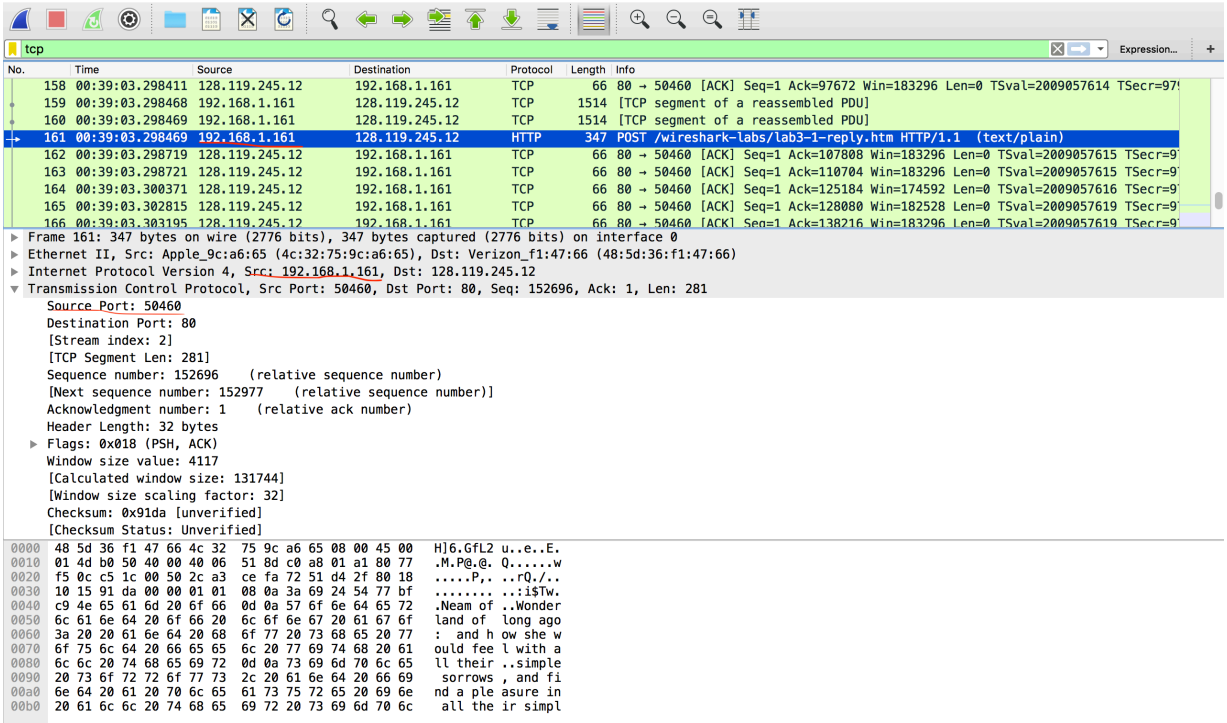
Computer Networks
Lab 4 - TCP
By:
Monil Shah
mds747

1) What is the IP address and TCP port number used by the client computer (source) that is transferring the file to gaia.cs.umass.edu? To answer this question, it's probably easiest to select an HTTP message and explore the details of the TCP packet used to carry this HTTP message, using the "details of the selected packet header window" (refer to Figure 2 in the "Getting Started with Wireshark" Lab if you're uncertain about the Wireshark windows.

Ans.) Client Computer:
IP address: 192.168.1.161
Source Port: 50460

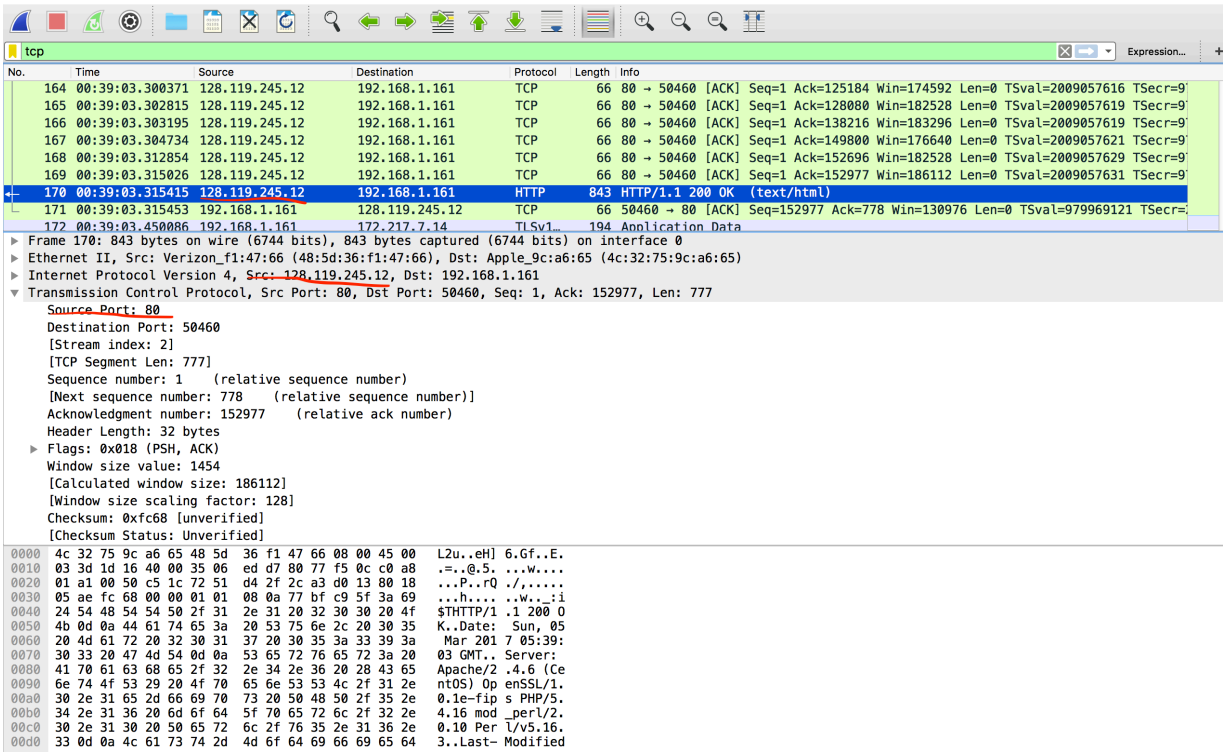


2) What is the IP address of gaia.cs.umass.edu? On what port number is it sending and receiving TCP segments for this connection?

