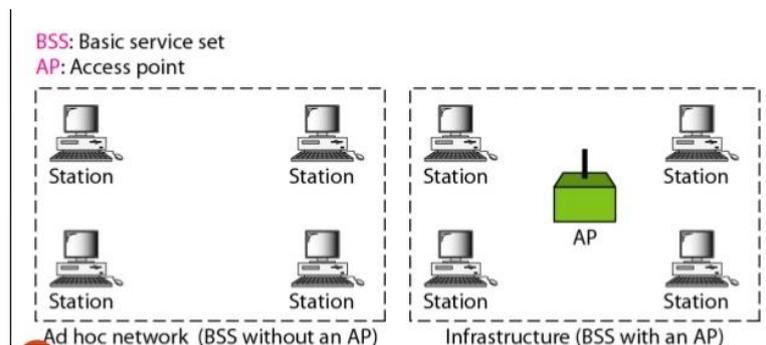
**802.11 services:**

The two types of services are

- 1) Basic services set (BSS)
- 2) Extended services set (ESS)

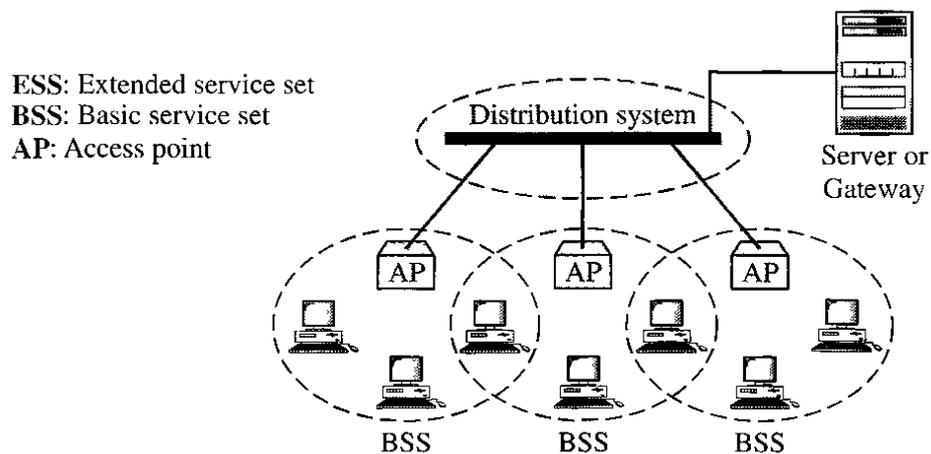
**Basic services set (BSS)**

- 1) The basic services set contains stationary or mobile wireless stations and a central base station called an access point (AP).
- 2) The use of an access point is optional.
- 3) If the access point is not present, it is known as a standalone network. Such a BSS cannot send data to other BSSs. These types of architecture are known as ad hoc architecture.
- 4) The BSS in which an access point is present is known as an infrastructure network.



**Extended services set (ESS):**

- 1) An extended service set is created by initializing two or more basic services set (BSS) having access points (APs).
- 2) These extended networks are created by joining the access points of basic station set through a wired LAN known as a distribution system.
- 3) The distribution system can be any IEEE LAN.
- 4) There are two types of stations in ESS:
  - **Mobile Station:** These are normal stations inside a BSS.
  - **Stationary Station:** These are AP stations that are part of a wired LAN.Communication between two stations in two different BSSs usually occurs via two APs. A mobile station can belong to more than one BSS at the same time.



## ii. Wi-Max

**Define:** Wi-Max is worldwide interoperability for Microwave Access. It is a wireless communication standard which can provide data rates up to 1 Gbps.

It refers to interoperable implementation of IEEE 802.16 family of standards.

### Uses and Application:

- 1) To provide portable mobile broadband connectivity.
- 2) It can be used as an alternative to cable, digital subscriber line (DSL) for providing a broad band access.
- 3) To provide services such as voice on IP (VOIP)
- 4) For providing a source of internet connectivity.

### Internet Access

- 1) Wi-Max is capable of providing at home or mobile internet access across the whole city or country.
- 2) It is cheap to use Wi-Max to provide Internet Access to the remote locator.

### c) Explain the relation between TCP and IP.

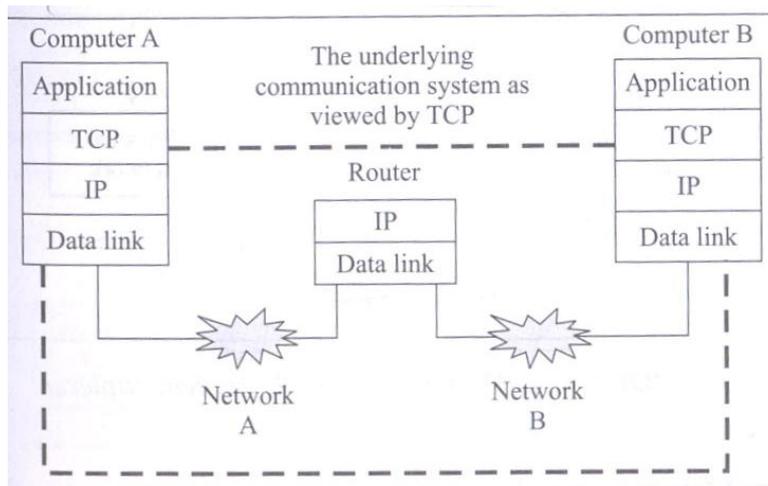
(Diagram 1M, explanation 3M)

- 1) Each TCP message gets encapsulated in an IP datagram and then the datagram is sent across the internet.
- 2) IP acts like the postal service that simply transfers datagrams between two computers; therefore, from the view point of TCP, IP is simply a communication channel that connects computers at two endpoints. Thus, TCP views the entire internet as a communication channel that can accept and deliver messages without altering or interpreting their contents.
- 3) From the view point of IP, each TCP message is some data that needs to be transferred.

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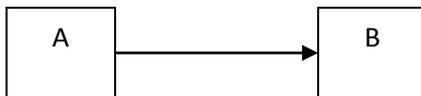
**Q.2. Attempt any FOUR of the following:**

a) **List and describe various communication modes.**

(Explanation 2M; examples 2M)

**Simplex:**

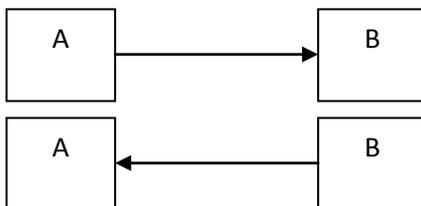
In these systems, the information is communicated only in one direction, called as simplex system eg. TV broadcasting or radio.



