a) write about The elements and Services Provided by Transport layer?

The services Provided by transport layer are similar to the services Provided by Data link layer.

→ The data link layer Provides services within a single network but the transport layer provides services across multiple inter connected networks.

→ The various services Provided by Transport layer are,

i) Segments:

The Transport layer makes data transmission easy and efficient.

→ It breaks down data from session layer into small units called as segments.

→ The segments are transmitted through network. These segments are assembled again upon arrival.

ii) Reliable Data Delivery:

→ Transport layer Protocols like, TCP ensure Reliable delivery of data.

→ They implement error detection, and they re-transmite data if they are lost.

→ They also have acknowledgment mechanisms to confirm successfy) Data tranfmission.

iii) Flow control:

→ The transport layer regulates the flow of data between sender and receiver.

→ The sender and reciever may operate at different speeds, This layer manages both efficiently.

iv) Congestion control:

Transport layer protocols help manage network congestion by adjusting the rate of data transmission

→ This prevents resources from becoming overloaded, ensuring efficient data transfer.

v) Quality of Service (QoS):

→ Transport layer protocols support Quality of service ~~protocols~~ mechanisms to prioritize certain types of traffic.

→ This ensure timely delivery of critical data such as audio or video

2) Explain about connection management in Transport layer

(or)

Explain TCP connection management?

TCP connection management:

Transmission control Protocol (TCP) is a connection oriented Protocol

→ This means that the client and server should be connected before transmission of data.

→ management of connections between endPoints is known as connection management

→ the several steps in TCP connection management are

i) connection establishment
ii) Data Transfer
iii) connection Termination

→ these steps are used to establish connection then transfer data and terminate connection.

→ these are 3 main phases of TCP connection management.

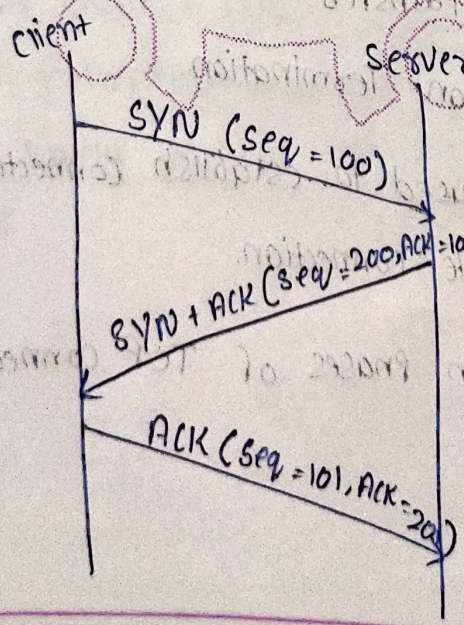
i) Connection Establishment:

→ The TCP Protocol follows full duplex communications which means the data is transfered simultaniously in both direction

→ for connection establishment in TCP we use "Three way handshaking"

* The client initiats the connection by sending SYN (Synchronize) Packet to the server
* The server responds with SYN-ACK (Synchronize acknowledgment) indicating that it recived request from ~~server~~ client and it also sends its own SYN.
* The client then acknowledges the server's SYN by sending ACK.

→ The connection is established and data can be transmitted.



ii). Data Transfer:-

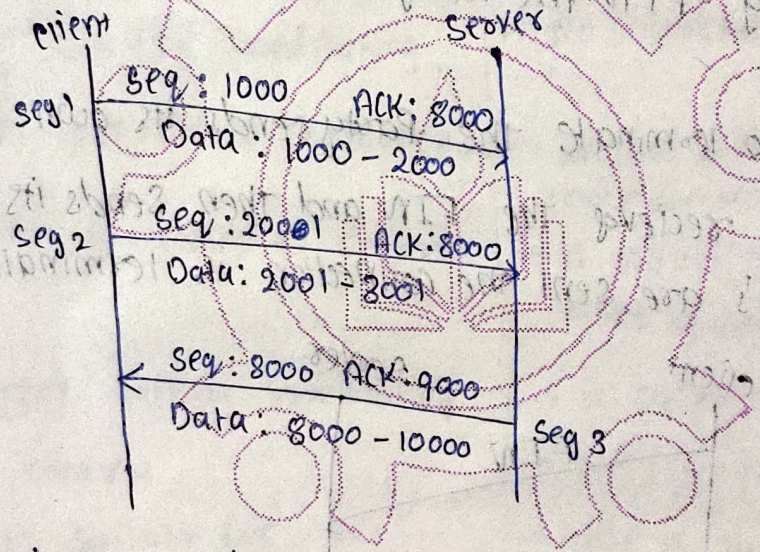
Once the connection is established, then client can send the data to server and server can also send the data to client.

