

(a) Give the sequence numbers associated with each of the 4 segments sent by the sender.

t1 = 202 t3 = 902
t2 = 552 t4 = 1252

(b) Give the ACK numbers the receiver sends in response to each of the segments.

ACK = 552 ACK = 902
ACK = 1252 ACK = 1602

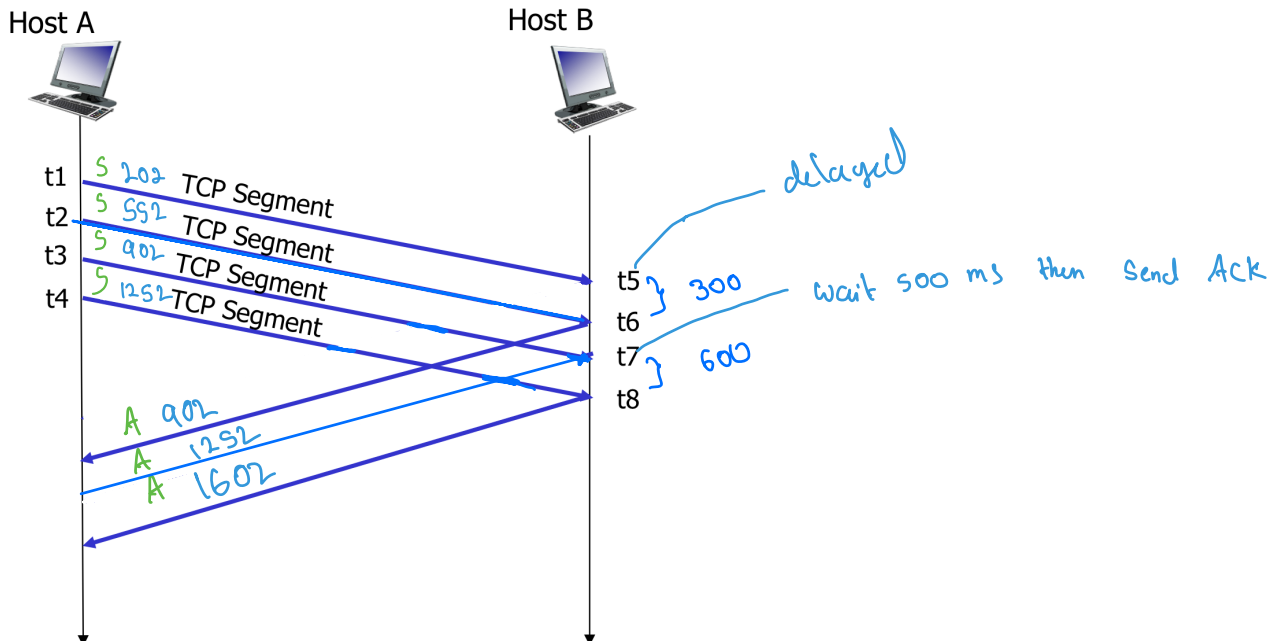
(c) What would be the answer to questions (a) and (b) if the second packet (packet sent at t₂) is lost?

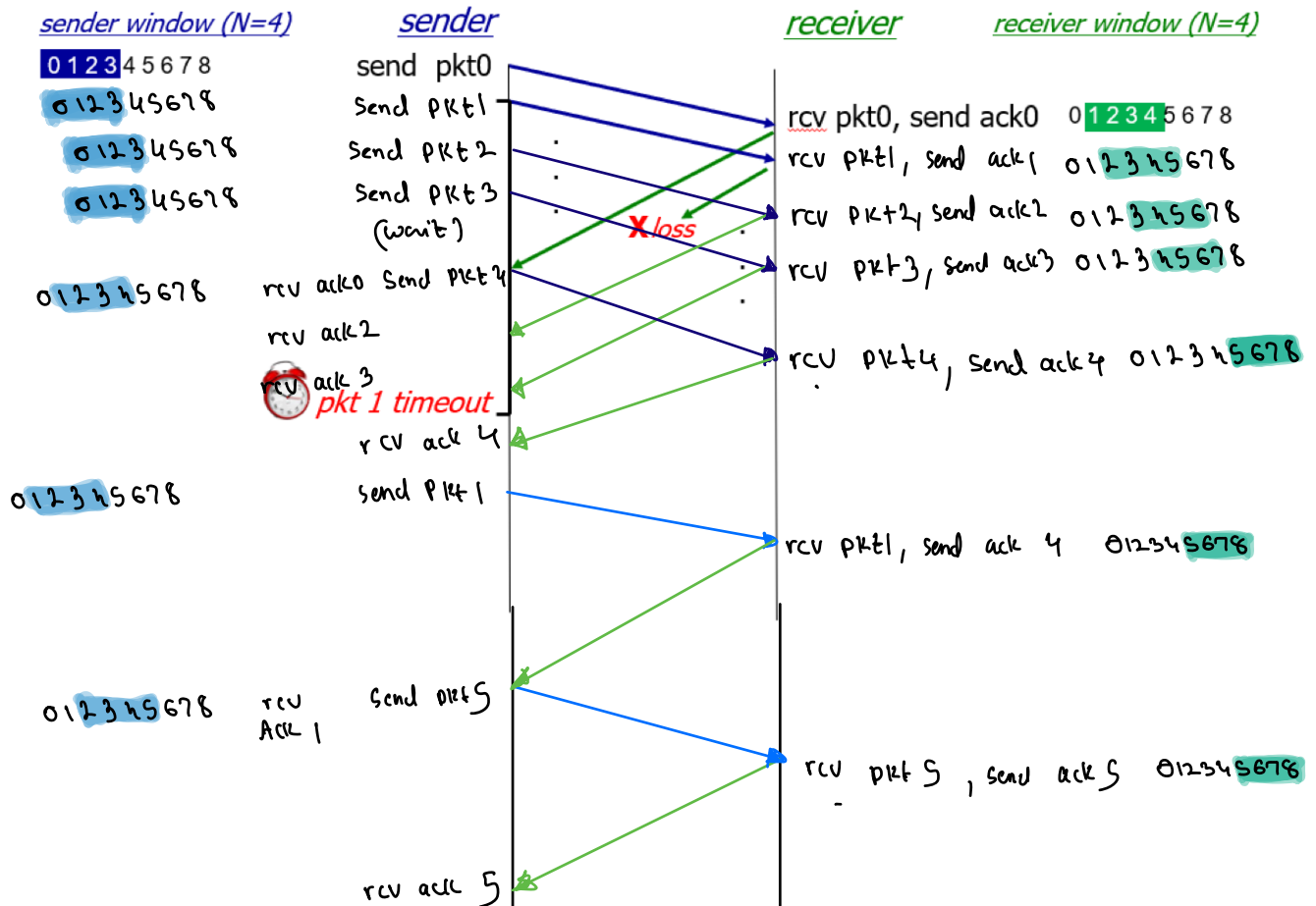
t1 = 202 t3 = 902
t2 = 552 t4 = 1252
ACK = 552 ACK = not received
ACK = 552 ACK = 552

