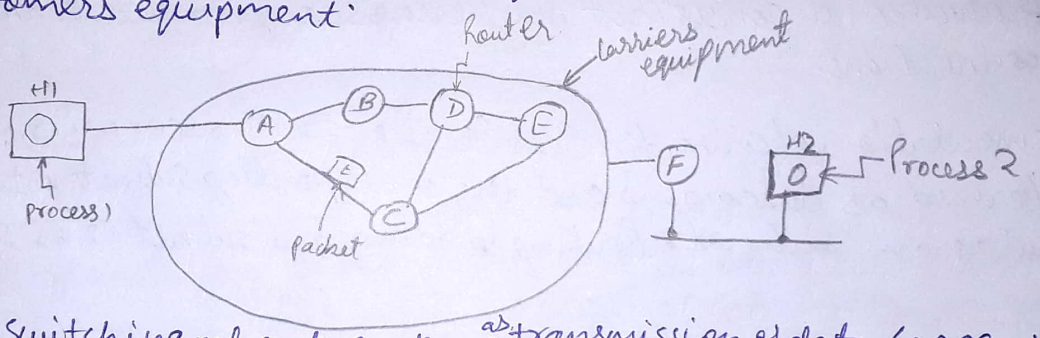
Q1 A network layer decides the address of the physical path that information has to be transmitted. A network layer comes up with certain design issues and are:

1.) Store and forward packet switching:

here the foremost elements are the carrier's equipment (the connection between routers through transmission lines) and the customers equipment.

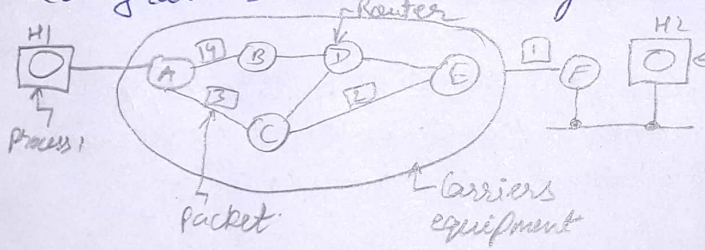


The switching network performs as transmission of data happens when the host (H1) with a packet transfers it to the nearby router through LAN or point to point connection to the carrier.

2.) Service provided to the transport layer:
Through the network/transport layer interface, the network layer delivers its services to the transport layer. services offered by the network layer are outlined considering few objectives:

→ offering services must not depend on router technology.
→ The transport layer needs to be protected from type, number and the topology of the available routers.
→ Network addressing the transport layer needs to ~~be~~ follow ~~protected~~ a consistent numbering scenario also at LAN & WAN connections.

3.) Implementation of connectionless Service: In this scenario, packets are termed as datagrams and the corresponding subnet is termed as datagram subnet. Routing in datagram subnet is as shown:



A's table.

initial	later
A –	A –
B B	B B
C C	C C
D B	D B
E C	E B
F C	F B

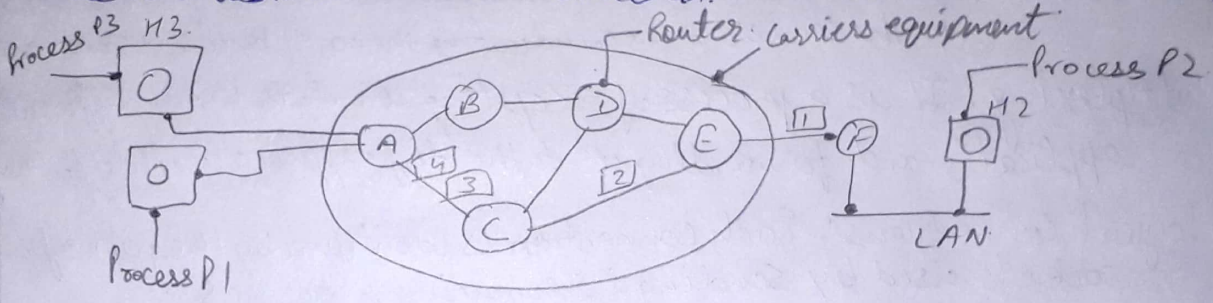
C's table.

A	A
B	A
C	–
D	D
E	E
F	E

E's table.

A	C
B	D
C	C
D	D
E	–
F	F

4) Implementation of Connection Oriented Service:
here the functionality of connection-oriented service works on the virtual subnet. A virtual subnet performs the operation of avoiding a new path for each packet transmission. As a substitute for this, when there forms a connection, a route from a source node to a destination node is selected and maintained in tables



Q2 TCP stands for Transmission Control Protocol. It provides full transport layer services to applications. It is a connection-oriented protocol; means the connect^{n} established b/w both the ends of the transmission, for creating the connect^{n}, TCP generates a virtual circuit b/w sender and receiver for the duration of a transmission.

Features of TCP protocol:

1.) Stream Data transfer: It transfers the data in the form of contiguous stream of bytes.

