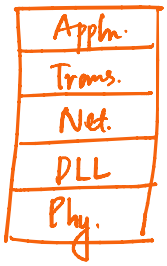
Module 3: Transport Layer - 1

Monday, February 7, 2022 3:23 PM



Message (created by the application process)

→ a segment = TCP segment / UDP segment } depends on the segment header.

IP protocol — responsible for host-to-host | hop-to-hop delivery.

TCP/UDP protocols — responsible for process-to-process delivery.

Best-effort delivery service: makes "best effort" to deliver segments between communicating hosts but makes no guarantees.

IP protocol is unreliable (does not guarantee orderly delivery, duplication of segments can occur, segments can have errors).

UDP's Services:

1. process-to-process delivery
2. error checking.

} Similar to IP protocol, UDP is also unreliable and does not guarantee that the data delivery by one process will arrive intact to the destination process.

TCP's Service:

1. process-to-process delivery

① process-to-process delivery

② error checking.

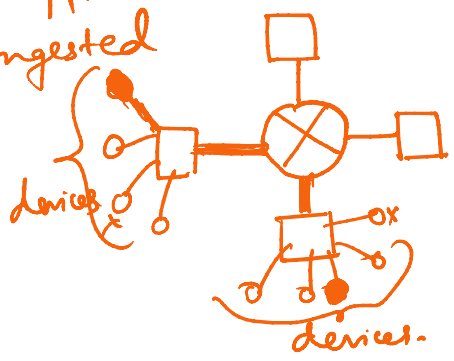
③ Reliable data transfer: uses flow control, sequence numbers, acknowledgements, and timers to ensure that the data is delivered from sending process to receiving process and in order.

(Converts IP's unreliable service between end systems into a reliable data transfer service between processes).

④ Congestion control: prevents any one TCP connection from overwhelming the links and routers between communicating hosts with an excessive amount of traffic.

TCP gives each connection using a congested link an equal share of the link bandwidth — regulating the rate at which the sender can send traffic into the network.

(Congestion window / flow control)



Multiplexing and Demultiplexing Services.

① Each host runs hundreds of processes

② Each host handles multiple TCP connection.

↳ each connection is carrying messages created by an application process.

↓

to be consumed by

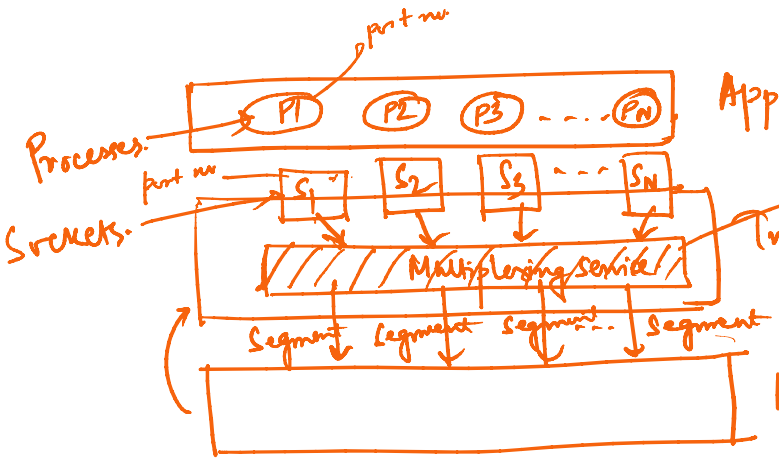
For multiplexing

(1) Socket with unique identifiers

(1) Socket with unique identifiers

(2) Special field in each segment that identifies to socket where to be delivered.

↓ to be consumed by a process that is running the same application.



gathering data chunks from different sockets, encapsulating each data chunk with the header information to create segments, and passing the segments to the NW layer.

TCP Socket

- Connection-oriented multiplexing and demultiplexing.
- identified by four tuples — Source IP address, Source port number, destination IP address, destination port number.
- two TCP segments with different Source IP addresses or source port numbers will be directed to two different sockets.
- The server host may support many simultaneous TCP connection sockets — each socket is attached to a process and each socket is identified by four-tuples.

UDP Sockets.

- connectionless multiplexing and demultiplexing.
- identified by two tuples — destination IP address and destination port number.
- IF two UDP segments have different source IP

- If two UDP segments have different source IP address and/or source port number, but have same destination IP address and same destination port number, then two segments will be directed to the same destination process via the same destination socket.

UDP

(1) Lacks handshaking mechanism (connection establishment) due to which it cannot guarantee orderly delivery of segments.

(2) Applications that use UDP as the underlying TL protocol.

- Real time application — aim for delivery with minimal delay — not concerned about reliability.
- Delay is minimized as UDP does not establish any connection between source and destination.
- Less overhead
- Smaller segment size (UDP header is only 8 bytes)

(3) Limitations of using UDP in multimedia streaming

- Lack of congestion control: a faster source-destination pair with swamp the link BW and denying the other pairs from using the link.
  - other pairs → TCP connection
  - denying → lead to degradation of NW performance.

NW performance.

↳ TCP Connection

- Other TCP Connections sensing a Congestion Situation can reduce their sending rate → reduces the overall NW throughput.

- UDP packets are filtered out or blocked from entering into a network.