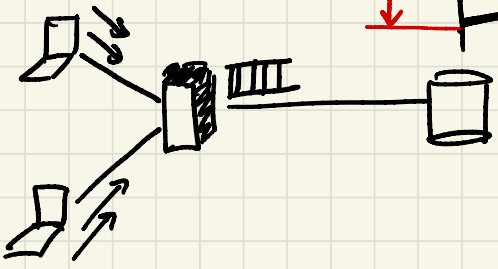
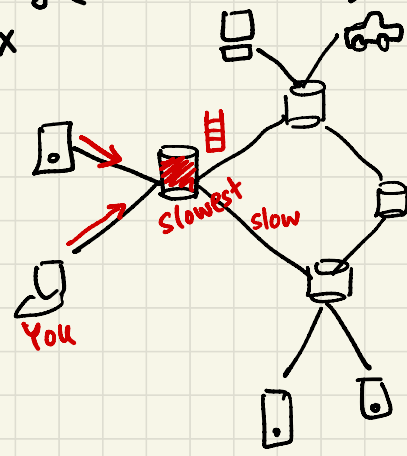
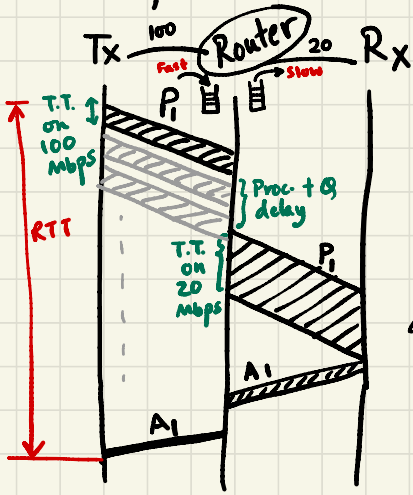
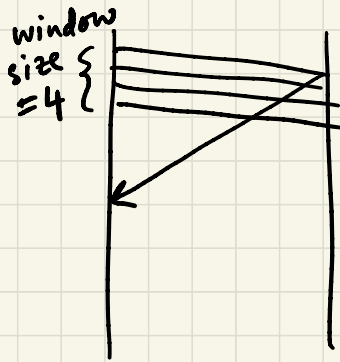


# Oct 1 : TCP

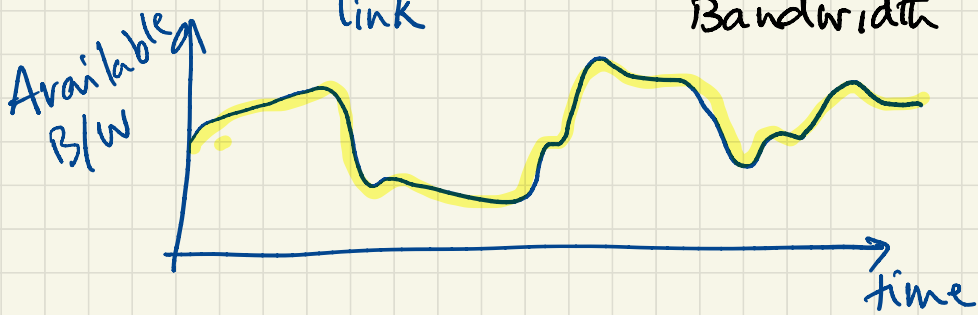
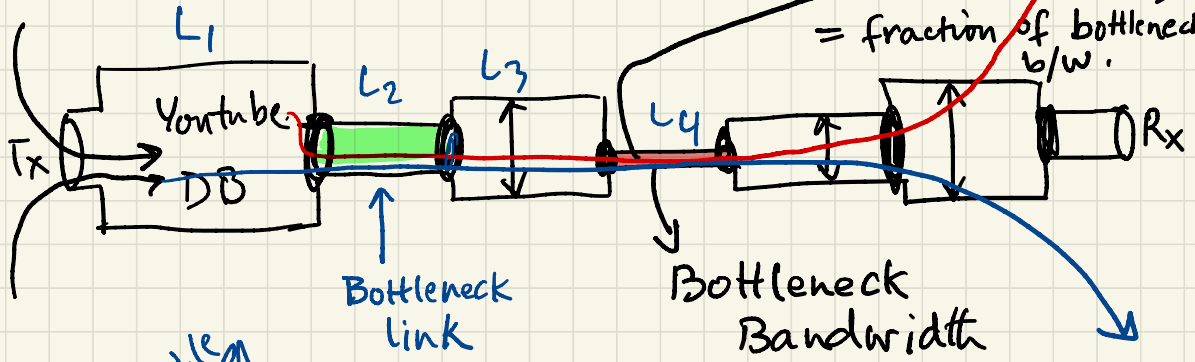
Selective ACK = Selective Repeat

