Class: CS-372
Term: Fall 2017
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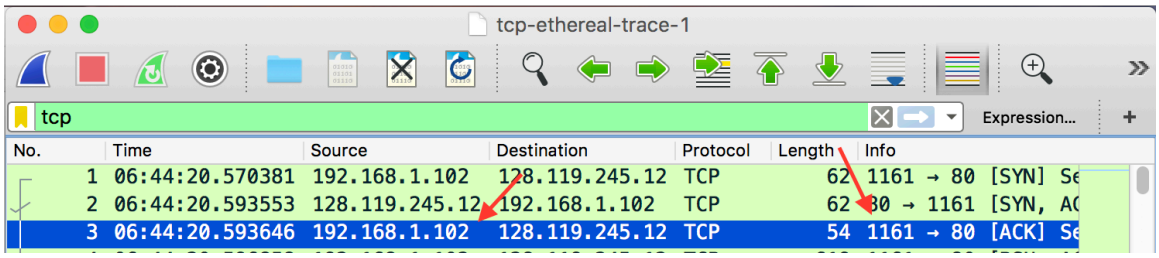
Date: November 5, 2017
Lab: #3

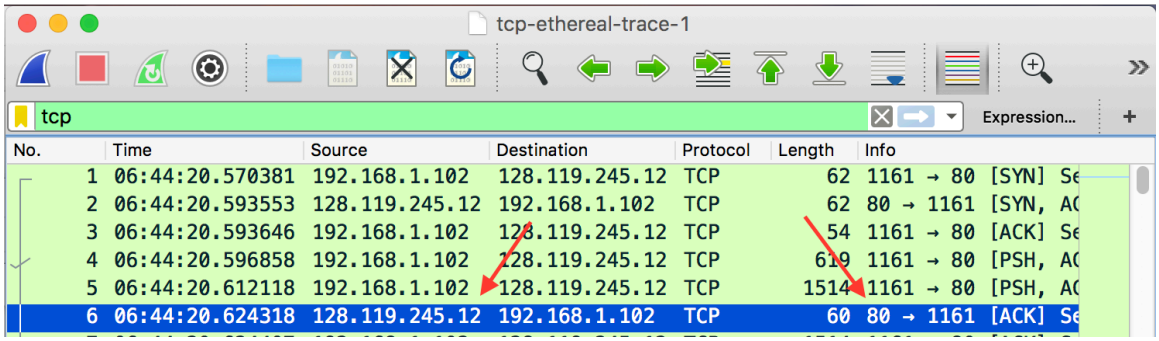
1) What is the IP address and TCP port number used by the client computer (source) that is transferring the file to gaia.cs.unmass.edu?

Answer:
IP address: 192.168.1.102
Port number: 1161
See screenshot below.



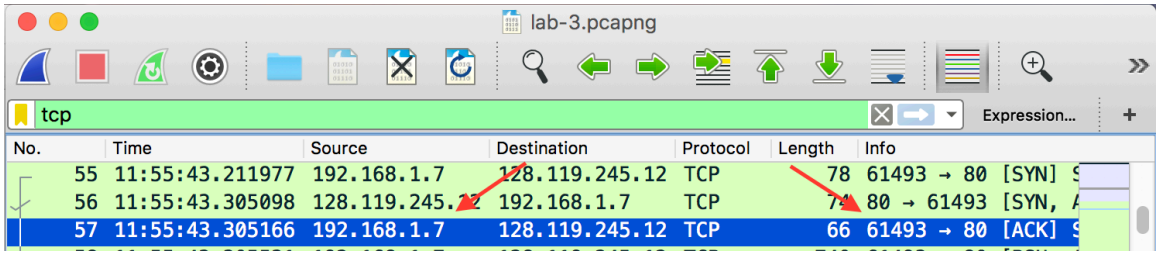
2) What is the IP address of gaia.cs.umass.edu? On what port number is it sending and receiving TCP segment for this connection?

Answer:
IP address: 128.119.245.12
Port number: 80
See screenshot below.



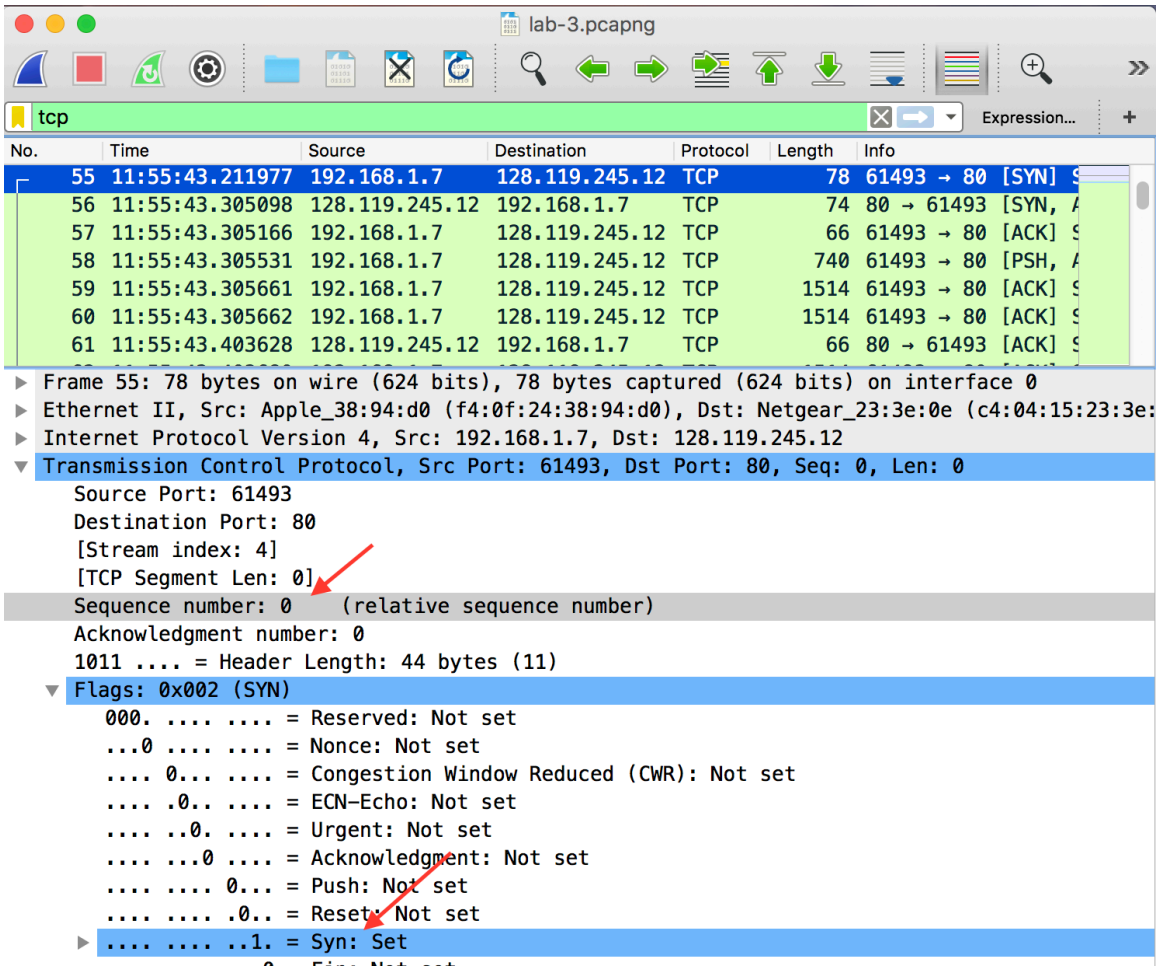
3) What is the IP address and TCP port number used by your client computer (source) to transfer the file to gaia.cs.unmass.edu?

