Lecture 15

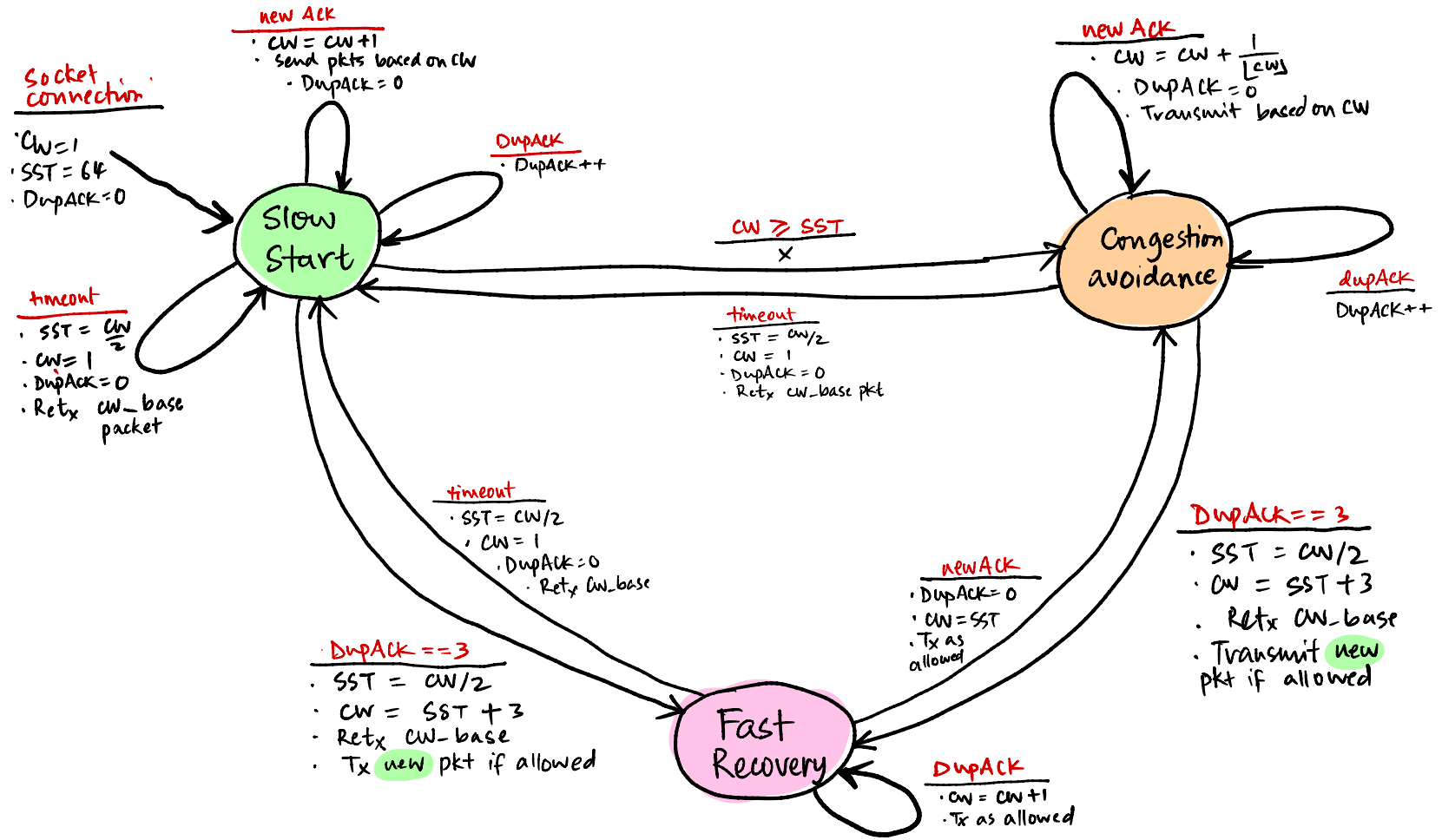
- State Diagram
- Examples
- Saw tooth
- Single timer