**Half duplex:**

In these systems, the information is communicated only by one party in one direction, & another party can not transmit until current sender releases transmission link called as simplex system eg. Walky-Talky, FAX

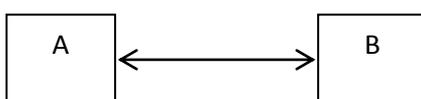
Transmission one at a time but both way



**Full duplex:**

In these systems, both parties involved in communication can send and receive data simultaneously eg. Mobile communication, telephone, Computer Communication

Transmission both way





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b) State the meaning of

- i. Amplitude
- ii. Frequency
- iii. Bandwidth
- iv. Bauds

(Each 1M)

- i. **Amplitude:** The amplitude of a signal is the absolute value of its highest intensity, proportional to the energy it carries. It is the maximum voltage a signal attains. For electric signals, peak amplitude is normally measured in *volts*.
- ii. **Frequency:** Frequency is the rate of change with respect to time.

OR

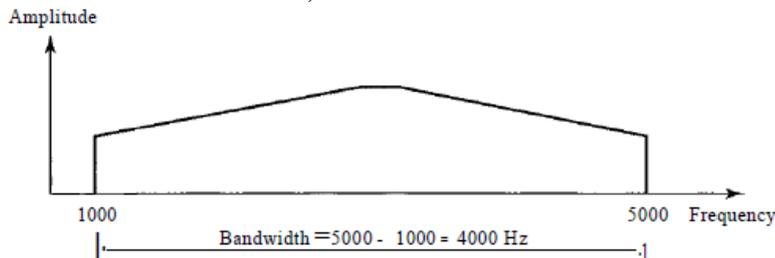
Frequency is also defined as the number of cycles per second, which is the inverse of Period.

- iii. **Bandwidth:** it is a measure of the width of a range of frequencies over which the signal can pass.

OR

The range of frequencies contained in a composite signal is its **bandwidth**.

For example, if a composite signal contains frequencies between 1000Hz and 5000Hz, its bandwidth is  $5000 - 1000$ , or 4000.



- i. Bauds

It is the rate of change of a signal on the transmission medium after the encoding and modulation in a data communication system.

OR

Baud Rate is the number of Signal Units / Sec

c) Draw a neat diagram of circuit switching and explain in brief.

(Diagram -1M, Explanation -3M)

A circuit switched network consists of a set of switches connected by physical links. A connection between two stations is a dedicated path made of one or more links. However, each connection uses only one dedicated channel on each link. Each link is normally divided into  $n$  channels by using FDM or TDM

A circuit-switched network is made of a set of switches connected by physical links, in which each link is divided into  $n$  channels.

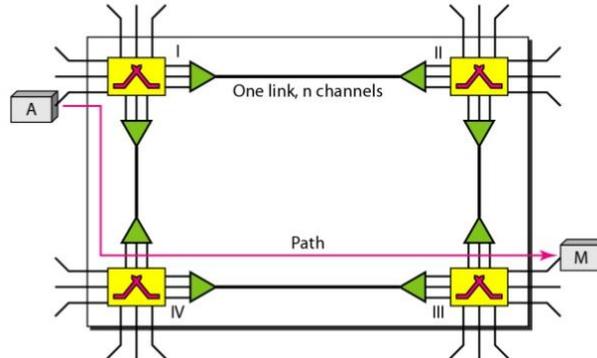
- Circuit switching takes place at the physical layer.
- Before starting communication. This station must take a reservation for the resources to be used during the communication. These resources, such as channels (bandwidth in FDM and time slots in TDM), switch buffers, switch processing time, and switch input/output ports, must remain dedicated during the entire duration of data transfer until the teardown phase.
- Data transferred between the two stations are not packetized (physical layer transfer of the signal). The data are a continuous flow sent by the source station and received by the destination station, although there may be periods of silence.

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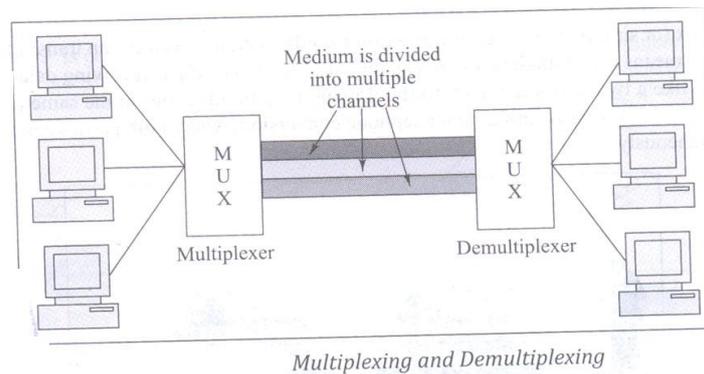
- There is no addressing involved during data transfer. The switches route the data based on their occupied band (FDM) or time slot (TDM). There is end-to-end addressing used during the setup phase.



d) **What is multiplexing? Give its use.**

(Explanation 3M, types 1M)

Multiplexing divides the physical line or a medium into logical segments called channels. In multiplexing, different channels carry data simultaneously over the same physical medium. Hardware equipment called multiplexer (or mux in short) combines (or multiplexes) the inputs from different sources, and loads them on different channels of a medium. The combined data traverses over the medium simultaneously. At the destination, a demultiplexer (also called demux) separates (or demultiplexes) the signals meant for different destinations. The demultiplexer sends these separated signals appropriately to the different destinations. This is depicted in fig. This is cheaper than having three separate lines.



Thus, the mux is responsible for both multiplexing and demultiplexing.

**Types of Multiplexing**

There are basically two ways in which multiplexing and demultiplexing can be achieved. They are **Frequency Division Multiplexing (FDM)** and **Time Division Multiplexing (TDM)**.

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e) **What is WAN addressing? Give its use.**

**(WAN Addressing 2M, uses 2M)**

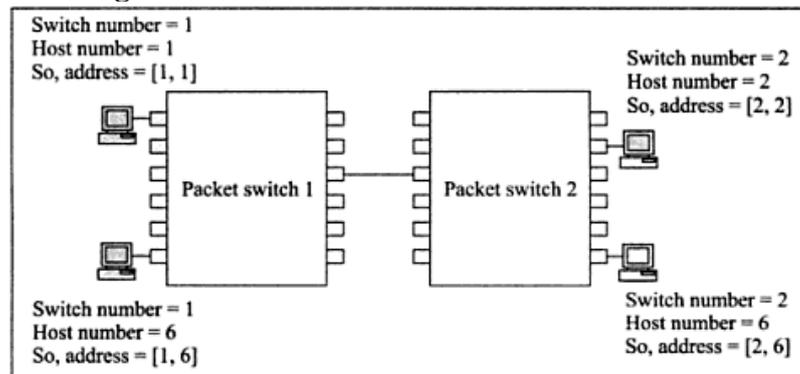
**WAN Addressing:** -WAN addressing is hierarchical addressing system .The address of a host on WAN is composed of two parts as follow

1. Switch no:-It identifies switch to which host is connected
2. Host no.:- It identifies Host which is attached to that switch

Overall address is made up of combination of switch no. & host no. as shown in following fig

<b>switch no</b>	<b>.</b>	<b>Host no</b>
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**Fig:-WAN Addressing scheme**



In given Example hosts are connected to WAN switches 1,2 The host in this example will be identified by its switch ID & its own ID relevant to that switch .

