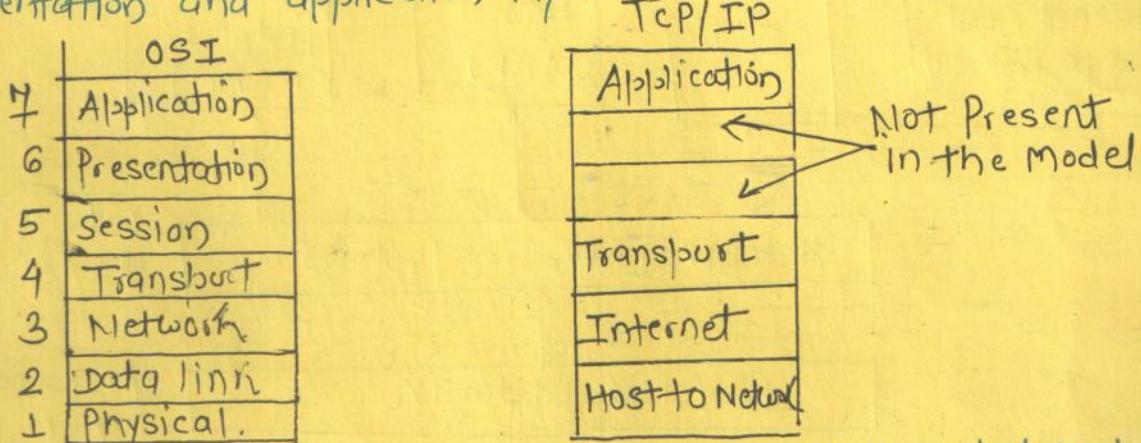


Q1) Draw and explain TCP/IP Protocol architecture? 06M

Ans: TCP/IP reference Model:

The TCP/IP protocol suite was defined having four layers. host to network, internet, transport and application. Host to network layer is equivalent to combination of physical and data link layer. The internet layer is equivalent to the network layer. and application layer is related to session, presentation and application layer.



- Physical and data link layer: At the physical and data link layer. TCP/IP does not define any specific protocol. It supports all the standard protocols.

- Network layer - At the Network layer TCP/IP supports internetworking protocol ARP, RARP, ICMP, and IGMP

Internetworking Protocol (IP)

- IP assumes the unreliability of underlying layer and does its best to get a transmission through to its destination
- IP supports transports data in packets called datagrams each of which is transported separately
- IP does not keep track of routes and has no facility for recording datagrams once they arrive at their destination

