Assignment #3

CSc 4220/6220 - Computer Networks

October 19, 2017

→ ***For CSc 4220/6220, students have to answer all question.***
→ ***You should submit your own work except programming assignment.***

1. You should answer the following short answer question:

   (a) Consider a TCP connection between Host A and Host B. Suppose that the TCP segments traveling from Host A to Host B have source port number x and destination port number y. What are the source and destination port numbers for the segments traveling from Host B to Host A?

   (b) Describe why an application developer might choose to run an application over UDP rather than TCP.

2. In the **R**eliable **D**ata **T**ransfer (**rdt**) protocols,

   (a) why did we need to introduce sequence numbers?

   (b) why did we need to introduce timers?

3. UDP and TCP use 1s complement for their checksums. Suppose you have the following three 8-bit bytes: 01010011, 01100110, 01110100. What is the 1s complement of the sum of these 8-bit bytes? (Note that although UDP and TCP use 16-bit words in computing the checksum, for this problem you are being asked to consider 8-bit sums.) Show all work. Why is it that UDP takes the 1s complement of the sum; that is, why not just use the sum? With the 1s complement scheme, how does the receiver detect errors? Is it possible that a 1-bit error will go undetected? How about a 2-bit error?

4. Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 126. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 80 and 40 bytes of data, respectively. In the first segment, the sequence number is 127, the source port number is 302, and the destination port number is 80. Host B sends an acknowledgment whenever it receives a segment from Host A.

   (a) In the second segment sent from Host A to B, what are the sequence number, source port number, and destination port number?

(b) If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number, the source port number, and the destination port number?

(c) If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?

(d) Suppose the two segments sent by A arrive in order at B. The first acknowledgment is lost and the second acknowledgment arrives after the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgments sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number.

5. Host A is sending an enormous file to Host B over a TCP connection. Over this connection there is never any packet loss and the timers never expire. Denote the transmission rate of the link connecting Host A to the Internet by R bps. Suppose that the process in Host A is capable of sending data into its TCP socket at a rate S bps, where S = 10 R. Further suppose that the TCP receive buffer is large enough to hold the entire file, and the send buffer can hold only one percent of the file. Elaborate:

   (a) What would prevent the process in Host A from continuously passing data to its TCP socket at rate S bps?

   (b) TCP flow control?

   (c) TCP congestion control?

   (d) Or something else?

6. ***Programming Assignment:***

Based on the content covered in the class, you are required to implement a simplified network client-server simulating program. You can conduct the homework by yourself or work with another student as a group. You are required to set up your system with computers to emulate the sender, receiver and router, which are connected with TCP as shown in the following figure.

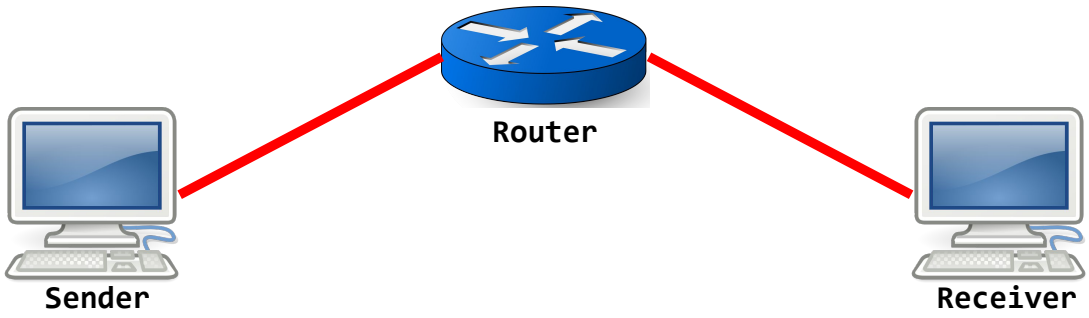

Figure 1: Network Transmission Model (Topology)

The sender will send Y packets (changing Y from $10, 20, 40, 60, 80, 100$) via the router to the receiver. The receiver will reply with corresponding acknowledge packet as in the following figure.

- We apply the Selective Repeat mechanism for sender and receiver. For the window size, you should use window size equals to 5.
- The router in the middle will randomly drop a packet and ACK with a probability (10+X) %, where X is the last digit of your panther ID+ your partners last digit of the Panther ID.
- We further assume that the router not only randomly drop data packets, but also acknowledge packets.

You have to:

(a) Implement programs (with your preferred programming language) running on the ***sender***, ***router***, and the ***receiver*** by using of TCP transmission protocol (sample code blocks in iCollege)

(b) Submit all your code blocks into the iCollege

(c) Demonstrate your program to the TA during the TAs office hour

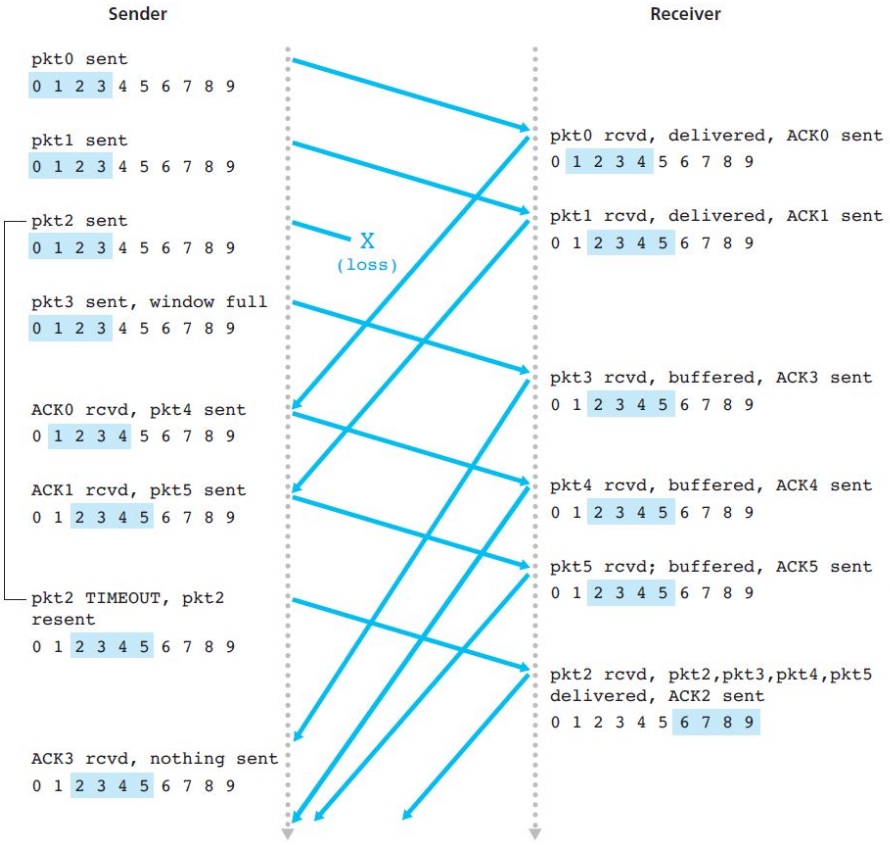

Figure 2: Packet transmission between sender and receiver