Wireshark Lab -- TCP

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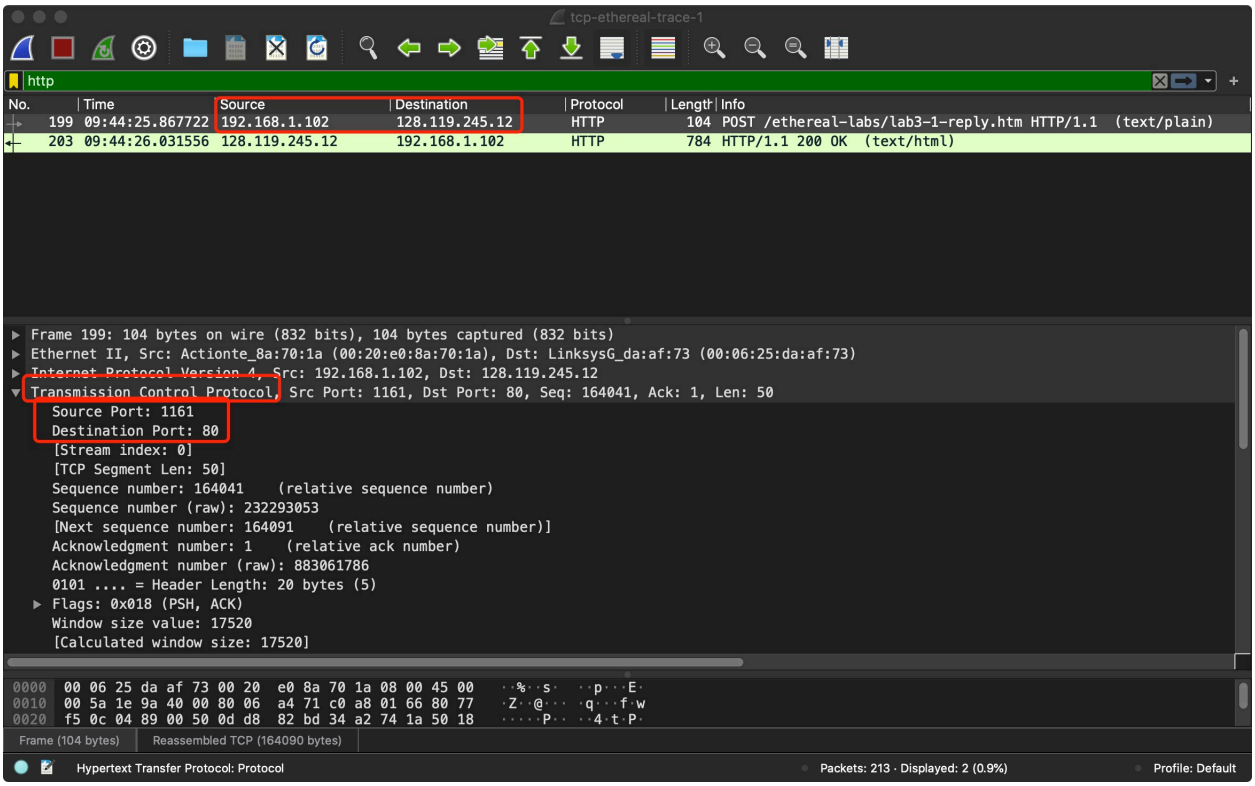
Lab environment:

Answer: My PC uses macOS Catalina 10.15.6, shows the following setting with *ifconfig*:

Q1. 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

Answer: As shown in the screenshot below, the IP address of client computer(source) is 192.168.1.102 and the TCP port number of client computer is 1161.

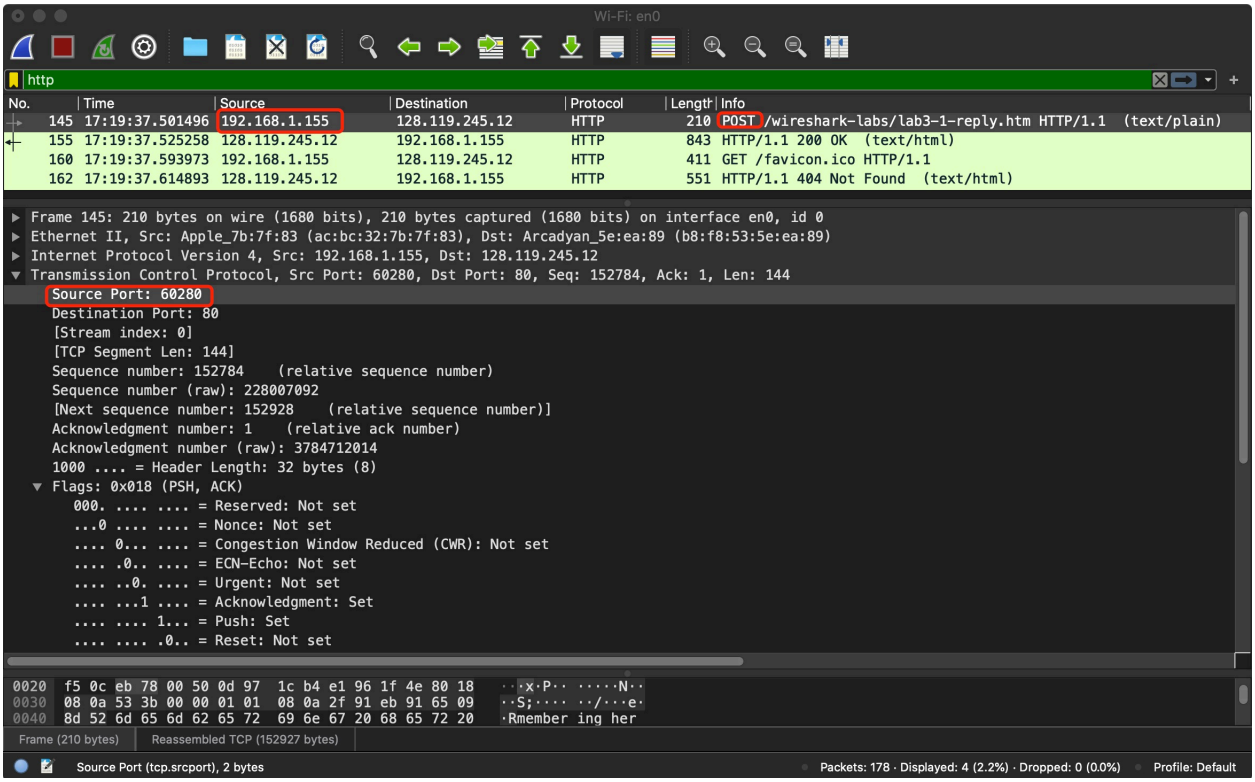


Q2. What is the IP address of gaia.cs.umass.edu? On what port number is it sending and receiving TCP segments for this connection?

Answer: As shown in the screenshot above, the IP address of gaia.cs.umass.edu(destination) is 128.119.245.12 and the TCP port number of destination is 80.

