

# CS118 Discussion 1B

Week 3

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- Transport Layer

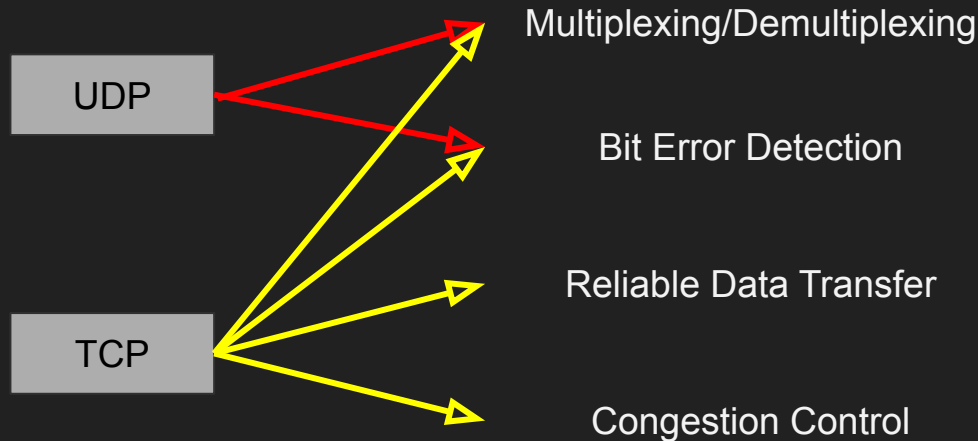
# Transport Layer

# Minimal Transport Layer Services

- Multiplexing and Demultiplexing
  - Extend host-to-host communication to process-to-process communication
  - host  $\Leftrightarrow$  multiple processes
- Bit Error Detection
  - Include checksum in segment's header (we usually call a transport layer packet a segment)

# TCP and UDP

- UDP provides minimal transport layer services
  - Finer application control over what data to send and when to send
  - No connection overhead
  - Small header
- TCP provides way more
  - Explain why its header is longer and logic is much more complicated



# Checksum calculation (TCP/UDP)

- Pseudo header: bring important fields from IP header
  - Source IP address, Destination IP address
  - Protocol
  - TCP/UDP packet length
- Checksum:
  - Pseudo header
  - + UDP/TCP header
  - + UDP/TCP data

Source Address			
Destination Address			
zero	PTCL	TCP Length	

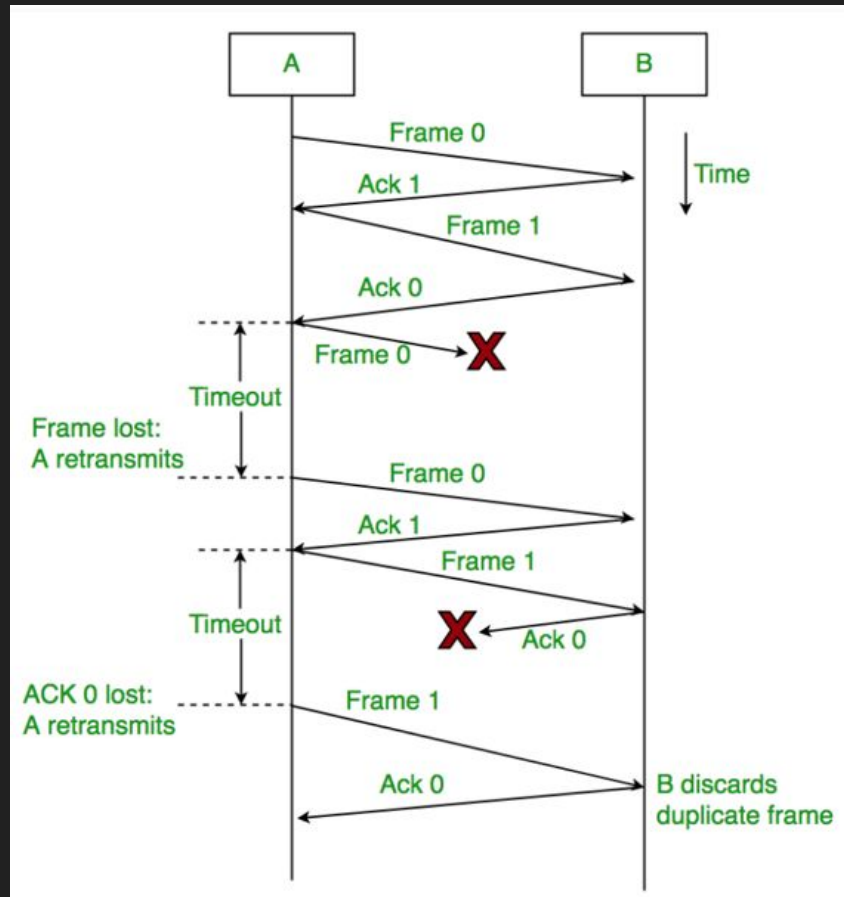
source address			
destination address			
zero	protocol	UDP length	