**Uses:**

- 1) WAN IPs is commonly used for server connections, because the address can be used to connect to servers over the Internet.
- 2) The efficient routing of the packets can be done by the hieratical nature of WAN addressing.

f) **Explain DQDB (Distributed Queue Dual Bus)**

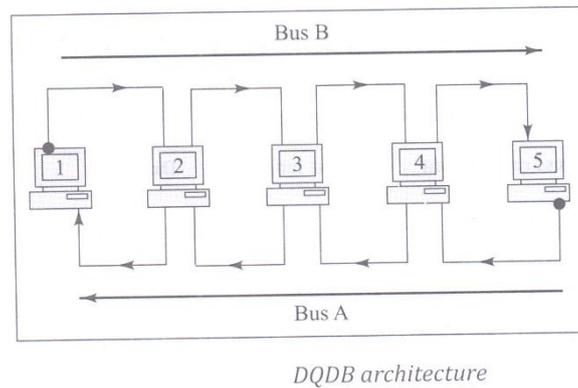
**(Explanation 3M, Diagram 1M)**

**Basics of 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.



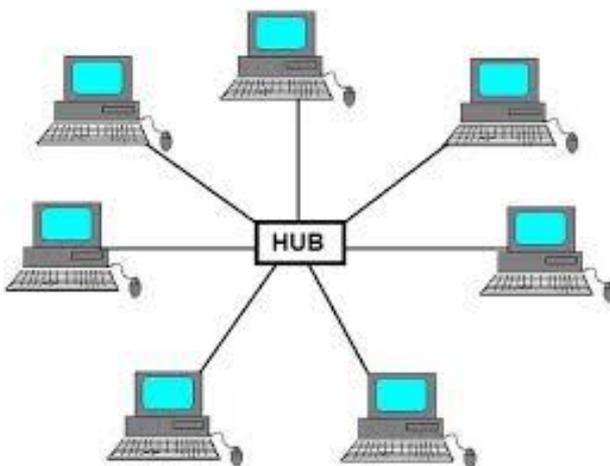
Distributed Queue Dual Bus (DQDB) is an example of MAN. IT uses the mechanism of a dual queue. There are two buses connecting all the computers on a DQDB network. Each bus allows traffic in a single direction only. To transmit data, the sending host must select one of the two buses. A host reserves the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

**Q.3. Attempt any FOUR of the following: 16**

**a) What is star topology? Give its advantages over other topologies.**

**(Star topology 2 marks 2 marks advantages)**

1. In star topology, all the hosts or workstations are connected to central device called hub.
2. The connection of devices to hub is with a point-to-point connection.
3. All the data on the star topology passes through the central device before reaching the intended destination.
4. Hub manages and controls whole of the network.



**Advantages over other topologies:**

1. Star topology is cheaper than mesh topology.
2. It is relatively easier to install, maintain and reconfigure.
3. It is robust i.e. if one link goes down; network will still continue functioning except that node.
4. It is easier to detect the fault and troubleshoot the problem.

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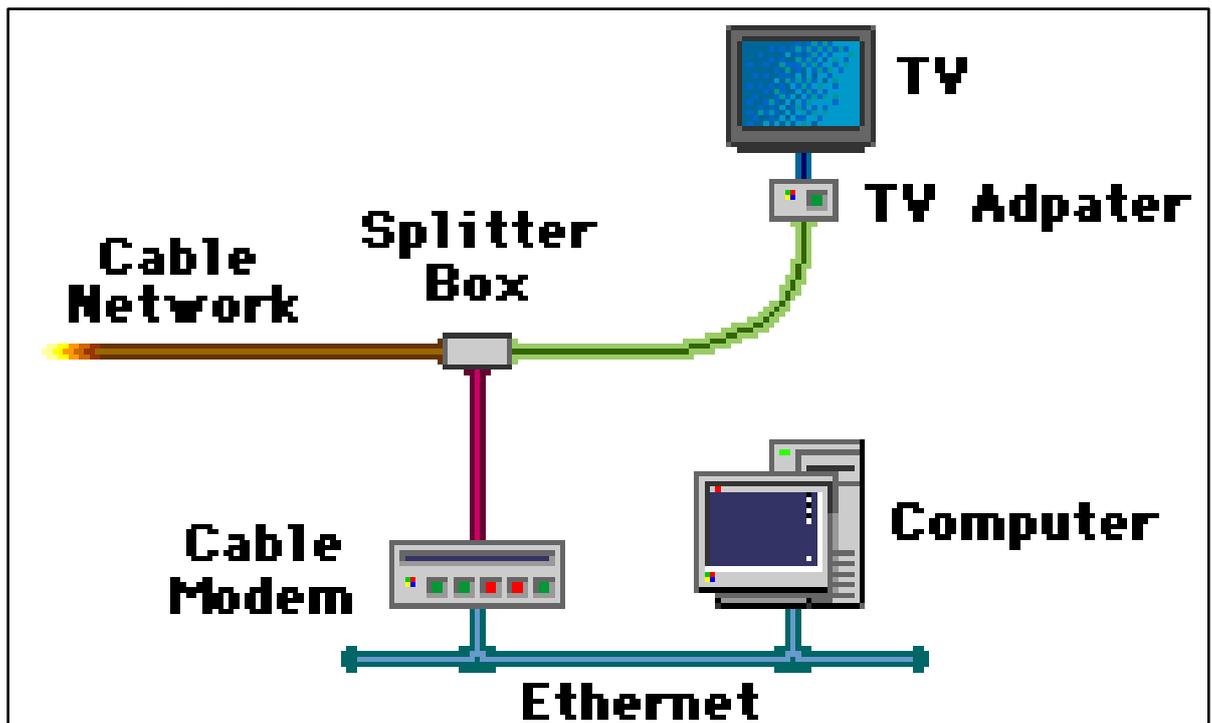
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5. Eliminates traffic problem.
6. Fast as compared to ring topology.

**b) Describe cable modem with neat diagram.  
(diagram 2 marks ,description 2 marks )**

1. Cable modems are one of the ways of accessing the internet.
2. It provides the internet access to a home user along with cable television access.
3. As the capacity of the coaxial cable is huge, the unused capacity is utilized to carry internet traffic.
4. The architecture of internet access via cable modem is shown in fig.
5. When a user wants to access the internet, he invokes the computer browser.
6. The browser's request reach the Network Interface Card(NIC) of the computer.
7. A device called splitter is fitted inside the premises of a cable TV user.
8. The splitter is a device that splits the signals inside a coaxial cable into two parts.
9. One part of the signal is the television signal and the other part of the signal carries the internet data.
10. Two separate parts of the signal arrives in separate wires. One wire goes to television set and the other wire carrying the IP packets is connected to the cable modem.
11. The cable modem converts a computer's digital data into analog signals that the wire can carry and vice versa.
12. The cable company serves each town through a number of central nodes. Each node serves about 500 customers
13. Many such central nodes are connected via high speed optical fiber links into a single head end .
14. The head end receives television signals from satellites and internet access via high speed connections with NAPs.