Ans.) Server Computer(gaia.cs.umass.edu):

IP address: 128.119.245.12

Source Port: 80

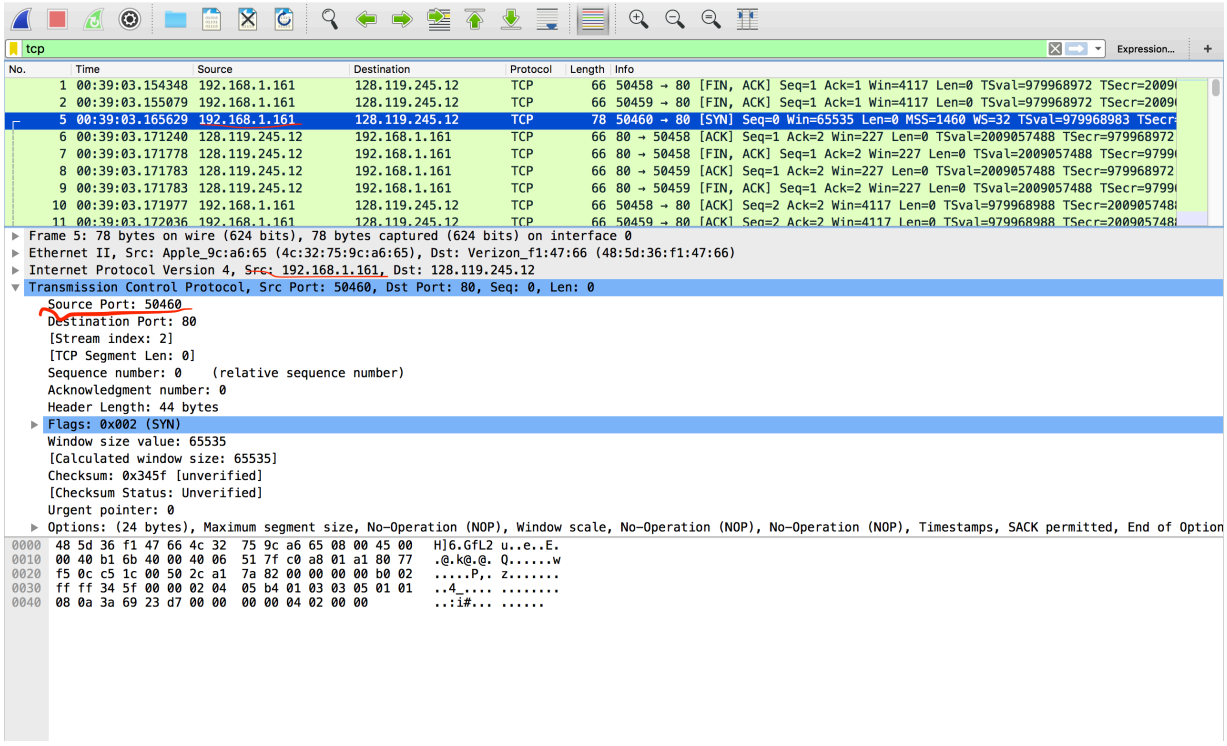


3) What is the IP address and TCP port number used by your client computer (source) to transfer the file to gaia.cs.umass.edu?

Ans.) Client Computer(Source):