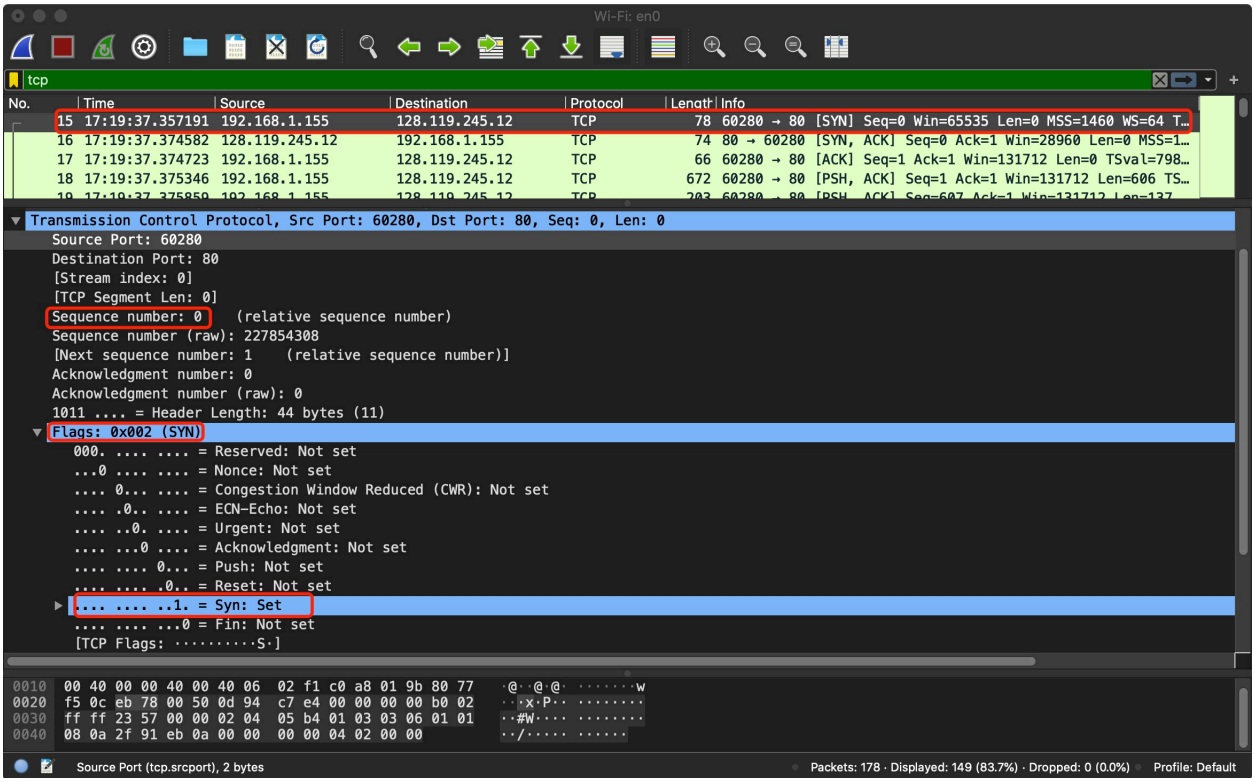
3. What is the IP address and TCP port number used by your client computer (source) to transfer the file to gaia.cs.umass.edu?

Answer: As shown in the screenshot below, the IP address of source(my laptop) is 192.168.1.155 and the TCP port number used by my client computer is 60280.



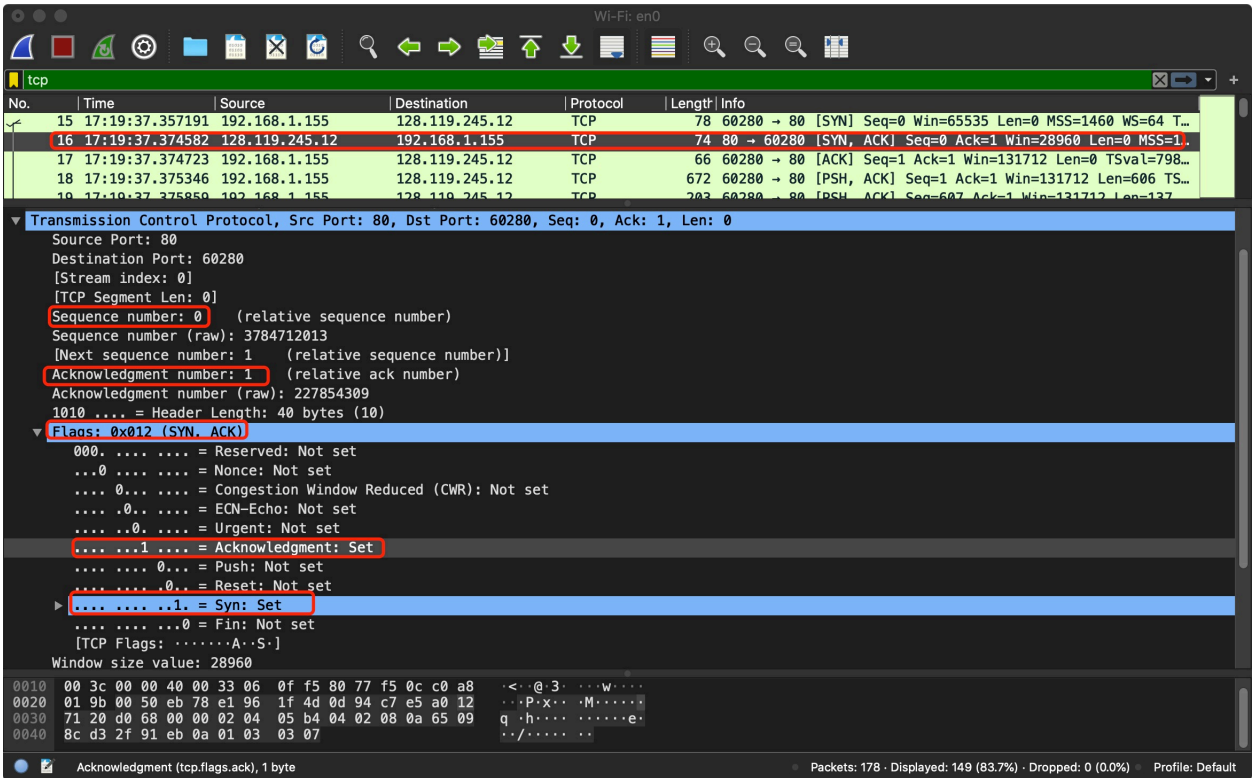
4. What is the sequence number of the TCP SYN segment that is used to initiate the TCP connection between the client computer and gaia.cs.umass.edu? What is it in the segment that identifies the segment as a SYN segment?

Answer: As shown in the screenshot below, 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. Here the SYN flag is 1 so as to identifies the segment as a SYN segment.



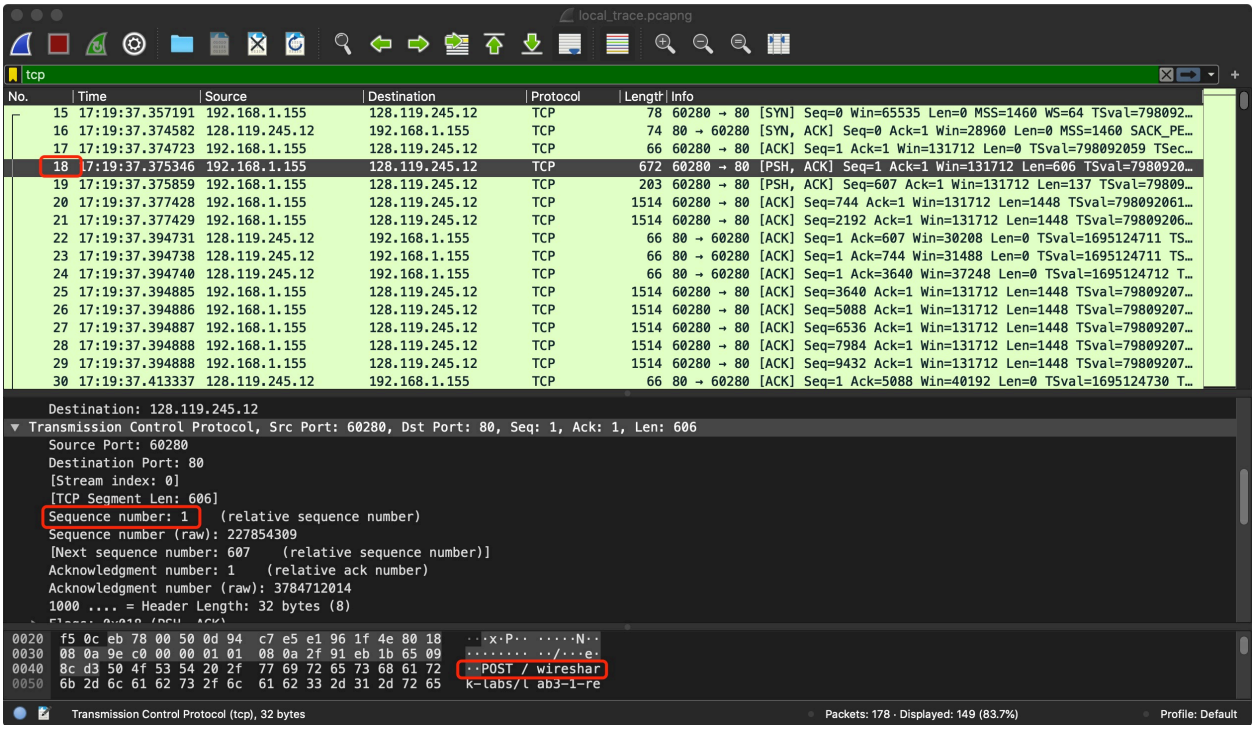
5. What is the sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN? What is the value of the Acknowledgement field in the SYNACK segment? How did gaia.cs.umass.edu determine that value? What is it in the segment that identifies the segment as a SYNACK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

Answer: As shown in the screenshot below, the sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN is 0. Here the value of the Acknowledgement field in the SYNACK segment is 1. gaia.cs.umass.edu *determined* that value by adding one to the value of the initial sequence number of SYN segment sent by the client. Here, as we can see in the last screenshot, the initial sequence number of SYN segment sent by client is 0. Here, the SYN flag and Acknowledgement flag were set to 1, which identifies the segment as a SYNACK segment.



