Q) Transport Layer:-

→ The transport layer is the fourth layer in the OSI Model.

Functions:-

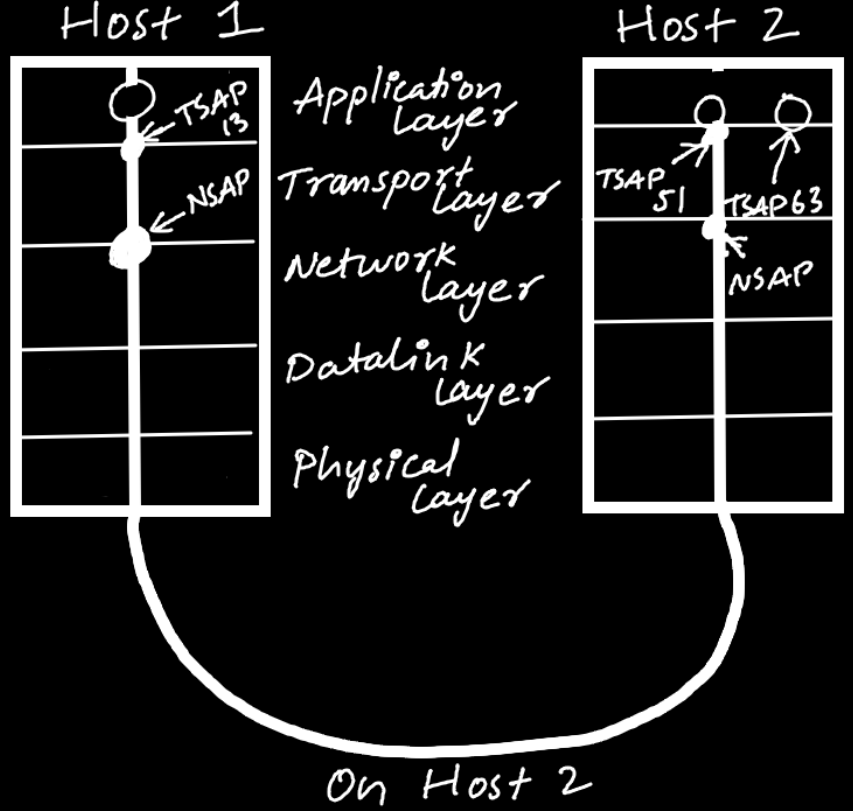
→ It accepts data from session layer, divide it into pieces (TPDUS) if required & pass this pieces to network layer & provide assurance about correct receiver.
→ It starts and terminates the connections across network.
→ It multiplexes the data.

Elements of transfer protocols:-

(i) Addressing
(ii) Connection establishment & connection release
(iii) Flow control & buffering
(iv) Multiplexing
(v) Crash recovery

Addressing:-

→ When a user one transport entity wants to establish a connection with other transport entity then port number, network number, transport entity identification, user identification is required.
→ TSAP (Transport Service Access Point) NSAP (Network Service Access Point) are used


Host 1
Host 2
TSAP 13
NSAP
Application Layer
Transport Layer
Network Layer
Datalink Layer
Physical Layer
TSAP 51
TSAP 63
NSAP
On Host 2

Connection establishment (3-way handshake) :-

→ To establish a connection, TCP uses 3-way handshake.

→ It's called as 3-way handshake because 3 segments are exchanged.

Following are steps followed in 3-way handshake.

(i) The client sends a packet with "SYN bit" set and a sequence number X.

(ii) Server sends a packet with an ACK + "SYN bit" set.

(iii) The client sends a packet with an ACK.