IP address: 192.168.1.161

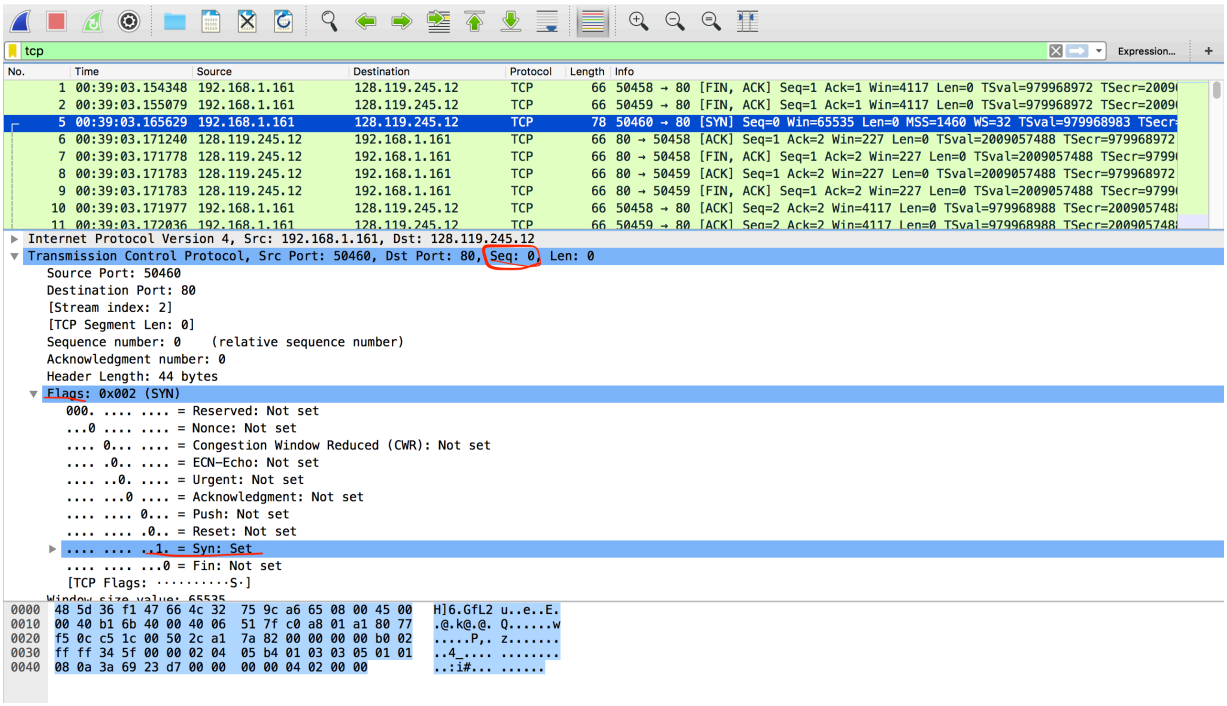
TCP Port: 50460



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.umass.edu? What is it in the segment that identifies the segment as a SYN segment?

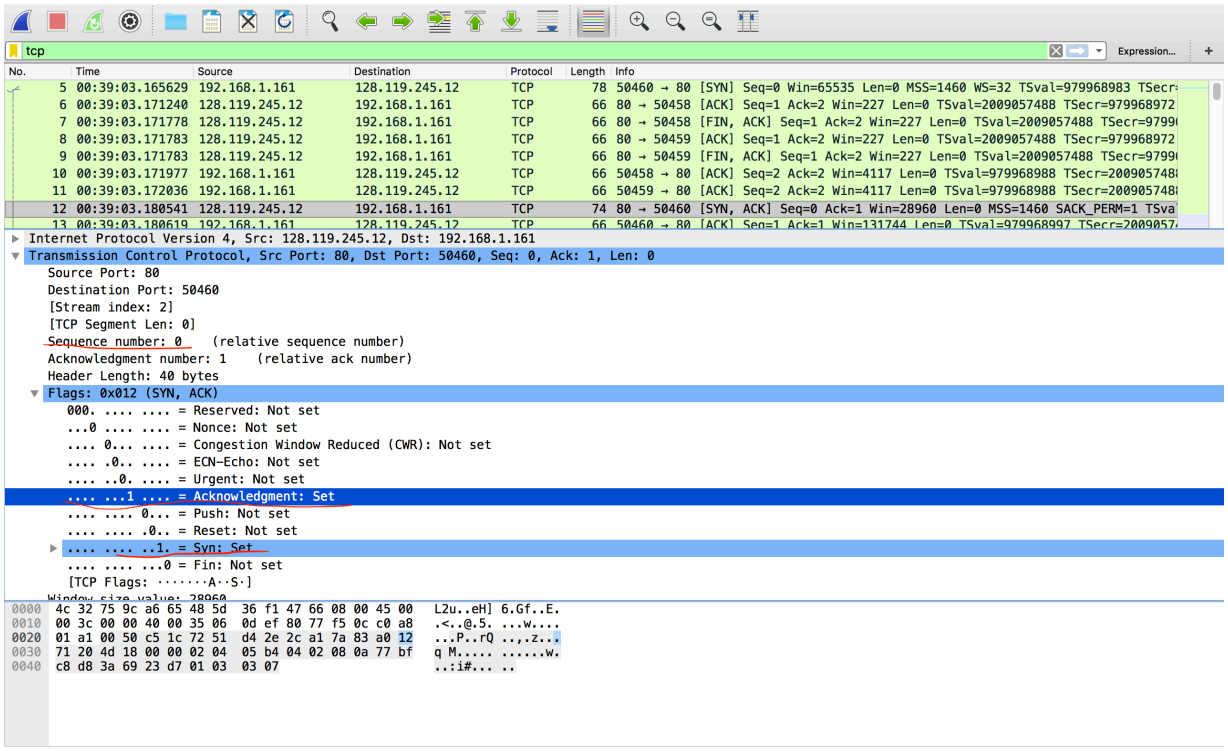
Ans.) The sequence number of the TCP SYN segment that is used to initiate the TCP connection between the client computer and gaia.cs.umass.edu is 0.

As shown in figure below, “Flags” section identifies the segment as a SYN segment. The Syn flag is set to 1.



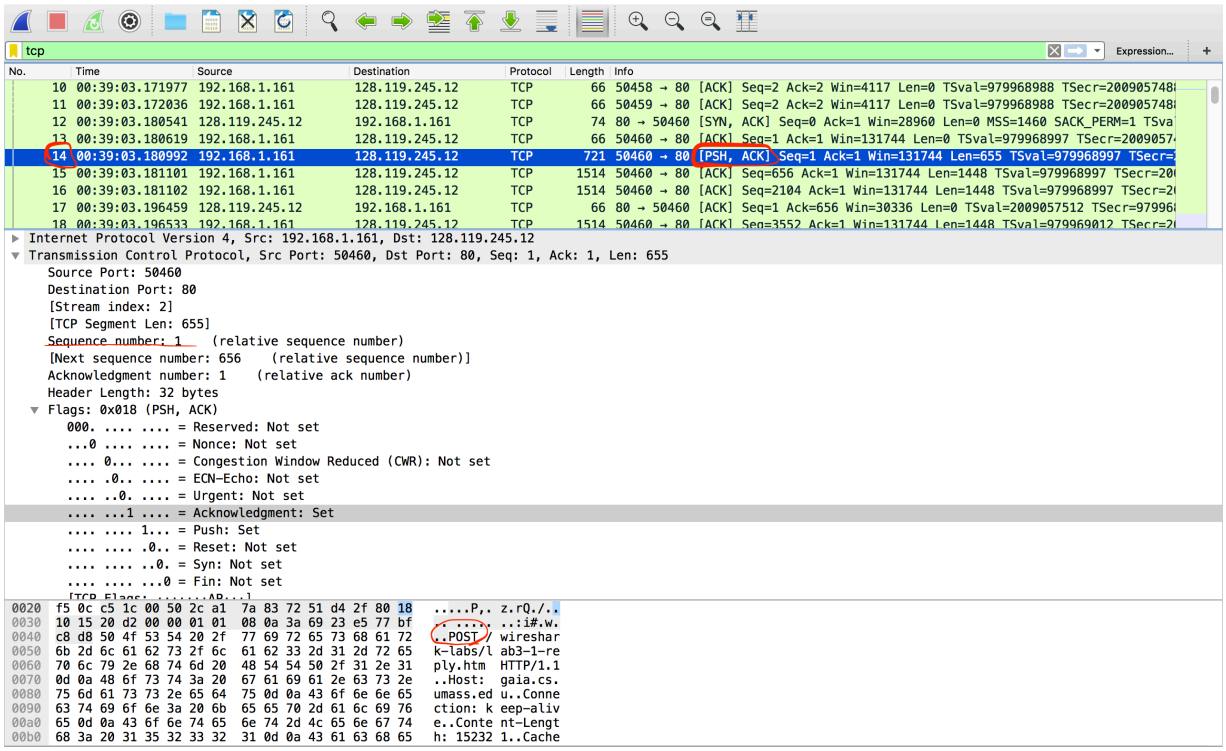
5) What is the sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN? What is the value of the Acknowledgement field in the SYNACK segment? How did gaia.cs.umass.edu determine that value? What is it in the segment that identifies the segment as a SYNACK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