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.

Answer: As shown in the screenshot below, the packet is No. 18 contains the HTTP POST command, and the sequence number of the TCP segment containing the HTTP POST command is 1.



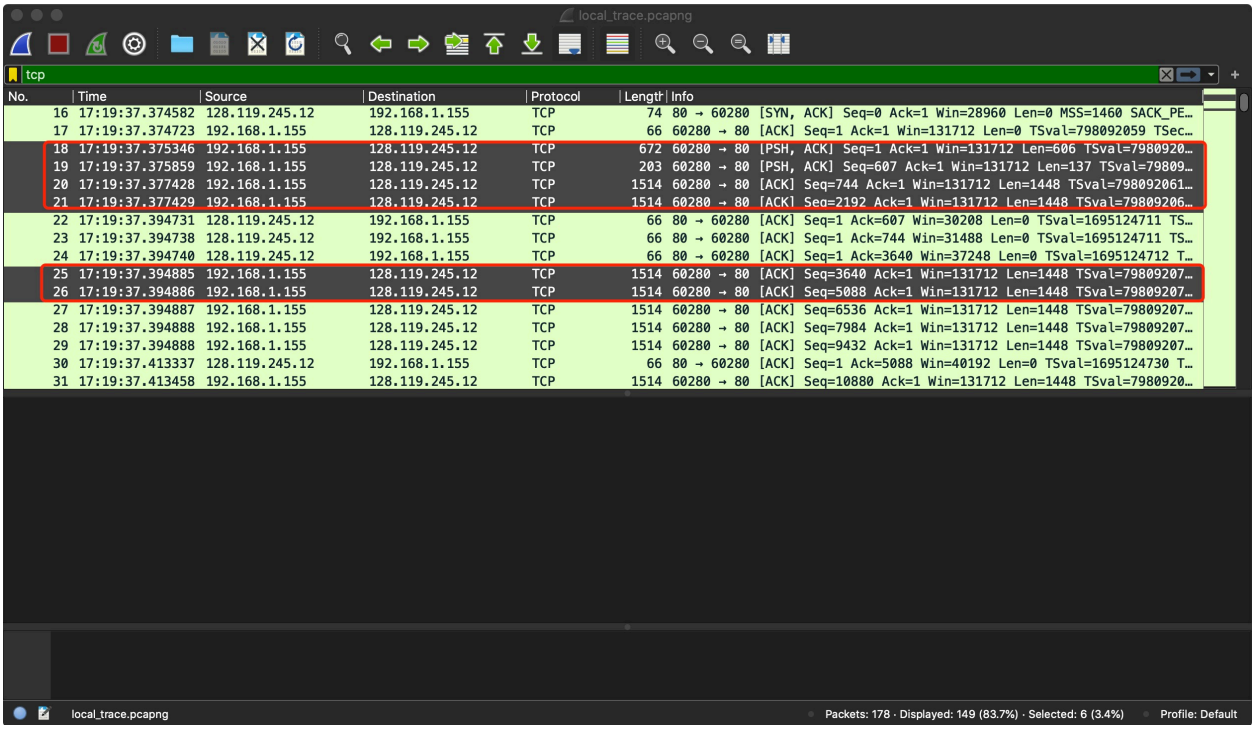
7. Consider the TCP segment containing the HTTP POST as the first segment in the TCP connection. What are the sequence numbers of the first six segments in the TCP connection (including the segment containing the HTTP POST)? At what time was each segment sent? When was the ACK for each segment received? 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 EstimatedRTT 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.

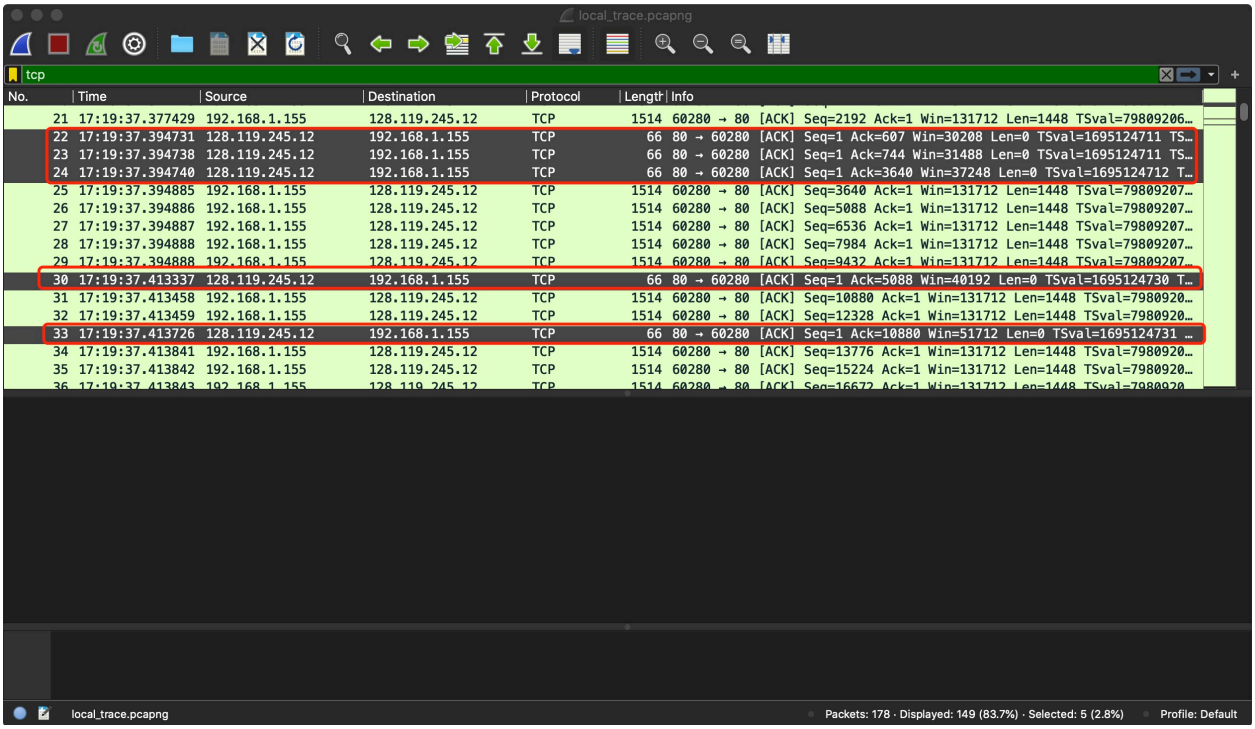
Note: Wireshark has a nice feature that allows you to plot the RTT for each of the TCP segments sent. Select a TCP segment in the "listing of captured packets" window that is being sent from the client to the gaia.cs.umass.edu server. Then select: Statistics->TCP Stream Graph->Round Trip Time Graph.

