

46747200

ComS3200

 \overline{msec}

15/4/23

①

$$3 \times \left(1 \text{ msec} + \frac{1000 \text{ bits}}{1 \times 10^6 \text{ b/s}} \right) = 6 \text{ msec}$$

②

Util limited by R_1 and R_2 $\therefore \frac{10 \text{ Mbps}}{100 \text{ Mbps}} = 1$

③

Max throughput limited by slowest link = 10 Mbps

④

$$R_s = 1 \times 10^{-4} + \frac{1000 \text{ bits}}{25 \times 10^6 \text{ b/s}} = 0.00014$$

$$+ R = 1 \times 10^{-4} + \frac{1000}{200 \times 10^6} = 0.000105$$

$$+ R_c = 1 \times 10^{-4} + \frac{1000}{50 \times 10^6} = 0.00012$$

$$= 365 \text{ msec}$$

System limited by $R_s = 200 \text{ Mbps}$

$$\therefore \text{util of } R_c = \frac{200 \times 10^6}{300 \times 10^6} = 0.67$$

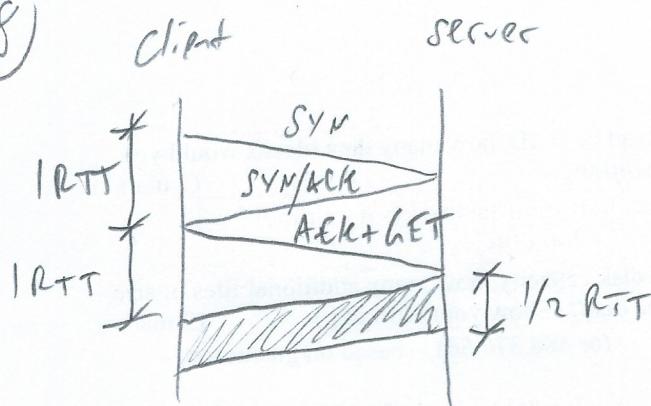
⑥ removed

⑦

UDP RFC 768 specifies on pg 2, second paragraph

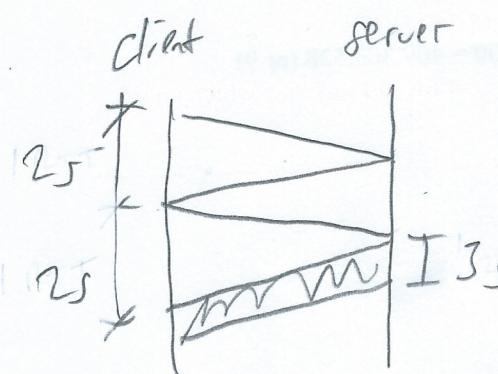
Length includes header + data

⑧



$$\begin{aligned} \text{Total} &= 1 + 1 + \frac{1}{2} \\ &= 2.5 \text{ RTT} \end{aligned}$$

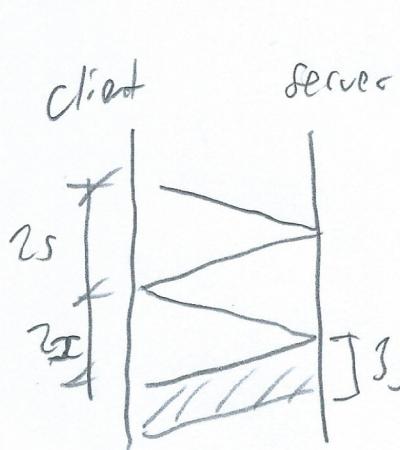
⑨



HTTP 1.0 : non persistent

$$\begin{aligned} 100 \text{ requests} \times (2+2+1) &= 700 \text{ sec} \end{aligned}$$

