

# Lecture 13

29 September 2021 17:11

- Recap

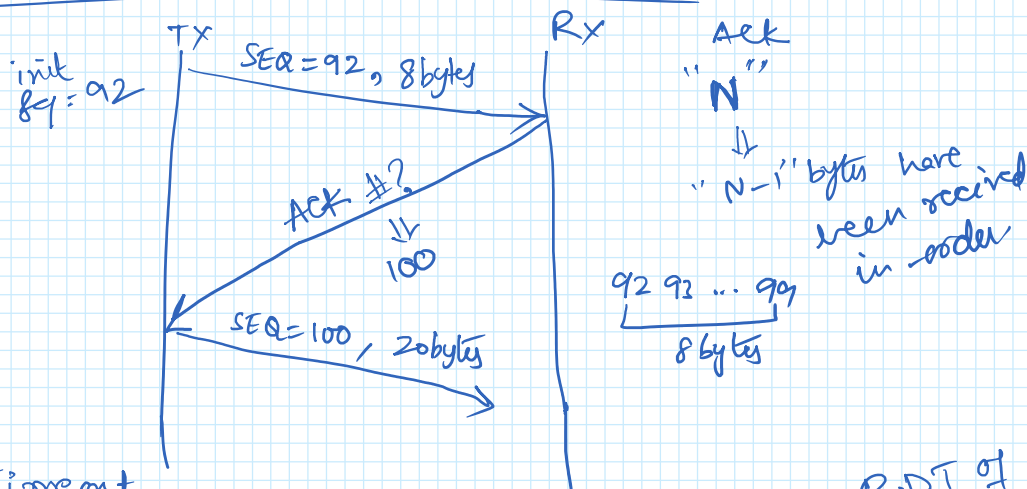
- Connection Management in TCP

Congestion Control — > general principles

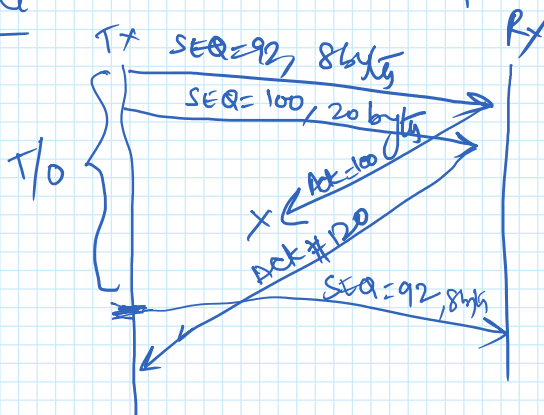
↳ TCP cong. algorithm

Example of TCP Timing diagrams  
(simple version)

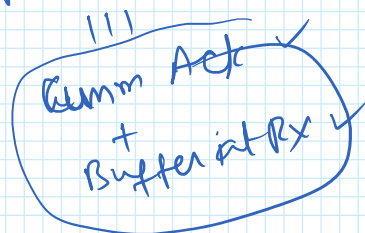
↳ No Cong. control / flow control / DupAck



Timeout



RDT of TCP



Fast retransmit

seq = 100

If 3 dup Ack, the Re-tr the expected packet (seq 100)

TCP Connection

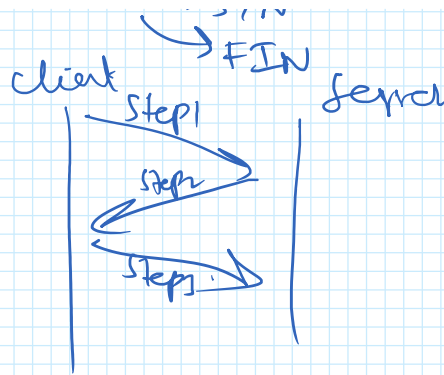
3 Flags for connection

→ RST

→ SYN

→ FIN

client ... server



Step 1:

- (i)  $SYN=1 \Rightarrow$  requesting to establish a new conn
- (ii) init-seq  $\Rightarrow$  Just put init-seq num in SEQ field of header
- (iii) No App. data

Step 2: (if no app is running in the port number)

- (i)  $RST=1 \Rightarrow$  TCP Rx is saying that connection is not possible

else

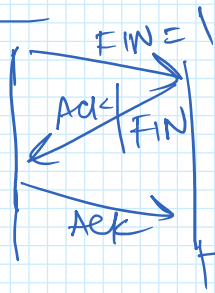
- (ii)  $SYN=1 \Rightarrow$  confirmation of conn established
- (iii) Ack with seq num = init-seq + 1
- (iv) Ack flag = 1
- (v) Rx-init-seq num.
- (vi) No app. data is sent
- (vii) Alloc some buffer size & share that info to Tx using "RWND" header field

Step 3:

- (i) If  $RST=1$  was received, it will not communicate any further
- (ii) If  $SYN=1, Ack=1$  are received,
- (iii) Alloc buffers, and send that info to Rx