# Review RDT 2

- 2.0: Bit error
  - Error detection mechanism: NACK when checksum is wrong
  - Receiver feedback: ACK/NACK
  - Retransmission when NACK
- 2.1: How to deal with duplicate retransmission when retransmitting packets after receiving corrupted ACK/NACK?
  - 1 bit sequence number: receiver compares received seq with the latest correct packet's seq, if matches, drop it
- 2.2: Do we really need NACK?
  - ACK only: duplicate ACK means NACK

# Review RDT 3

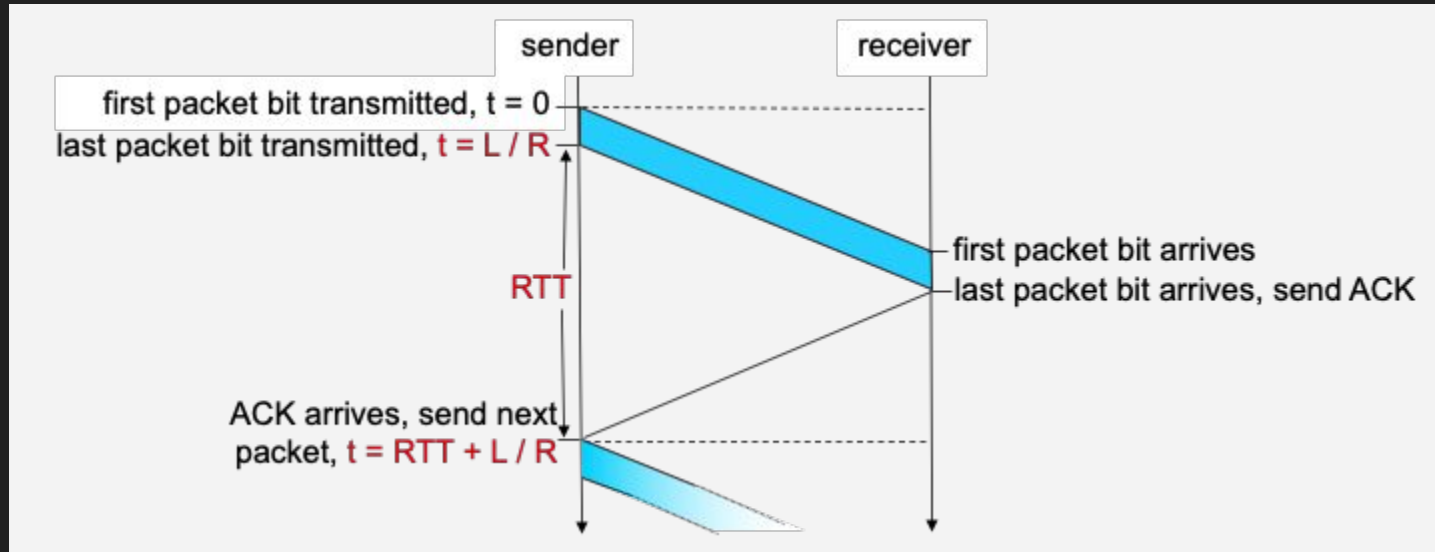
- How to handle packet loss?
  - Retransmission timer: retransmit if time out (no ack back)
- RDT 3 is a stop and wait protocol
  - Stop and wait for **ACK**
  - **Time out** to retransmit
  - **Sequence number** to handle duplicate pkts





# Performance issue

- Low utilization of the bandwidth
  - Sender is idle in RTT
  - Utilization:  $\text{Transmission Time} / (\text{Transmission Time} + \text{RTT})$



# How to address the low utilization?

- Pipelining
  - Go-back-N (GBN)
    - Drop out of order pkts
    - Re-ack pkt with the highest in-order pkt's seq
    - Timer for oldest unAcked packet only, when time out, retransmit all packets after the acked seq
  - Selective repeat
    - Buffer out of order pkts
    - Timer for each pkt and retransmit any unAcked ones
- To help you understand:

[https://www.ccs-labs.org/teaching/rn/animations/gbn\\_sr/](https://www.ccs-labs.org/teaching/rn/animations/gbn_sr/)