2.) Reliability: It assigns a sequence no. to each byte transmitted and expects a time acknowledgement from the recieveing TCP.

3.) Flow Control: When recieveing TCP sends an acknowledgement back to the sender, the no. indicating the no. of bytes it can recieve.

4.) Multiplexing: It is a process of accepting the data from different applicat"s and forwarding it to the diff. applicat" of diff. computers.

5.) logical Connections: Each connection is identified by the pair of sockets used by sending & recieveing processes.

6.) Full duplex: TCP allows the data flow in both directions at same time.

Source port address 16 bits								Destinat" port address 16 bits.
Sequence number 32 bits								
Acknowledgement number 32 bits								
HLEN 4bits	Reserved 6 bits	U R G	A C K	P S H	R S T	S Y N	F I N	Window size 16 bits
Checksum 16 bits								Urgent pointer 16 bits.
options & padding								

TCP segment

Source port address : to define the address of the applicat^n prog. in a source computer.

Destination port address : address of applicat^n in destination computer.

Sequence Number : It represents the position of data in an original data stream.

Acknowledgement no : It acknowledge the data from other communicating devices.

HLEN : Header Length, it specifies the size of the TCP header in 32 bit words

Reserved : It is a six bit field which is reserved for feture use.

Control bits : It defines the use of a segment or serves as a validity check for other fields.

URG, ACK, PSH, RST, SYN, FIN : Six flags in control field.

Disadvantages of TCP : (1) It is not generic in nature, so it fails to represent any protocol stack other than TCP/IP suite.

(2) It does not clearly separate the concepts of services, interfaces and protocols.

(3) It is not optimized for small networks like LAN, PAN

Q3 Similarity

Basically data layer provides error free transmission across a single link (2 consecutive stations) whereas Transport layer ensures the communication between source and destination.

Thus to ensure the communication both layers will provide:

1.) flow control : which controls the flow of data ensuring no overhead to the destination.

2.) Error Detection and Correction : detect errors in data and correct them if possible.

	Data link layer.	Transport layer
1.)	It detects transmission errors.	It detects segmentation fault.
2.)	It detects node to node error.	It detects end to end errors.
3.)		

Differences

The transport layer is the 4th layer in the open system interconnectn. model responsible for end to end communicatn over a network It provides logical communicatn b/w application processes running on different hosts within a layered architecture of protocols and other network components.

whereas

The data link layer or layer 2 is the second layer of the 7 layered OSI model of computer networking. This layer is the protocol layer that transfers the data b/w adjacent network nodes in a wide area network (WAN) or b/w nodes on the same Local Area Network (LAN) segment.

Q4 (A) C is capacity of bucket = 1 mb
data input rate = 25 mbps.
output rate = 2 mbps

(i) $T = \frac{C}{\text{input rate}} = \frac{1}{25} = 40\text{msec}$

(ii) $T_{out} = \frac{C}{\text{output rate}} = \frac{1}{2} = 500\text{msec}.$

[B]

	Leaky Bucket	Token Bucket
1)	It is used to determine whether some sequence of discrete events conforms to defined limits on their average & peak rates or frequencies.	It is used in packet switched computer networks and is used to check that data transmissions conform to defined limits on bandwidth & burstiness.
2)	input rate can vary, output rate is constant.	depending on size of burst output rate vary.
3)	Token independent	Token dependent.
4)	When bucket is full, packet or data is discarded.	if bucket is full, token are discarded but not the packet
5)	Packets are transmitted continuously.	Packets can only be transmitted if there are enough tokens.

Q5 [A] A client/server can create a mechanism that allows a user to establish a session on the remote machine and then run its applications. The two remote login protocols used are TELNET and SSH.

1.) TELNET: It is a TCP/IP standard for establishing a connection to a remote system. It allows a user to log in to a remote machine across the internet by first making a TCP connection and then pass the detail of the application from the user to the remote machine

2.) Secure Shell (SSH) Protocol: SSH is another remote login protocol based on UNIX prog. It uses TCP for communicat^n but is more powerful and flexible than TELNET and allows the user to more easily execute a single command on a remote client. It provides more secure communicat^n by encryption & authenticating messages. It also provides several additional data transfers over the same connection by multiplexing multiple channels that are used for remote login.

[B] E-mail protocols are set of rules that help the client to properly transmit the information to or from the mail server.

→ SMTP protocol: Simple Mail transfer protocol is a standard protocol used for sending e-mail efficiently & reliably over the internet. It handles exchange of messages over a TCP/IP network.

→ IMAP protocol: Internet Mail Access Protocol, allows the client prog. to manipulate the e-mail message on the server without downloading them on the local computer. It enables the users to search the emails and allows concurrent access to multiple mailboxes on multiple mail servers.

→ POP ~~stands~~ Protocol: Post Office Protocol, is generally used to support a single client. POP3 is current version of POP. It is an application layer internet standard protocol which allows offline access to the messages, thus requires less internet usage time. In order to access messages on POP, it is necessary to download them.