Today's short lecture

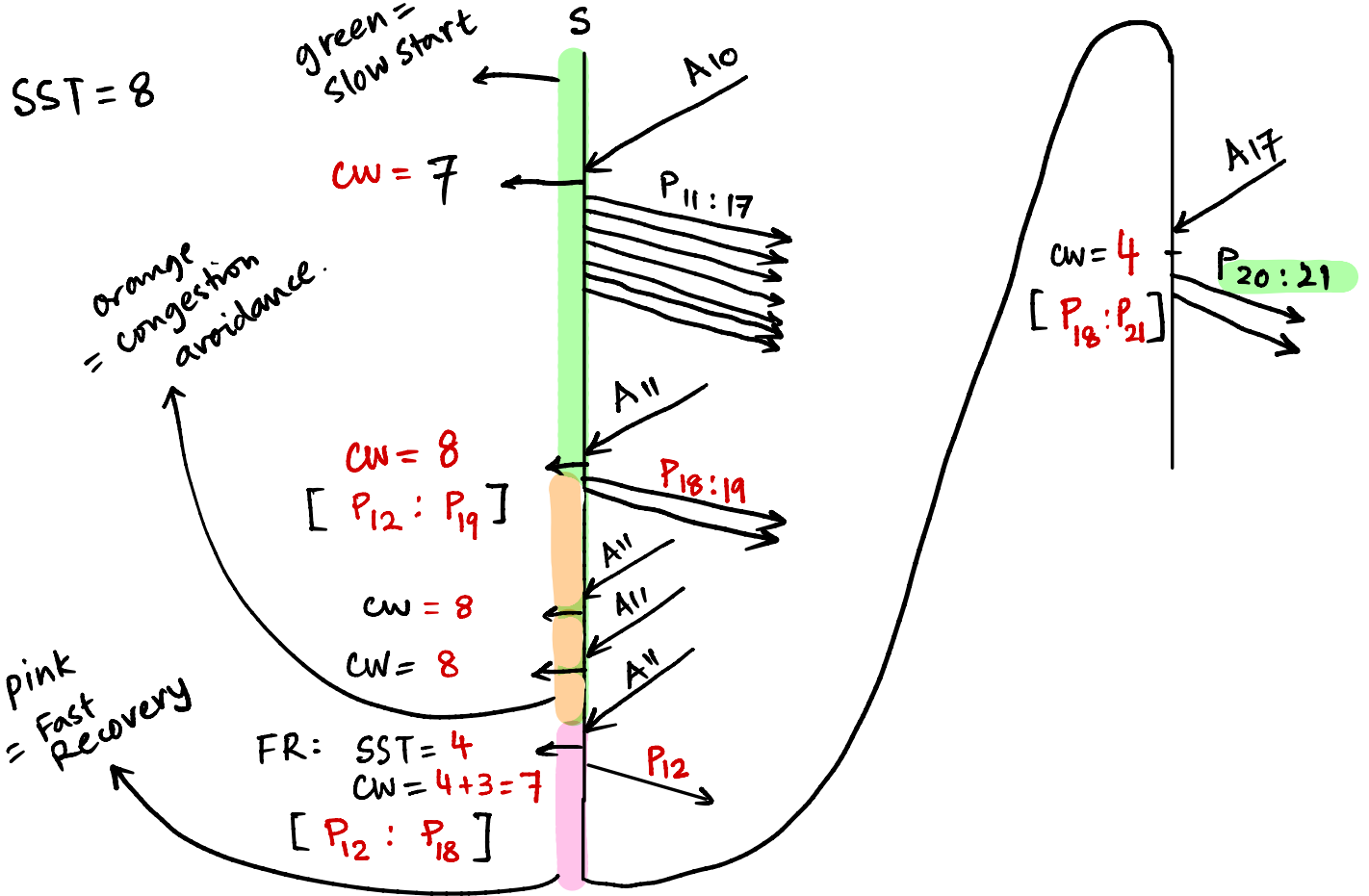
- RTO Estimation
- Packets to Bytes
- TCP Flow Control
- TCP Fairness
- TCP cross layer / wireless