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c) Explain Hand-off operation in mobile phones.  
(Diagram 1 mark; description 3 marks)

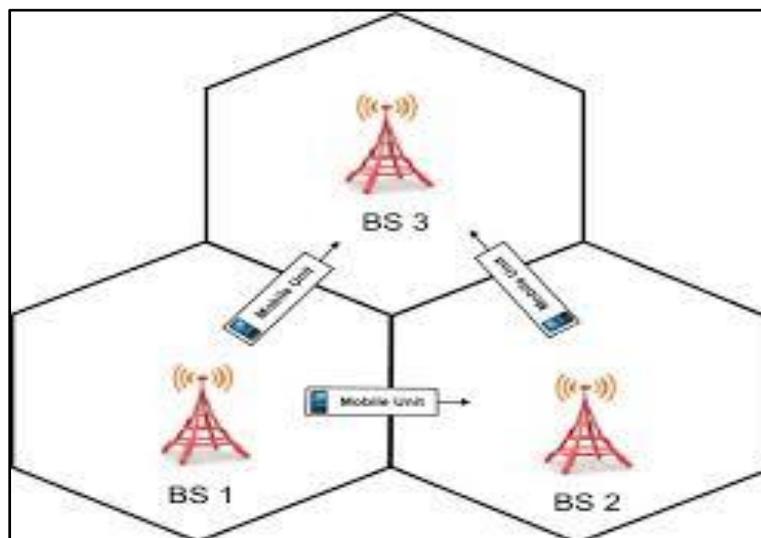
1. While call in progress it may happen that user may move from one cell to another cell or in area where signal of current cell becomes too weak.
2. During the conversation, if the mobile phone crosses the cell, the signal can become weak.
3. The MTSO constantly checks the signal level, and if it finds it low, it immediately seeks a new cell that can look after the communication better.
4. The MTSO changes the cell carrying channel so smoothly that the user hardly notices.
5. The process of handling the signal off from the old channel to the new channel is called handoff operation

Following are various types of handoffs. Supported by a Mobile Station (MS):

1. Hard Hand Off
2. Soft Hand off

**Hands off Procedure**

1. During a call, the serving base station monitors the signal strength (RSS) from the mobile on a reverse voice channel.
2. If the signal strength falls below a pre designated threshold, the base station sends a request to the MTSO for a hand off of the call.
3. The MTSO then requests the location receivers of neighboring base stations to measure the signal strength (RSSI) from the mobile.
4. If another base station from one of the neighboring cells indicates better signal strength, then under instructions from the MTSO the serving base station sends a signaling message to the mobile on the speech channel asking the mobile to return to a free channel in the neighboring cell.
5. The mobile returns to the new call.





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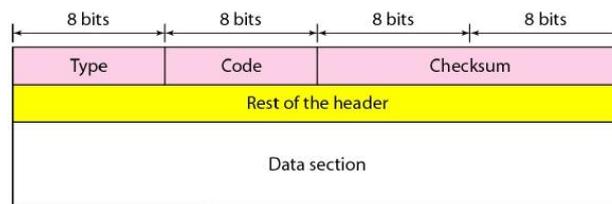
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**d) Explain ICMP protocol.**

**(4M for explanation: If diagram drawn, marks may be awarded)**

1. One of the main responsibilities of ICMP is to report errors. Five types of errors are handled: destination unreachable, packet too big, time exceeded parameter problems, and redirection.
2. The checksum for ICMP is calculated by using both the header and the data fields of the ICMP message.
3. Packet InterNet Groper (ping) is an application program that uses the services of ICMP to test the reachability of a host.
4. ICMP messages are divided into two broad categories: error reporting messages and query messages
5. The error reporting messages report problems that router or a host may encounter when it processes an IP packet.
6. The query messages, which occur in pairs, help a host or a network manager get specific information from a router or another host.
7. Host can discover and learn about routers on their network.
8. The message format of ICMP is as given below.



**e) Describe the application of IEEE standard.  
( 4 points 4 marks)**

- 1) IEEE 802.1:- Specifies LAN & MAN Architecture, handles over all network management
- 2) IEEE802.2:-It defines LLC sublayer of Data link layer of OSI Model .
  - a. type 1 –It Provides point to point transmission ,multicast transmission & broadcast transmission
  - b. type2 – It provides connection oriented services
  - c. type 3- used only in point to point transmission
- 3) IEEE 802. 3:- It is used to specify Ethernet Lan technology
- 4) IEEE 802.4:- Specify Token bus network
- 5) IEEE 802.4:- Specifies token ring protocol
- 6) IEEE 802.11:- Specifies standards for wireless LAN

**f) Explain the function of Bridges and repeater in internet.  
(2mks bridges, 2 marks repeaters )**

**Functions of bridges**

1. Bridge divides large network into smaller segments.
2. Bridge is a connecting device which works on data link layer of OSI model.
3. Each incoming packet will pass to MAC layer of bridge



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4. Here Physical address of destination is checked if it is destined to another subnet then it is forwarded to that subnet but if that subnet is of different type then LLC will remove header and apply new header.
5. To identify destination present on which subnet, bridge maintains forwarding table containing information about on which port data has to be handed over for which destination
6. By analyzing source address of incoming Packet, Bridge upgrades its forwarding table by learning about which device present on which subnet. Bridge does not change physical address.
7. If bridge is having different LAN on segment then bridge will have separate MAC& LLC layer per type of LAN.

**Functions of repeater:**

1. Repeater is an electronic device that operates on physical layer of OSI model.
2. A repeater is used to regenerate the signal.
3. A repeater allows us to extend the physical length of a network.
4. A repeater is used to boost the weak signal when the signal loses the strength as it passes along the cable.
5. A repeater does not amplify the signal.

**Q.4. Attempt any FOUR of the following:**

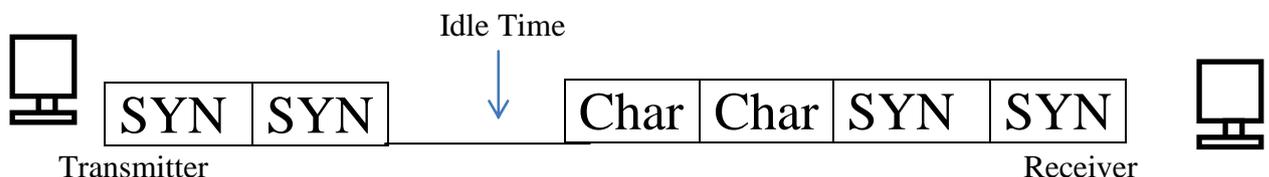
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- a) **Compare fast Ethernet and Gigabit Ethernet (4points only)**  
**(Any four points, 1M each)**

Fast Ethernet	Gigabit Ethernet.
1. It provides a data rate of 100 megabits per second.	1. It provides a data rate of 1 Gbps or 1000 Mbps.
2. Fast Ethernet uses twisted pair copper cables as the media of communication.	2. Gigabit Ethernet uses optical fiber as the media of communication
3. It is used mainly within the LAN.	3. It is used mainly as a backbone for large networks(WANS).
4. It is easy and cheap to implement.	4. It is difficult and costly to implement.
5. Devices connected to Fast Ethernet configure automatically themselves.	5. Devices connected to Gigabit Ethernet needs manual configuration up to some extent.