Ans.) The sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN is 0. The value of the Acknowledgement field in the SYNACK segment is 1. To determine the value of ACK field in the SYNACK segment, the server adds 1 to the initial sequence number of SYN segment form the client computer. The initial sequence number of SYN segment from the client computer is 0, thus the value of the ACK field in the SYNACK segment is 1.
The segment is identified as SYNACK segment if it has both SYN and ACK flags set to 1.



6) What is the sequence number of the TCP segment containing the HTTP POST command? Note that in order to find the POST command, you'll need to dig into the packet content field at the bottom of the Wireshark window, looking for a segment with a "POST" within its DATA field.

Ans.) As shown in figure below, Sequence number of TCP segment containing HTTP POST command is 1. Segment 14 contains HTTP POST .



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 239 in text) after the receipt of each ACK? Assume that the value of the EstimatedRTT is equal to the measured RTT for the first segment, and then is computed using the EstimatedRTT equation on page 239 for all subsequent segments. Note: Wireshark has a nice feature that allows you to plot the RTT for each of the TCP segments sent. Select a TCP segment in the "listing of captured packets" window that is being sent from the client to the gaia.cs.umass.edu server. Then select: Statistics->TCP Stream Graph- >Round Trip Time Graph.

Ans.) According to figures below, The Segment numbers 1-6 are 14,15,16,18,20,21 and their ACK are numbers: 17,19,22,25,28,31

Segment No.	Sequence Number	Sent Time	ACK Received Time	RTT
1	1	0.180992	0.196459	0.015467
2	656	0.181101	0.197500	0.016399
3	2104	0.181102	0.197836	0.016734
4	3552	0.196553	0.211130	0.014577
5	5000	0.197575	0.213564	0.015989
6	6448	0.197836	0.213918	0.016082