→ TCP ensures reliable data delivery by implementing sequence numbers and acknowledments.

→ it also re transmits lost data and ensure data integrity.

→ The data is divided into segments of equal size.

→



→ The client sending a segment of data (1000 - 2000) bytes with sequence number 1000 and it expects an ack of 8000

→ The client sends another segment of data (2001 - 3001) bytes with sequence number 2001 and it expects an ack of 8000

→ The server then responds to client by sending segment of data (8000 - 10000) and Ack of 9000

→ As They are sending both Seq and ACK this is called as Piggybagging.

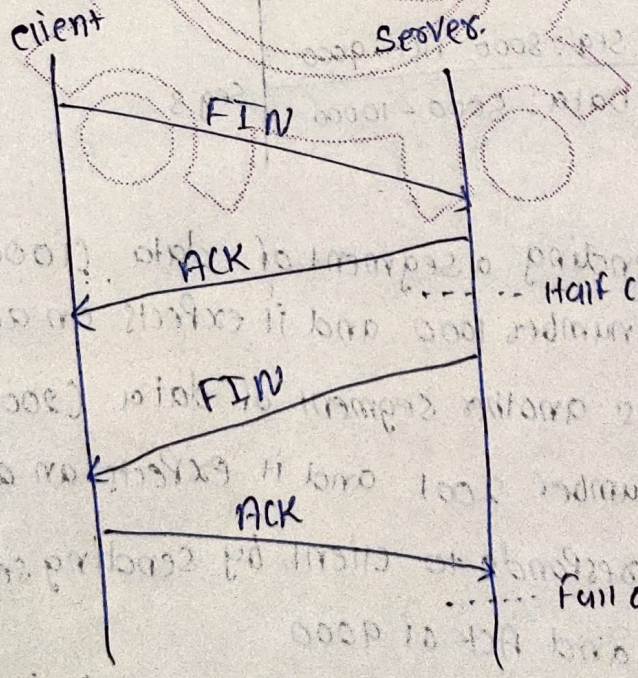
iii) Connection Termination:

→ After the successful Data transmission the connection needs to be terminated

→ for connection Termination TCP uses "four way handshaking"

→ The Termination can be initiated by both client and server

* The Party wishing to terminate connection sends FIN Packet to other Party.
* After receiving FIN the Party sends ACK that it recieved FIN.
* once ready to terminate the Party sends its own FIN.
* The other Party recieves the FIN and then sends its ACK.
* After both ACK's are sent the connection is terminated.



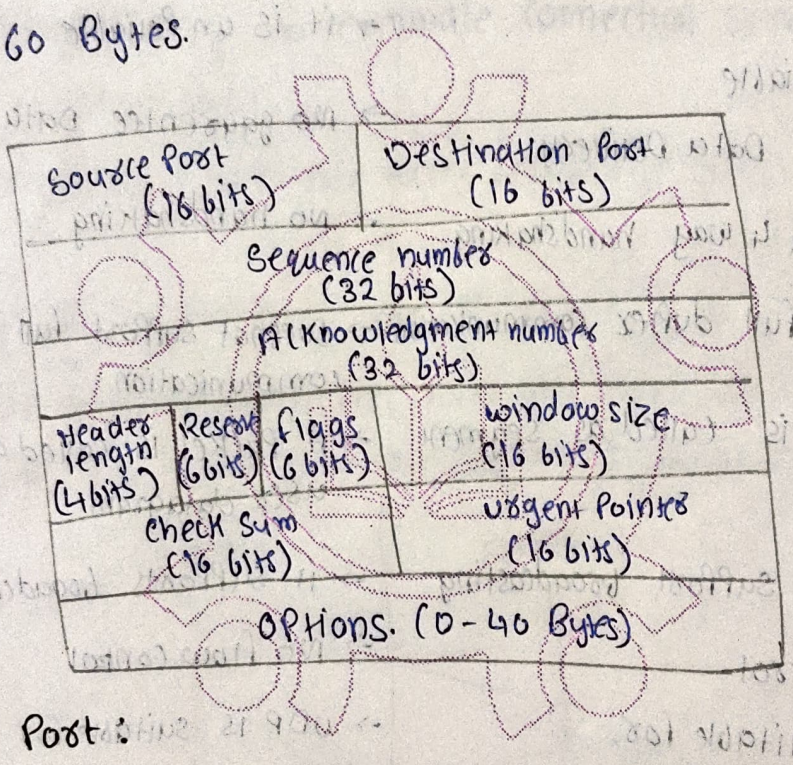
3) Compare and contrast between TCP and UDP
(or) Differences between connection oriented & connection less Protocol.