- b) **Draw and explain synchronous transmission mode.**  
**(diagram 2 marks, explanation 2 marks)**

- In synchronous transmission, whole block of character is transferred at once, instead of one character at a time.
- A special synchronization character 'SYN' is used for indicating start of block.
- For proper synchronization, two 'SYN' characters are used.
- It does not use start and stop bits.

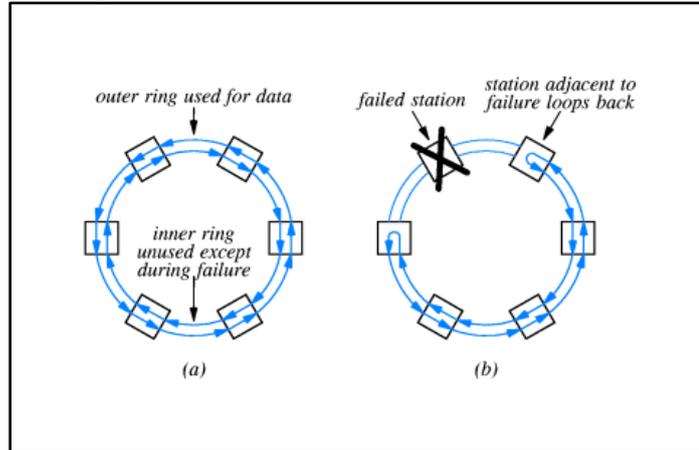


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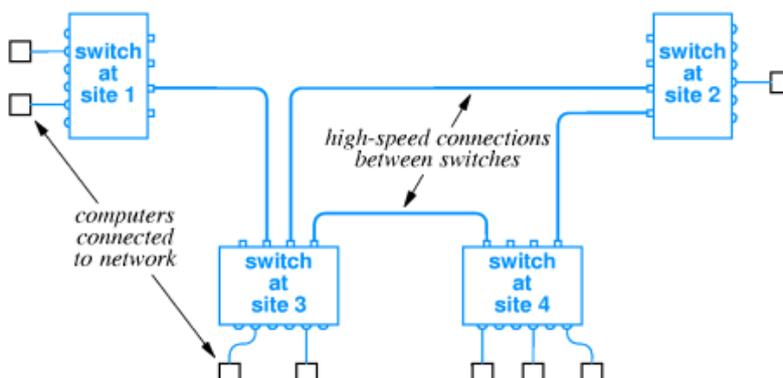
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- c) **Explain the FDDI system.**  
(Explanation-4M)  
(Diagram 2 marks, explanation 2 marks)



- 1) The Fiber Distributed Data Interface (FDDI) network architecture is a LAN protocol standardized by ANSI and other organizations.
- 2) It supports data transmission rates of up to 100 Mbps, and is an alternative to Ethernet and Ring architectures.
- 3) Originally, FDDI was developed using optical fiber as the transmission medium because only optical fiber could support data rates of 100 Mbps.
- 4) FDDI uses glass fibers for data transmission. And therefore, encodes data bits in the form of pulses of light.
- 5) The main properties of FDDI can be summarized as follows. Token passing for Media Access Control- Like the Token Ring Protocol, FDDI also uses the concept of a token frame to regulate medium access. The same principles of token frame apply here. FDDI is also a ring-like structure where the network medium starts from a computer, passes through all the hosts in the network, and ends back at the original host.
- 6) Self healing mechanism- the self healing mechanism of the FDDI network is made possible by second ring.
- 7) When a network error occurs, or a host is down, the NIC uses the second ring which is used as a backup for such failures for data transmission. This is called loop back.
- 8) Whenever the first ring fails or a host on a ring fails, the second ring is used to create another closed loop.

- d) **Explain WAN architecture with neat diagram.**  
( 2 marks diagram ,2 marks Explanation)





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- 1) A WAN is formed by connecting a number of packet switches together.
- 2) A packet switch has multiple I/O ports, thus it can connect to many computers.
- 3) Fig. shows a WAN formed by four switches and 13 computer connected together.
- 4) In WAN packet switches are connected to other switches using a very high speed lines.

**e) Describe the working of ARP & RARP.  
(2 marks each)**

1. ARP stands for Address Resolution Protocol.
2. ARP is a protocol for mapping an Internet Protocol address (IP) to a physical machine address.
3. It operates at layer 2 of the OSI model.
4. It provides the interface between the IP addressing system used by IP and the Hardware addresses used by the data link layer protocol.
5. ARP broadcasts an IP address in an effort to discover its equivalent hardware address

**RARP (Reverse Address Resolution Protocol):**

- 1) Reverse address resolution protocol is a network protocol used to resolve a data link layer address to the corresponding network layer address.
- 2) 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.
- 3) RARP does the opposite of ARP. While ARP broadcasts an IP address in an effort to discover its equivalent hardware address, RARP broadcasts the systems hardware address.
- 4) 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.

**f) Define standards. List various standard organizations.  
(Definition 2 marks ,list 2 marks)**

- 1) Standards are essential in creating and maintaining an open and competitive market for equipment Manufacturers and in guaranteeing national and international interoperability of data and telecommunication technology and processes.
- 2) They provide guidelines to manufacturers, Vendors, govt. agencies and other service providers to ensure the kind of interconnectivity necessary in today's market place and in international communication.

**Standard organizations (any two organizations 1mark per organization)**

- 1) International standard organization (ISO)
- 2) American National Standard institute (ANSI)
- 3) Institute of electrical & electronics engineers (IEEE)
- 4) The Electronics Industries Association. (EIA)

**Q.5. Attempt any FOUR of the following:**

**16**

- a) **What is DNS server? Describe concept of DNS.**

**(Definition-1M, concept -2M, diagram -1M)**

A domain name server is 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.

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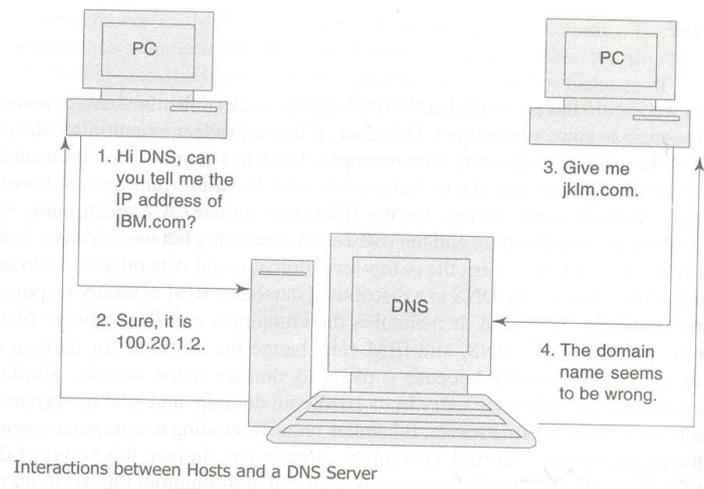
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The DNS works very similar to a telephone directory inquiry service. Basically, DNS server does two things :

- 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 DSN server and try to locate the IP address for the name requested. It may have to do this more than once.
- It can return an error message because the requested domain name is invalid or does not exist.