Answer:
IP address: 192.168.1.7
Port number: 61493
See screenshot below.



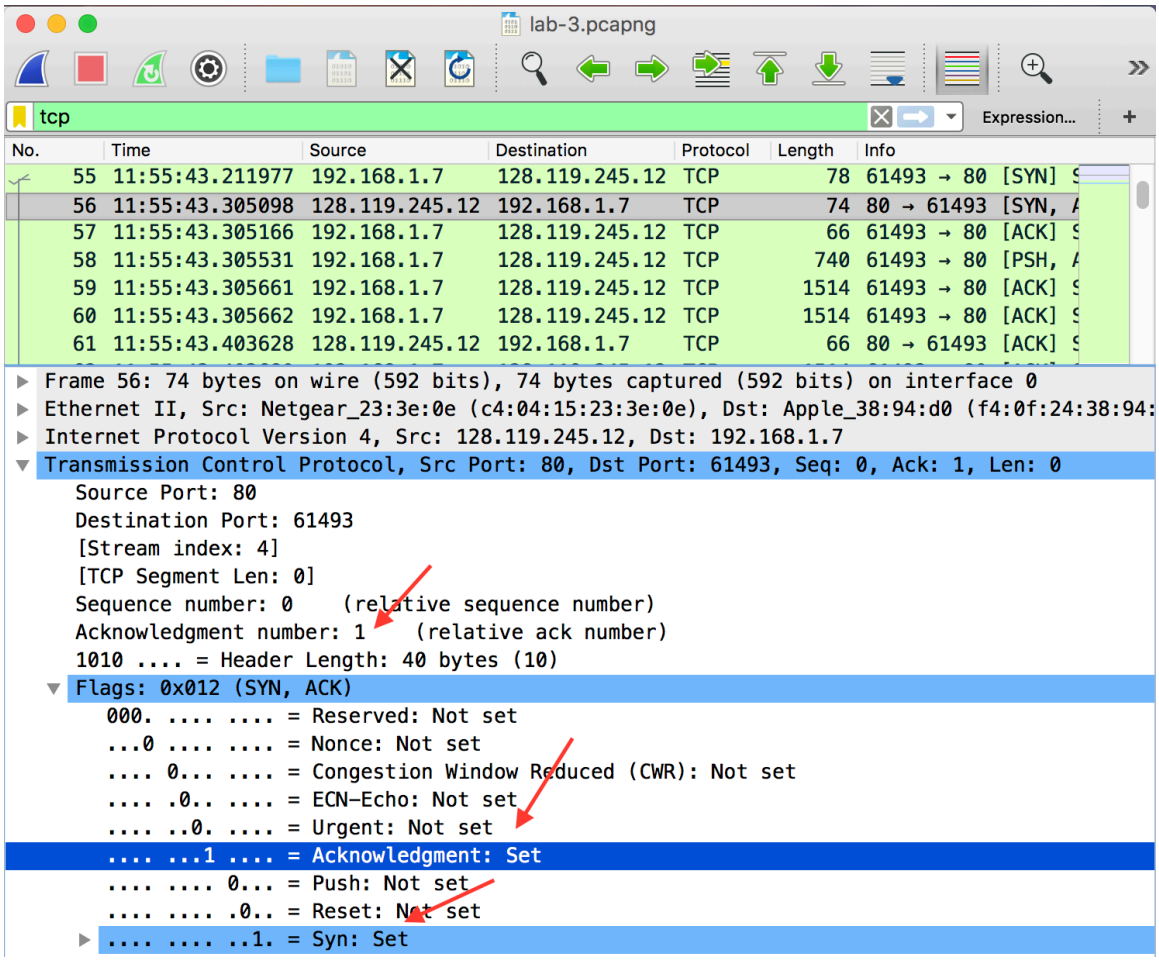
4) What is the sequence number of the TCP SYN segment that is used to initiate the TCP connection between the client computer and gaia.cs.unmass.edu? What is it in the segment that identifies the segment as a SYN segment?

Answer:
Sequence number of the TCP SYN segment: 0 (relative sequence number)
Identifier: The Syn flag is set.
See screenshot below.