TCP	UDP
→ TCP stands for Transmission control Protocol	→ UDP stands for user Datagram Protocol
→ it is a connection oriented Protocol	→ it is a connection less Protocol
→ it is Reliable	→ it is un Reliable
→ Gaurantee Data Delivery	→ No gaurentee Data delivery.
→ 3 way & 4 way handshaking	→ No handshaking.
→ Support full duplex communication	→ Doesnot support full duplex communication.
→ A Packet is called as segment	→ A Packet is called as user datagram
→ it doesn't support broadcasting	→ it supports broadcasting
→ Flow control	→ No flow control
→ TCP is suitable for, • Email • file sharing	→ UDP is suitable for • Audio streaming. • video streaming
→ slower than UDP	→ faster than TCP
→ more overhead	→ less overhead.

4) Describe each field of TCP segment header.

The TCP segment header contains several fields that provide essential information for establishing and managing TCP connections.

→ The size of a TCP segment header varies from 20 - 60 Bytes.



i) Source Port:

→ It indicates the Port number of the sender

→ it is of 16 bits or 2 bytes

ii) Destination Port:

→ it specifies the Port number of the reciever

→ It is of 16 bits or 2 bytes.

iii) Sequence number:

identifies the sequence number of current segment used for ordering of data segments at reciver end

→ it is of 32 bits or 4 bytes

iv) Acknowledgment number:

→ it contains the sequence number that the sender is expecting from the reciever

→ it is of 32 bits or 4 bytes

v) Header length:

→ it specifies the size of the TCP header

→ it is of 4 bits

vi) Reserved:

→ Reserved for future use and must be set to zero.

→ it is of 6 bits

vii) Flags:

→ contains control flags that determine the purpose and behavior of TCP segment.

→ it is of 6 bits and contains 6 flags

viii) window size:

→ specifies the size of recive window that the sender is willing to accept

→ it is of 16 bits or 2 bytes

ix) Checksum:

→ used for error detection, ensuring the integrity of TCP header and data

→ it is of 16 bits or 2 bytes

x) Urgent Pointer:

→ Indicates the end of urgent data within the segment

→ it is of 16 bits or 2 bytes.

xi) Options:

→ may include additional information or parameters related to the connection

→ it is of 0 - 40 bytes.

* The combination of all these fields enable TCP to provide reliable, connection oriented communications over networks.

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5) write about the Performance issues of Transport layer?

The Transport layer, Represented by Protocols like TCP and UDP plays a crucial role in network communication.

→ It is very important part of the modern day internet but it faces few Performance issues

→ The Performance issues of Transport layer are,

i) Latency:

→ Latency refers to the delay between initiation of a communication request and recieving of response

→ Due to connection oriented nature of TCP, there can be a delay specially in few networks

→ the retransmissions in TCP can also increase latency.

ii) Connection Establishment overhead:

→ TCP requires a three way handshake to establish a connection between two endPoints

→ This includes exchange of multiple messages before actually establishing a connection, this increase overhead.

iii) UDP's Reliability:

UDP offers low overhead and latency compared to TCP but it lacks in Realiability

→ The UDP applications must implement their own Error detection.

iv) Buffering:

TCP maintains buffers to store incoming and outgoing data

→ In situations of high network congection the buffer size can grow and lead to Performance issues.