**CSCE 560 Homework / Wireshark Lab 3**

**Chapter 3 – Transport Layer**

**Fall 18**

**Marvin Newlin**

**Assigned: Monday, 22 Oct**

**Due: Wednesday, 14 Nov, 1400**

**Problem 1**. Chapter 3, R3

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?

**Sol’n:**

A TCP socket is uniquely identified by (Src IP, Src Port, Dst IP, Dst Port). Since A has src port x and dst port y (Host B) then when B sends segments back they will have src port y and dst port x (host A).

**Problem 2**. Chapter 3, R4

Describe why an application developer may choose to run an application over UDP rather than TCP. [Provide at least three reasons.]

**Sol’n:**

1. Control over exact timing (where and when) packets are sent
2. No overhead for connection setup
3. Need for a larger number of UDP ports since a server can support more UDP than TCP ports

**Problem 3**. Chapter 3, R6

Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP? If so how?

**Sol’n:**

Yes it is possible if you build the principles of RDT into the application itself, then it is possible to have RDT over UDP.

**Problem 4**. Chapter 3, R8

Suppose that a Web server runs in Host C on port 80. Suppose this Web server uses persistent connections, and is currently receiving requests from two different hosts: A and B. Are all of the requests being sent through the same socket at Host C? If they are being passed through different sockets, do both of the sockets have port 80? Discuss and explain.

**Sol’n:**

All the sockets get passed through port 80 for initial connection socket. Once the connection is set up then it gets passed off to another port on the server.

From the hosts originally they all have destination port 80 but on the actual server itself the connections are demultiplexed to have a port number different from port 80.

**Problem 5**. Chapter 3, R14

True or False:

1. Host A is sending Host B a large file over a TCP connection. Assume Host B has no data to send to Host A. Host B will not send acknowledgements to Host A because Host B cannot piggyback the acknowledgements on data.

False. It is possible to send an ACK with no data

1. The size of the TCP RcvWindow (rwnd) never changes throughout the duration of the connection.

False. The receive window is based on the buffer on the receiver side so as the buffer gets closer to full it will decrease the window size and increase it as the buffer empties.

1. Suppose Host A is sending Host B a large file over a TCP connection. The number of unacknowledged bytes that A sends cannot exceed the size of the receive buffer.

True

1. Suppose Host A is sending a large file to Host B over a TCP connection. If the sequence number for a segment of this connection is m, then the sequence number for the subsequent segment will necessarily be m + 1.

False. The sequence number for the next segment depends on the number of bytes sent. If it send k bytes of data then the sequence number in the next segment will be m+k.

1. The TCP segment has a field in its header for RcvWindow (rwnd).

True

1. Suppose that the last SampleRTT in a TCP connection is equal to 1 sec. The current value of TimeoutInterval for the connection will necessarily be >= 1 sec.

True. TCP will not adjust the timeout interval to < 1 sec if the previously measured SampleRTT was 1 sec.

1. Suppose Host A sends Host B one segment with sequence number 38 and 4 bytes of data. Then in this same segment the acknowledgement number is necessarily 42.

False. The ACK in the same segment will not necessarily be 42 it depends on the sequence number and amount of data sent in the previous packet from Host B.

**Problem 6**. Chapter 3, R15

Suppose Host A sends two segments back-to-back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110.

a. How much data is in the first segment?

**Sol’n:** The first segment contains 20 bytes of data (bytes 90-109)

b. Suppose that the first segment is lost, but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number?

**Sol’n:** It will ACK for sequence number 90 since that is the next byte that Host B is expecting.

**Problem 7**. Chapter 3, R16

Consider the Telnet example discussed in Section 3.5. A few seconds after the user types the letter ‘C’ the user types the letter ‘R’. After typing the letter ‘R’ how many segments are sent and what is put in the sequence number and acknowledgment fields of the segments?

**Sol’n:**

After ACKing the echo of the ‘c’ it has sequence number 42 and ACK of 80. So then the net character sent (‘R’) it will have a sequence number of 43 and ACK of 81.