- (iii) Alert buffers, and send that info to Rx
- (iv)  $\checkmark$  Ack seq num of Rx
- (v)  $\text{SYN} = 0$ ,
- (vi) App data in this segment

## Connection Termination



Connection will be closed

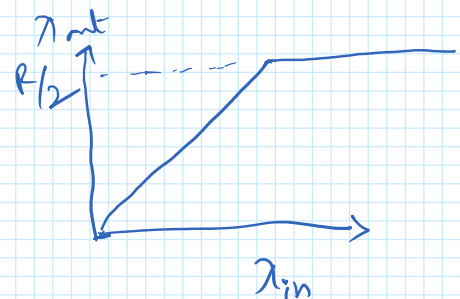
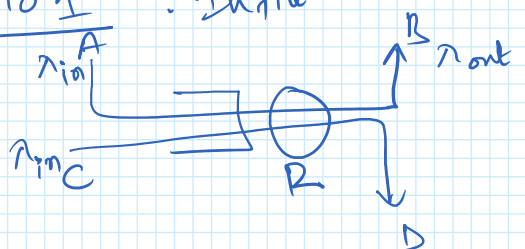
Deallocate buffers etc & close.

RDT ✓  
Flow control ✓  
Conn Mgmt ✓

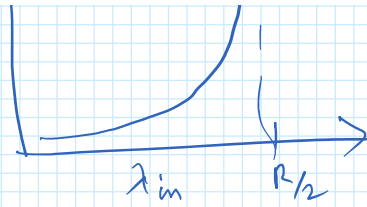
## Congestion Control

- What is congestion? ✓
- If no Cong. control, what will happen?
  - ↳ Large Delay ✓
  - Packet loss ✓

Scenario 1: Infinite buffer at router



⇒ large delays

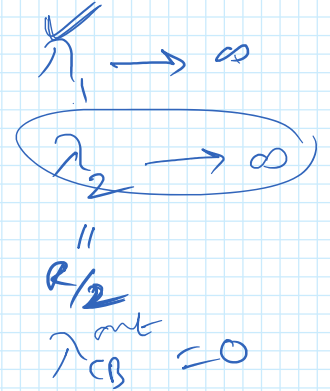
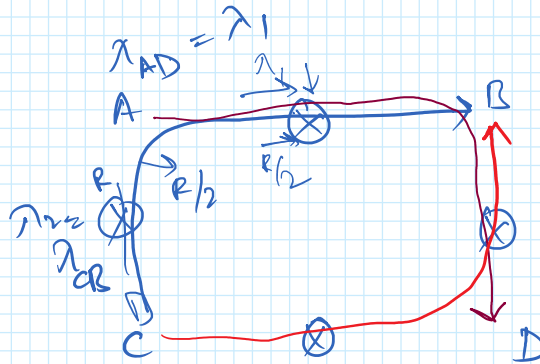


$\Rightarrow$  large delays if you go close to capacity

Scenario

Flow

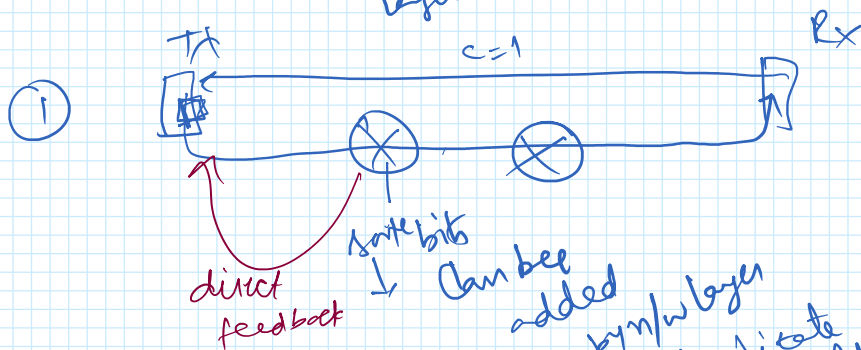
$f_{CB}$   
 $f_{AD}$



for

Congestion Control - How to do?

- ✓ N/w layer assisted congestion control
- ✓ End-End congestion without any assistance from n/w layer



② Direct feedback by Router to sender

TCP Congestion Control (End-End based without any help from n/w layer)

(window size)  $\downarrow$   
 $\rightarrow$  Packet loss  
 (or)  
 $\rightarrow$  long delay's in Acks

- CW = 1 → (slow path)

$$\begin{aligned} &= 1 + 2 \\ &= 2 \end{aligned}$$

## Congestion Avoidance phase

$\Downarrow$

Tv starts at a place

Tx  $\Downarrow$  stops slow start phase  
& enters a new phase  
"Congestion avoidance" phase.

"CA" phase

$$CW = CW + \frac{1}{\lfloor CW \rfloor} \text{ for every new ACK}$$

$$\lfloor 9.7 \rfloor \Rightarrow 9$$

for every  $\Downarrow$  RTT  $CW = CW + 1$ .

$\Downarrow$   
Linear increase phase