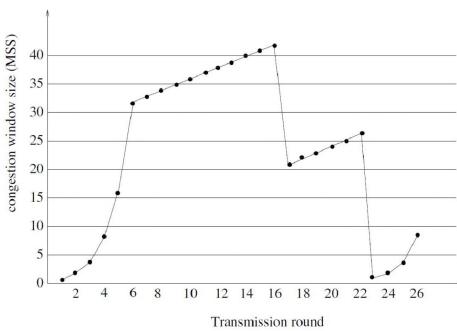


Name: Alan Palayil

Assignment #5

1. Assuming TCP Reno is the protocol experiencing the behavior shown below. Answer the following questions. Provide a short discussion (be brief) justifying your answer.



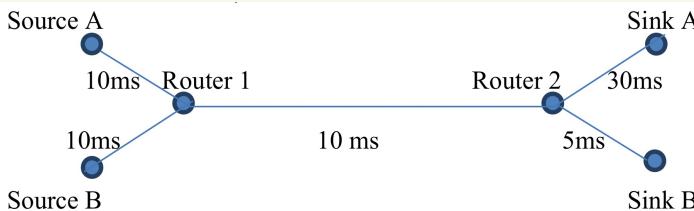
- a) It is during transmission rounds 1-6 and 23-26 during the sections of exponential growth.
- b) It is during transmission rounds 6-16 and 17-22 as these are during the linear growth transmissions. You may indicate that 16-17 is not apart of this due to packet loss.
- c) It is by a triple duplicate ACK as a timeout would drop the congestion window to 1.
- d) It is by a timeout as the congestion window is reset to 1.
- e) It may be around 31 to 32 MSS. This may be seen as the exponential growth stops and begins the linear growth.
- f) It is about 21 MSS. As it is equal to half of the value before the packet/segment loss which was 42 MSS.

g) It is about 13 MSS. This may be seen as it is after a timeout, so the slow start threshold is equal to half of the size before the segment was lost. At 23 it was 26 so we divide that by 2 to get 13 MSS.

h) If you add up the total MSS sent per transmission round you may find it goes up to 1 during 1st, up to 3 during the 2nd, up to 7 during the 3rd, up to 15 during the 4th, up to 31 during the 5th, up to 63 during the 6th, and finally up to 96 during the 7th. Therefore the 70th segment was sent during the 7th round.

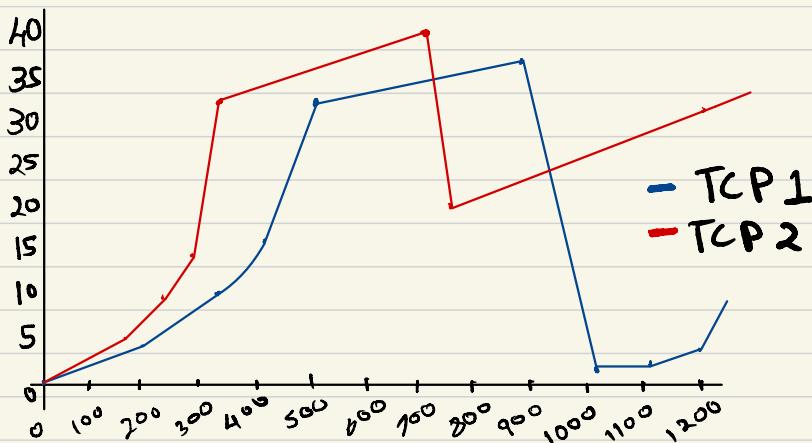
i) The slow start threshold may be determined by performing half of the value window size at transmission round 26, being 8 so $8/2 = 4$. Similarly to get the window we know that each time congestion occurs - the congestion window is halved so once again our current window is $8/2 = 4$. From here it may grow linearly at this point due to a fast retransmit followed by fast recovery for TCP Reno.

2)



(a) For the TCP1 transmission, draw the resulting congestion window, assuming that a packet loss (triple duplicate ACKs) is detected at time $t=900\text{ms}$.

(b) For the TCP2 transmission, draw the resulting congestion window, assuming that a packet loss (triple duplicate ACKs) is detected at $t=650\text{ms}$.



- 3) It is because the TCP does not know what causes the duplicate ACK. It could be a lost segment or even a rearranging of segments. Therefore, it waits for a small number of duplicate ACKs to be received to ensure that we want the retransmit to go through. In the case, that three or more duplicate ACKs are received, it may mean that the segment was lost in transmission. It further ensures that we do not preemptively reconduct retransmitting when it is not needed. This further save time, money, and overall efficiency.