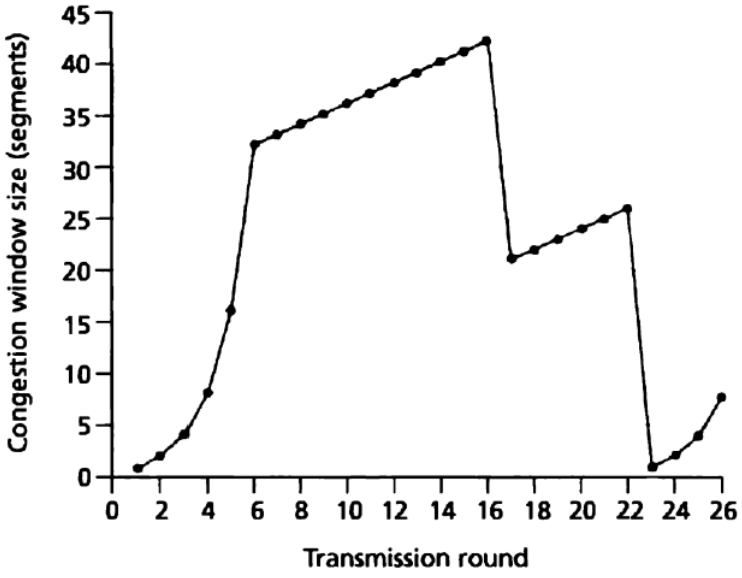
COMP 9121 Week 9 Tutorial

1. TCP



Consider the above figure. Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions. In all cases, you should provide a short discussion justifying your answer.

(1). Identify the intervals of time when TCP slow start is operating. 1,2,3,4,5,23,24,25,26

(2). Identify the intervals of time when TCP congestion avoidance is operating. 6--22

(3). After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? triple duplicate ACK

(4). After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? timeout

(5). What is the initial value of ssthresh at the first transmission round? 32

(6). What is the value of ssthresh at the 18th transmission round? 21

(7). What is the value of ssthresh at the 24th transmission round? 13

(8). During what transmission round is the 70th segment sent?

7th round (first 6 rounds 1+2+4+8+16+32=63, 7 round 33)

(9). Suppose TCP Tahoe is used (instead of TCP Reno), and assume that triple duplicate ACKs are received at the 16th round. What are the ssthresh and the congestion window size at the 19th round? ssthresh=21. 17:1, 18:2 19:4

(10). Again suppose TCP Tahoe is used, and there is a timeout event at 22nd round. How many packets have been sent out from 17th round till 22nd round, inclusive?

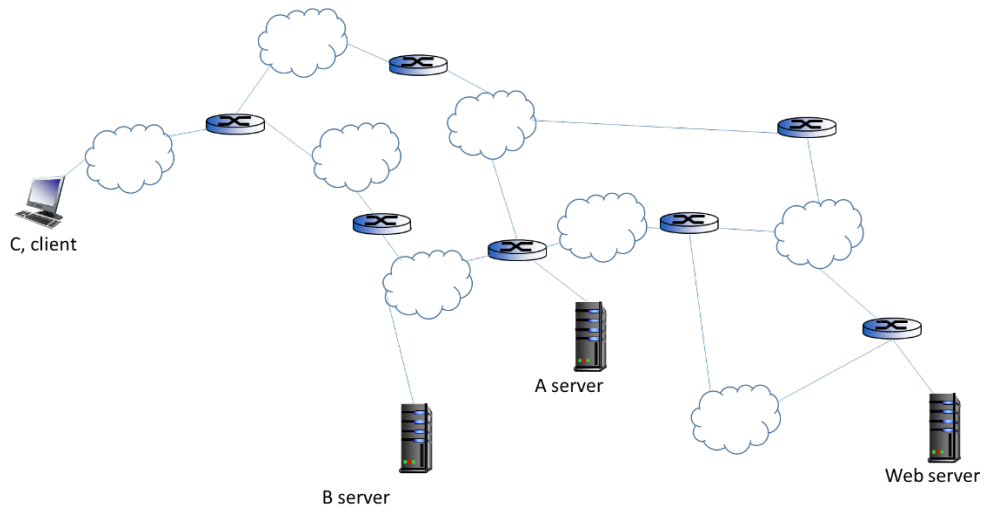
	17	18	19	20	21	22	sum
cwnd	1	2	4	8	16	21	52
ssthresh	21	21	21	21	21	21	

2. Cross-layer (HTTP, TCP, Routing)
Consider the network shown below. Assume that the one-way delay through each “cloud” in the figure is 1 ms (for example, it takes 1 ms from C to LC). In the system, RIP routing protocol is used. The cost of each “cloud” is 1.

Client C wishes to see a webpage on Web server. The size of the main web page is small. After obtaining the main page, C finds that there are 2 small objects to be fetched. One object is stored in Server A, the other object is stored in Server B. Suppose that persistent HTTP is used.

(1) How long in total does it take for C to successfully obtain the webpage (including the main page and two objects). Suppose that C can start to connect to server A after the main page is fully downloaded. C can start to connect to server B after object 1 is fully downloaded.

(2) Re-do the problem if the two objects are not small. Each object fits into 10 TCP segments. ssthresh=4 segments. Ignore transmission delay. No packet is lost.



C to web one way delay: 4 ms

C to A one way delay: 3 ms

C to B one way delay: 3 ms

(1)

C gets main page from web, 2 RTTs: 16 ms.

C gets object from A, 2RTTs, 12 ms.

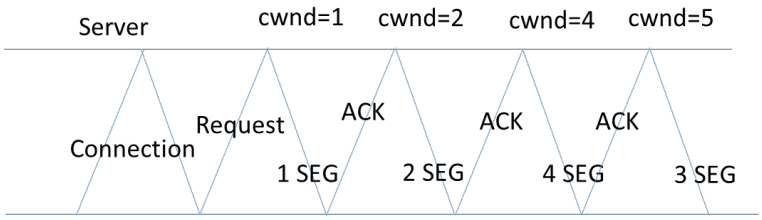
C gets object from B, 2RTTs, 12ms.

In total: 40ms

(2)

C gets main page from web, 2RTTs: 16ms.

C gets object from A, 5RTT, 30ms. Need 1RTT for connection, then 4 RTTs for 10 segments.



(Please note, after the last packet in the above figure, C will send ACK to the server; C and the server will close the TCP. However, they are not considered in this question as all of the 10 segments have been received by C.)

C gets object from B, same as above, 30ms.

In total, 76ms.