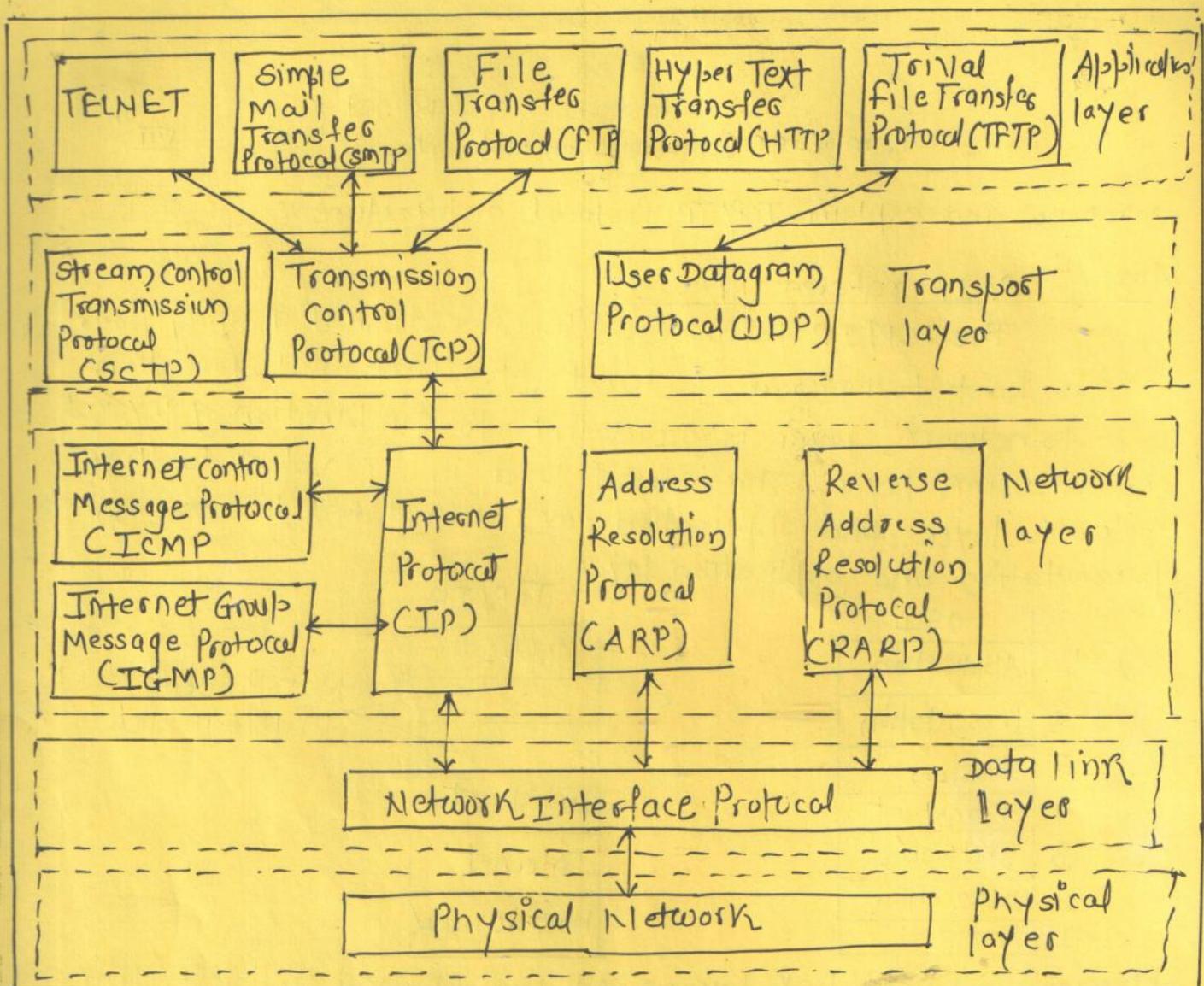


Fig 2 . Protocol and network in the TCP/IP model.

- (i) Address Resolution Protocol : ARP is used to associate a logical address with Physical layer . on a physical Network such as a LAN each device on a link is identified by a Physical or station address.
- (ii) Reverse address Resolution Protocol ; RARP allows a host to discover its internet address when it knows only its physical address. It is used when computer is connected a network for the first time .
- (iii) Internet control Message Protocol : ICMP is a mechanism used by hosts and gateways to send notification of datagram problems back to the sender . ICMP sends query and error reporting Messages.

(Q1b) Explain with neat sketch, the network architecture based on OSI reference model. Discuss the function of each layer and specify the protocol of each layer. 7M

Ans. The OSI Model is based on proposal developed by the International standards organisation (ISO) protocols used in the various layers. The model is called ISO OSI (open system interconnection) Reference model.

- An open system is a set of protocols that allows any two different systems to communicate req.
- OSI model is to show how to facilitate communication b/w different systems without requiring changes to the logic of the underlying hardware and software.
- The OSI Model is layered network framework for the design of network systems that allows communication b/w all types of computer system.
- The function of each layer should be chosen with an eye toward defining internationally standardized protocols.