EstimatedRTT = (1-α)*EstimatedRTT + α*SampleRTT , where α = 0.125

For Segment 1, EstimatedRTT = 0.015467 ms

For Segment 2, Estimated RTT = 0.875*0.015467 + 0.125*0.016399 = 0.015549 ms

For Segment 3, Estimated RTT = 0.875*0.015549 + 0.125*0.016734 = 0.015625 ms

For Segment 4, Estimated RTT = 0.875*0.015625+ 0.125*0.014577 = 0.015493 ms

For Segment 5, Estimated RTT = 0.875*0.015493 + 0.125*0.015989 = 0.015557 ms

For Segment 6, Estimated RTT = 0.875*0.015557 + 0.125*0.016082 = 0.015622 ms

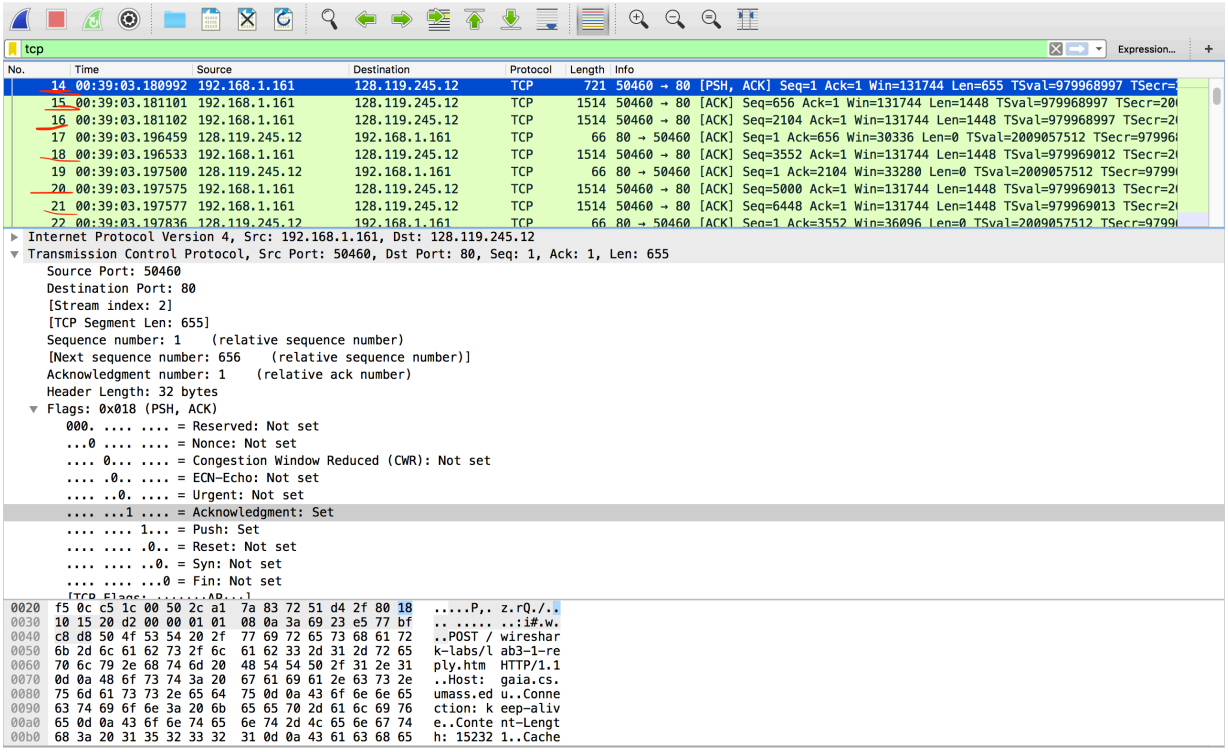


Fig: Segements 1-6

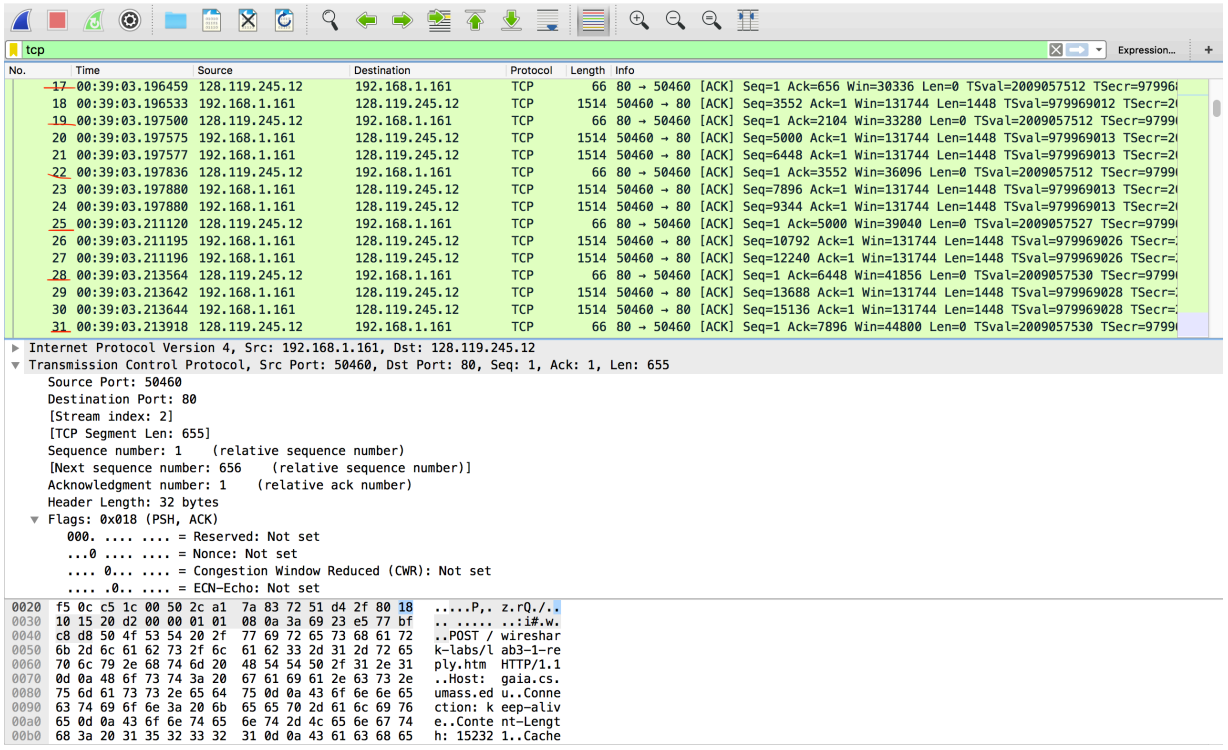
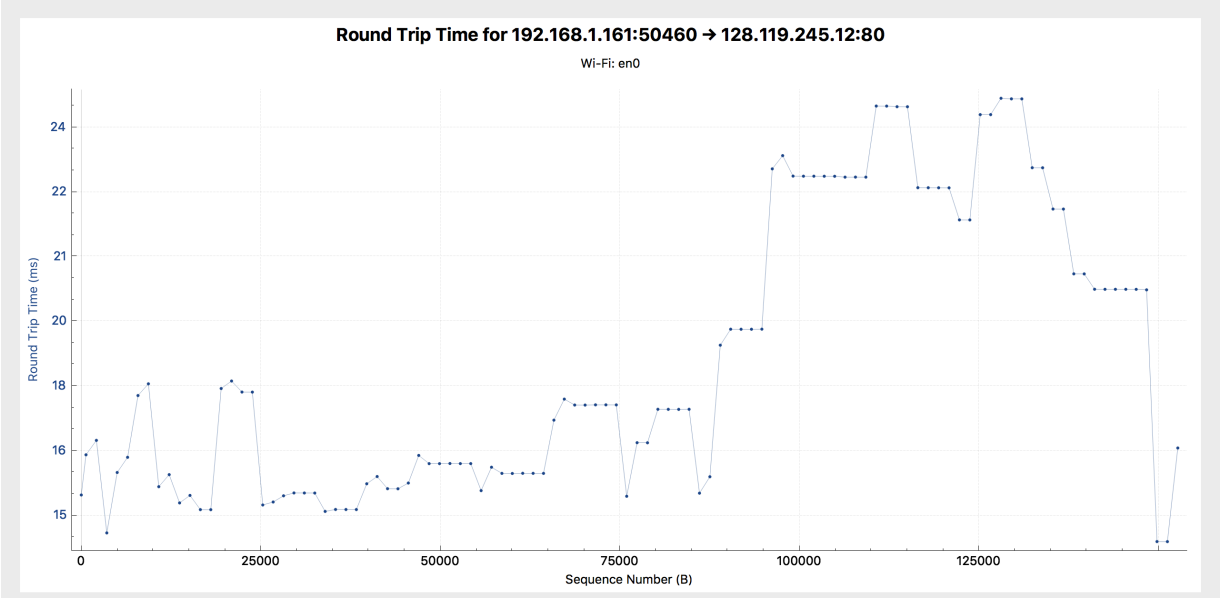
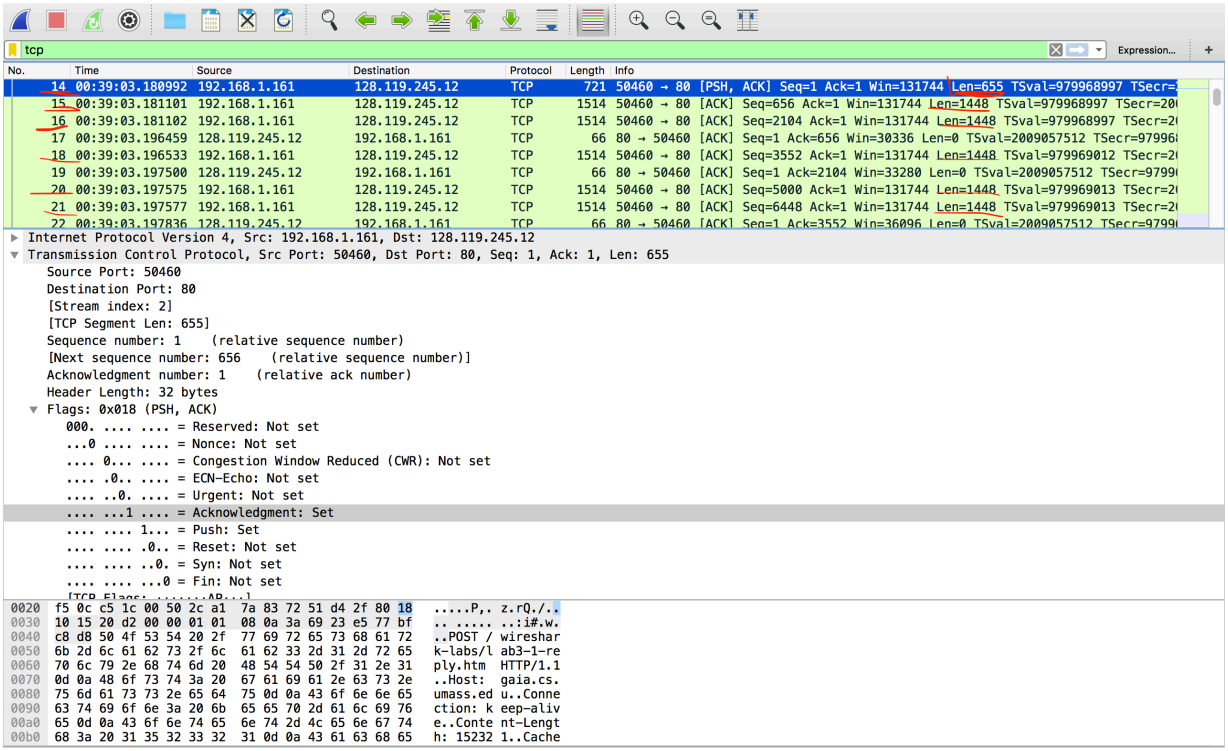