⑩

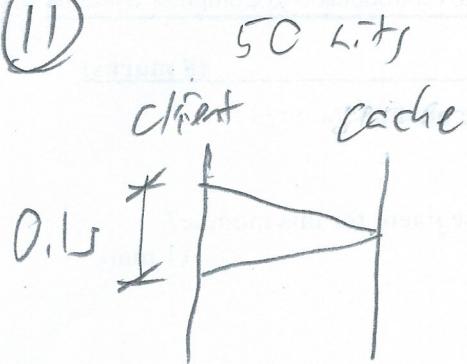


HTTP 1.1 : persistent

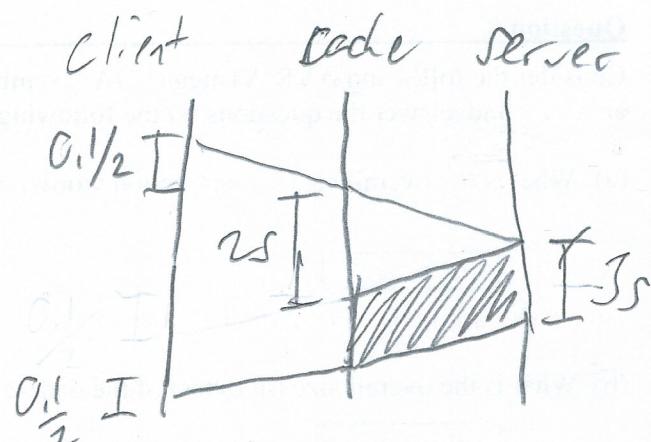
TCP connect time occurs once

$$2s + 100 \times (2+1) = 502s$$

(11)



$$50 \times 0.1 = 5$$



$$50 \times (0.1 + 2.5) = 255$$

$$\therefore \text{total} = 5 + 255 = 260$$

(12)

Clients are sending $4 \times 10 \text{ Gbps} \times 1 \times 10^6 \text{ bits}$

$$= 40 \times 10^6 \text{ bits/s}$$

$$\text{Util} = \frac{40 \times 10^6}{100 \times 10^6} = 0.4$$

(13)

- Create UDP socket with `socket(AF_INET, SOCK_DGRAM)`
- Specific server identified with `IP and port# when sending`
- Send to server using socket

(14)

- Create UDP server socket with
socket(AF_INET, SOCK_DGRAM)
- Client specified by IP and port # when sending
- Send to client with socket
- Server knows IP and port # from earlier datagram

(15)

- Create TCP with socket(AF_INET, SOCK_STREAM)
- Client sends to server using socket from connect()
- Send to socket created from

(16)

A source \rightarrow 6515

B source \rightarrow 3200

C source \rightarrow 5313

C dest \rightarrow 3201

D source \rightarrow 6287

D dest \rightarrow 3202

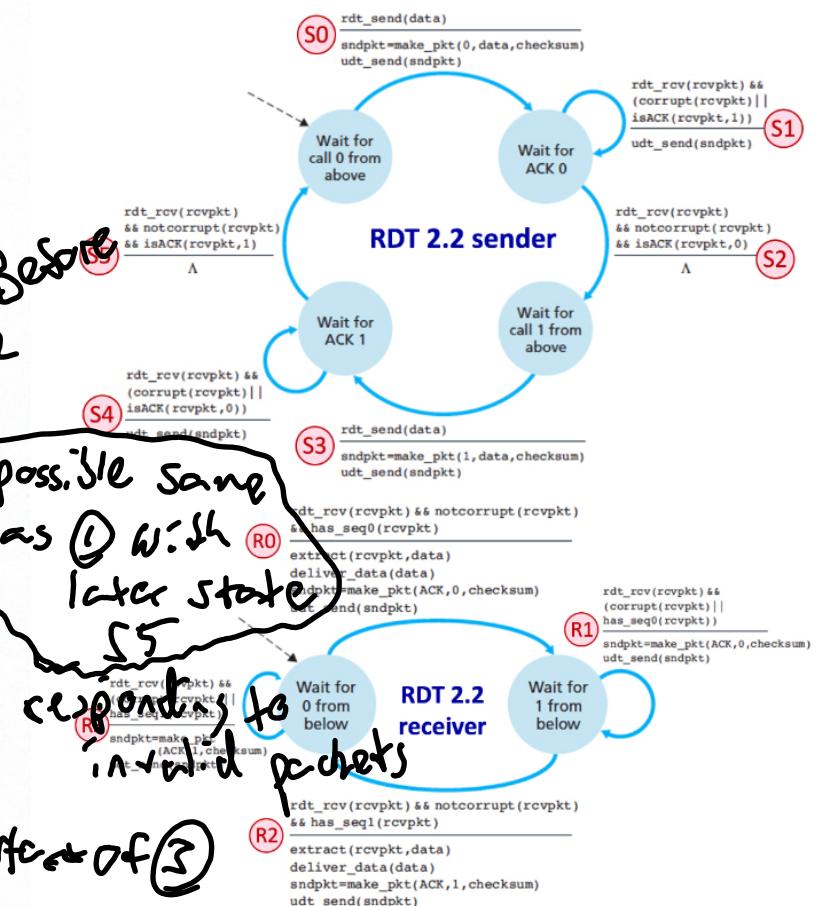
(17)