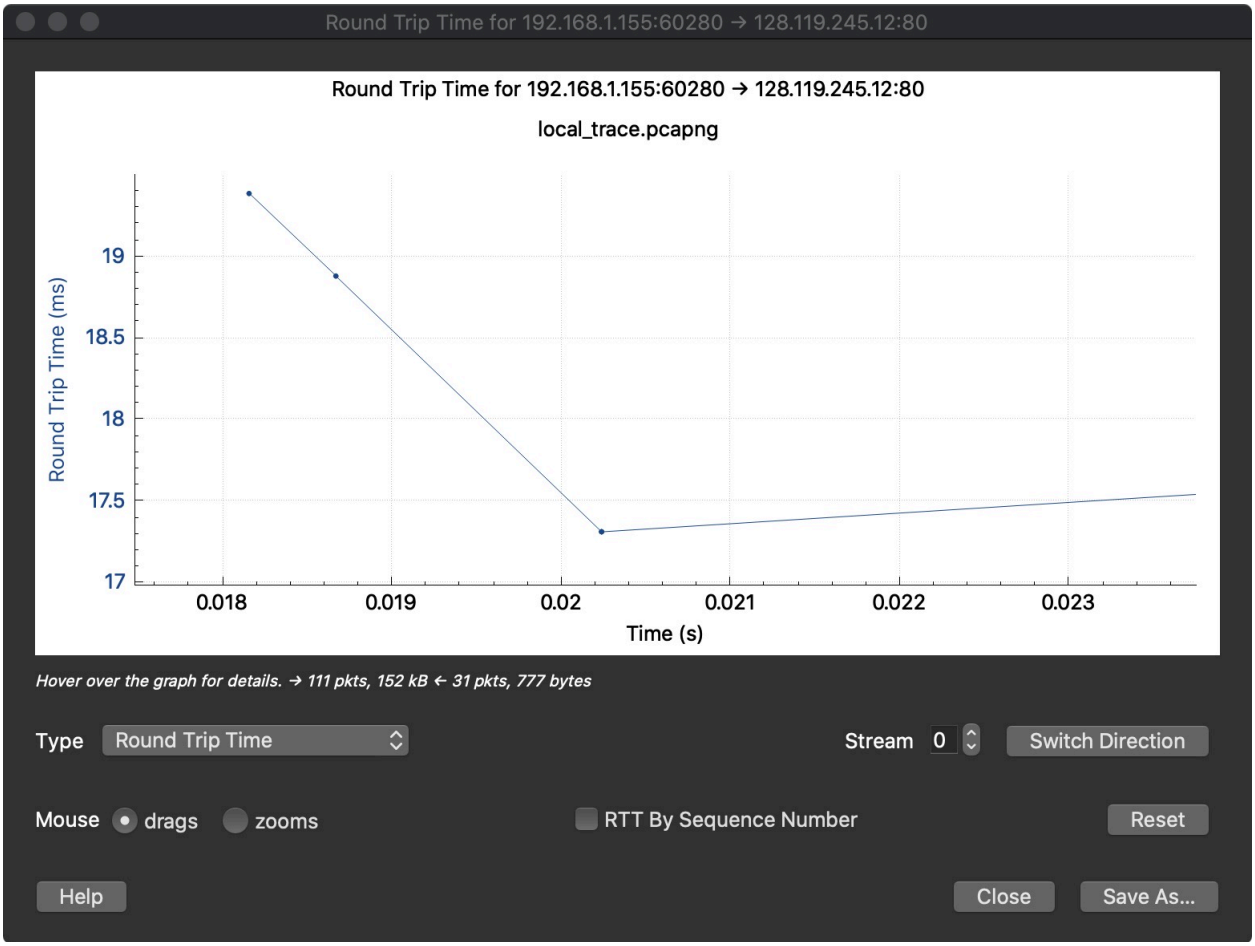
Answer: As shown in the screenshot below, the first six segments are packets No.18, No.19, No.20, No.21, No.25, No.26.
The ACKs of these segments are packets No. 22, No.23, No.24, No.24, No.30 and No.33
And the sequence numbers are of segments are:
Segment 1(No.18) seq number: 1, sent at 17:19:37.375346, ack received at 17:19:37.394731
Segment 2 (No.19) seq number: 607, sent at 17:19:37.375859, ack received at17:19:37.394738
Segment 3 (No.20) seq number: 744, sent at 17:19:37.377428, ack received at17:19:37.394740
Segment 4 (No.21) seq number: 2192, sent at 17:19:37.377429, ack received at17:19:37.394740
Segment 5 (No.25) seq number: 3640, sent at 17:19:37.394885, ack received at17:19:37.413337
Segment 6 (No.26) seq number: 5088, sent at 17:19:37.394886, ack received at17:19:37.413726

Here are the RTTs:
Segment 1 RTT: 0.394731 - 0.375346 = 0.019385 sec
Segment 2 RTT: 0.394738 - 0.375859 = 0.018879 sec
Segment 3 RTT: 0.394740 - 0.377428 = 0.017312 sec
Segment 4 RTT: 0.394740 - 0.377429 = 0.017311 sec
Segment 5 RTT: 0.413337 - 0.394885 = 0.018452 sec
Segment 6 RTT: 0.413726 - 0.394886 = 0.018840 sec

Here are the EstimatedRTTs (EstimatedRTT=0.875·EstimatedRTT+0.125·SampleRTT):
Segment 1 EstimatedRTT: Segment 1 RTT = 0.019385 sec
Segment 2 EstimatedRTT: 0.875 * 0.019385 + 0.125 * 0.018879 = 0.019322 sec
Segment 3 EstimatedRTT: 0.875 * 0.019322 + 0.125 * 0.017312 = 0.019071 sec
Segment 4 EstimatedRTT: 0.875 * 0.019071 + 0.125 * 0.017311 = 0.018851 sec
Segment 5 EstimatedRTT: 0.875 * 0.018851 + 0.125 * 0.018452 = 0.018801 sec
Segment 6 EstimatedRTT: 0.875 * 0.018801 + 0.125 * 0.018840 = 0.018806 sec