(d) What would be the answer to questions (a) and (b) if the second ACK (ACK sent at time t₆) is lost?

t1 = 202 t3 = 902
t2 = 552 t4 = 1252
ACK = 552 ACK = not received
ACK = 1252 ACK = 1602

(e) Draw the timing diagram for these 4 TCP segments for the case that "delayed ACK" technique is used in the receiver side, and t₆-t₅=300ms, and t₈-t₇=600ms. This means you should draw a diagram like above showing all TCP segments sent from the sender to receiver and all ACKs sent from the receiver to the sender. For each ACK sent from the receiver, specify the ACK number in your diagram.





Q3:

Suppose that TCP's current estimated values for the round-trip time (*estimatedRTT*) and deviation in the RTT (*DevRTT*) are 320 msec and 15 msec, respectively. Suppose that the next four measured values of the RTT are 270 msec, 430 msec, 360 msec, and 300 msec, respectively. Compute TCP's new value of *DevRTT*, *estimatedRTT*, and the TCP timeout value after the fourth measured RTT values is obtained. Use the values of $\alpha = 0.125$, and $\beta = 0.25$. Round your answers to two decimal places after leading zeros.

$$RTT_{est} = 320$$

$$RTT_{dev} = 15$$

$$RTT_1 = 270$$

$$RTT_2 = 430$$

$$RTT_3 = 360$$

$$RTT_4 = 300$$

$$\alpha = 0.125$$

$$\beta = 0.25$$

270 ms

$$\begin{aligned} Est\ RTT &= (1 - 0.125) \times 320 + 0.125 \times 270 \\ &= 313.75 \end{aligned}$$

$$\begin{aligned} Dev\ RTT &= (1 - 0.25) \times 15 + 0.25 \times |270 - 320| \\ &= 23.75 \end{aligned}$$

$$\begin{aligned} Time\ out &= 313.75 + 4 \times 23.75 \\ &= 408.75 \end{aligned}$$

430 ms

$$\begin{aligned} Est\ RTT &= (1 - 0.125) \times 313.75 + 0.125 \times 430 \\ &= 328.28 \end{aligned}$$

$$\begin{aligned} Dev\ RTT &= (1 - 0.25) \times 23.75 + 0.25 \times |430 - 313.75| \\ &= 46.88 \end{aligned}$$

$$\begin{aligned} Time\ out &= 328.28 + 4 \times 46.88 \\ &= 515.8 \end{aligned}$$

360ms

$$\begin{aligned}\text{Est RTT} &= (1 - 0.125) * 328.28 + 0.125 * 360 \\ &= 332.25\end{aligned}$$

$$\begin{aligned}\text{Dev RTT} &= (1 - 0.25) * 46.88 + 0.25 * |360 - 328.28| \\ &= 43.09\end{aligned}$$

$$\begin{aligned}\text{Time out} &= 332.25 + 4 * 43.09 \\ &= 504.61\end{aligned}$$

300ms

$$\begin{aligned}\text{Est RTT} &= (1 - 0.125) * 332.25 + 0.125 * 300 \\ &= 328.22\end{aligned}$$

$$\begin{aligned}\text{Dev RTT} &= (1 - 0.25) * 43.09 + 0.25 * |300 - 332.25| \\ &= 40.38\end{aligned}$$

$$\begin{aligned}\text{Time out} &= 328.22 + 4 * 40.38 \\ &= 489.74 \text{ ms}\end{aligned}$$