Computer Networks: Homework 6 Written

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Problem 1. Hosts A and B are communicating over a TCP connection. Host B has already received from A all bytes up through byte 248. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 40 and 60 bytes of data respectively. In the first segment, the sequence number is 249, the source port number is 503, and the destination port number is 80. Host B sends an acknowledgement whenever it receives a segment from Host A.

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

The sequence number is 349 since (249 + 40 + 60), source port number is 503 and destination port number is 80.

b.) Suppose the first segment arrives before the second segment. Host B sends an acknowledgement in response to the first segment: what is the acknowledgment number, the source port number, and the destination port number?

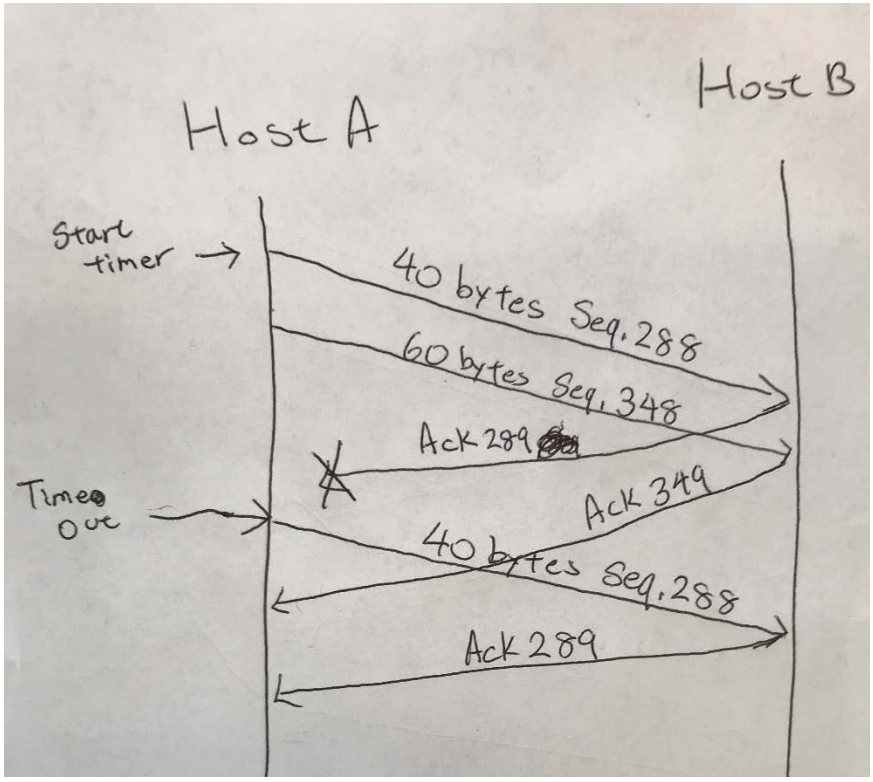
Acknowledgement number is 289 since (249+40), source port number is 80 and destination port number is 503.

c.) Suppose the second segment arrives before the first segment. Host B sends an acknowledgement in response to the first segment. What is the acknowledgement number?

The acknowledgement number is 249.

d.) Suppose the two segments sent by A arrive in order at B. The first acknowledgement is lost and the second acknowledgement arrives after the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgements 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 acknowledgement that you add, provide the acknowledgement number.

See diagram below.



Problem 2. Figure 1 plots the TCP window size over time for TCP reno. Using Figure 1, answer the following questions.

a.) Identify the transmission rounds when TCP slow start is operating.

At transmission rounds from 1 up to 7 and from 28 to 29.

b.) Identify the transmission rounds when TCP congestion avoidance is operating.

At transmission round from 7 to 15 and from 19 to 27.

c.) Identify the transmission rounds when TCP fast retransmit is operating.

From transmission rounds 16 to 18.

d.) After round 15, is segment loss detected by a triple duplicate ACK or a timeout?

Triple duplicate Ack because it transitions to Fast Retransmit.

e.) After round 27, is segment loss detected by a triple duplicate ACK or a timeout?

Timeout because it goes back to slow start.

f.) What is the value of ssthresh at the first transmission round?

64KB

g.) What is the value of ssthresh at the 16th transmission round?

Since ssthresh = cwnd/2 at this time, 72/2 = 36.

h.) What is the value of ssthresh at the 19th transmission round?

Ssthresh = 36 since ssthresh = cwnd at this point

i.) What is the value of ssthresh at the 28th transmission round?

Ssthresh = 22 since ssthresh = cwnd/2 here. So 44/2 = 22.

j.) During what transmission round is the 61st segment transmitted?

During the 6^{th} transmission round.