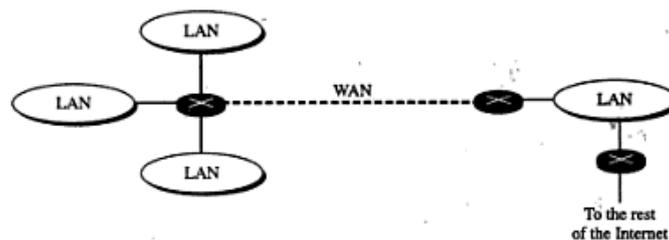


**b) Describe the following:**

- i. Routers.**
- ii. Gateways**  
(Router 2M, Gateway 2M)
- i. Routers.**

**Router** is network layer device that routes packets based on their logical address (host to host address) Router normally connects LAN and WANS in the internet using route information stored in routing table

Routing table of router is tabular database which stores information about destination and path (next Hop address through with to reach) information routing table is updated dynamically depending on changes in network



**ii. Gateway**

**Gateway** is device which operates on all layers of OSI model & TCP/IP

Gateway is protocol converter. Gateway enables communication between different network architecture and environments. Gateway connects two systems that do not use the same protocol, data format, language and architecture.

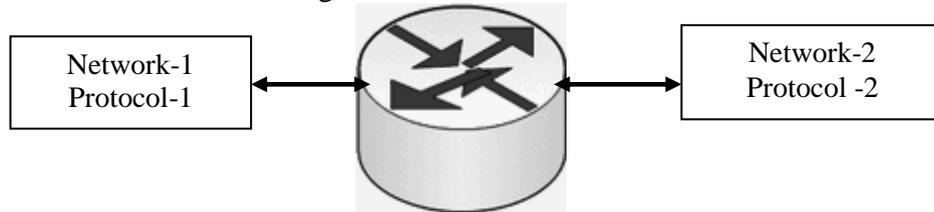
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Convert commonly used protocols (e.g. TCP/IP) to a specialized protocol (for example, an SNA: System Network Architecture). Convert message formats from one format to another. Translate different addressing schemes



c) Explain Data Fragmentation and Reassembly.

( 2 marks fragmentation ,2 marks reassembly)

For transferring data over network each transfer protocol applies upper limit to size of data in PDU (packet) .If size of datagram is larger than MTU then it is divided into small units of size supported called fragment & this activity of dividing datagram into small unit is called as fragmentation

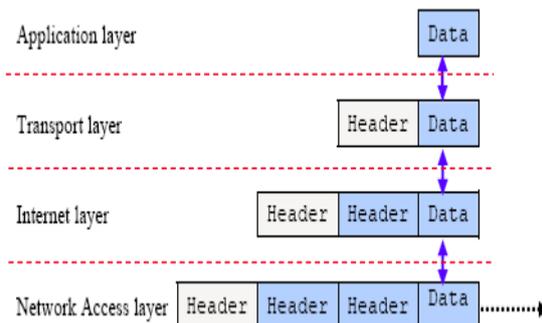
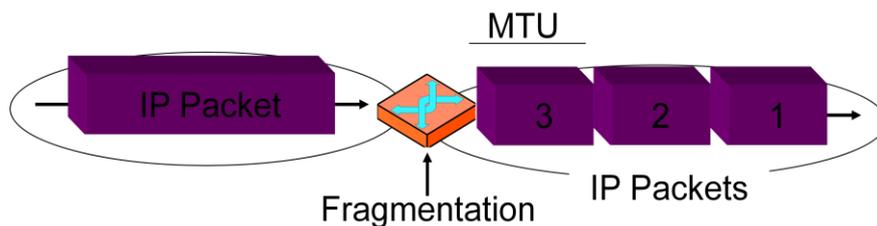


Fig process of fragmentation

**Reassembly:-** When a datagram is fragmented, either by the originating device or by one or more routers transmitting the datagram, it becomes multiple fragment datagrams. The destination of the overall message must collect these fragments and then *reassemble* them into the original message. Reassembly is accomplished by using the special information in the fields we saw in the preceding topic to help us “put the jigsaw puzzle back together again”.

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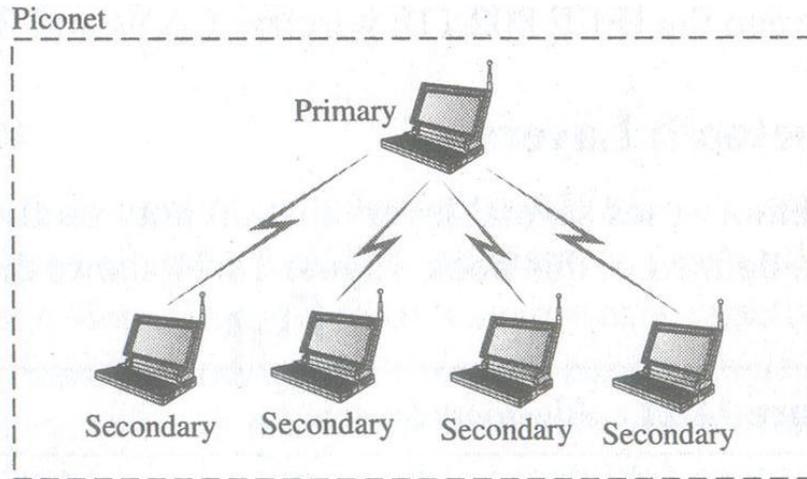
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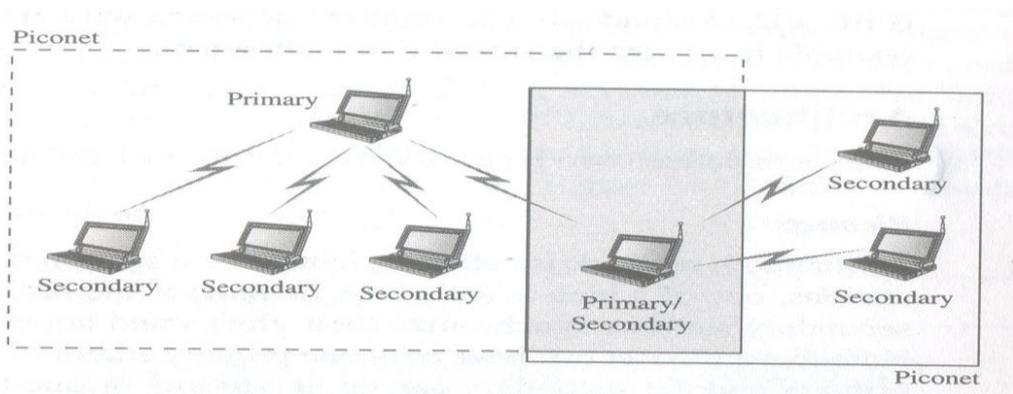
d) Explain the architecture of Bluetooth.