1 0 1 1 0 1 0 0	0 1 0 1 0 1 1 0
0 1 0 0 1 0 0 0	0 1 1 0 1 1 1 1
<hr/>	
1 1 1 1 1 1 0 0	1 0 1 1 0 1 0 1
0 0 0 0 0 1 1	0 1 0 0 1 0 1 0

Is comp

(18)

- ① S0, R0, S2, S3, R2
possible S2, S3 before R2
- ② S0, R0, S2, S3, R2, S5 → possible same as ① wish
later states
- ③ S0, R0, S1, R1, S1 → possible
S1, R1, S1 responds to invalid packets
- ④ S0, R0, S1, R1 → possible, same as state of ③



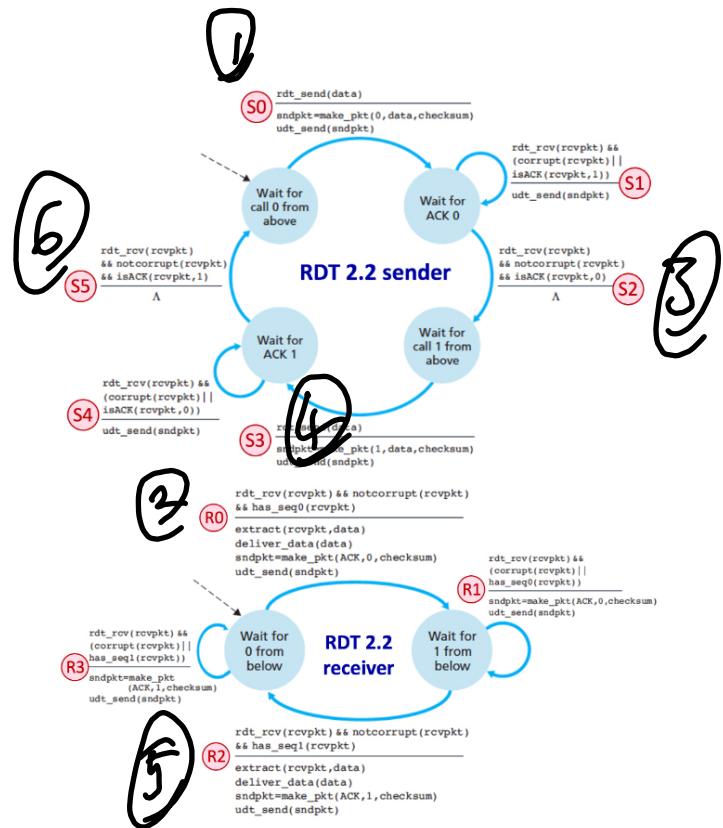
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$$t_1 = S2$$

$$t_2 = S3$$

$$t_3 = R2$$

$$t_4 = S5$$



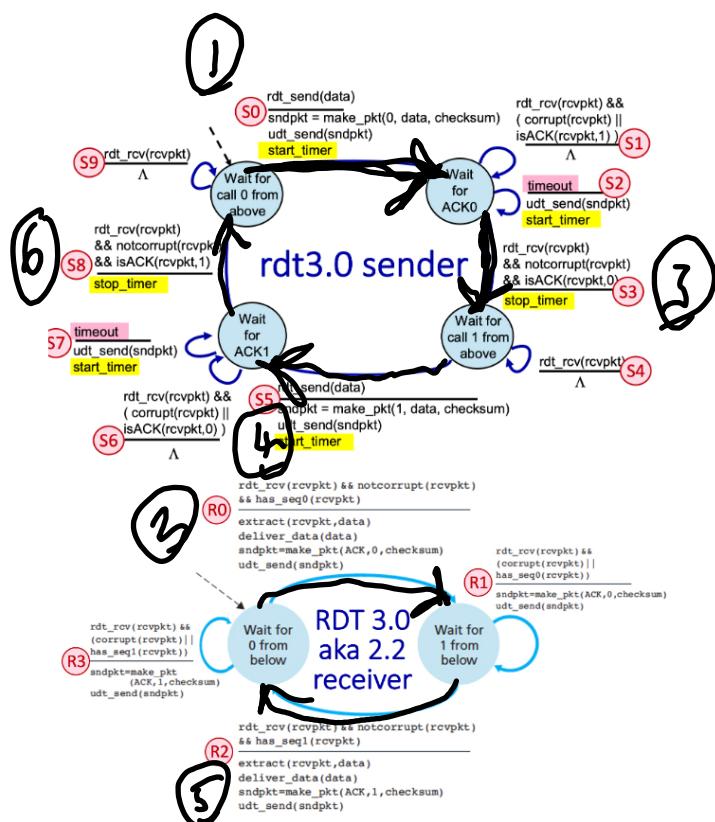
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$$t_1 = S3$$