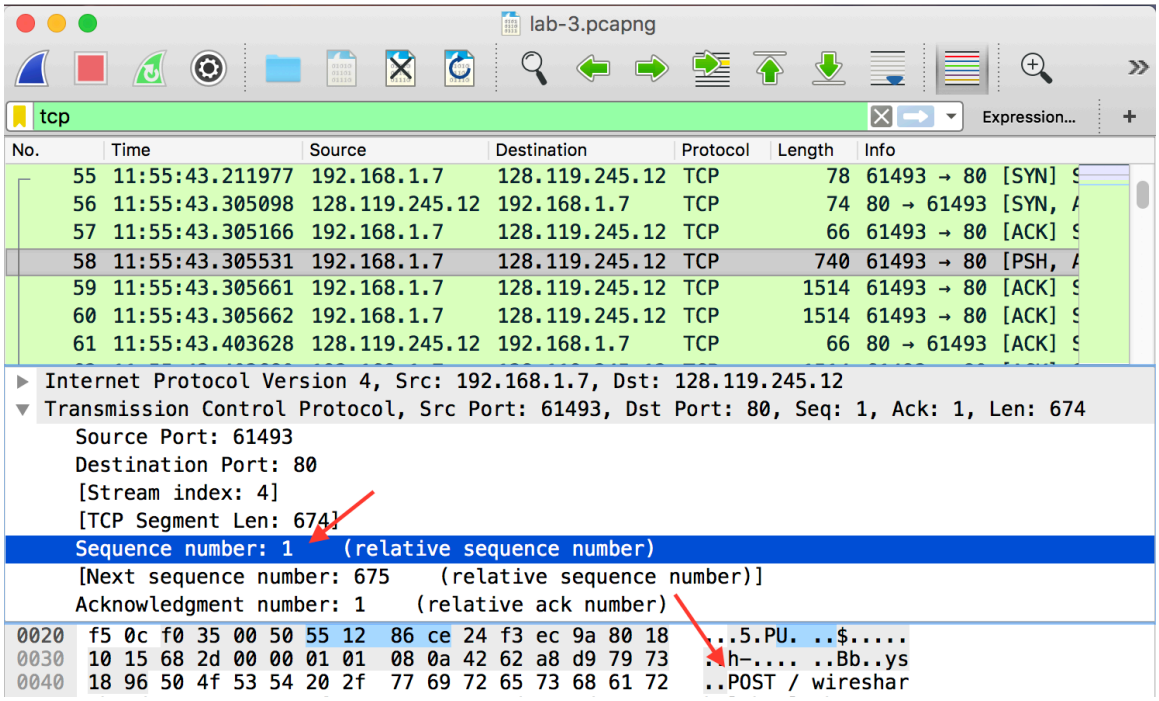
5) What is the sequence number of the SYNACK segment sent by gaia.cs.unmass.edu to the client computer in reply to the SYN? What is the value of the Acknowledgement field in the SYNACK segment? How did gaia.cs.unmass.edu determine the value? What is it in the segment that identifies the segment as a SYNACK segment.

Answer:
Sequence number of the SYNACK segment: 0
Acknowledgement value in SYNACK segment: 1
How: gaia.cs.unmass.edu determined the value by adding 1 to the initial sequence value.
Identifier: The Acknowledgment and Syn flags are set.
See the screenshot below.



6) What is the sequence number of the TCP segment containing the HTTP POST command?

Answer:
Sequence number: 1
See screenshot below.



7) Consider the TCP segment containing the HTTP POST as the first segment in the TCP connection. What are the sequence numbers of the first six segments in the TCP connection (including the segment containing the HTTP POST)? At what time was each segment sent? When was the ACK for each segment received? Given the difference between when each TCP segment was sent, and when its acknowledgement was received, what is the RTT value for each of the six segments? What is the EstimatedRTT value (see Section 3.5.3, page 242 in text) after the receipt of each ACK? Assume that the value of the Estimated RTT is equal to the measured RTT for the first segment, and then is computed using the EstimatedRTT equation on page 242 for all subsequent segments.

Answer:
Segment numbers 1-6 are the following: 58,59,60,62,65,66 in the screenshot below.
Acknowledgement segment numbers 1-6 are the following: 61,63,64,69,70,71 in the screenshot below.

Segment number 1
No. 58
Sequence number: 1
Time sent: 11:55:43.305531
No. 61
Time received: 11:55:43:.403628

RTT: 0.098097 seconds
EstimatedRTT = 0.098097 seconds

Segment number 2
No. 59
Sequence number: 675
Time sent: 11:55:43.305661
No. 63
Time received: 11:55:43.404498
RTT: 0.098837 seconds
EstimatedRTT = 0.875*EstimatedRTT + 0.125*SampleRTT
EstimatedRTT = 0.875* 0.098097 + 0.125* 0.098837
EstimatedRTT = 0.098189 seconds

Segment number 3
No. 60
Sequence number: 2123
Time sent: 11:55:43.305662
No. 64
Time received: 11:55:43.404501
RTT: 0.098839 seconds
EstimatedRTT = 0.875*EstimatedRTT + 0.125*SampleRTT
EstimatedRTT = 0.875* 0.098189 + 0.125* 0.098839
EstimatedRTT = 0.09827 seconds