(Piconet 2M, Scatternet 2M)

**Piconets** A Bluetooth network is called a piconet, or a small net. A piconet can have up to eight stations, one of which is called the primary; the rest are called secondaries. All the secondary stations synchronize their clocks and hopping sequence with the primary.



**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.



e) What is LAN? List its advantages.

(Definition 2M, advantages 2M)

**Definition:** A local area network (LAN) is generally a privately owned within a single office, building or campus, covering a distance of few kilometers.

**Advantages:**

1. LAN is to share resources such as disk, printers, programs and data.
2. It also enables the exchange of information

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**f) Compare TCP and UDP(4points only)**

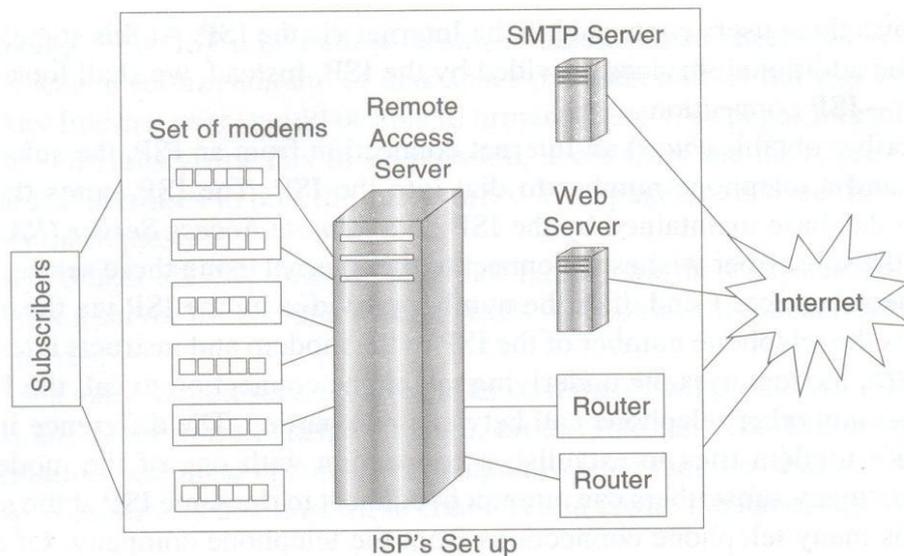
**(1mark per valid point)**

<b>Factors</b>	<b>TCP</b>	<b>UDP</b>
i) Protocol connection s/w	It is connection oriented. Connection must be established before sending data.	It is connectionless. Data sent without connection setup.
ii) Data interface to application	Lost data is Retransmitted automatically.	Auto –retransmission is not performed. Application must detect lost of data and retransmit it by its own.
iii) Reliability	Reliable because data is delivered with acknowledgment	Unreliable because data is delivered without acknowledgement
iv) Overhead	Overhead is low, but higher than UDP	Overhead is Very low

**Q.6. Attempt any FOUR of the following:**

**16**

**a) Draw architecture of ISP and Explain.  
(Diagram 2M, Explanation 2M)**



A subscriber of an ISP connects to one of the telephone lines of the ISP via modem. ISP is an equipment.

The ISP's modem routes the subscriber to the remote access server (RAS) to authenticate the subscriber.

Once the user is authenticated, the subscriber is as good as connected to the internet.

Once he connected to the internet, the user can requests web pages, send/receive emails or files, so on.

The user interaction with the internet is coordinated by the RAS (remote Access Server), the ISP allows the user to create an email ID and use it for sending/receiving emails.

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The main point is that since the internet users are not always connected to the internet, an ISP stores emails on their behalf on the SMTP server temporarily.

Web server performs two operations

- i. It can be used by the ISP to setup a portal
- ii. This web can be used to store the web pages created by the subscribers.  
These web pages belongs to the ISP's portal, can be hosted by different web servers for security and maintenance.

**b) Describe dial-up network with its specifications.  
(Description 2M, Specification –any two-2M)**

**Dialup network**

**Dial-up Internet access** is a form of Internet access that uses the facilities of the public switched telephone network (PSTN) to establish a connection to an Internet service provider (ISP) by dialing a telephone number on a conventional telephone line.

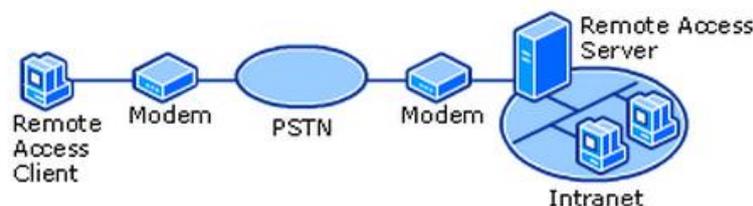
Dialup internet service is a service that allows connectivity to the internet through a standard telephone line. By connecting the telephone line to the modem in computer and inserting the other end into the phone jack, and configuring the computer to dial a specific number provided by internet service provider (ISP) to access the internet on your computer.

Dial up internet service is provided through several ISP. In order to get a dial up internet service a person must definitely have a computer and even more important a modem. There are different types of modems, to the modem.

A dial-up remote access connection contains the following components:

- Remote access client
- Remote access server
- WAN infrastructure

Dial-up equipment and the WAN infrastructure



The physical or logical connection between the remote access server and the remote access client is facilitated by dial-up equipment installed at the remote access client, the remote access server, and the WAN infrastructure. The nature of the dial-up equipment and WAN infrastructure varies, depending on the type of connection. The most common methods for dial-up remote access include:

- Public Switched Telephone Network (PSTN)
- Integrated Services Digital Network (ISDN)

**Specifications of Dial up connection:**

1. Uses the facility of telephone lines(PSTN)
2. Requires modem of 56Kbps for conversion of digital to analog and vice versa.
3. Dial-up lines generally support speeds of 2,400 to 9,600 bps.
4. No dedicated path.



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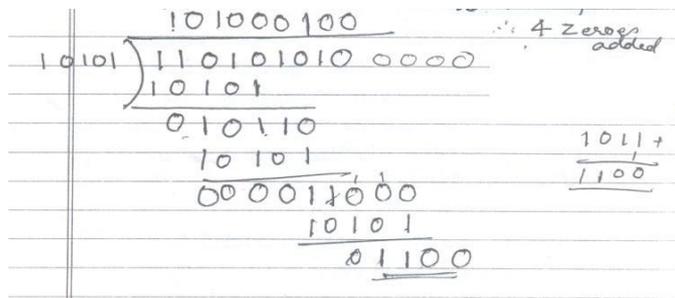
c) Name error detection methods. Describe CRC with example.  
(List 1M, CRC 3M)

**Error detection** is a process of error control by which any error in the transmission is detected. The content errors are detected by introducing additional check bits in a block of data bits. The sender encodes the check bits in such a way that the receiver can be able to detect the content errors. There are coding schemes that enable the receiver to correct the error also. The receiver requests the sender for retransmission of data blocks whenever it detects errors.