$$t_2 = S5$$

$$t_3 = R2$$

$$t_4 = S8$$



$$\textcircled{21} \quad \text{est RTT} = 300 \text{ ms} \quad \text{Dev RTT} = 18$$

RTT JSC

$$\text{est RTT} = 0.875 \times 300 + 0.125 \times 330 = 303.75$$

$$\text{Dev RTT} = 0.95 \times 18 + 0.25 \times |330 - 300| = 17.25$$

$$\therefore \underline{17}$$

$$\textcircled{22} \quad t_1 \text{ seg} = 0, \text{ size} = 100$$

$$t_2 \text{ seg} = 100, \text{ size} = 100 \quad \therefore t_2 = 100$$

$$\textcircled{23} \quad t_6 \text{ ACK} = 100$$

$$t_7 \text{ ACK} = 200$$

$$t_8 \text{ ACK} = 300$$

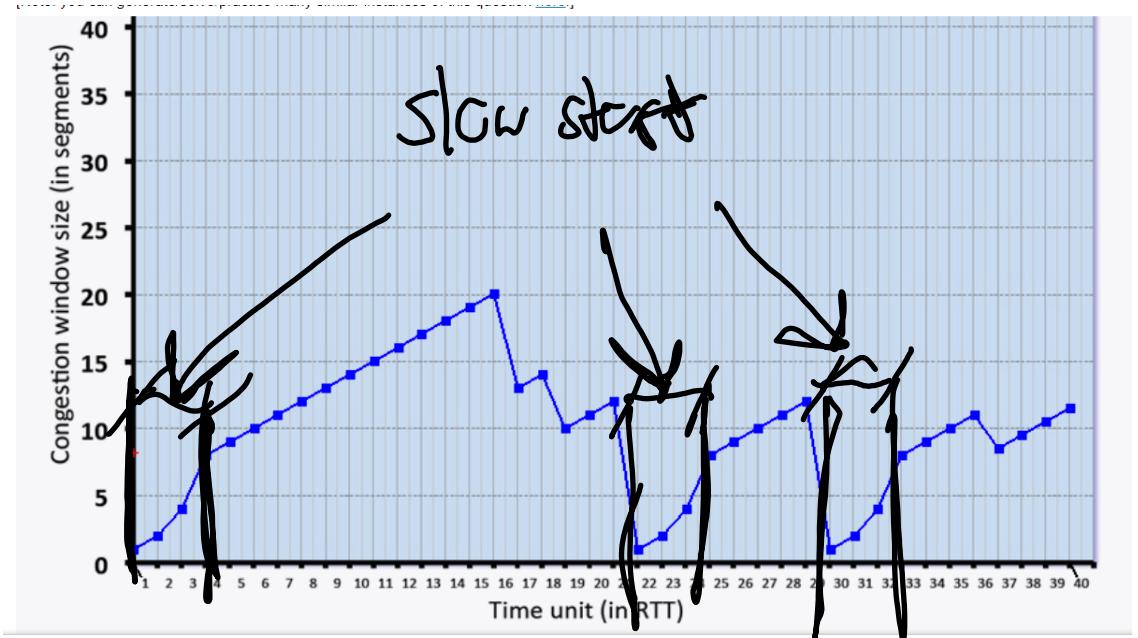
$$t_9 \text{ ACK} = NA$$

t₁₀ ACK = 300 since last successful packet was acked with 300

24

[1, 3]

[22, 24]



15

[6, 15]

17

[19, 20]