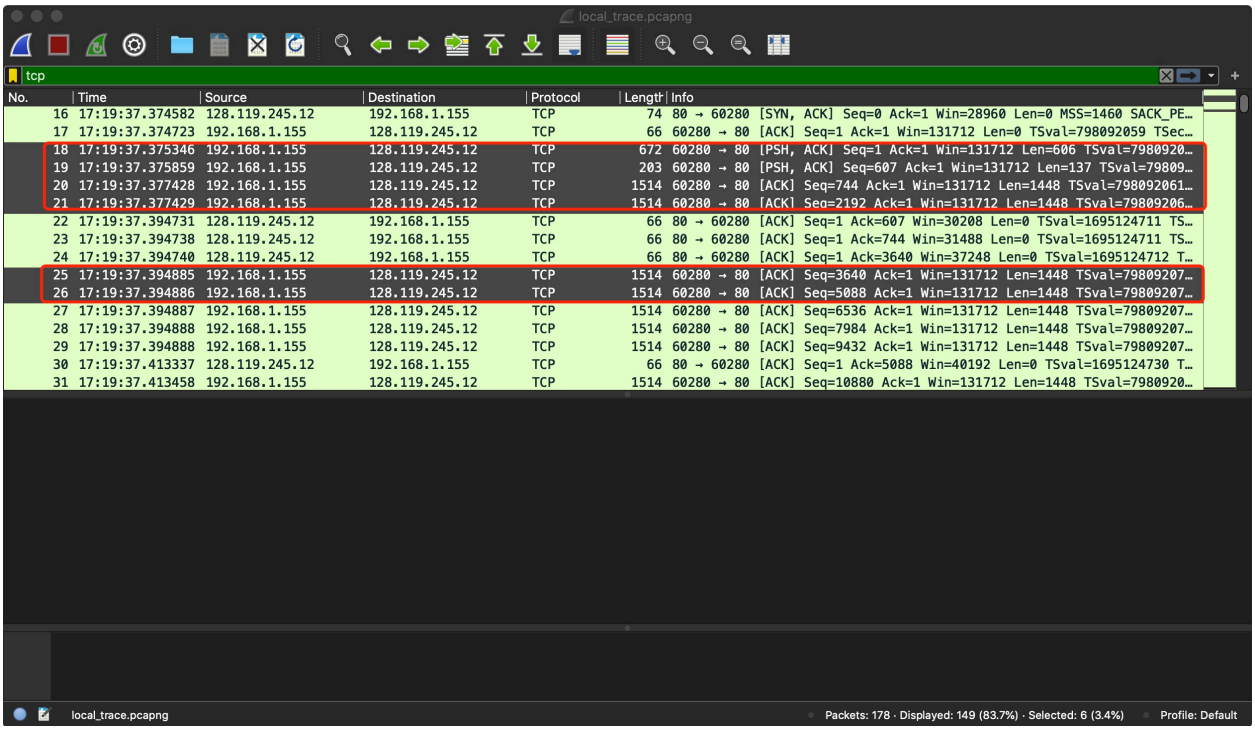



local_trace.pcapng
tcp
No. Time Source Destination Protocol Length Info
21 17:19:37.377429 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=2192 Ack=1 Win=131712 Len=1448 TSval=79809206…
22 17:19:37.394731 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=607 Win=30208 Len=0 TSval=1695124711 TS…
23 17:19:37.394738 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=744 Win=31488 Len=0 TSval=1695124711 TS…
24 17:19:37.394740 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=3640 Win=37248 Len=0 TSval=1695124712 T…
25 17:19:37.394885 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=3640 Ack=1 Win=131712 Len=1448 TSval=79809207…
26 17:19:37.394886 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=5088 Ack=1 Win=131712 Len=1448 TSval=79809207…
27 17:19:37.394887 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=6536 Ack=1 Win=131712 Len=1448 TSval=79809207…
28 17:19:37.394888 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=7984 Ack=1 Win=131712 Len=1448 TSval=79809207…
29 17:19:37.394888 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=9432 Ack=1 Win=131712 Len=1448 TSval=79809207…
30 17:19:37.413337 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=5088 Win=40192 Len=0 TSval=1695124730 T…
31 17:19:37.413458 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=10880 Ack=1 Win=131712 Len=1448 TSval=7980920…
32 17:19:37.413459 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=12328 Ack=1 Win=131712 Len=1448 TSval=7980920…
33 17:19:37.413726 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=10880 Win=51712 Len=0 TSval=1695124731 …
34 17:19:37.413841 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=13776 Ack=1 Win=131712 Len=1448 TSval=7980920…
35 17:19:37.413842 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=15224 Ack=1 Win=131712 Len=1448 TSval=7980920…
local_trace.pcapng
Packets: 178 · Displayed: 149 (83.7%) · Selected: 5 (2.8%)
Profile: Default


Round Trip Time for 192.168.1.155:60280 → 128.119.245.12:80
Round Trip Time for 192.168.1.155:60280 → 128.119.245.12:80
local_trace.pcapng
Round Trip Time (ms)
19
18.5
18
17.5
17
0.018
0.019
0.02
0.021
0.022
0.023
Time (s)
Hover over the graph for details. → 111 pkts, 152 kB ← 31 pkts, 777 bytes
Type
Round Trip Time
Stream
0
Switch Direction
Mouse
drags
zooms
RTT By Sequence Number
Reset
Help
Close
Save As...

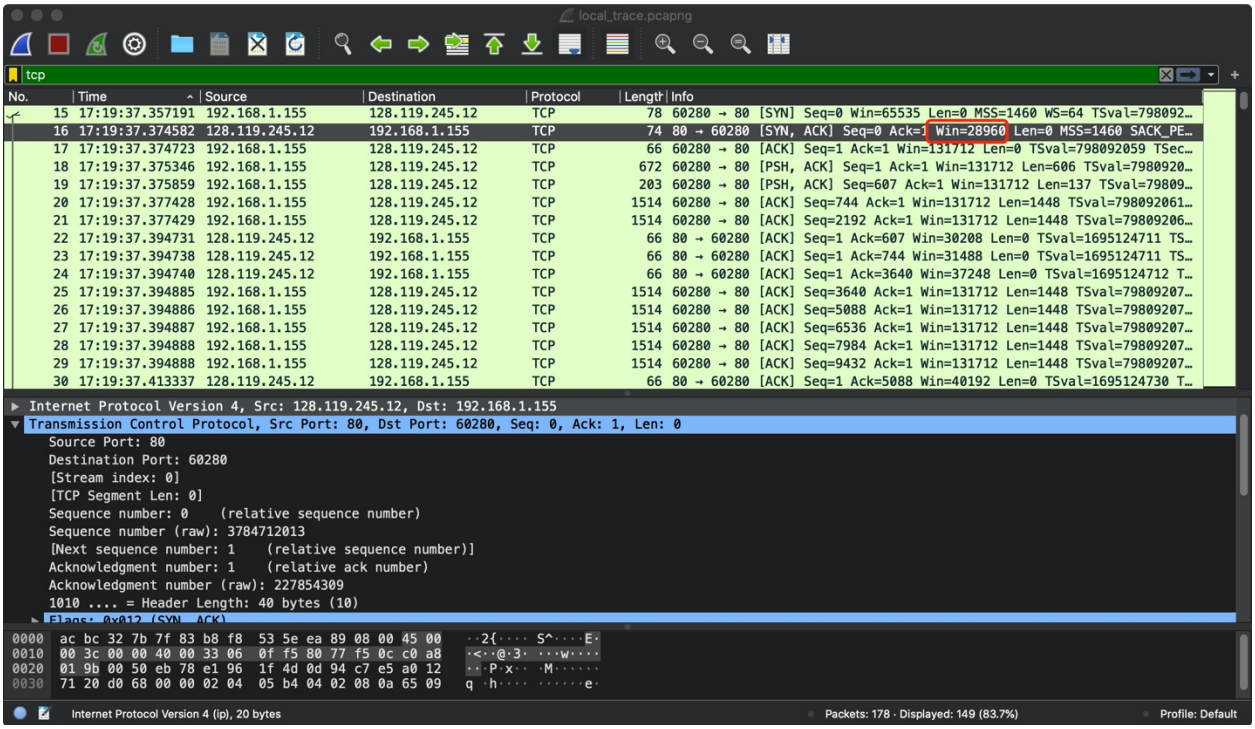
8. What is the length of each of the first six TCP segments?

Answer: As shown in the screenshot below, the length of each of the first six TCP segments are:
Segment 1: 606 bytes
Segment 2: 137 bytes
Segment 3,4,5,6 : 1448 bytes for each



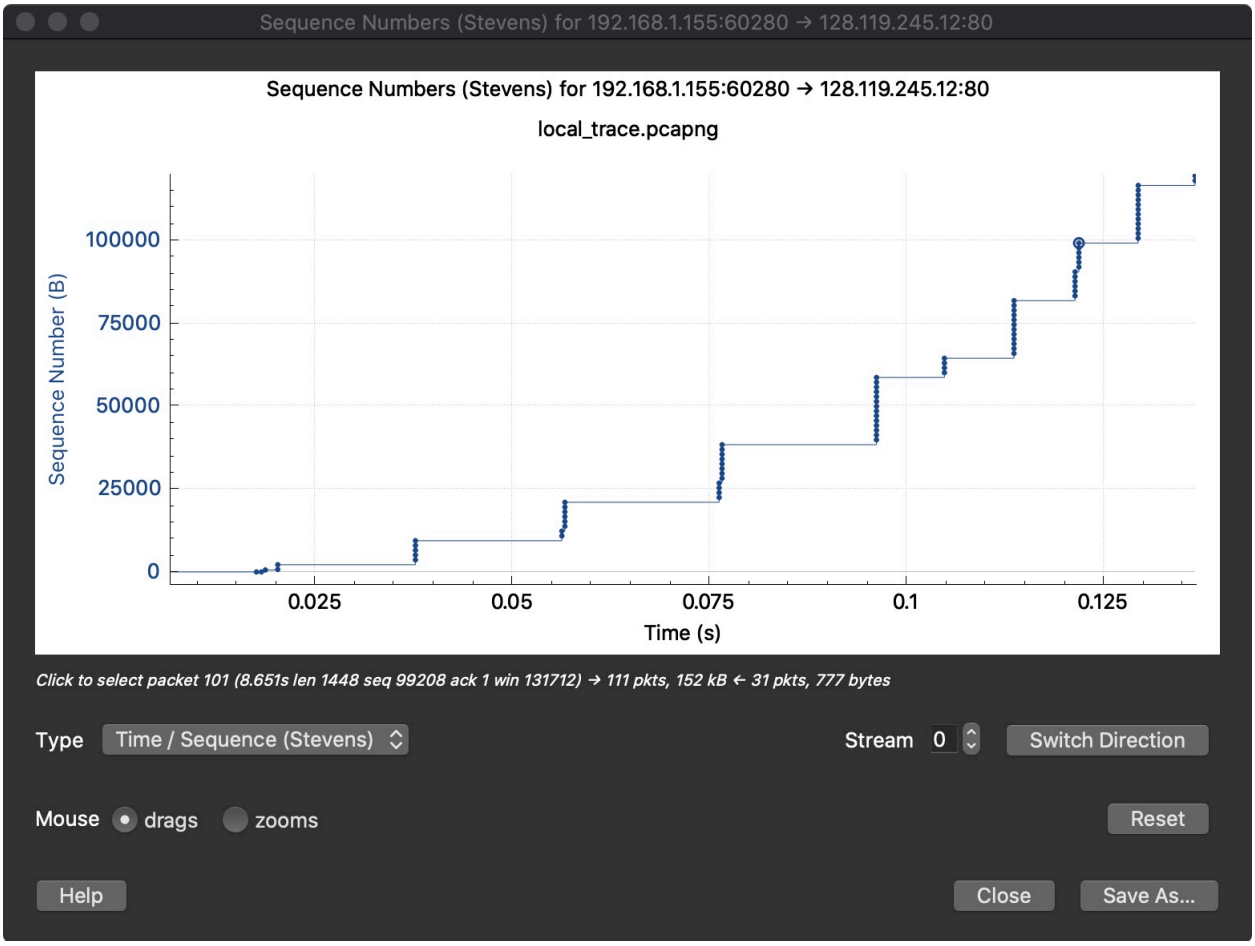
9. What is the minimum amount of available buffer space advertised at the received for the entire trace? Does the lack of receiver buffer space ever throttle the sender?