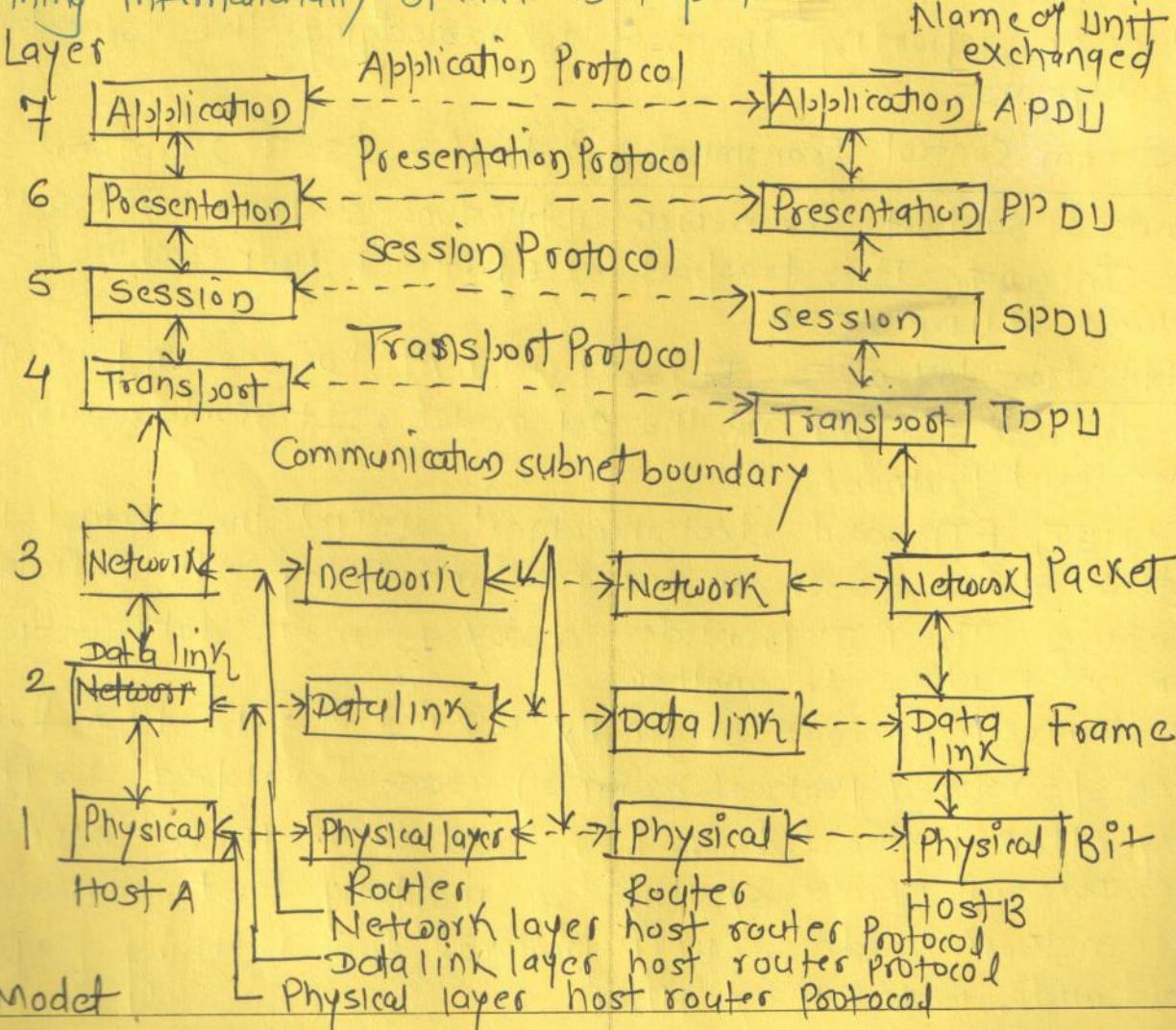


Fig.
OSI Model

N) Internet Group message Protocol - is used to facilitate the simultaneous transmission of message to group of recipients.

3) Transport layer - IP is a host-to-host protocol means it can deliver a packet from one physical device to another.

UDP & TCP are transport layer protocol for delivery of message from one another.

(i) User datagram Protocol - UDP is simple of two standard TCP/IP transport protocol. It is a process-to-process protocol that adds only port address, checksum error control.

(ii) Transmission Control Protocol - TCP is reliable transport protocol. It is connection oriented. A connection must be established b/w both ends of transmission.

- TCP ensures that the combination b/w the sender & receiver is reliable.
- TCP software is responsible for checking the CRC, detecting any errors, reporting them & acknowledging the correct delivery of datagrams.

(iii) Stream Control Transmission Protocol - SCTP Protocol

provides support for newer applications such as voice over the Internet. It is transport layer protocol that combine best features of UDP & TCP.

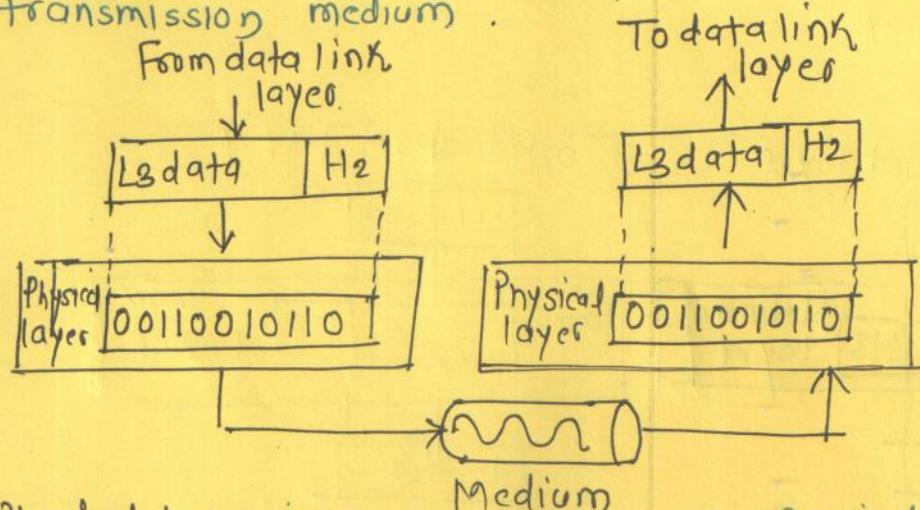
4) Application layer - It is equivalent to session, presentation and application layer in the OSI model. It contains all the higher level protocol.

• TELNET, FTP and electronic mail (SMTP) the virtual terminal protocol allows a user on one machine to log onto a distant machine. The FTP provides a way to move data efficiently from one machine to another.

• Electronic mail was originally a kind of file transfer but later specialised protocol (SMTP) was developed for it.

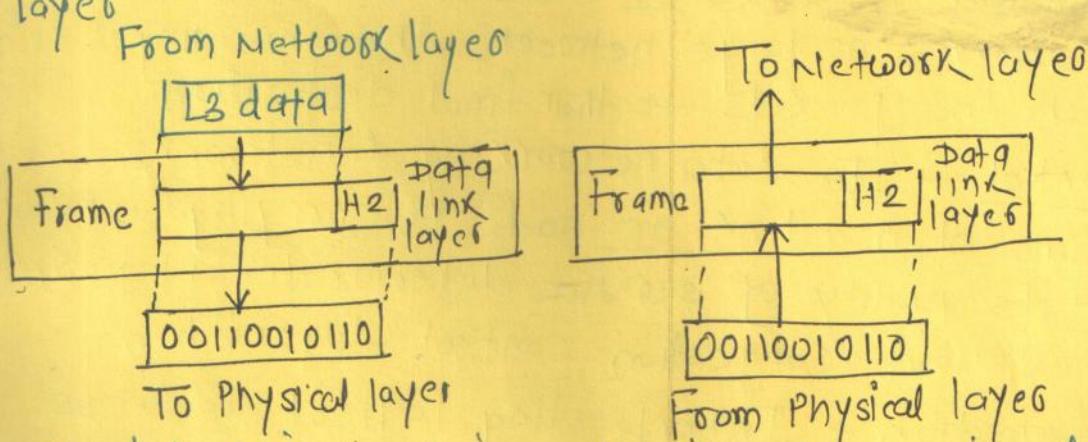
Many other protocol have been added to these over the years. Domain Name system for mapping host names onto their network address. HTTP protocol for fetching pages on world wide web & many others.