Window size =  $f(\text{Bottleneck Link})$

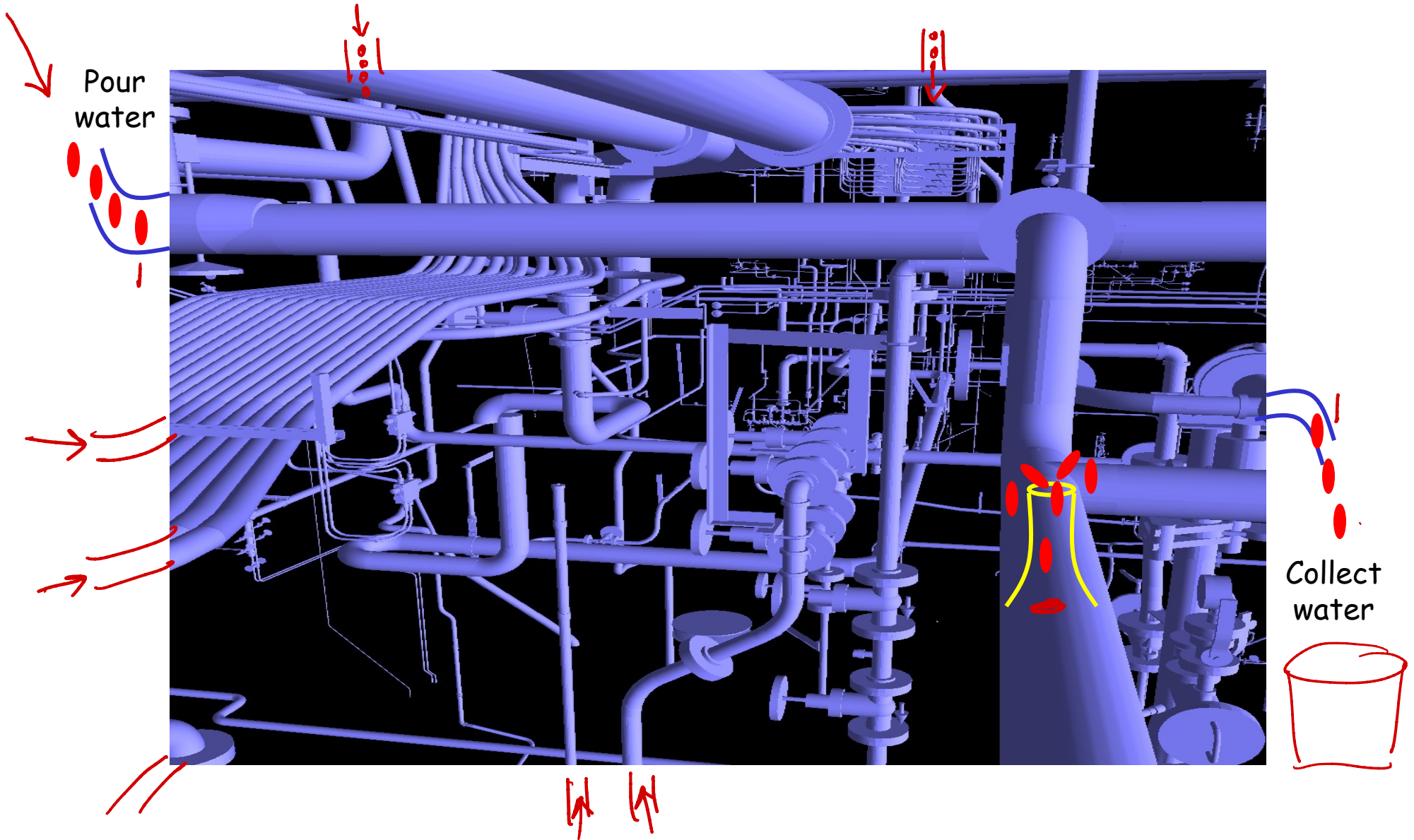
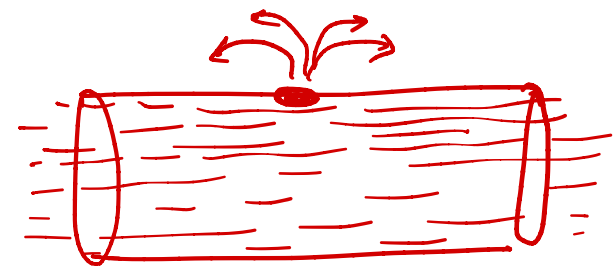


