CS341: Intro to Computer Networks

Fall 2018
Homework #4
Submit PDF on KLMS by Oct 8 (Mon) 23:59

[Problem 1.] Why is it that voice and video traffic is often sent over TCP rather than UDP in today's Internet?

[Problem 2.] Suppose a process in Host C has a UDP socket with port number 6789. Suppose both Host A and Host B each send a UDP segment to Host C with destination port number 6789. Will both of these segments be directed to the same socket at Host C? If so, how will the process at Host C know that these two segments originated from two different hosts?

[Problem 3.] Consider the GBN and SR protocols. Suppose the sequence number space is of size *k*. What is the largest allowable sender window that will avoid the occurrence of problems such as that in Figure 3.27 for each of these protocols?

[Problem 4.] Suppose Host A and Host B use a GBN protocol with window size *N=3* and a long-enough range of sequence numbers. Assume Host A sends six application messages to Host B and that all messages are correctly received, except for the first ACK and the fifth data segment. Draw a timing diagram (similar to Figure 3.22), showing the data segments and the acknowledgments sent along with the corresponding sequence and acknowledge numbers, respectively.

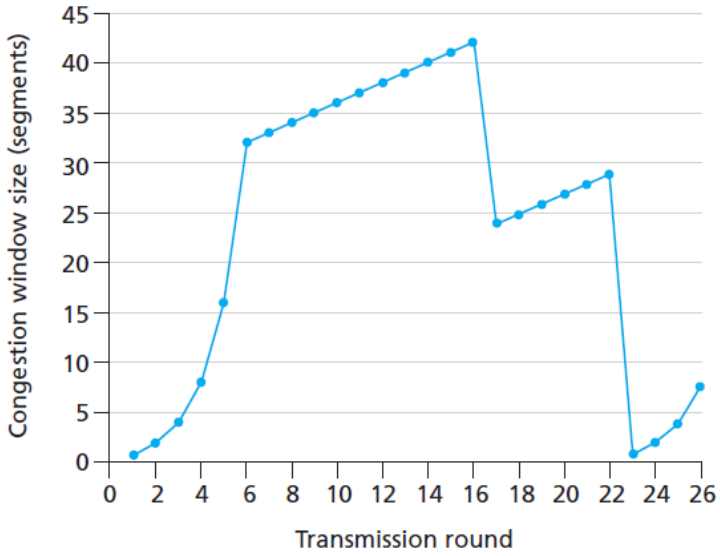
[Problem 5.] Compare GBN, SR, and TCP (no delayed ACK). Assume that the timeout values for all three protocols are sufficiently long such that 5 consecutive data segments and their corresponding ACKs can be received (if not lost in the channel) by the receiving host (Host B) and the sending host (Host A) respectively. Suppose Host A sends 5 data segments to Host B, and the 2nd segment (sent from A) is lost. In the end, all 5 data segments have been correctly received by Host B.

a. How many segments has Host A sent in total and how many ACKs has Host B sent in total? What are their sequence numbers? Answer this question for all three protocols.
b. If the timeout values for all three protocol are much longer than 5 RTT, then which protocol successfully delivers all five data segments in shortest time interval?

[Problem 6.] Recall the macroscopic description of TCP throughput. In the period of time from when the connection's rate varies from $W/(2 \cdot \text{RTT})$ to W/RTT, only one packet is lost (at the very end of the period).

a. Show that the loss rate (fraction of packets lost) is equal to $L = \dfrac{1}{\frac{3}{8}W^2 + \frac{3}{4}W}$.
b. Use the result above to show that if a connection has loss rate *L*, then its average rate is approximately given by $= \dfrac{1.22 \cdot MSS}{RTT \cdot \sqrt{L}}$.

[Problem 7.] Consider the figure below. Assuming TCP Reno is the protocol in operation, answer the following questions. In all cases, you should provide a short discussion justifying your answer.



a. Identify the intervals of time when TCP slow start is operating.
b. Identify the intervals of time when TCP congestion avoidance is operating.
c. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
d. After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
e. What is the initial value of `ssthresh` at the first transmission round?
f. What is the value of `ssthresh` at the 18th transmission round?
g. What is the value of `ssthresh` at the 24th transmission round?
h. During what transmission round is the 70th segment sent?
i. Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and of `ssthresh`?
j. 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?
k. 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?

[Problem 8.] Design a human protocol for (i) initial communication between a lady and a gentleman when they got introduced by a mutual friend (i.e., the mutual friend has provided the phone number of each other), and (ii) when a couple ends their romantic relationship. Use FSM to illustrate your protocol. Provide FSM for both sides, for him and for her; or for two men or two women, whichever you prefer. We don't judge. Or you could label them "more desperate" and "less desperate." You design it. It's your protocol!

[Essay] What is currently the toughest challenge you are facing in your life? How do you plan to overcome it? [If this is too personal and you'd rather not share, write the toughest challenge you're willing to disclose]