(i) Physical layer — The Physical layer coordinates the function required to carry a bit stream over Physical medium. It deals with mechanical & electrical specifications of the interface and transmission medium.



Physical layer is concerned with the Physical characteristics of interface and medium. The Physical layer data consist of stream of bits. The transmission rate the number of bits sent each second is also defined by the Physical layer. The sender & receiver must use the same bit but also must be synchronised at bit level. The Physical topology defines how devices are connected to make a network. Devices can be connected by using mesh topology. The physical layer also defines the direction of transmission betw two devices.

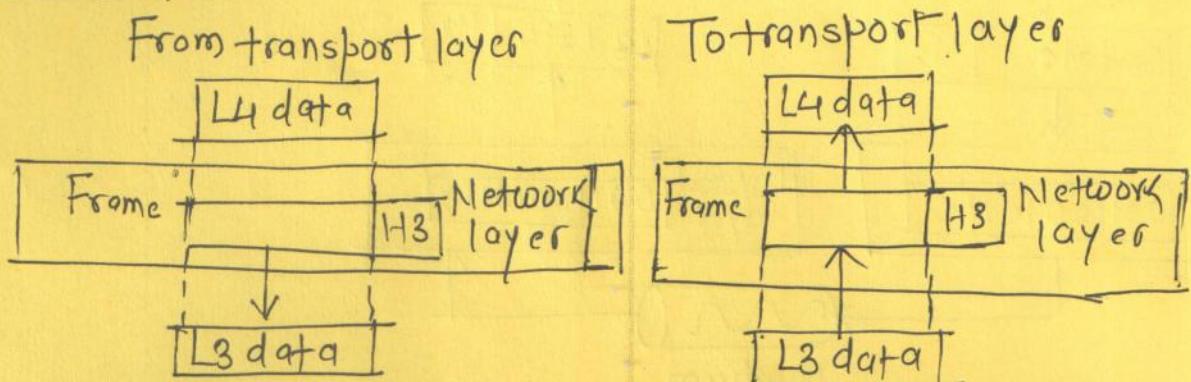
(2) Data link layer — The data link layer transforms physical layers. It makes the physical layer appear errorfree to the upper layers.



- The data link layer is responsible for moving frames from one hop to the next.
- The data link layer divides the stream bits received from the network layer into manageable unit called frames.

- The data link layer adds reliability to the physical layer by adding mechanism to detect and retransmit damaged or lost frames.
- When two or more devices are connected to the same link, data link layer protocol.

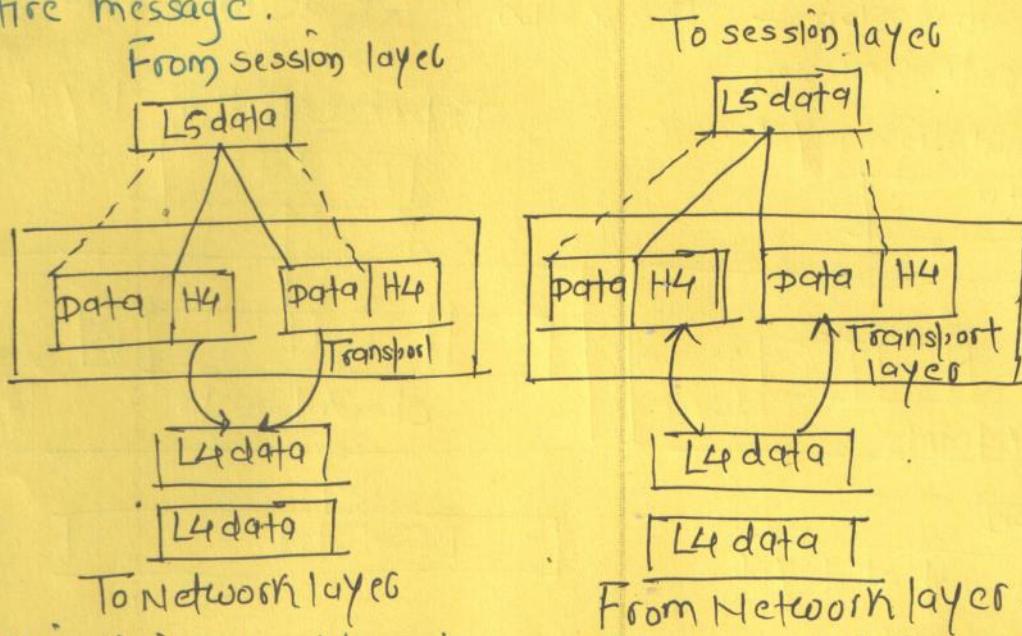
(3) Network layer



To data link layer

- The Network layer is responsible for source to destination delivery of a packet.
- If two systems are connected to the same link there is usually no need of network layer, but if two systems are attached to different networks then there is need of network layer.
- The network layer is responsible for the delivery of individual packet from source to destination host.
- The network layer adds a header to the packet coming from upper layers.
- When independent networks or links are connected to create internetworks or large network, the connecting devices route or switch the packets to their final destination.
- Congestion control - In data networking & network Congestion occurs when a link or node is carrying so much data that its quality of service deteriorates. Network layer provides various congestion control algorithms.
- Address transformation - Interfacing logical address to get their physical equivalent.