(iv) Client sends data

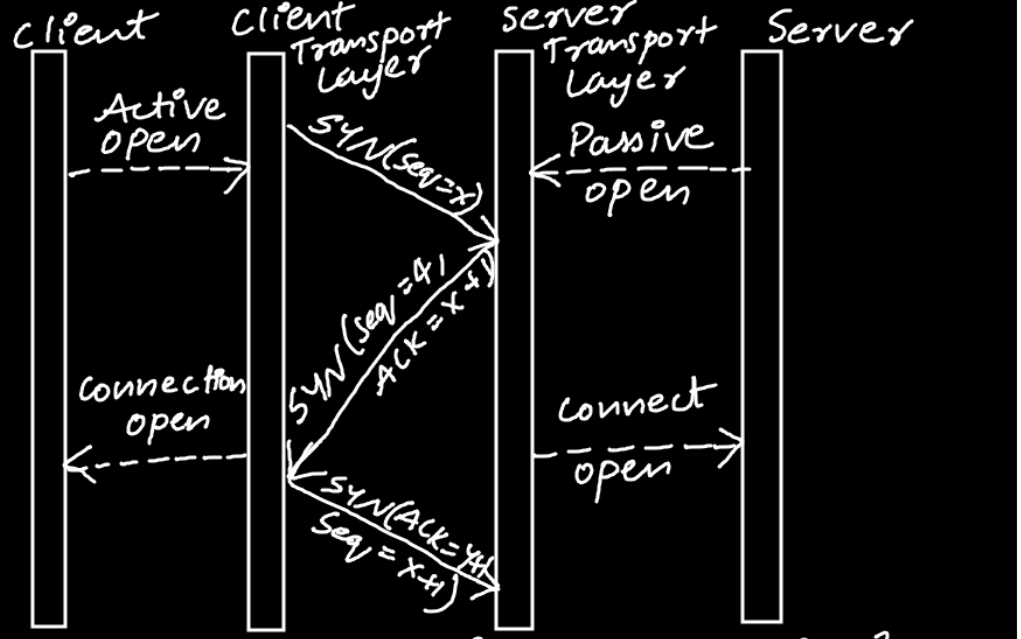


Diagram:- Establish connection using 3-way handshake.

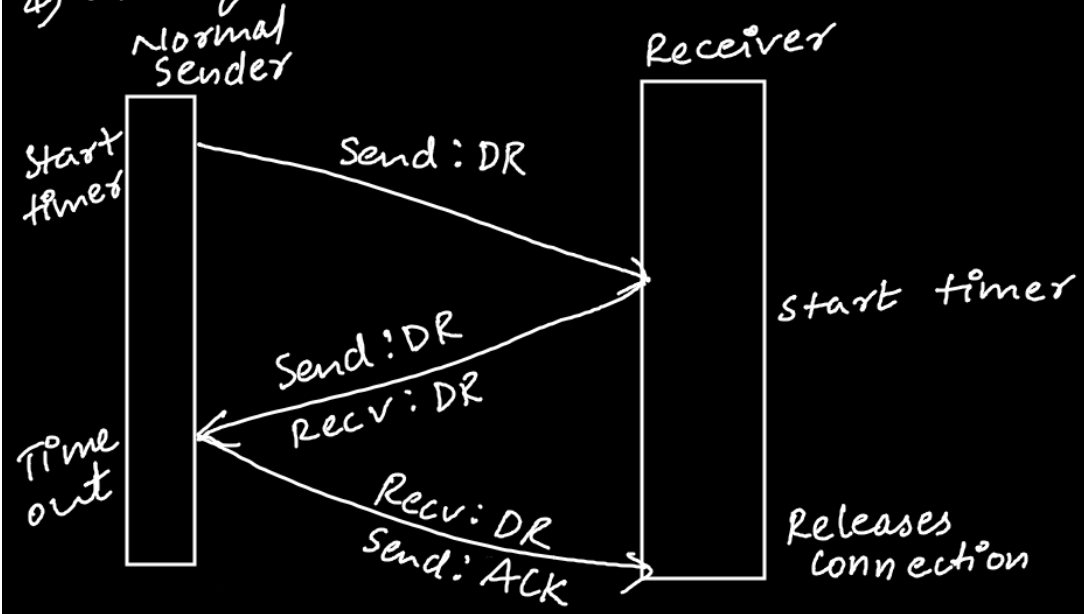
There are 3 scenarios in 3-way handshake protocol.

1) Normal Case
2) Duplicate SYN segment
3) Duplicate SYN & ACK segment

Connection Release:-

→ Four scenarios for releasing a connection

1) Normal way of releasing a connection
2) Lost of final ACK.
3) Response from receiver lost.
4) Subsequent responses lost.



Sender sends DR and starts timer. Receiver receives DR and sends DR to sender. If DR of receiver doesn't arrives on time then sender releases the connection & sends ACK to receiver

Q) Flow Control & Buffering

A) For flow control a sliding window is used on each connection to keep a fast transmitter from over running a slow receiver.

→ Various methods used for reserving the buffer are

(i) Fixed size buffer
(ii) Variable size buffer
(iii) Circular size buffer

Fixed Size buffer:- In this types of buffer only one TPDU is stored in a buffer.

→ If TPDU size is small then buffer space is wasted.

Variable Size buffer:-

→ In this type of buffer memory is utilized to maximum.

Circular Size buffer:- It's used when traffic is more but the disadvantage is that buffer space is wasted. Sender contains less load.

Q) Crash Recovery?

A) When the server crashes while receiving the data from the client the outstanding TPDU is lost.

→ The server might send a broadcast TPDU to all other host, announcing that it had just crashed and request the clients to open connections.

→ To recover the data when the server comes back, it's tables are reinitialized.

→ Client can be in one of two states

(i) TPDU outstanding

(ii) No TPDU Outstanding

→ Based on the above state info the client must decide whether to retransmit the TPDU (or) not.

→ To avoid the duplicate of data. The client should retransmitt only if it has acknowledgement TPDU outstanding.