Fig: ACK of 1-6



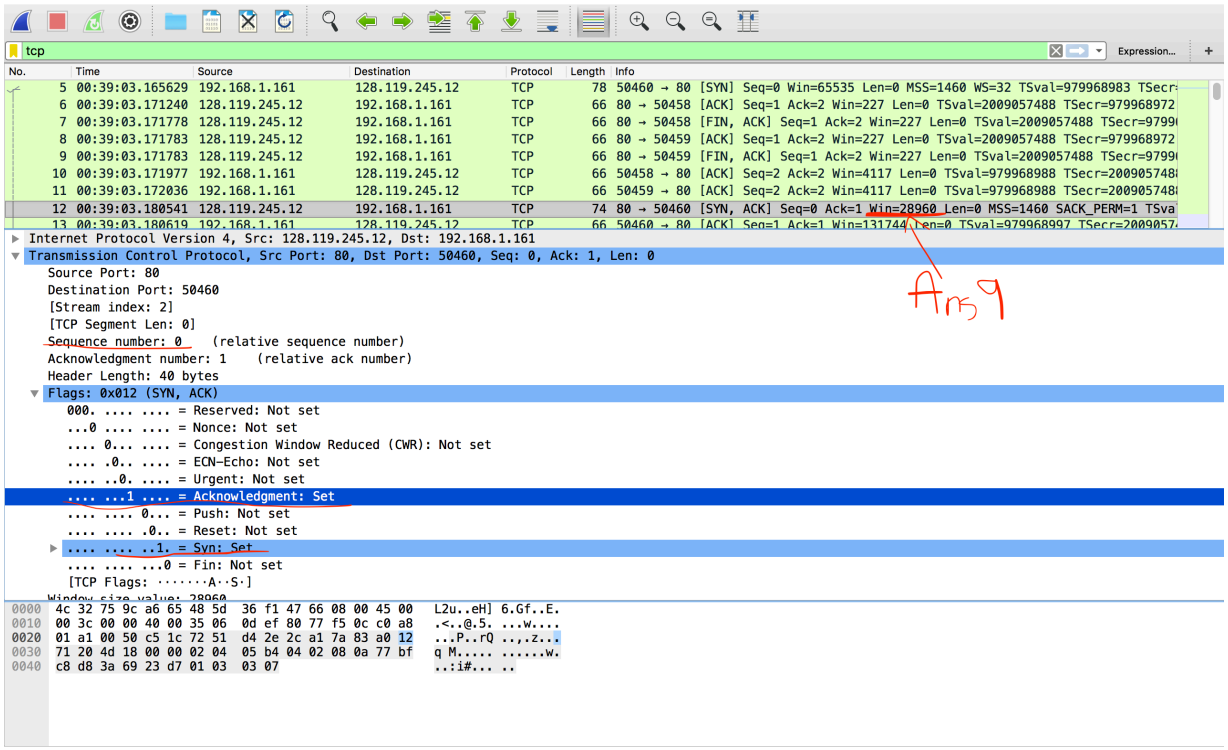
8) What is the length of each of the first six TCP segments?