Answer: As shown in the screenshot below the minimum amount of available buffer space advertised at the received for the entire trace is 28960 bytes, which is the first ACK from the server. The window size of other ACK is all larger than 28960 bytes. Lack of receiver buffer space didn't ever throttle the sender as length of the TCP segments didn't decrease, it was keeping in 1448 after the first segment.



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: There isn't any retransmitted segments in the trace file. We can know this from the Time-Sequence_graph(Stevens) shown below. The Sequence Numbers are always increasing during the transmit process. If there is any retransmitted segment, there should be fluctuation in the graph. The the seq number of the retransmitted segment would smaller than the seq number of the segments that sent before and after it.



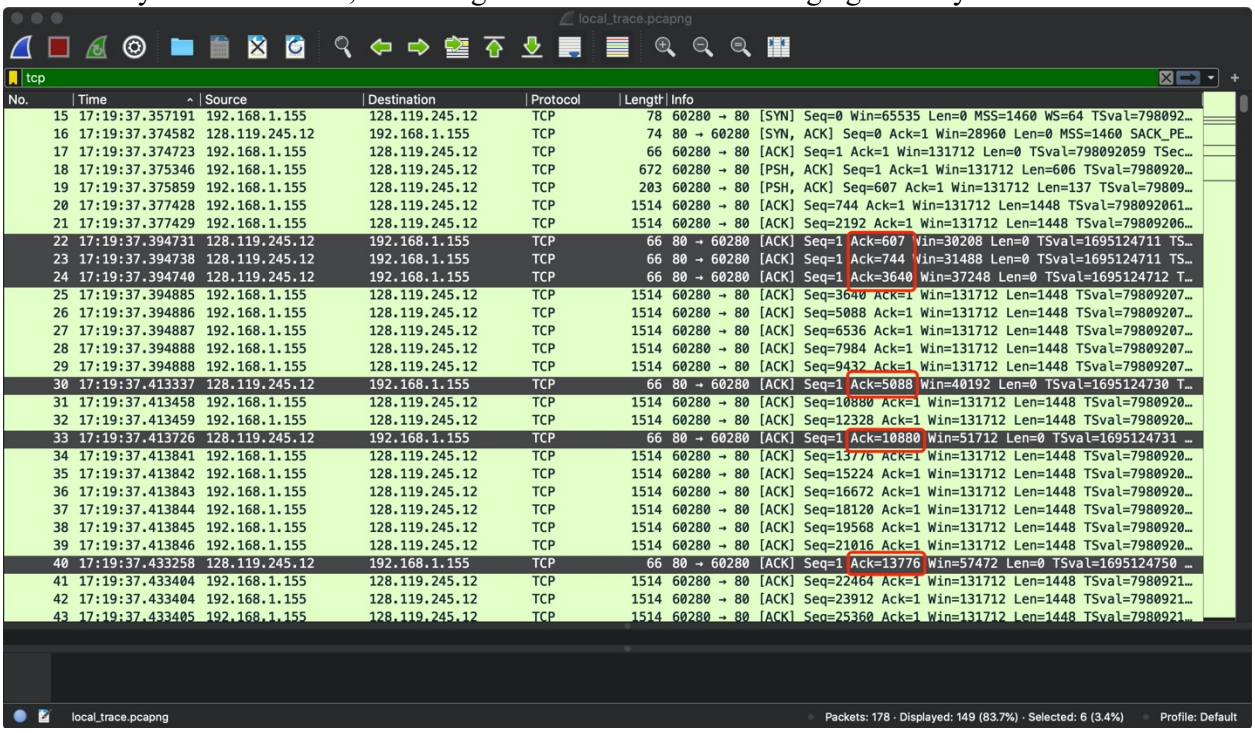
11. How much data does the receiver typically acknowledge in an ACK? Can you identify cases where the receiver is ACKing every other received segment (see Table 3.2 on page 250 in the text).

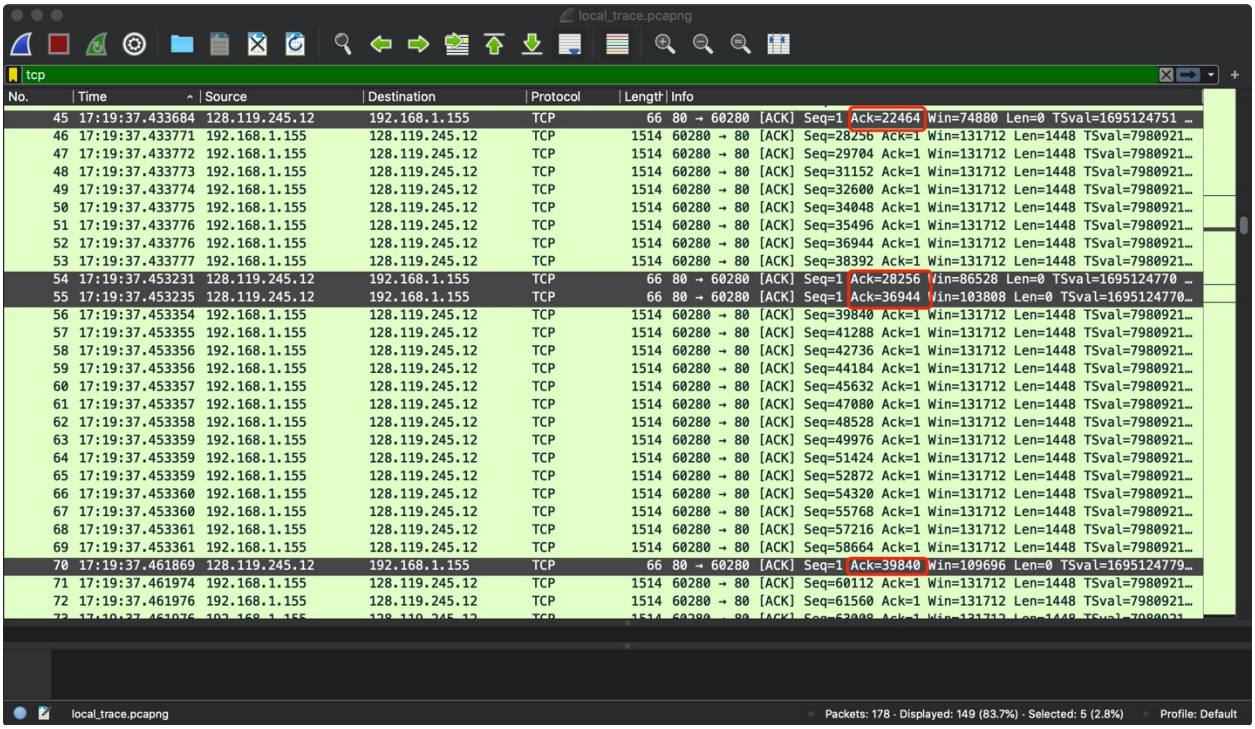
Answer:

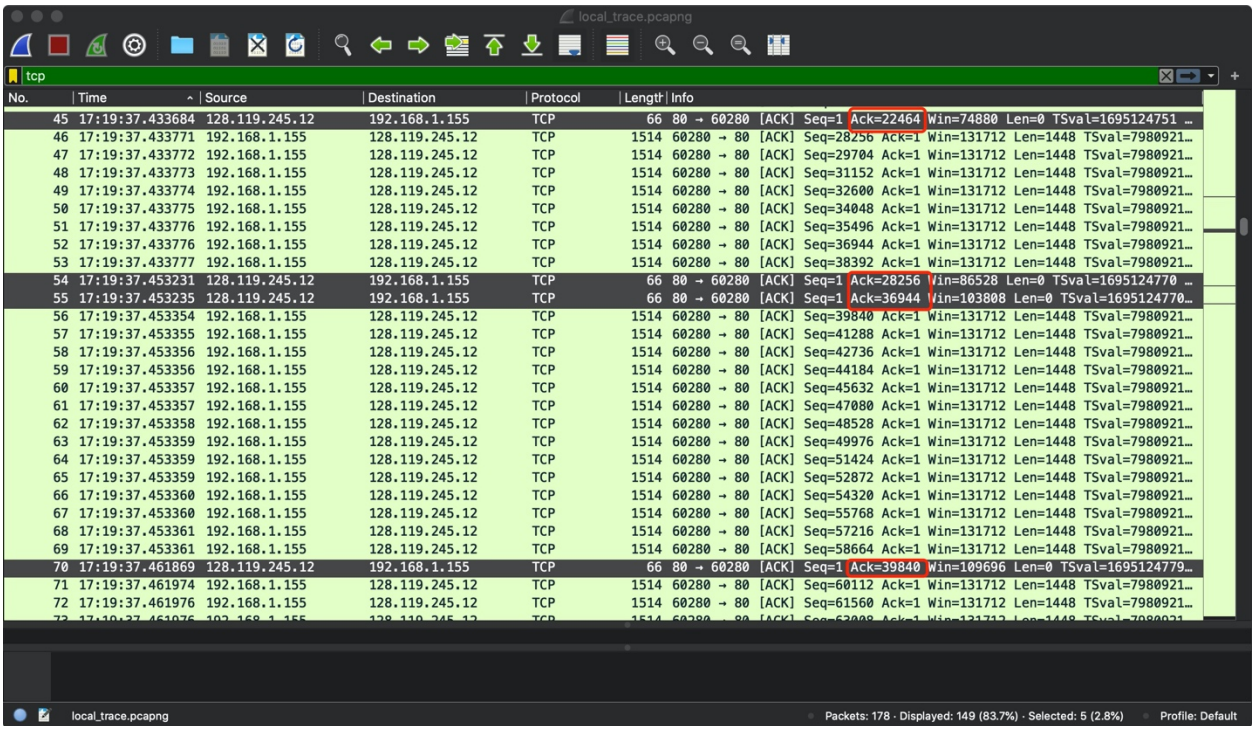
	Acknowledged sequence number	Acknowledged data
ACK1	607	607
ACK2	744	137
ACK3	3640	2896
ACK4	5088	1448
ACK5	10880	5792
ACK6	13776	2896
ACK7	22464	8688
ACK8	28256	5792
ACK9	36944	8688
ACK10	39840	2896
ACK11	54320	14480
ACK12	60112	5792

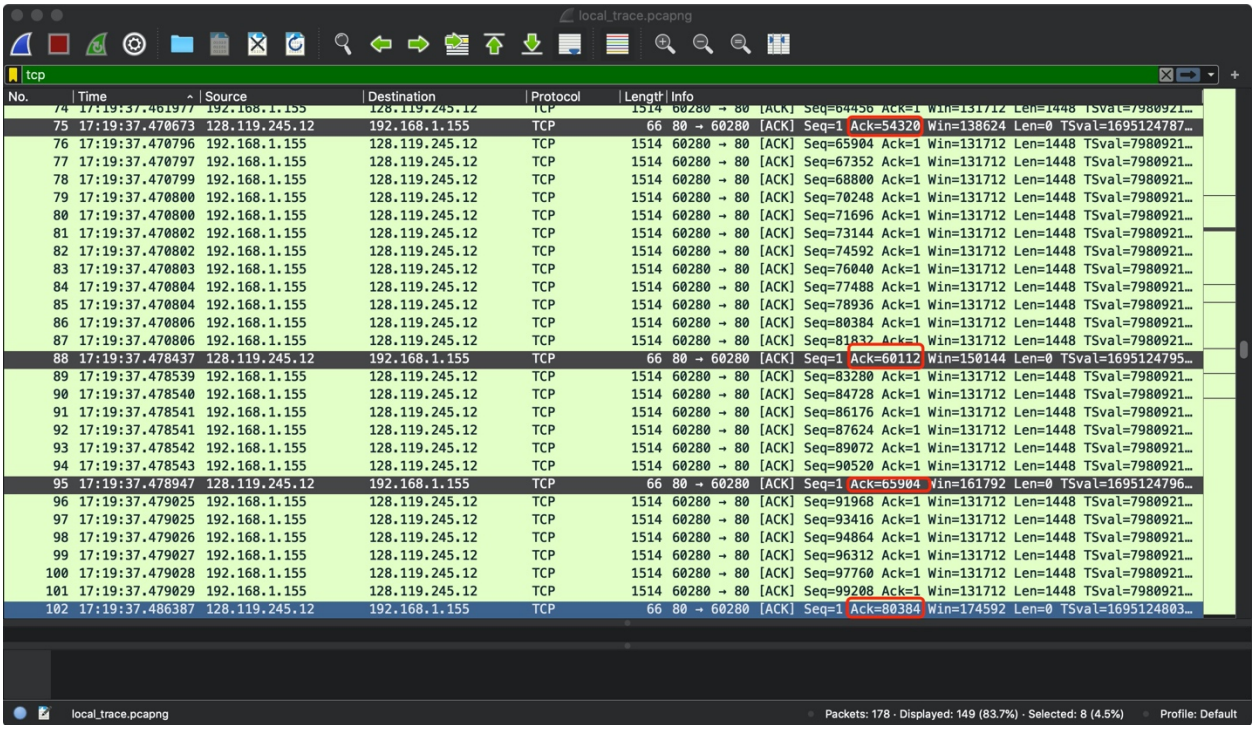
ACK13	65904	5792
ACK14	80384	14480
ACK15	83280	2896
ACK17	91968	8688
ACK18	94864	2896
ACK19	96312	1448