**Problem 8**. Chapter 3, P15 [Modified problem from text]

Consider the cross-country example shown in Figure 3.17. How big would the window size (number of segments) have to be for the channel utilization to be greater than 95 percent? Suppose that the size of a packet is 1,500 bytes, including both header fields and data.

**Sol’n:**

The bandwidth delay product is given by RTT\*bandwidth

From the example then the bandwidth-delay product is 30 msec so the BDP is given by

30 msec \* 109 bps = 30\*106 bps = 30 Mbits. This means that for 100% utilization we should send 30Mbits before expecting an ACK. We want 95% utilization so 95% of 30 is 28.5 Mbits. We can send in 1500 byte packets. So the number of segments we should set the send window to is given by

**Problem 9**. Chapter 3, P26

Consider transferring an enormous file of L bytes from Host A to Host B. Assume an MSS of 536 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 four bytes.

**Sol’n:**

There are 32 bits for the TCP sequence number so assuming it starts at 0 we have 0-232-1 as available numbers for our segments. We can transfer 536 bytes per segment so then the number of segments we can send before we exhaust the numbers is given by

Thus, we can determine L as

b. For the L you obtain in (a), find how long it takes to transmit the file. Assume that a total of 66 bytes of transport, network, and data-link header are added to each segment before the resulting packet is sent out over a 155 Mbps link. Ignore flow control and congestion control, so A can pump out the segments back-to-back and continuously.

**Sol’n:**

The time to transmit a single packet is given by

= 30.968 µsec

Multiplying this by the number of segments we send we get

30.968 µsec \* 232-1 = 133006.547 sec = 36.946 hours

Thus, tt = 36.946 hours

**Problem 10**. Chapter 3, P40

Consider the following plot of TCP window size as a function of time. Assuming TCP Reno is the protocol experiencing the behavior shown, 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.

Slow start is operating from round 1 to round 6 and then again from round 23 to round 26. The doubling of values provides the exponential shape we see in these sections.

b. Identify the intervals of time when TCP congestion avoidance is operating.

Congestion avoidance is happening at round 16 and round 23. Here we see the halving of the congestion window that occurs when 3 duplicates ACKs are received, indicating congestion.

c. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

As stated in (b), since the window size is halved and not reset to 1 it is a triple duplicate ACK.

d. After the 22th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

It is a timeout since the congestion window size is reset to 1.

e. What is the initial value of Threshold (ssthresh) at the first transmission round?

It is 1, since that is the initial congestion window size.

f. What is the value of Threshold (ssthresh) at the 18th transmission round?

It is 22.

g. What is the value of Threshold (ssthresh) at the 24th transmission round?

2 since it is one after the timeout and with slow start the one after the initial round is 2

h. During what transmission round is the 70th segment sent?

Through the first 6 rounds we send 63 segments since that is the sum of 1,2,4,8,16, and 32. So the 70th segment is transmitted during the 7th round since we transmit 33 in that round.

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 (ssthresh)?

Given that a triple duplicate ACK halves the currrent congestion window size and the current size is 8 the new congestion window during the 27th round will be 4.

**Problem 11**. Chapter 3, Supplemental Question 1

Visit http://www.iana.org. What are the well-known port numbers for the simple file transfer protocol (SFTP)? For the network news transfer protocol (NNTP)?

**Sol’n**:

The official TCP port for the NNTP service is 119

SFTP usually uses port **22**

**Wireshark Lab**

Complete the lab in 03 - Wireshark\_TCP.pdf.

You will notice several packets labeled as **[TCP segment of a reassembled PDU]**. This can be very confusing for someone new to Wireshark, so I recommend disabling this feature in Wireshark by unchecking **Allow subdissector to reassemble TCP streams** in Edit 🡪 Preferences 🡪 Protocols 🡪 TCP.

Combine your answers to questions 7 and 8 in a table similar to the following.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sequence # | Time sent | Time ACK rcd | RTT  (seconds) | Est RTT (seconds) | Seg Length (bytes) |
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