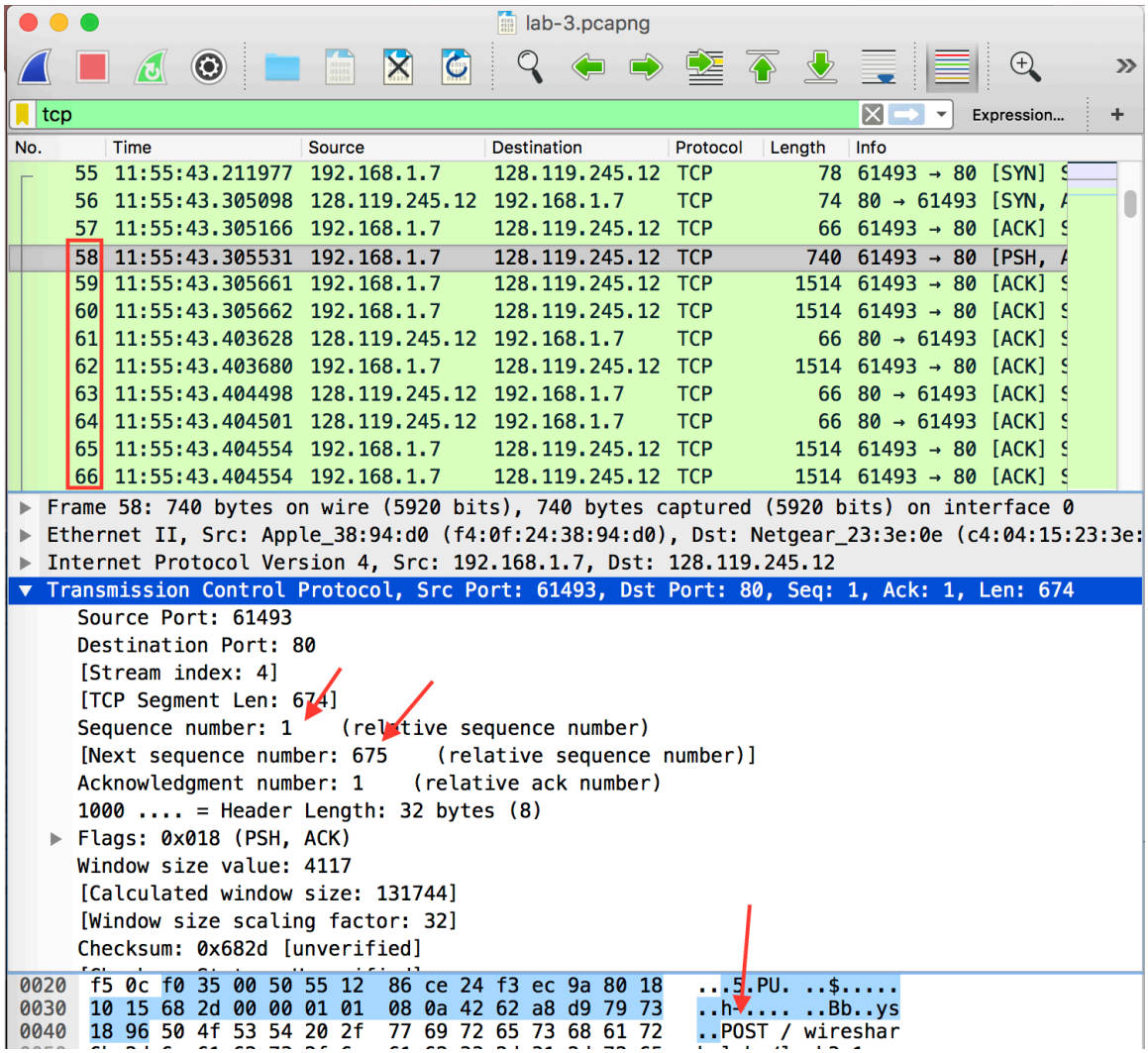
Segment number 4
No. 62
Sequence number: 3571
Time sent: 11:55:43.403680
No. 69
Time received: 11:55:43.511239
RTT: 0.107559 seconds
EstimatedRTT = 0.875*EstimatedRTT + 0.125*SampleRTT
EstimatedRTT = 0.875* 0.09827 + 0.125* 0.107559
EstimatedRTT = 0.09943 seconds

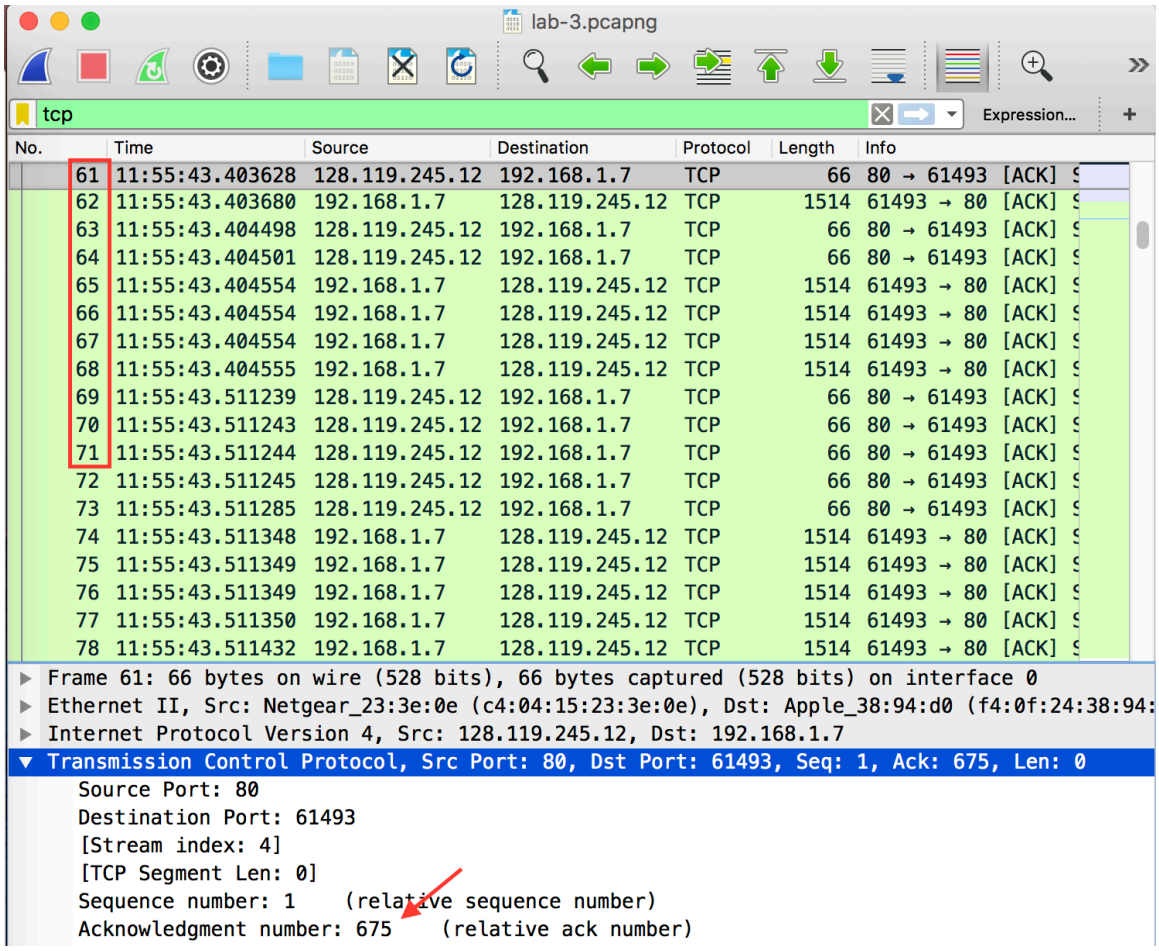
Segment number 5
No. 65
Sequence number: 5019
Time sent: 11:55:43.404554
No. 70
Time received: 11:55:43:511243
RTT: 0.106689 seconds
EstimatedRTT = 0.875*EstimatedRTT + 0.125*SampleRTT
EstimatedRTT = 0.875* 0.09943 + 0.125* 0.106689
EstimatedRTT = 0.100337 seconds