**List of Error Detection Methods:**

- 1) Parity checking
- 2) Checksum error detection
- 3) Cyclic Redundancy Check (CRC)

1. **Cyclic Redundancy Check** is very powerful. A CRC Code word of length  $l$  with  $n$ -bit data word is referred to as  $(l, n)$  cyclic code and contains  $(l, n)$  check bits. These check bits are generated by mod-2-division. The dividend is the data word followed by  $r=l-n$  Zeroes and the divisor is a special binary word of length  $r+1$ . The CRC code word is formed by mod-2 addition of dividend and the remainder. In the CRC code any cyclic shift of a code word result in another valid code word. Example: create CRC code for the data word 110101010 using the divisor 10101 Data word=110101010 Divisor=10101  $L=9, n=5, r=l-n=4$



**Step by step procedure**

1. Append a string of  $r$  OS to the data word where  $r$  the no. of bits predecided divisor by 1 bit i.e. if divisor-5 bits then  $r= 4$  zeroes.
2. Divide the newly generated data unit in step 1 by the divisor it is binary division
3. The remainder obtained after division is the  $r$  bit CRC.
4. This CRC will replace the  $r$  Zeros appended to the data unit, transmitted.

Data word-110010101 Divisor-10101  $L=9, r=4, n=5, l-n=r$  The transmitted code word-1100101011100

d) Explain the concept of Asynchronous TDM.  
(Diagram 2M, Explanation 2M)

Asynchronous time-division multiplexing is used to multiplex cells coming from different channels. Multiplexers fill a slot with a cell from any input channel that has a cell; the slot is empty if none of the channels has a cell to send.

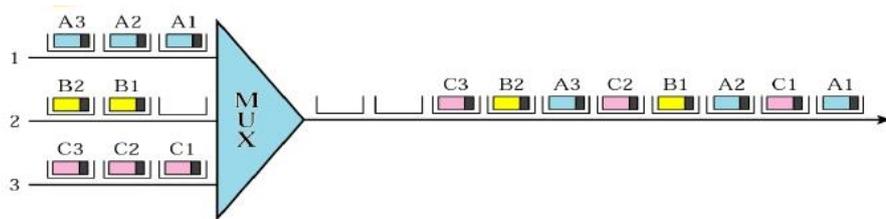
Figure shows how cells from three inputs are multiplexed. At the first tick the clock, channel 2 has no cell (empty input slot), so the multiplexer fill the slot with a cell from the third channel. When all the cells from all the channels are multiplexed the output slots are empty.

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- e) **State the need for internet. What are the problems with internetworking?**  
(Needs 2M, Problems 2M)

**Need for internet:**

- 1) **Resource sharing:** goal is to make all program equipments and especially data available to anyone on the network without regard of physical locator.
- 2) **High reliability:** This can be provided by alternate source of supply. Presence of multiple CPU's means that if one goes down, the other may be able to take over its work at a reduced performance.
- 3) **Saving money:** Data are stored in one or more shared file server machine in case of internet. Here the users are called client and whole arrangement in client server model so that anybody can uses in the internet.
- 4) **Communication medium :** B using internetworking, it is easy for two or more people who live apart can get in touch and can share their data. So it is a powerful communication medium.

**Problem of internet working**

- 1) Addressing: Each net may have its own addressing approach. Ethernet uses 6-byte ID, Telephone uses 10-digit numbers.
- 2) Bandwidth and Latency: Link bandwidth would vary from net to net from bits/sec to Gb/sec. Latencies can be from  $\mu$ s to several secs.
- 3) Packet size: In general varies between networks
- 4) Loss rates & QoS: All networks vary considerably in these. These depend on traffic volume, congestion, service demands, ...
- 5) Packet routing: Routing of packets may be handled differently by different nets.

- f) **Draw OSI reference model. Describe working of any two layers.**  
(Diagram of reference model- 2M, Each layer working- 1M)

- OSI model (open system interconnection) model was developed by ISO (international standard organization)
- **Function of OSI model:**
  - i. It provides way to understand how internetwork operates.
  - ii. It gives guideline for creating network standard.
- OSI model has 7 layers as shown in the figure.

Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data link Layer
Physical Layer



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OSI model has following 7 layers as Physical layer, data link layer, Network layer, Transport layer, session layer, presentation layer, application layer.

1. **Physical layer:** It co-ordinates the functions required to transmit bit stream over physical medium. It deals with mechanical and electrical specifications of interface and transmission medium. For transmission it defines procedures and functions that devices and transmission medium has to perform
  - Physical characteristics of interfaces and media.
  - Representation of bits: Data rate(transmission rate).
  - Synchronization of bits.
  - Line configuration: Point to point or multipoint configuration should be used.

2. **Data link layer:** It is responsible for transmitting group of bits between the adjacent nodes. The group of bits is called as frame. The network layer passes a data unit to the data link layer. Header and trailer is added to the data unit by data link layer. This data unit is passed to the physical layer. Data link layer is responsible for moving frames from one node to the next.

**Functions of data link layer are:**

- 1) Framing
- 2) Physical addressing
- 3) Flow control
- 4) Error control
- 5) Media access control
- 6) Node to node delivery

3. **Network layer:** It is responsible for routing the packets within the subnet i.e. from source to destination. It is responsible for source e to destination delivery of individual packets across multiple networks. It ensures that packet is delivered from point of origin to destination.

**Functions of network layer:**

- 1) Logical addressing
- 2) Routing.
- 3) Congestion control
- 4) Accounting and billing
- 5) Address transformation
- 6) Source host to destination host error free delivery of packet.

4. **Transport layer:** Responsibility of process to process delivery of message Ensure that whole message arrives in order.

**Functions of Transport layer:**

- 1) Service point addressing
- 2) Segmentation and reassembly
- 3) Connection control
- 4) Flow control: Flow control is performed end to end 5) Error control

5. **Session layer:** Establishes, maintains, and synchronizes the interaction among communication systems It is responsible for dialog control and synchronization.

**Functions of Session layer:**

- 1) Dialog control
- 2) Synchronization, session and sub session



3) Session closure

6. **Presentation layer:** It is concerned with syntax, semantics of information exchanged between the two systems.

**Functions of Presentation layer:**

- Translation: presentation layer is responsible for converting various formats into required format of the recipient
- Encryption: Data encryption and decryption is done by presentation layer for security.
- Compression and Decompression: data to be transform compressed while sending and decompress while receiving for reducing time of transmission.

7. **Application layer:** It enables user to access the network. It provides user interfaces and support for services like email, remote file access.

**Functions of Application layer:**

- Network virtual terminal
- file transfer access and management
- mail services and directory services