Problem 3. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support up to 70 interfaces, and Subnet 2 and 3 are each required to support up to 60 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.

Subnet 1: 223.1.17.0/25 gives 128 addresses

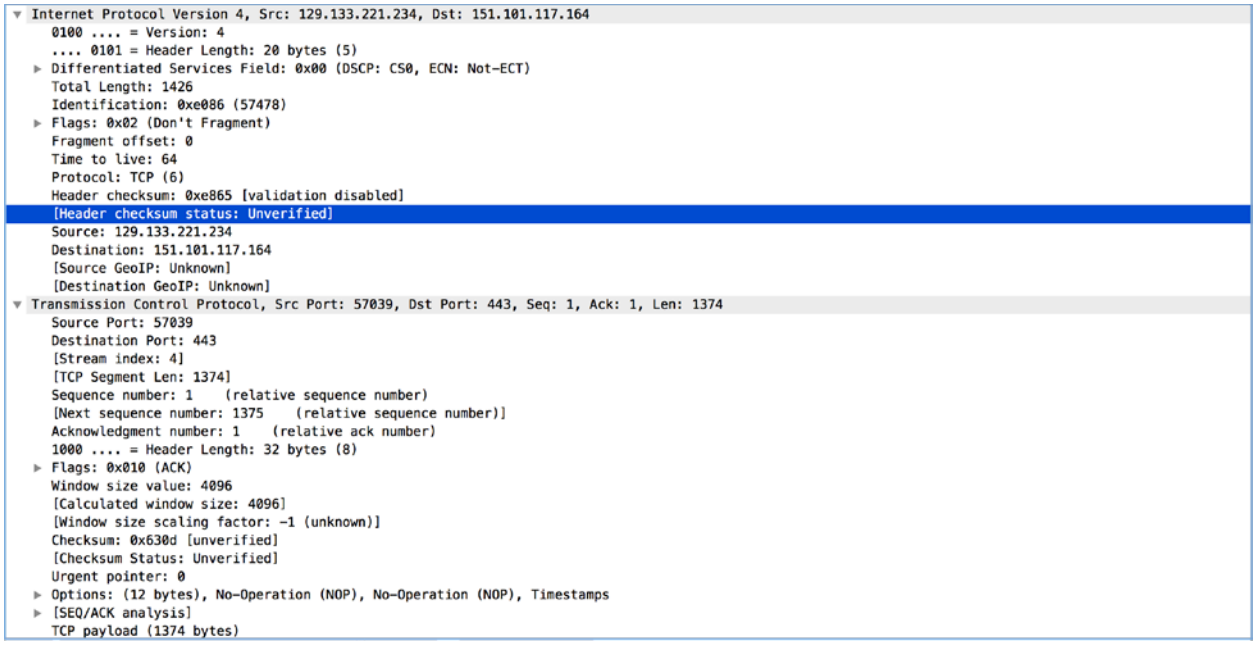
Subnet 2: 223.1.17.128/25 gives a different set of 128 addresses

Subnet 3: 223.1.17.0/26 gives 256 addresses

Problem 4. Open wireshark. While recording traffic, open www.nytimes.com. Once the webpage has loaded, stop recording traffic and enter the filter ip.addr == 151.101.117.164, which is the IP address for www.nytimes.com.

a.) Choose a packet sourced from www.nytimes.com that contains actual data sent by the nytimes server. Take a screenshot of the packet, with the IP header expanded and making sure to include the Transmission Control Protocol line.

Insert picture here



b.) How many bytes are in the IP header for the packet in part (a)? How many bytes are in IP packet? List all of the fields you see in the IP header and the number of bytes used by each field.

As seen in the picture above, there are 20 bytes in the IP header, and there are 1426 bytes total in the IP packet.

We can see how many bytes are used by each field by highlighting each field and looking at how much space it occupies in the hexadecimal display.

Version: 4 bit

Header Length: 4-bit

Differentiated services field: 1 byte

Total Length: 2 bytes

Identification: 2 bytes

Flags: 3 bits (reserved bit, don’t fragment, and more fragments flags)

Fragment offset: 13 bits (flags take up 3 of the 16 bits)

Time to live: 1 byte

Protocol: 1 byte

Header checksum: 2 bytes

Source: 4 bytes

Destination: 4 bytes

Source [GeoIP]: 4 bytes

Dest [GeoIP]: 4 bytes

c: How many bytes are in the TCP header for the TCP segment contained in the packet in part (a)? How many bytes are in the TCP segment?

As seen in the picture, there are 32 bytes in the TCP header and 1374 bytes in the segment.

d: For the traffic you have recorded, which IP header fields change from one packet to the next?

Source, Destination, Header checksum, Identification, Total Length, Time to Live, Differentiated services field,