Segment number 6
No. 66
Sequence number: 6467
Time sent: 11:55:43.404554
No. 71
Time received: 11:55:43:511244

RTT: 0.10669 seconds
EstimatedRTT = 0.875*EstimatedRTT + 0.125*SampleRTT
EstimatedRTT = 0.875* 0.100337 + 0.125* 0.10669
EstimatedRTT = 0.10113 seconds

See screenshots below.

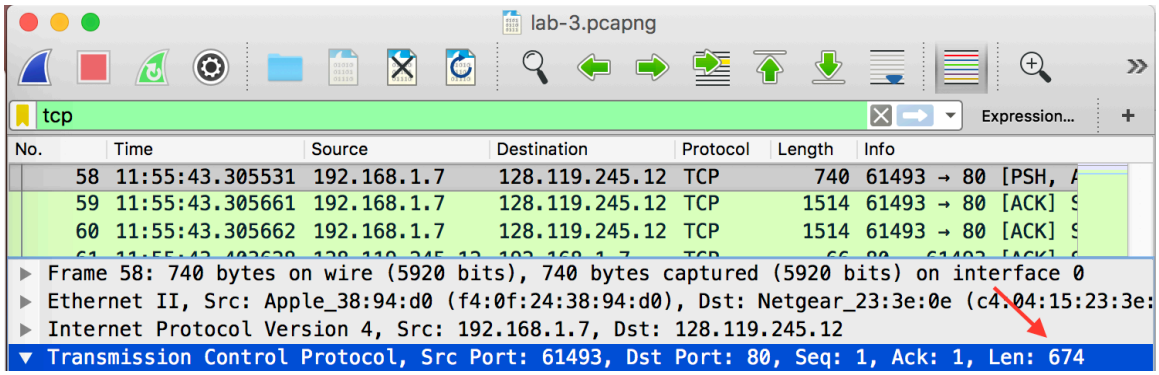




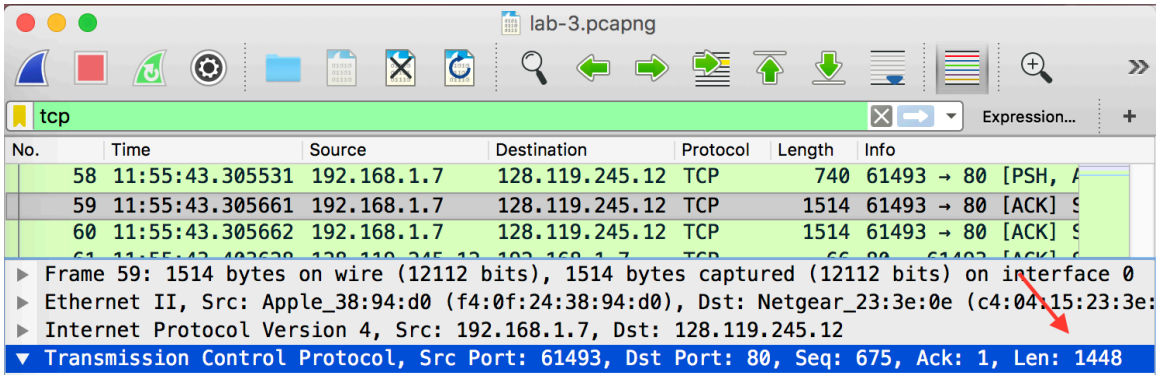
8) What is the length of each of the six TCP segments?

Answer:
See screenshots below.