4) Transport layer - is responsible for process to process delivery of entire message.



a) Service Point addressing - The transport layer headers include a type of address called service point address. The network layer gets each packet to correct computer.

b) segmentation and reassembly - A message is divided into transmittable segment with each segment containing a sequence number.

c) connection control - The transport layer can be either connectionless or connection oriented. A connectionless transport layer treats each segment & independent packet & delivers to the transport layer at the destination.

d) Flow control - link the data link layer & the transport layer is responsible for flow control.

e) Error control - link the data link layer & the transport layer is responsible for errors control.

The sending transport layer makes sure that the entire message arrives at the receiving transport layer without error. Error correction is usually achieved through retransmission.

5) Session layer -

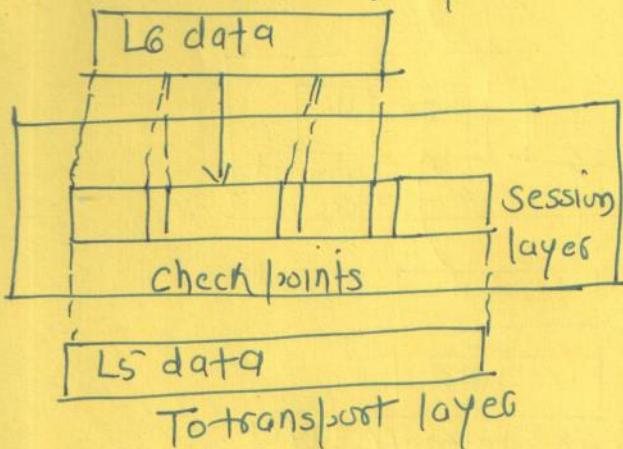
a) Dialog control - The session layer allows two system to enter into a dialog. It allows the communication betw two process to take place in either half duplex or full duplex mode.

b) Synchronization - The session layer allows to process to add

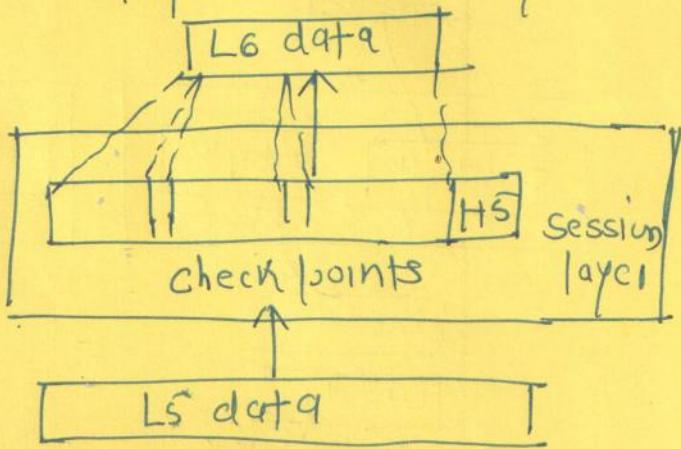
checkpoints or synchronisation points to stream of data.

c) Session & Subsession — The session layer divides into subsessions for avoiding retransmission

