TRANSPORT LAYER

The transport layer is 4th layer of OSI model
It responds to service request from the session layer and issues service request to network layer.
It provides transparent transfer of data between hosts.
It is located between Application layer and Network layer

FUNCTIONS

1.] Process to process Communication
- It is responsible for delivering data to appropriate application process on the host computer.
- This involves Multiplexing of data.

2.] Addressing ~~Port~~ Port Number:
Ports are the essential way to address multiple entities at the same time at same location.
It allows to use more than one network based application at the same time.

3.] Encapsulation and Decapsulation.
- To send a message from one part to another the transport layer encapsulates & decapsulates.
- Encapsulation happens at sender's site. The transport layer adds its header
- Decapsulation happens at reciever's site. The header drops and message is sent to destination program.

4.] Multiplexing and Demultiplexing.
When an entity accepts items from more than one source. this is reffered to as multiplexing.
When an entity delivers item ~~from~~ ~~one~~ to many ~~source~~ source is called demultiplexing

5.] Flow control
It is a process of managing the rate of data transmission between two nodes to prevent a fast sender from overwhelming a slow reciever.
It provides reciever to manage the ~~control~~ speed of transmission so it is not overwhelmed.

6] Error Control.

It is responsible for
- Detecting and discarding corrupted packets.
- keeping track of lost & discarded packets. & resending
- Recognizing duplicate packets. & discarding them
- Buffering out of order packets until the missing packets arrive.

7] Congestion control.

- Congestion in a network may occur when the packet sent are greater than the capacity of the network.
- Congestion control refers to mechanism which keep the load below the capacity.
- They are divided into two types.

Open loop	closed loop.
prevent congestion before it occurs.	handles congestion after it has occured.

PORT NUMBER

The transport layer provides process to process communication.
Process which run on local host are called client the process on remote host are called server.
These process are assigned unique 16-bit port number on that host
This also provides multiplexing & Demultiplexing.
ICANN [International Corporation for Assigning Name and Number]
has divided ports into 3 ranges.

- Well known ports
- Registered ports
- Ephemeral ports.

TRANSPORT LAYER PROTOCOL

Three protocols are associated with Transport layer

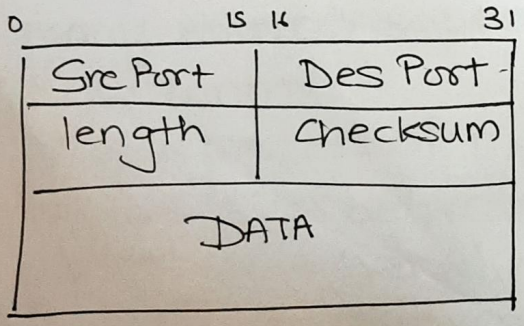
1.] UDP User Datagram protocol
2.] TCP Transmission control protocol
3.] SCTP Stream control transmission protocol.

- UDP : UDP is a unreliable connectionless transport layer protocol used for its simplicity and efficiency. where error control can be provided by application layer process.
- TCP : TCP is a reliable connection oriented protocol that can be used in any application where reliability is important.
- SCTP : Its a new transport layer protocol ~~used~~ designed to combine features of UDP & TCP in an effort to create a better protocol.

UDP :

It is a simple demultiplexer
It doesnt provide flow control, reliable or ordered delivery.
Can be used to send small messages
Sending UDP is faster and takes less interaction between sender and reciever.
Some well known UDP ports are.
7 - Echo, 53 - DNS, 111 - RPC, 161 - SNMP etc. de
<Port, host> are used as <key, value> for multiplexin
Ports are used as message queues.

UDP PACKET DIAGRAM



UDP services.

Process to Process
Connectionless Service
Flow Control
Error Control
Checksum
Queuing
Congestion Control
Encapsulation, Decapsulation
Demultiplexing.

TRANSMISSION CONTROL PROTOCOL

Its a full duplex protocol

It has a pair of byte stream one in each direction.

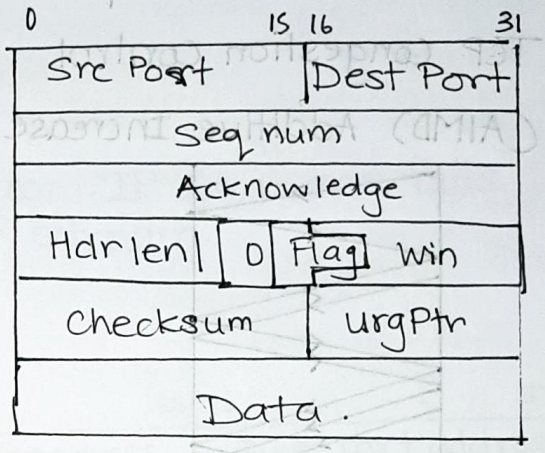
Services:

- process to process
- Stream delivery:

It creates an environment in which the two process seem to be connected by a tube. this carries their bytes accross internet.