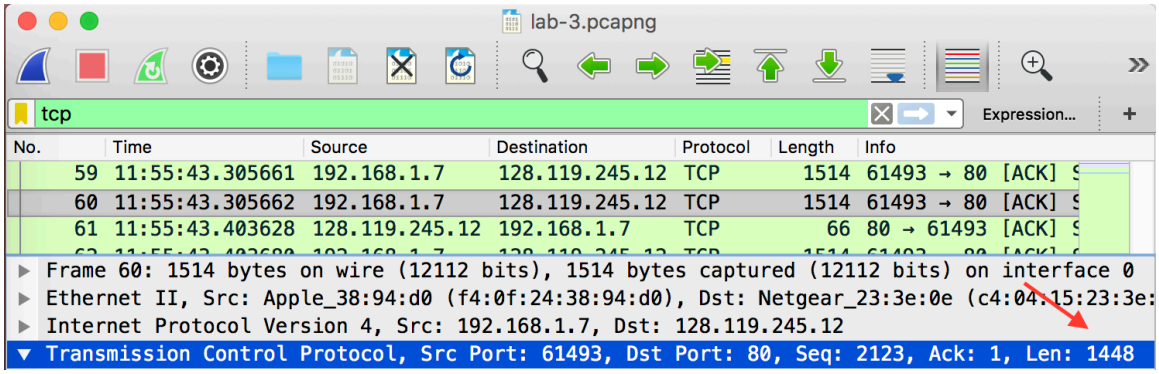
Segment number 1
674 bytes



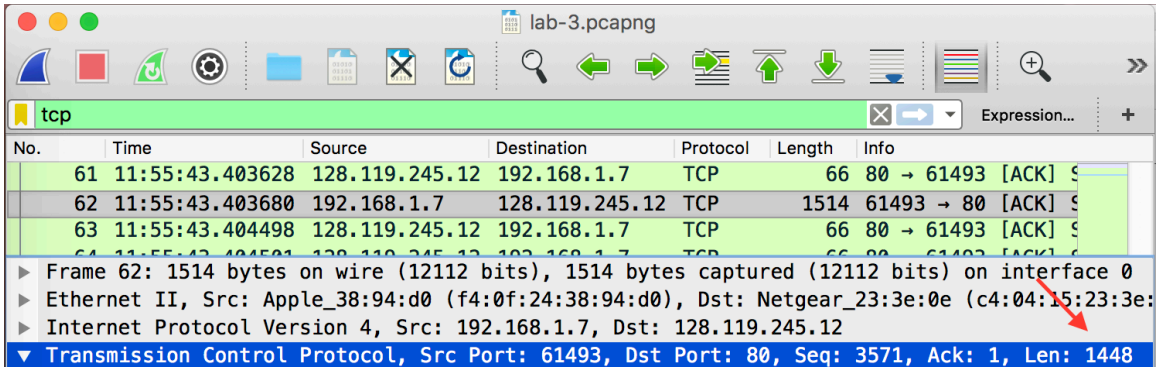
Segment number 2
1448 bytes



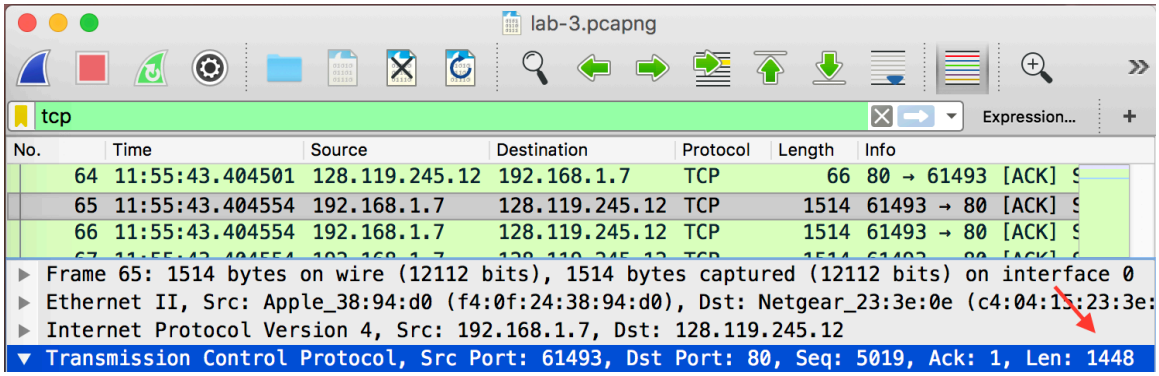
Segment number 3
1448 bytes



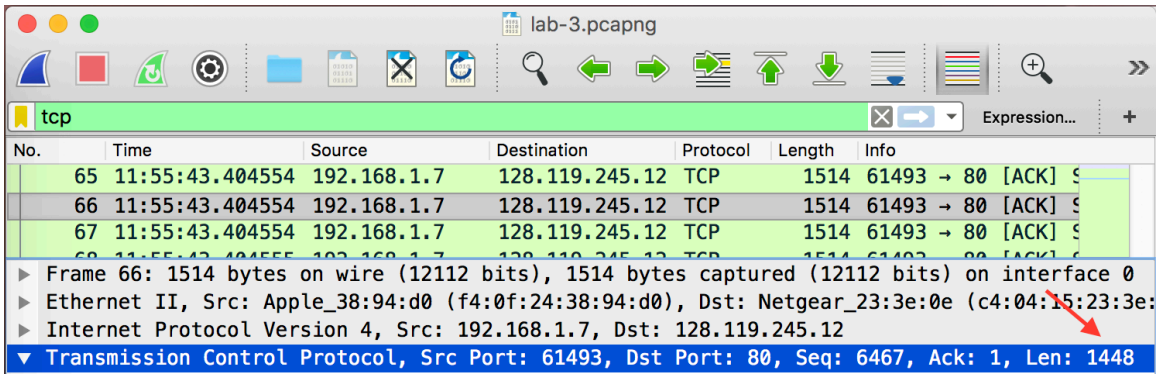
Segment number 4
1448 bytes



Segment number 5
1448 bytes

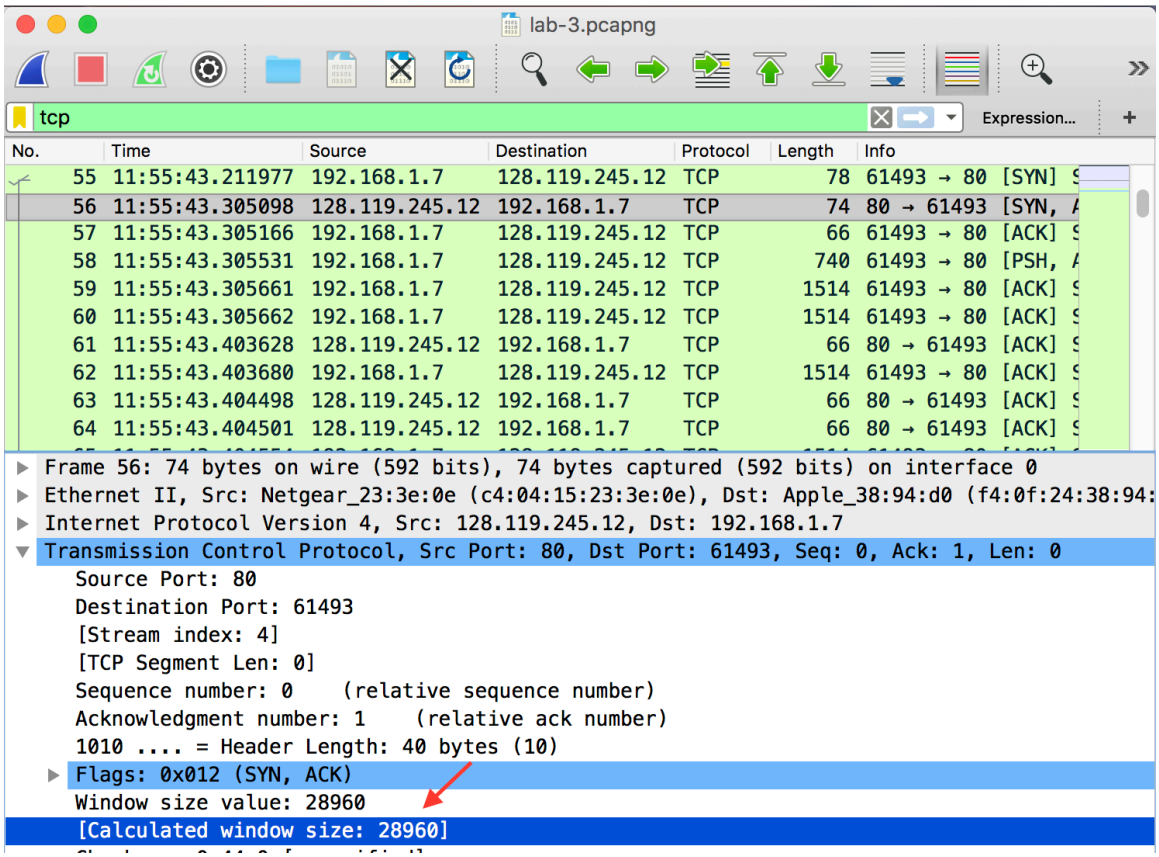


Segment number 6
1448 bytes



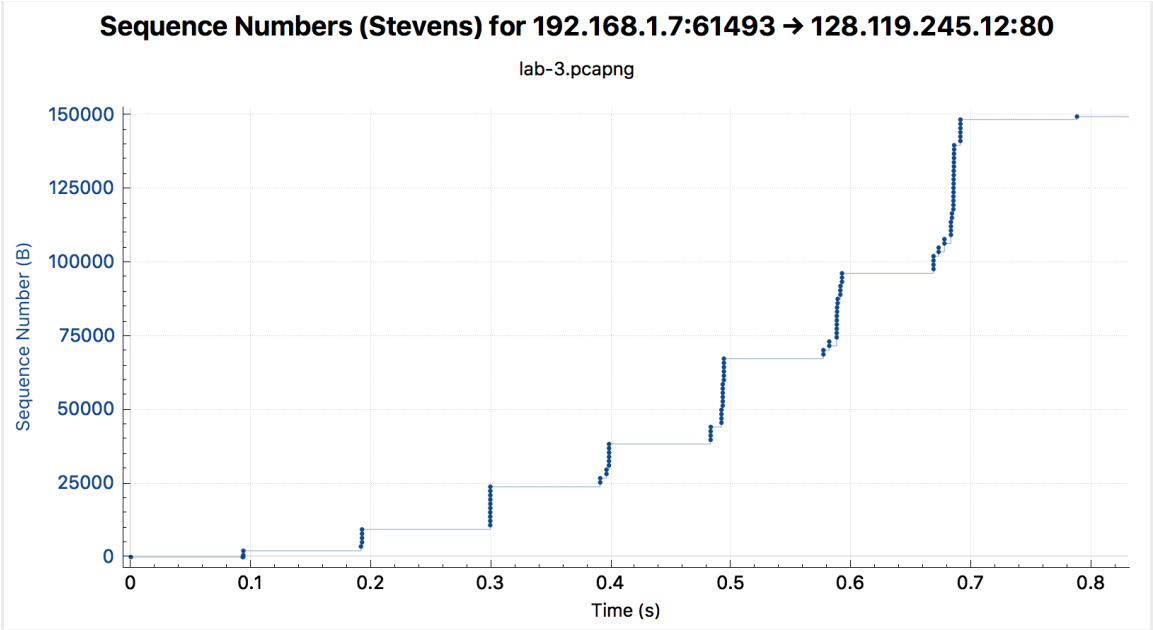
9) What is the minimum amount of available buffer space advertised at the received for the entire trace? Does the lack of receiver buffer space ever throttle the sender?

Answer:
28960 bytes
This lack of receiver buffer space does not throttle the sender.
See screenshots below.



10) Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?

Answer:
No. This was determined because the sequence numbers of the TCP segments in the trace file increase. I checked the Time-Sequence-Graph (Stevens) in order to answer this question.
See screenshot below.