From presentation layer

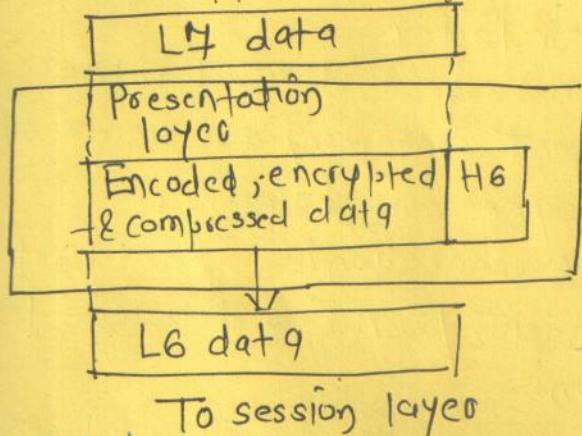


To presentation layer

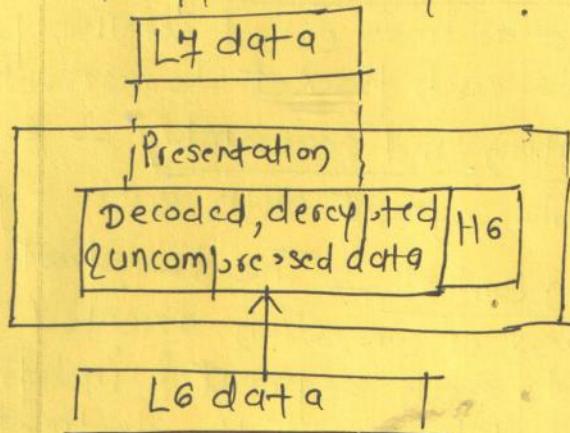


d) Presentation Layer —

From application layer



To application layer

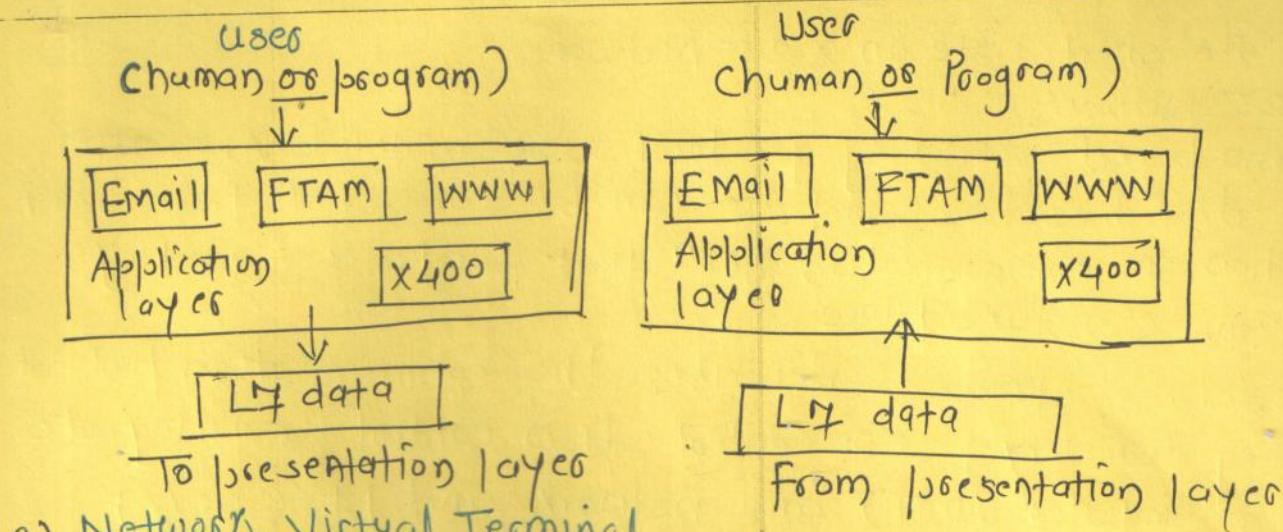


Translation — The process in two systems are usually exchanging information in the form of character strings, numbers & so on

Encryption — To carry sensitive information a system must be able to ensure privacy. Encryption means that the sender transforms the original information to another form & sends the resulting message over the network.

Compression — Data compression reduces the number of bits contained in the information. Data compression becomes important in the transmission of multimedia such as text, audio

e) Application layer — The application layer enables the user (whether human or software) to access the network. It provides user interfaces & support for services such as electronic



a) Network Virtual Terminal

A network virtual terminal is software version of a physical terminal & allows a user to log on to remote host -

- b) File transfer, access and management — This application allows user to access files in remote host to retrieve files from a remote computer for use in the local computer and to manage or control files in a remote computer.
- c) Mail services — The application provides the basic email forwarding and storage.
- d) Directory services — This application provides distributed database sources and access for global information about various objects and services.

Q2a) Write short note on X.25 Network?

6M

Ans. X.25 Network.

- X.25 is a packet switching protocol used in Wide Area Network.
- X.25 describes how computer can be connected to a WAN and how the communication betⁿ that computer & rest of the WAN can take place.
- It defines standards describes the communication protocol including delivery, error control, flow control, routing etc betⁿ a computer (DTE) and network and pt. (DCE).
- X.25 is a connection-oriented network. To use X.25 a computer first established a connection to the remote computer. This connection was given a connection number to be used in data transfer packets.
- Data packets are very simple consisting of 3 byte header and upto 128 bytes of data. The header consisted of 12 bit connection number a packet sequence number, an acknowledgement number and few miscellaneous bits.
- X.25 works at the bottommost three layers of OSI Model the physical layer, the data link and the network layer.
- At the physical layer X.25 defines a protocol called X.21 which specifies X.25 this is similar to the other physical layer protocols and defines voltage levels.
- A bit oriented protocol called Link Access Protocol is used at data link layer. It defines frame formats. This layer is responsible for flow control and error control betⁿ adjacent nodes.

compose between ATM and Frame Relay.

Features of Frame Relay

Frame Relay operates at a higher speed (1.544 Mbps and only 44.376 Mbps)

Frame relay operates in just the physical data link layers. Thus it can easily be used as a backbone network. It provides services to protocols that already have a network layer protocol.

Frame Relay allows bursty data.

Frame relay allows a frame rate of good bytes, which can accommodate all local area network frame sizes.

Frame Relay is less expensive than other traditional WAN.

Frame Relay has error detection at the data link layer only.

There is no flow control or error control.

Features of ATM Computer Network

ATM is Asynchronous Transfer Mode. It is streamlined packet switching interface. ATM also is connection oriented network.

ATM is the cell relay protocol designed by the ATM forum adopted by ITU-T. The combination of ATM and SONET allow high speed interconnection of all the world's network.

ATM uses packets and fixed data size for the communication. These packets are called ATM cells.

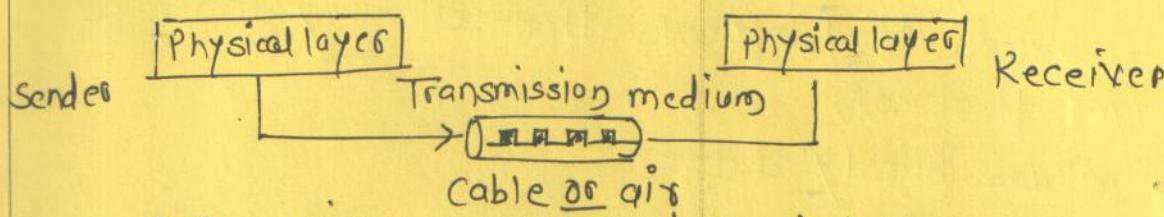
ATM is used for efficient data transfer over high speed network.

ATM provides real time and non real time services. The services provided are synchronous TDM streams such as T-1 services using the constant bit rates, compressed voice and video; IP based services using available bit rate and specified bit rate services.