Ans.) The length of first TCP segment is: 655 bytes.
The length of next 5 TCP segments is: 1448 bytes.



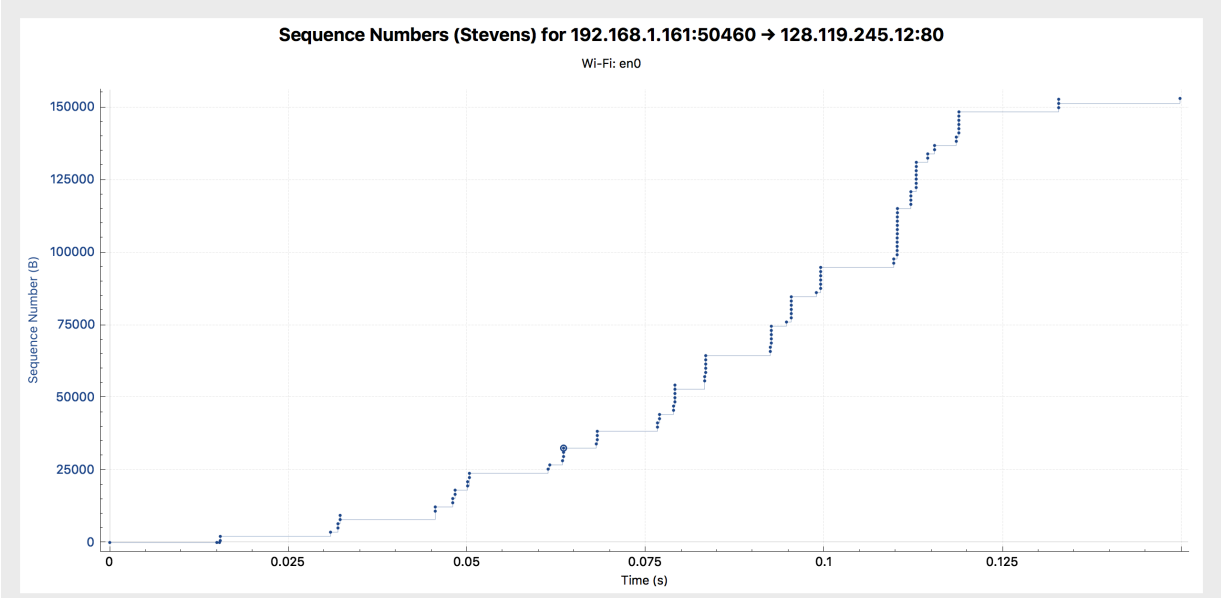
9) What is the minimum amount of available buffer space advertised at the received for the entire trace? Does the lack of receiver buffer space ever throttle the sender?

Ans.) The minimum amount of available buffer space advertised at the received for the entire trace is the value of first ACK from the server i.e. 28960 bytes. The reviver windows grows upto size of 62780 bytes, hence the sender is never throttled due to lack of receiver buffer space.



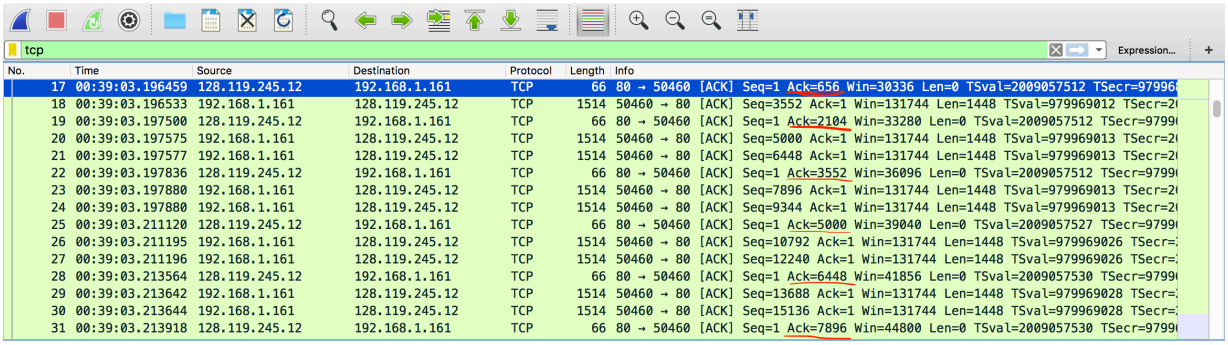
10) Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?

Ans.) There is no retransmitted segments in the trace file. In the time sequence graph (Stevens), all sequence numbers are monotonically increasing as shown in figure below.



11) How much data does the receiver typically acknowledge in an ACK? Can you identify cases where the receiver is ACKing every other received segment (see Table 3.2 on page 247 in the text).

Ans.) Data acknowledged in an ACK = The difference between the acknowledged sequence numbers of two consecutive ACKs . For Example No 17 and 19 have ACK sequence numbers 656 and 2104 respectively.
So 2104-656 = 1448 bytes.
The receiver is ACKing every other segment as shown in figure.