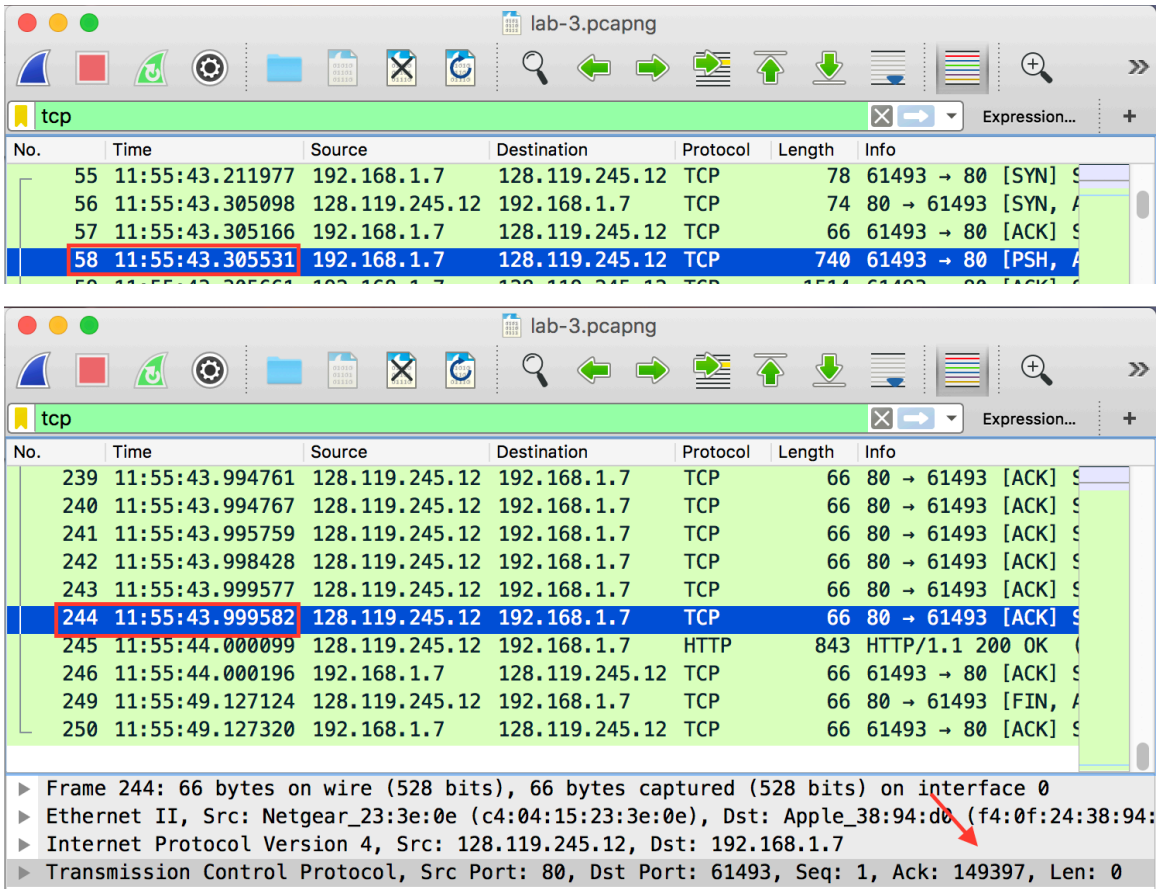


11) How much data does the receiver typically acknowledge in a ACK? Can you identify cases where the receiver is ACKing every other received segment (see Table 3.2 on page 250 in the text).

Answer:
For the first segment, the receiver acknowledged 674 bytes. For the rest, the receiver acknowledged 1448 bytes. After analyzing AKC numbers, they increased by 1448 bytes each time. From that, I would say that there were no cases where the receiver ACKed every other received segment.

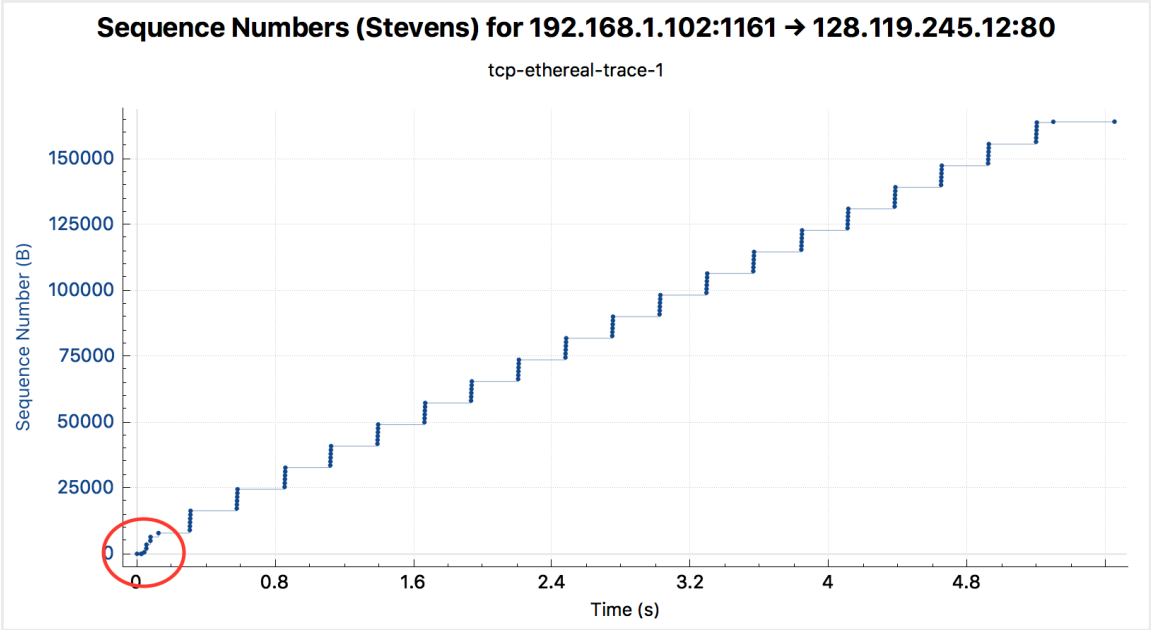
12) What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.

Answer:
The throughput can be calculated by taking the total amount of data that was transmitted and dividing it by the total connection time. Our time started at the segment that contained the HTTP POST (11:55:43.305531). Our time stopped when the last ACK comes back (11:55:43.999582). The total amount of data transmitted is the sequence number of the last ACK(149397 bytes). Putting it altogether, the total connection time => .694 seconds. Therefore, the throughput for the TCP connection is (149397 -1 bytes) / (.694 seconds) = 0.215 MBytes/sec.
See screenshot below.



13) Us the Time-Sequence-Graph (Stevens) plotting tool to view the sequence number versus time plot of segments being sent from the client to the Gaia.cs.umass.edu server. Can you identify where TCP's slowstart phase begins and ends, and where congestion avoidance takes over? Comment on ways in which the measured data differs from the idealized behavior of TCP that we've studied in the text.

Answer:
The slowstart happens in the beginning and is circled in the screenshot below. Also, the congestion avoidance takes over in the circled portion of the graph. This congestion control sets the limit of TCP segments that can be sent.
See screenshot below.



14) Answer question 13 for the trace that you captured when you transferred a file from your own computer to the gaia.cs.umass.edu.

Answer:
The slow start on my trace appears to be half the graph. The number of TCP segments that are being sent grows. As discussed previously, there was no congestion avoidance that took place because the window was large enough. I imagine if the file was larger that there would be some congestion avoidance that would come into play.
See screenshot below.