CNT 4704: Analysis of Computer Communication Networks

Homework 2 (Fall 2013)

Assigned Oct. 9th; Due midnight Oct. 21st via WebCourse

1. (13 points) Suppose Client A initiates a Telnet session with Server S. At about the same time, Client B also initiates a Telnet session with Server S. Provide an example source and destination port number used for

a). The segments sent from A to S.

b). The segments sent from B to S.

c). The segments sent from S to A.

d). The segments sent from S to B.

e). If A and B are different hosts, is it possible that the source port number in the segments from A to S is the same as that from B to S?

f). How about if they are the same host?

2. (10 points) Suppose we have packets that use 8 bits as their checksum and they use the UDP checksum computation introduced in class:

a). Suppose a packet has the following 2 bytes: 11110100 and 01101001. What is the checksum?

b). Suppose a packet has the following 4 bytes: 0xFA, 0xD9, 0x9F, 0x8B. What is the checksum?

3. (12 points) Justify your answer even if the answer is true. For statement (a)(b), you should justify it by drawing a protocol running example.

Answer true or false to the following statements and briefly justify your answer:

a). With the SR protocol, it is possible for the sender to receive an ACK for a packet that falls outside of its current window.

b). With GBN, it is possible for the sender to receive an ACK for a packet that falls outside of its current window.

c). The alternating-bit protocol is the same as the SR protocol with a sender and receiver window size of 1.

d). The alternating-bit protocol is the same as the GBN protocol with a sender and receiver window size of 1.

4. (15 points) Consider transferring an enormous file of L bytes from Host A to Host B. Assume an MSS of 1,400 bytes.

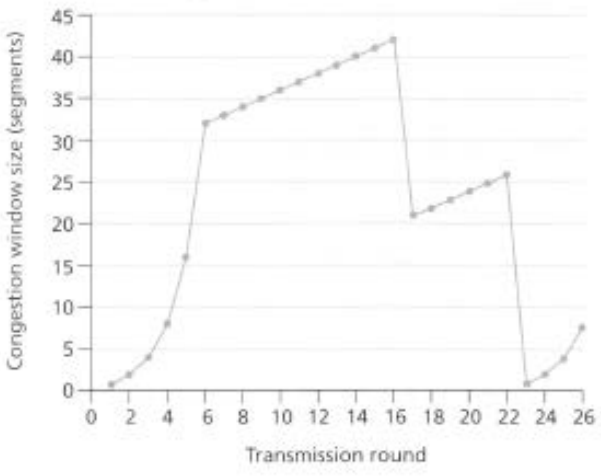
a). What is the maximum value of L such that TCP sequence numbers are not exhausted? Recall that the TCP sequence number field has 4 bytes.

b). Assume that the network is perfect and there is no error or retransmissions. For the L you obtain in (a), find how long it takes to transmit the file. Assume that a total of 60 bytes of transport, network and data-link header are added to each segment

before the resulting packet is sent out over a 10Mbps link. Ignore flow control and congestion control so A can pump out the segments back to back and continuously.

5. (20 points) TCP congestion control:

Consider the following plot of TCP window size as a function of time.



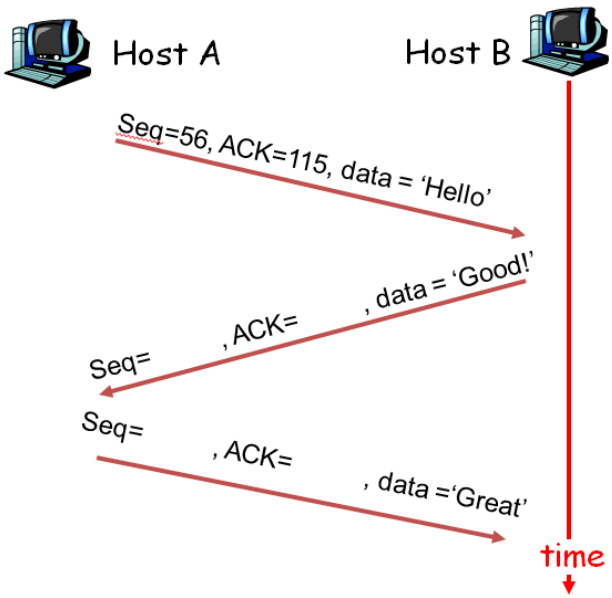
Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions. In all cases, you should provide a short discussion justifying your answer.

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 `Threshold` at the first transmission round?
f. What is the value of `Threshold` at the 18th transmission round?
g. What is the value of `Threshold` 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 `Threshold`?

...convergence of TCP's AIMD

6. (15 points) Consider the cross-country example shown in lecture notes Chapter3-part2.ppt (page 9-12). How big would the window size have to be for the channel utilization to be greater than 80 percent?

7.(15 points) TCP duplex communication: Suppose the TCP packet transmission between host A and host B (or a client and a server) follow the following scenarios, fill in the missing sequence number and ack number.


Host A
Host B
Seq=56, ACK=115, data = 'Hello'
, ACK=
, data = 'Good!'
Seq=
Seq=
, ACK=
, data ='Great'
time