Video lecture

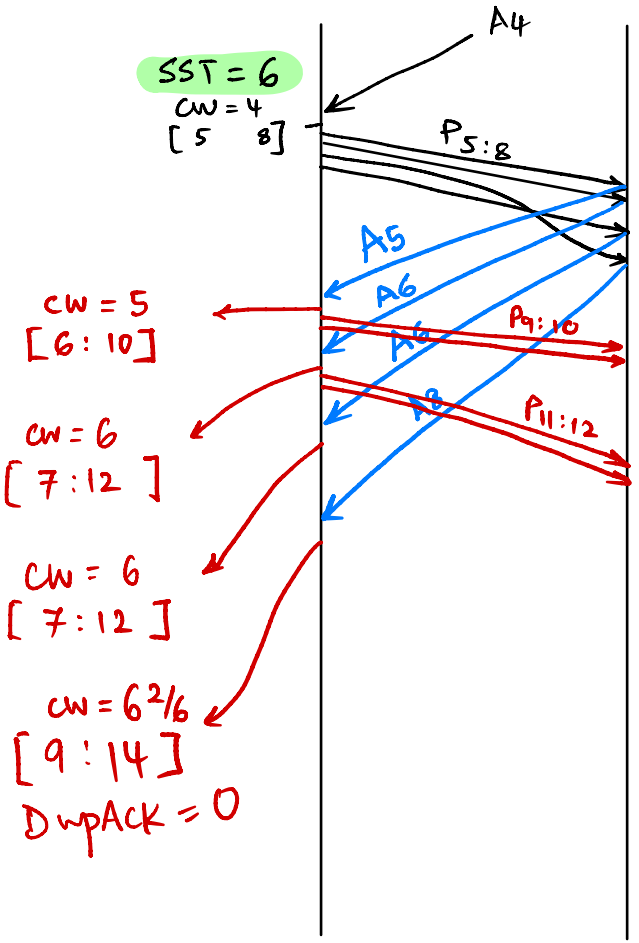
TCP Protocol : State Diagram

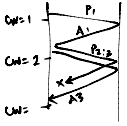


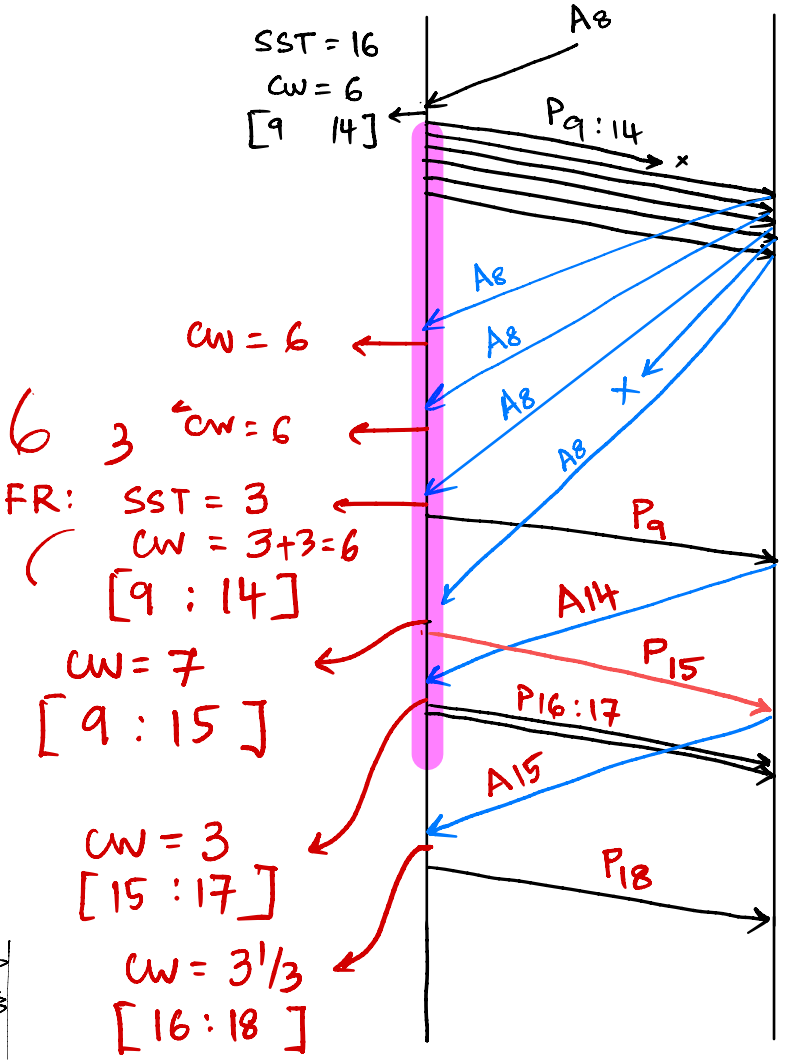
Clarification on Fast Recovery



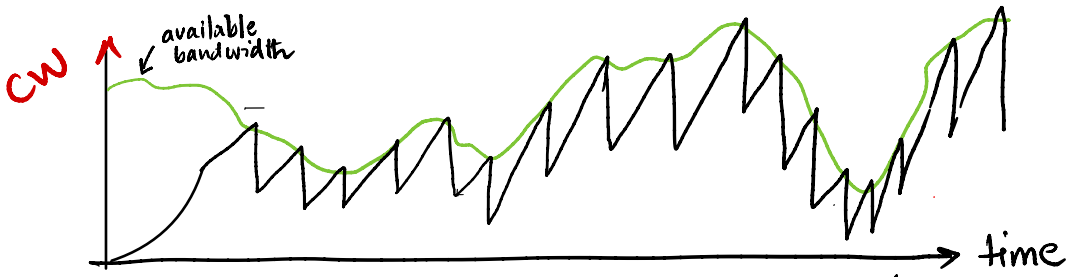
More examples

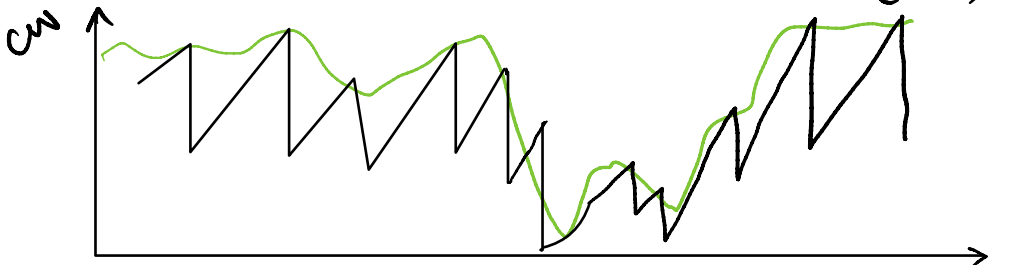




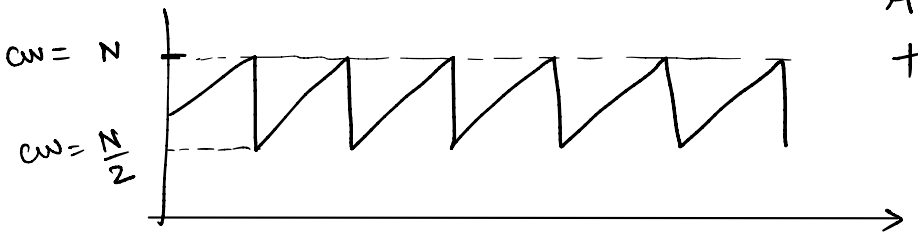


Saw Tooth Behavior





TCP CW exhibits a "saw tooth" behavior

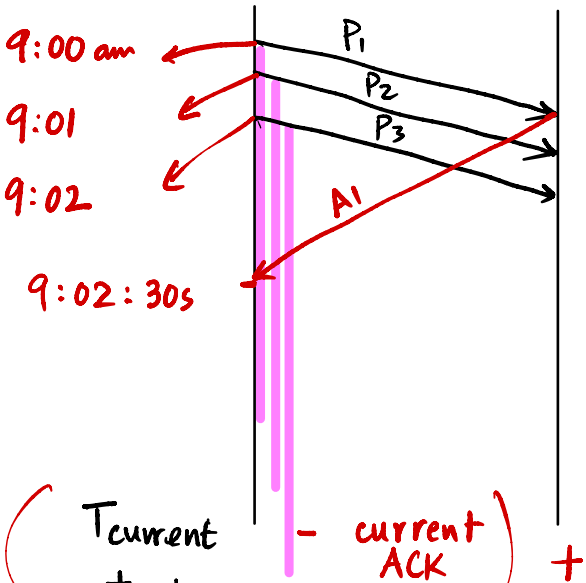


