Oct 1: TCP

Selective ACK = Selective Repeat

Window size \( W \) = 4

Available Bandwidth

Your window size

\[ W = f(\text{available bandwidth}) \]

\[ = \text{fraction of bottleneck b/w} \]
The TCP Intuition
TCP protocol → Rx has buffer (Sel. Repeat)

Cumulative ACK (GBN)

① Cumulative ACK (GBN)

\[ \perp_{\text{Aj}} \text{ implies that all packets until } j \text{ has been received by Rx} \]

Data Transport

Connection Setup

Called Exponential increase of \( CW \)

\( CW = 1 \)

\( CW = 2 \)

\( CW = 3 \)

\( CW = 4 \)

\( CW = 8 \)

RTT

SLOW START

Connection is doubling every RTT.
TCP says: After a while, reduce the rate at which CW increases.

\[ \text{Threshold} = 8 \]

Upon every new ACK, \( \text{CW} = \text{CW} + \frac{1}{|\text{CW}|} \)

Congestion Avoidance \( \Rightarrow \text{increase CW by 1 per RTT} \)
The TCP Protocol (in a nutshell)

- T transmits few packets, waits for ACK
  - Called slow start

- R acknowledges all packet till seq #i by ACK i (optimizations possible)
  - ACK sent out only on receiving a packet
  - Can be Duplicate ACK if expected packet not received

- ACK reaches T → indicator of more capacity
  - T transmits larger burst of packets (self clocking) … so on
  - Burst size increased until packet drops (i.e., DupACK or timeout)

- When T gets DupACK or waits for longer than RTO
  - Assumes congestion → reduces burst size (congestion window)