Available Bandwidth

Your window size =  $f(\text{available bandwidth})$   
 = fraction of bottleneck b/w.



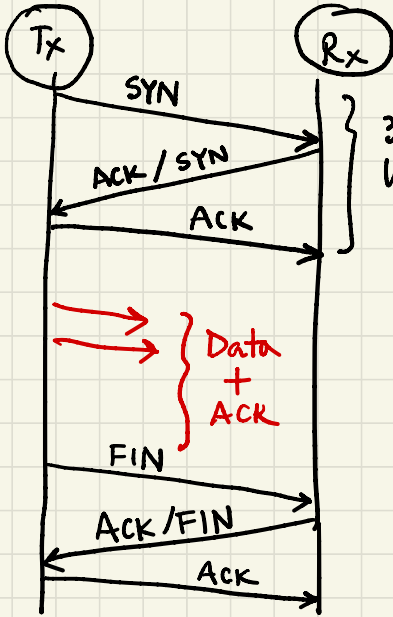
# The TCP Intuition



# TCP Protocol

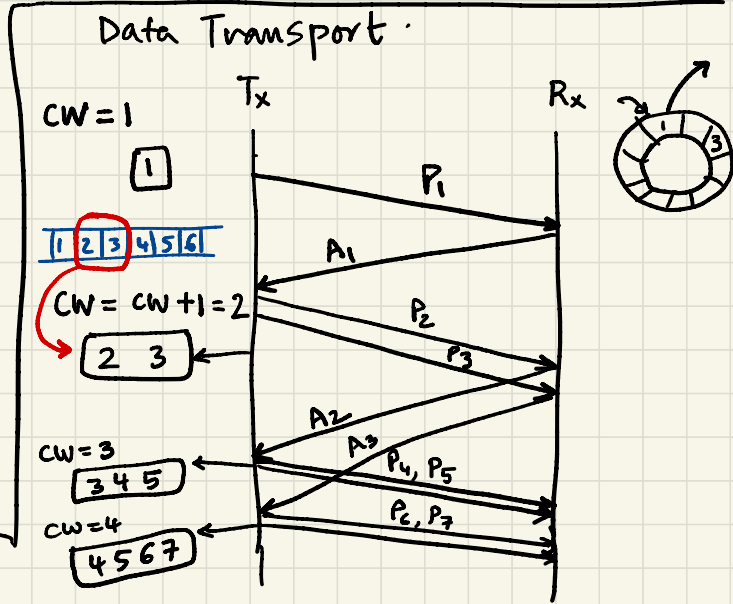
→ Rx has buffer (Sel. Repeat)  
 → Cumulative ACK (GBN)

↳  $A_j$  implies that all packets until  $j$  has been received by the Rx

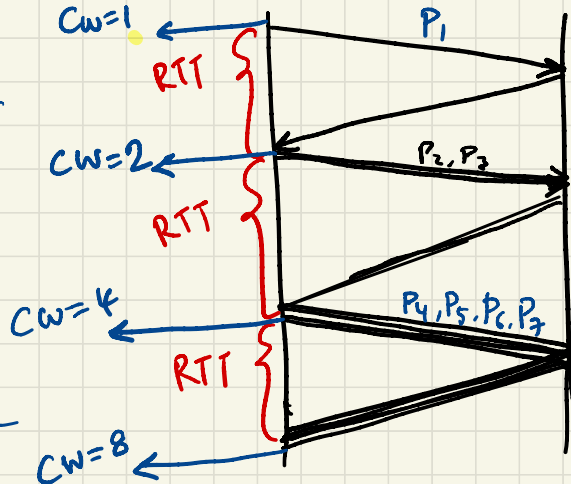


3-way handshake

Connection Set up.

