

ECE/CS 438: Homework 2: Transport Layer, TCP, UDP

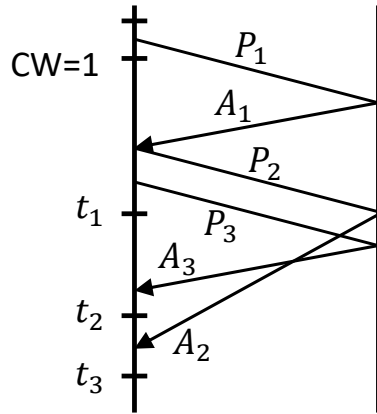
Fall 2018, UIUC

(I) Write True/False with a brief justification (around 1 sentence):

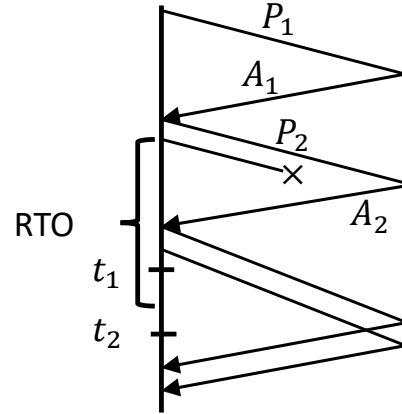
- (a) The TCP ACKs consume bandwidth. It would be better if the TCP receiver only sends NACKs upon receiving out of order (or corrupted) packets.
- (b) Assume TCP is in the Slow Start phase, with $SSThreshold$ as 32. At some time instant, the congestion window is 16. When the congestion window increases the next time, it will become 32.
- (c) A TCP socket creates an end to end connection between two devices.
- (d) The TCP sender has packets 20 to 30 in its congestion window (CW), all waiting for ACKs, when a timeout occurs. The sender will cut down CW to 1 and will have to gradually retransmit each of these packets.
- (e) Consider the case where a TCP sender transmits a file to a TCP receiver. A system administrator tells you that during this transfer, no timeout or dupACKs were recorded. In that case, the congestion window during the transfer should have never decreased (i.e., it should either remain same or increase).
- (f) The lower end of the TCP transmitter's window is never greater than the lower end of the TCP receiver's window.
- (g) TCP can cope with any amount of losses, and hence, TCP should work without modifications on lossy wireless networks.
- (h) The selective repeat receiver need not send an ACK if the received packet is less than its lower end of the (current) receive window.

(II) Answer the following questions on TCP – refer to Figure 1. Assume slow start, unless otherwise mentioned. Copy the timelines in your answer-sheet and work on them:

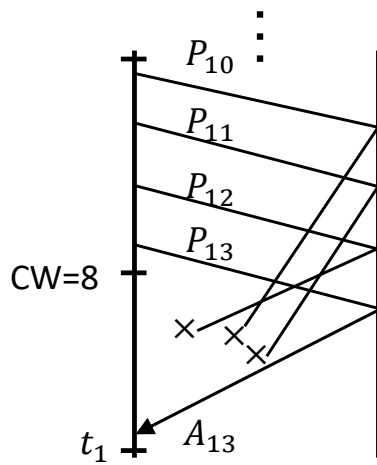
- (a) In Figure 1(a), what are the values of CW at times t_1 , t_2 , t_3 ? How should the TCP transmitter react after receiving A3 and A2.
- (b) In Figure 1(b), assume TCP starts from $CW=1$. What should CW be at times t_1 and t_2 ? How should the TCP transmitter react after the timeout? How should the TCP transmitter react when each of the the last two ACKs (shown in the figure) arrive?
- (c) In Figure 1(c), what should CW be at time t_1 ? How should the TCP transmitter react upon receiving A13?
- (d) In Figure 1(d), what should the CW be at times t_1 , t_2 , t_3 , and t_4 ? How should the TCP transmitter react upon receiving each of the four ACKs?
- (e) In Figure 1(e), say that the first ACK that is shown to arrive at the TCP transmitter is A5. What should the CW be at times t_1 and t_2 ? How should the TCP transmitter react upon receiving A5, when the timeout occurs, and upon receiving the last shown ACK (just before t_2)?
- (f) In Figure 1(f), LIT is the acronym for *linear increase threshold*. What should the values of CW be at times t_1 , t_2 , t_3 , and t_4 ? How should the TCP transmitter react upon receiving each of the ACKs?



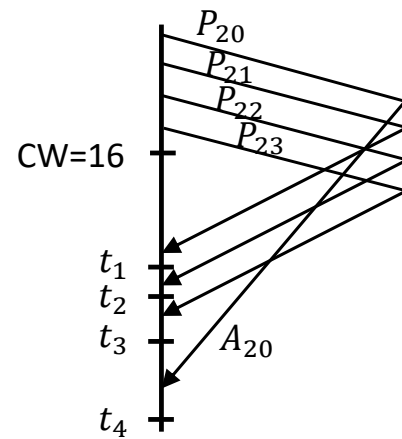
(a)



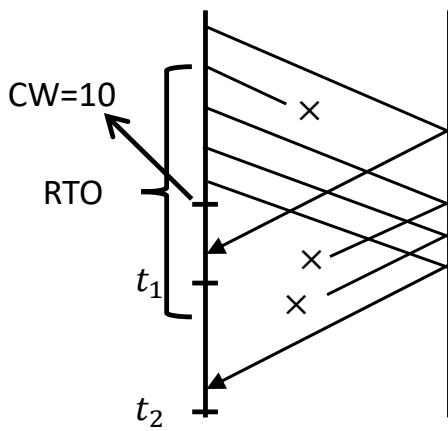
(b)



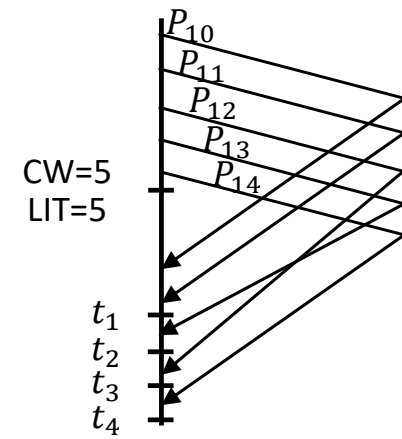
(c)



(d)



(e)



(f)

Figure 1: See question II