(Q3a) Explain the classification of Transmission Media. 7M.

Transmission Media

Transmission medium are the physical infrastructure components which carry data from source to destination. Transmission media are actually located below the physical layer and are directly controlled by the physical layer. They are at the basic of data communications.

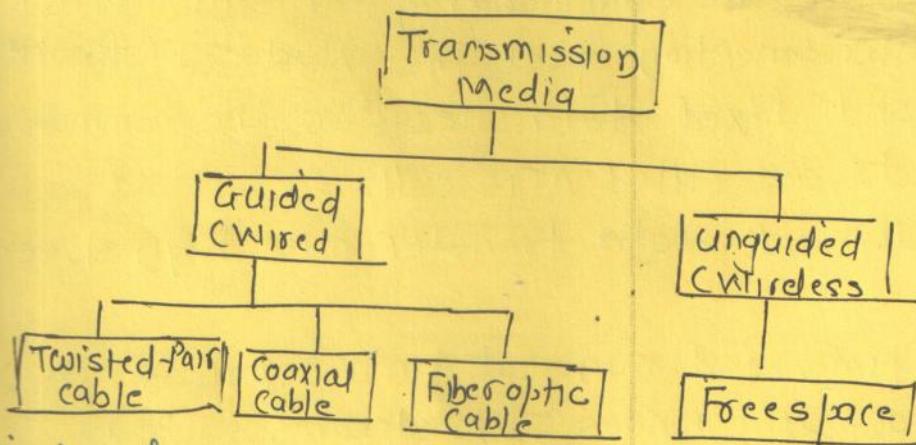


Transmission Media and Physical layer

Transmission media need not always be in the form of a physical wire they can be invisible as well.

For ex. the transmission medium for two people having a conversation is in the air. The air can also be used to convey the message.

In data communication the definition of the information and the transmission medium is more specific. The transmission medium is usually free space, metallic cable or fiber optic cable. The information is usually a signal that is the result of conversion of data from another form.



Simple form of transmission media are telephone wire that connects telephone to the central offices and coaxial cables that carry cable television transmission to homes.

In telecommunication transmission media can be divided into two categories guided & unguided. Guided media include twisted pair cable, coaxial cable, & fiber optic cable, unguided media are, free space

(Q3b) compare circuit switching and packet switching ? 7M

Ans circuit switching

- In case of circuit switching a physical connection path is established betw two computer. A circuit switched network is made of a set of switches connected by physical links, in which each link is divided into n channels using FDM or TDM.
- The computer can then communicate using the connection when the communication is over either computer can send a request for terminating this connection & only at that stage would the connection be released.
- As long as two computers communicate over this dedicated connection no other computer can use this portion of the connection ..
- A circuit switch is a device with m inputs & n outputs where m and n need not be equal. It creates a temporary dedicated connection betw an input device & an output device .
- circuit switching was mainly devised for telephone connection for computer to computer comm. circuit switching is not so efficient .
- computer might send some data to another & they may not send any more data for quite some time. comm. betw computers is less predictable & occurs in bursts . means that dedicated line is established betw two computer. this line may not be utilized for most of the time

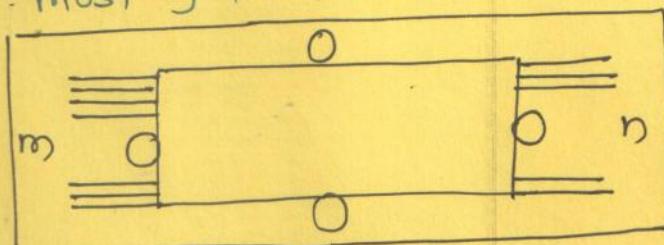


fig circuit switch

- Another problem of circuit switching is that once the connection is established that connection is used throughout the session of conversation . another drawback is no concept of message priority,

(Q4) Write short note on selection of IEEE 802.11, a, b, g and n
Ans 802.11 - In 1997, the institute of electronic Engineers IEEE created the first WLAN standard. They called it 802.11 after the name of the group formed to oversee its development. 802.11 only supported a max. network bandwidth of 2Mbps. too slow for most applications. The fig shows packet structure of 802.11 standard.

OSI PHY layers	OSI data link layers	Higher OSI layers	Packet Transfer		
PLCL Preamble/ headers	MAC headers	LLC (obj)	Network data	Fcs	End Delimiter

(ii) 802.11a - The signal is transmitted at 5GHz and can move upto 54 megabits of data per second. It uses orthogonal frequency-division multiplexing (OFDM) which is an efficient coding technique that splits the radio signal into several subsignals before they reach a receiver.

(III) 802.11 b - This is slowest and least expensive existing standard. 802.11b was the most popular standard because of its cost, but as faster standards get less expensive 802.11b is losing popularity. This standard transmits in the 2.4GHz frequency bandwidth. It can transmit upto 11 Megabits of data per second.

(IV) 802.11g - 802.11g transmits at 2.4GHz like 802.11b but at faster rate. It can transmit upto 54Mbps per second similar to 802.11a, 802.11g transmit faster because it uses OFDM instead of CCK.

(V) 802.11n - This is the most recent standard and is becoming commercially available. This standard significantly 15

improves speed and range. For instance although 802.11g theoretically transmits 54 Mbit/s data per second, it only achieves real world speeds of about 24 Mbit/s per second because of network congestion. 802.11g however can transmit as high as 140 Mbit/s per second.