$$\text{Avg TCP throughput} = \frac{\frac{N}{RTT} + \frac{N/2}{RTT}}{2}$$

$$= 0.75 \frac{N}{RTT}$$

TCP uses a single timer for timeouts :

T/o = 5 min



Set Alarm for t/o duration.

T_{next} + timeout

9:01

time at which current packet was sent = 9:00am

$$\left(T_{current} + \text{alarm time} - \text{current ACK time}\right) + \Delta\left(T_{next} - T_{current}\right) = T_{new}$$

9:01 am

Set alarm clock with T_{new}.

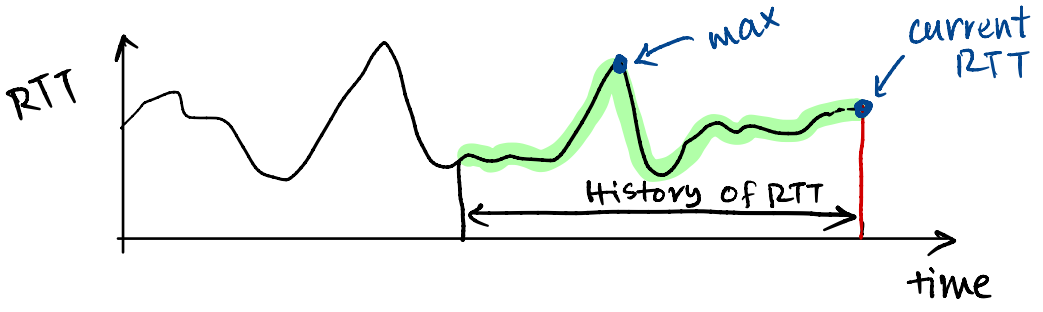
9:00 am + 5 min

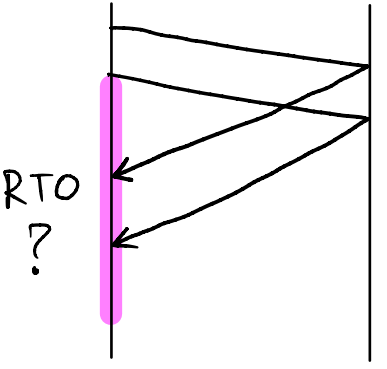
− 9:02:30s

T_{new} = 00 : 3 : 30s

How much should timeout duration be? RTO (Retransmit timeout).

RTO = f(historical RTT)





RTO = current RTT

RTO = max { last K RTT }

RTO = mean { last K RTT }

RTO = weighted avg. of historical RTTs + safety factor

↓ Estimated RTT ($\hat{R}$)

↓ Deviation of RTT ($\hat{\Delta}$)