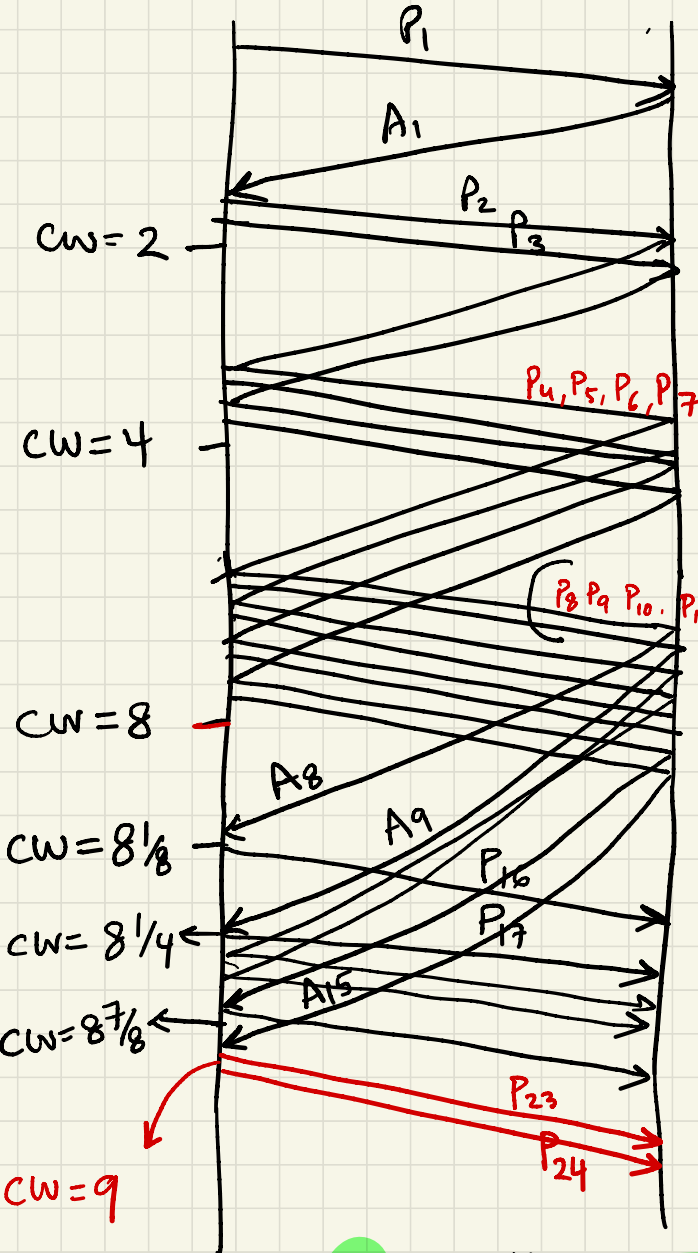


Called Exponential increase of CW  
 ↓  
**SLOW START**  
 Congestion window is doubling every RTT.

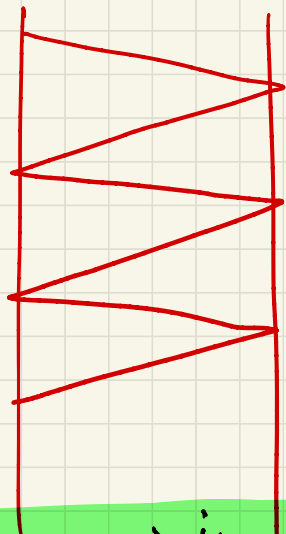


TCP says : After a while, reduce the rate at which CW increases.

Threshold = 8



Upon every new ACK.  
 $CW = CW + \frac{1}{[CW]}$



**Congestion Avoidance**  $\Rightarrow$  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**)