Basics of physical and logical Networking Concept

802

- Specifies a PHY that operates in the 5GHz UNII band in US initially 5.15 - 5.35 and 5.725
- uses orthogonal frequency division multiplexing
- Enhanced data speed 54 Mb/s.

802.11 a

- Enhancement to 802.11 that added higher data rate modes to DSSS already defined in the original 802.11 standard
- Boosted data speed to 11 Mb/s.
- 22 MHz bandwidth yields 3 non overlapping channels in frequency range of 2.4GHz.

802.11 g

- Extends the maximum data rate of WLAN device that operate in 2.4GHz band
- Uses OFDM modulation
- operates at up to 54 megabit per second with fall back speeds that include the 'b' speed.

802.11 n

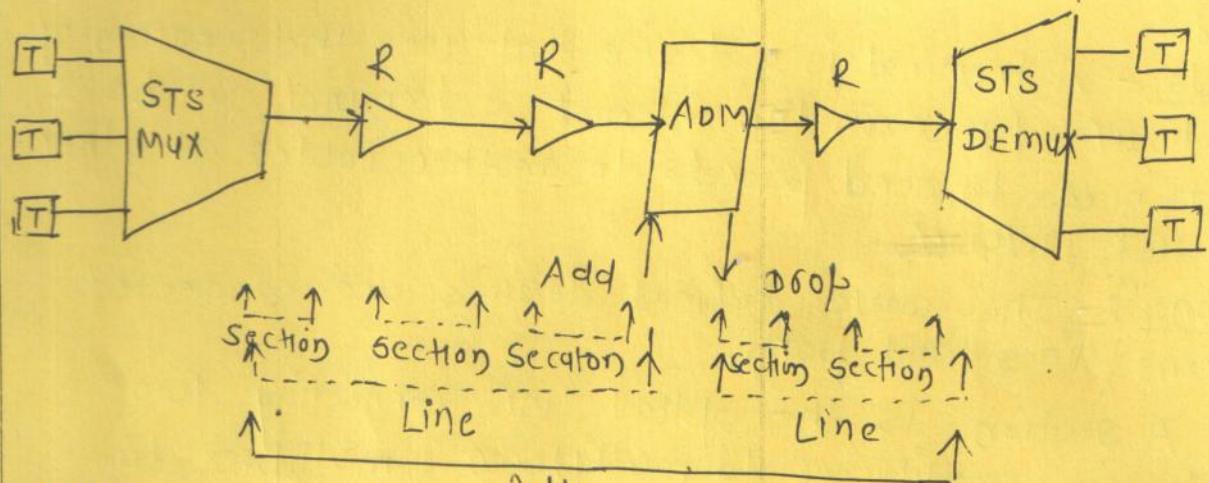
- Higher speed standard
- Several competing and non compatible technologies often called "Pre-n"
- Top speeds claimed of 108, 240, and 350+MHz
- Competing proposals come from the groups EWC, TGN sync, and WWise and are all variations based on MIMO (multiple Input multiple output)

Q4b) Explain SONET Network ?

7M

Ans SONET Network

- There are two popular protocols that allow multiplexing of multiple digital signals over optical fiber. The mechanism used could be lasers or light emitting diode. These protocols are called synchronous optical Networking (SONET). SONET was developed by ANSI and SDH was developed by ITU-T.
- SONET/SDH supports simultaneous transfer of signals from multiple different origins. Also this is done with the boundaries of a single framing protocol. ex. SONET/SDH is used for transferring ATM cells.



Where, ADM: Add/drop multiplexer.

STS MUX: synchronous transport single multiplexer

STS DEMUX: synchronous transport signal demultiplexer

(i) STS Multiplexers/ Demultiplexers -

STS provide the interface b/w an electrical tributary network and optical Network. An STS multiplexer multiplexes signals from multiple electrical sources & creates the corresponding OC signal. An STS demultiplexer demultiplexes an optical OC signal into corresponding electrical signal.

(ii) Regenerator - Regenerators extend the length of the link. A regenerator is a repeater that takes a received signal, demodulates it into the corresponding electric signal, regenerates the electric signal, and finally modulates the electric signal into its corresponding OC-n signal. A SONET regenerator replaces some of the

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existing overhead information with new information

(iii) Add/drop Multiplexes - Add/drop multiplexers allows insertion and extraction of signals. An add/drop multiplexer can add STS coming from different sources into a given path or can remove a desired signal from a path and redirect it without demultiplexing the entire signal.

- A number of incoming electronic signals are fed into an STS multiplexer where they are combined into a single optical signal.
- The regenerated signal from a number of sources are then fed into an add/drop multiplexer. The add/drop multiplexer recognises these signals.

(iv) Terminals - A terminal is a device that uses the services of a SONET network. For ex. in the internet, a terminal can be a router that needs to send packets to another router at other side of SONET Network.

Connections : The above defined devices are connected using sections, lines and paths.

section - A section is the optical link connecting two neighbouring devices multiplexes to multiplexes, multiplex to regenerator or regenerator to regenerator.

Lines - A line is the portion of the network bet'n two multiplexer STS multiplexer to add/drop multiplexer. two add/drop multiplexes or two STS multiplexers.

Path - A path is the end to end portion of the network between two STS multiplexers. In a simple SONET of two STS multiplexers linked directly to each other the section, line and path are the same.