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

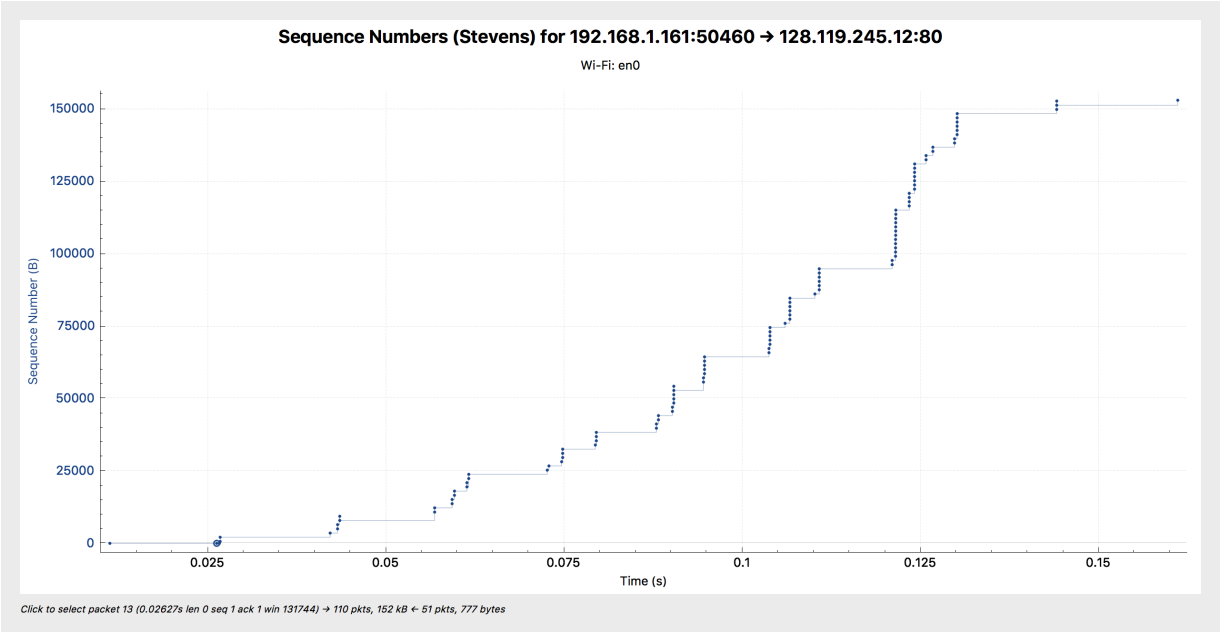
Ans.) The size of alice.txt is 152,138 bytes. The time difference between first TCP

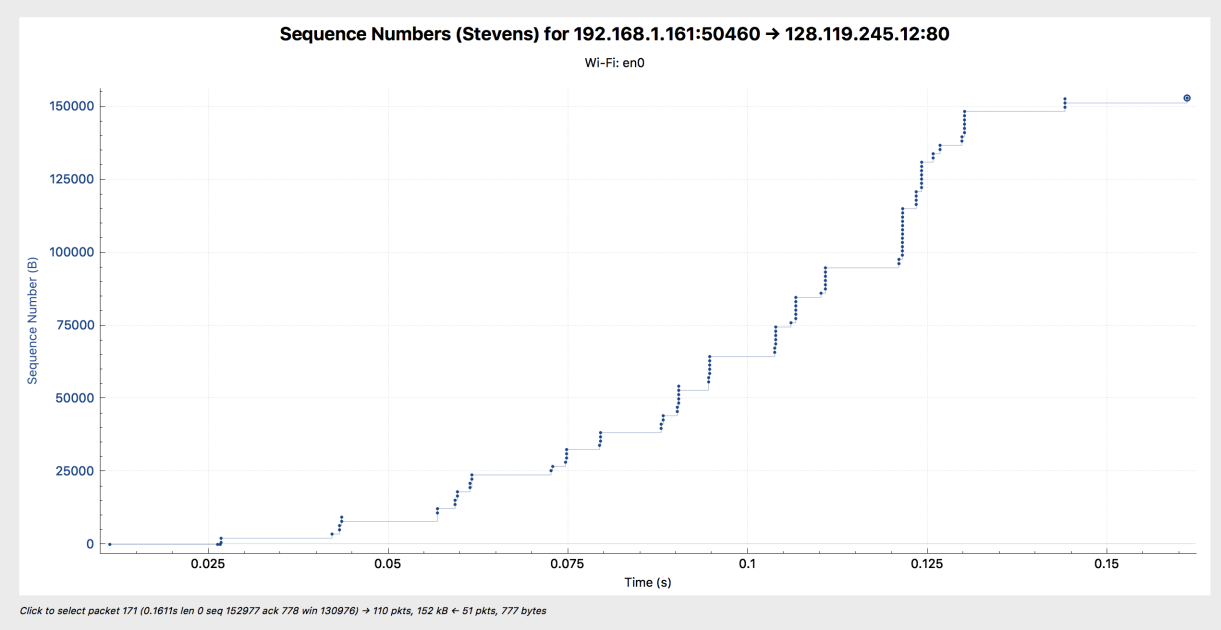
segment and the last ACK segment is 0.03926.

Therefore, Throughput = 152138/0.03926 = 3875.14 KB/sec

13) Use 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 slow start 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.

Ans.) The slow start of the TCP seems to begin at about 0.02627 seconds and then ends at about 0.1611 seconds. Congestion avoidance takes over at about 0.13 seconds because it cut down the amount being sent.
The idealized behavior of TCP in the text assumes that TCP senders are aggressive in sending data. Too much traffic may congest the network; therefore, TCP senders should follow the AIMD algorithm so that when they detect network congestion (i.e., packet loss), their sending window size should drop down.





14) Answer each of two questions above for the trace that you have gathered when you transferred a file from your computer to gaia.cs.umass.edu

Ans.) The answer is same as above.