- Full duplex
- Error Control
- Flow Control
- Congestion Control
- Multiplexing, Demultiplexing
- Connection oriented service.
- Reliable Service.

TCP PACKET DIAGRAM →

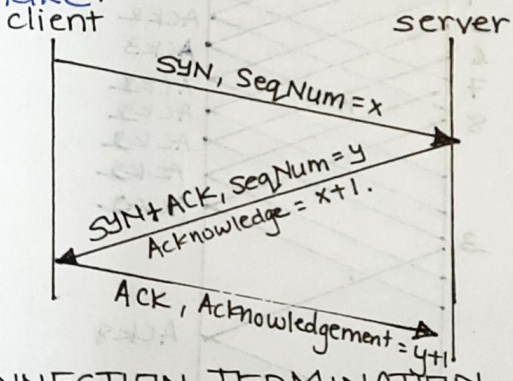


CONNECTION ESTABLISHMENT

While opening a connection the client & server want to agree on set parameter

The parameter are starting sequence number that is to be used for byte stream

This connection establishment is called threeway hand shake.

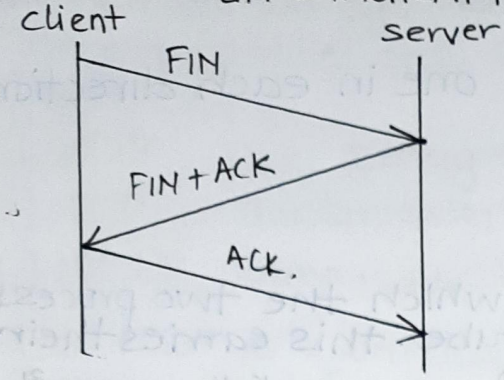


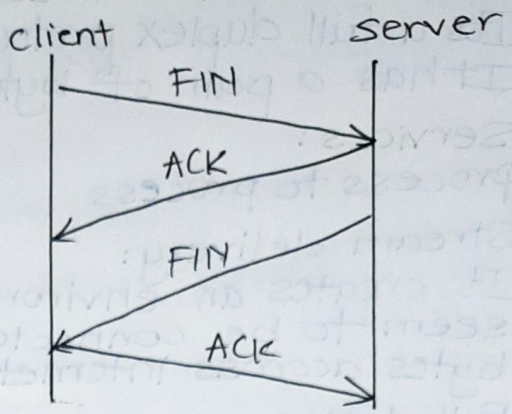
CONNECTION TERMINATION

Three way close: Both client and server close simultaneous

Half close: One of them closes first then other.

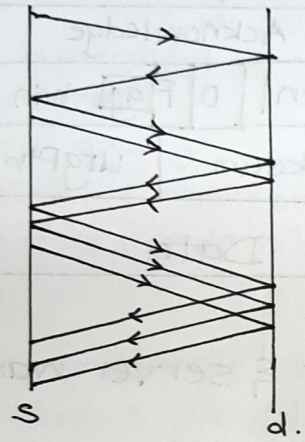
TERMINATION DIAGRAM



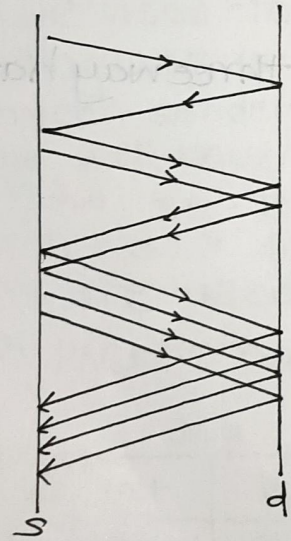


TCP Congestion Control

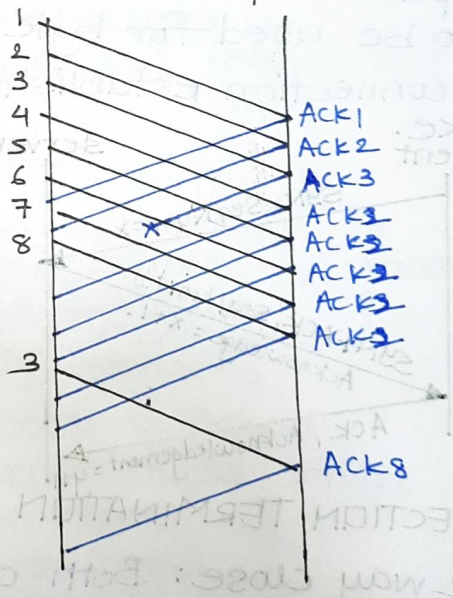
(AIMD) Additive Increase Multiplicative Decrease.



Slow Start.



Fast Retransmit & Fast recovery



SCTP

It is a reliable message oriented transport layer protocol

It has Mixed features of UDP & TCP

It maintains message boundaries and detects the lost data or duplicated data.

It is specially designed for internet application as well as multimedia communication.

Services:

Process to process

Multiple stream.

Multihoming: allows multiple stream IP so if one fails can send data through other stream.

Full duplex

Connection oriented service.

Reliable service.

PACKET DIAGRAM