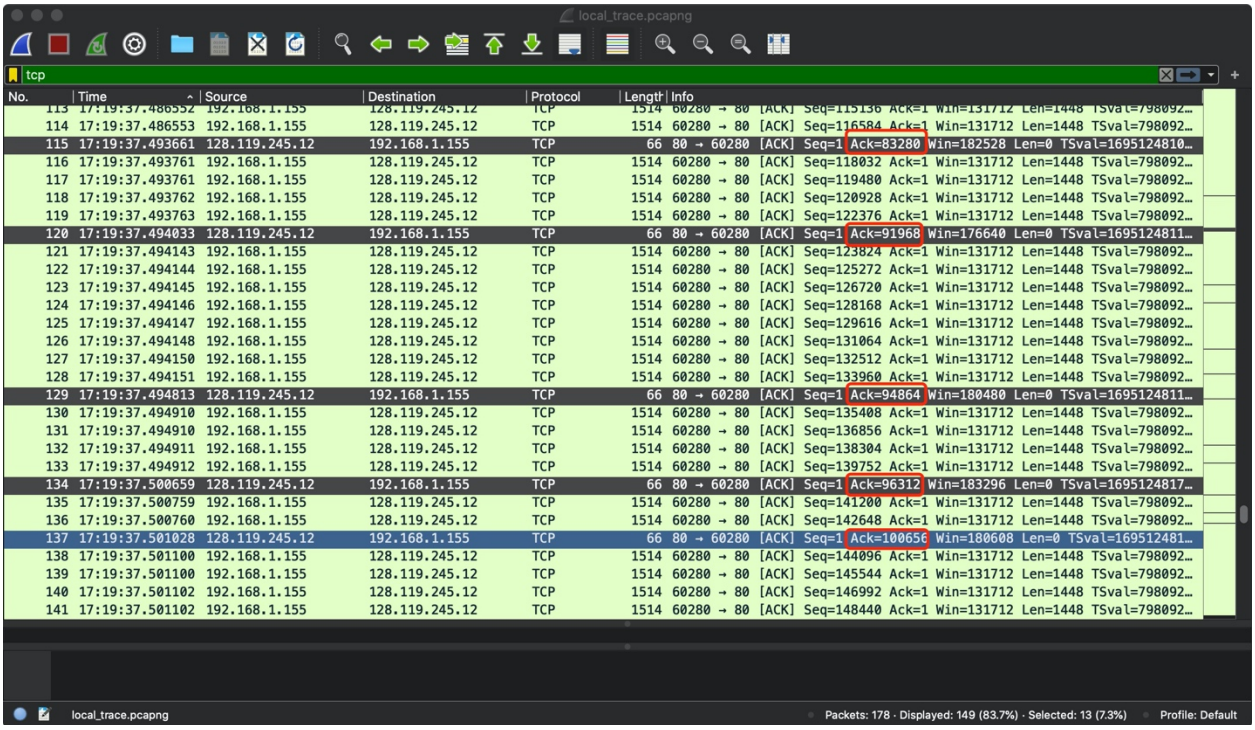
The data received by the sever = the difference between the acknowledge sequence numbers of two consecutive ACKs.
We can see the ACK numbers increase in the sequence of 2896,1448,5792,8688 and so on. There were cases where the receiver is ACKing every other segment. For instance, the ACK numbers increases by 2896 each time, indicating the receiver is acknowledging 2896 bytes.




local_trace.pcapng
tcp
No. Time Source Destination Protocol Length Info
45 17:19:37.433684 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=22464 Win=74880 Len=0 TSval=1695124751 …
46 17:19:37.433771 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=28256 Ack=1 Win=131712 Len=1448 TSval=7980921…
47 17:19:37.433772 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=29704 Ack=1 Win=131712 Len=1448 TSval=7980921…
48 17:19:37.433773 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=31152 Ack=1 Win=131712 Len=1448 TSval=7980921…
49 17:19:37.433774 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=32600 Ack=1 Win=131712 Len=1448 TSval=7980921…
50 17:19:37.433775 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=34048 Ack=1 Win=131712 Len=1448 TSval=7980921…
51 17:19:37.433776 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=35496 Ack=1 Win=131712 Len=1448 TSval=7980921…
52 17:19:37.433776 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=36944 Ack=1 Win=131712 Len=1448 TSval=7980921…
53 17:19:37.433777 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=38392 Ack=1 Win=131712 Len=1448 TSval=7980921…
54 17:19:37.453231 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=28256 Win=86528 Len=0 TSval=1695124770 …
55 17:19:37.453235 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=36944 Win=103808 Len=0 TSval=1695124770…
56 17:19:37.453354 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=39840 Ack=1 Win=131712 Len=1448 TSval=7980921…
57 17:19:37.453355 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=41288 Ack=1 Win=131712 Len=1448 TSval=7980921…
58 17:19:37.453356 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=42736 Ack=1 Win=131712 Len=1448 TSval=7980921…
59 17:19:37.453356 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=44184 Ack=1 Win=131712 Len=1448 TSval=7980921…
60 17:19:37.453357 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=45632 Ack=1 Win=131712 Len=1448 TSval=7980921…
61 17:19:37.453357 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=47080 Ack=1 Win=131712 Len=1448 TSval=7980921…
62 17:19:37.453358 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=48528 Ack=1 Win=131712 Len=1448 TSval=7980921…
63 17:19:37.453359 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=49976 Ack=1 Win=131712 Len=1448 TSval=7980921…
64 17:19:37.453359 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=51424 Ack=1 Win=131712 Len=1448 TSval=7980921…
65 17:19:37.453359 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=52872 Ack=1 Win=131712 Len=1448 TSval=7980921…
66 17:19:37.453360 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=54320 Ack=1 Win=131712 Len=1448 TSval=7980921…
67 17:19:37.453360 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=55768 Ack=1 Win=131712 Len=1448 TSval=7980921…
68 17:19:37.453361 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=57216 Ack=1 Win=131712 Len=1448 TSval=7980921…
69 17:19:37.453361 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=58664 Ack=1 Win=131712 Len=1448 TSval=7980921…
70 17:19:37.461869 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=39840 Win=109696 Len=0 TSval=1695124779…
71 17:19:37.461974 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=60112 Ack=1 Win=131712 Len=1448 TSval=7980921…
72 17:19:37.461976 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=61560 Ack=1 Win=131712 Len=1448 TSval=7980921…
local_trace.pcapng
Packets: 178 · Displayed: 149 (83.7%) · Selected: 5 (2.8%)
Profile: Default


local_trace.pcapng
tcp
No. Time Source Destination Protocol Length Info
45 17:19:37.433684 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=22464 Win=74880 Len=0 TSval=1695124751 …
46 17:19:37.433771 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=28256 Ack=1 Win=131712 Len=1448 TSval=7980921…
47 17:19:37.433772 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=29704 Ack=1 Win=131712 Len=1448 TSval=7980921…
48 17:19:37.433773 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=31152 Ack=1 Win=131712 Len=1448 TSval=7980921…
49 17:19:37.433774 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=32600 Ack=1 Win=131712 Len=1448 TSval=7980921…
50 17:19:37.433775 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=34048 Ack=1 Win=131712 Len=1448 TSval=7980921…
51 17:19:37.433776 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=35496 Ack=1 Win=131712 Len=1448 TSval=7980921…
52 17:19:37.433776 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=36944 Ack=1 Win=131712 Len=1448 TSval=7980921…
53 17:19:37.433777 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=38392 Ack=1 Win=131712 Len=1448 TSval=7980921…
54 17:19:37.453231 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=28256 Win=86528 Len=0 TSval=1695124770 …
55 17:19:37.453235 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=36944 Win=103808 Len=0 TSval=1695124770…
56 17:19:37.453354 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=39840 Ack=1 Win=131712 Len=1448 TSval=7980921…
57 17:19:37.453355 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=41288 Ack=1 Win=131712 Len=1448 TSval=7980921…
58 17:19:37.453356 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=42736 Ack=1 Win=131712 Len=1448 TSval=7980921…
59 17:19:37.453356 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=44184 Ack=1 Win=131712 Len=1448 TSval=7980921…
60 17:19:37.453357 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=45632 Ack=1 Win=131712 Len=1448 TSval=7980921…
61 17:19:37.453357 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=47080 Ack=1 Win=131712 Len=1448 TSval=7980921…
62 17:19:37.453358 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=48528 Ack=1 Win=131712 Len=1448 TSval=7980921…
63 17:19:37.453359 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=49976 Ack=1 Win=131712 Len=1448 TSval=7980921…
64 17:19:37.453359 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=51424 Ack=1 Win=131712 Len=1448 TSval=7980921…
65 17:19:37.453359 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=52872 Ack=1 Win=131712 Len=1448 TSval=7980921…
66 17:19:37.453360 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=54320 Ack=1 Win=131712 Len=1448 TSval=7980921…
67 17:19:37.453360 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=55768 Ack=1 Win=131712 Len=1448 TSval=7980921…
68 17:19:37.453361 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=57216 Ack=1 Win=131712 Len=1448 TSval=7980921…
69 17:19:37.453361 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=58664 Ack=1 Win=131712 Len=1448 TSval=7980921…
70 17:19:37.461869 128.119.245.12 192.168.1.155 TCP 66 80 → 60280 [ACK] Seq=1 Ack=39840 Win=109696 Len=0 TSval=1695124779…
71 17:19:37.461974 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=60112 Ack=1 Win=131712 Len=1448 TSval=7980921…
72 17:19:37.461976 192.168.1.155 128.119.245.12 TCP 1514 60280 → 80 [ACK] Seq=61560 Ack=1 Win=131712 Len=1448 TSval=7980921…
local_trace.pcapng
Packets: 178 · Displayed: 149 (83.7%) · Selected: 5 (2.8%)
Profile: Default

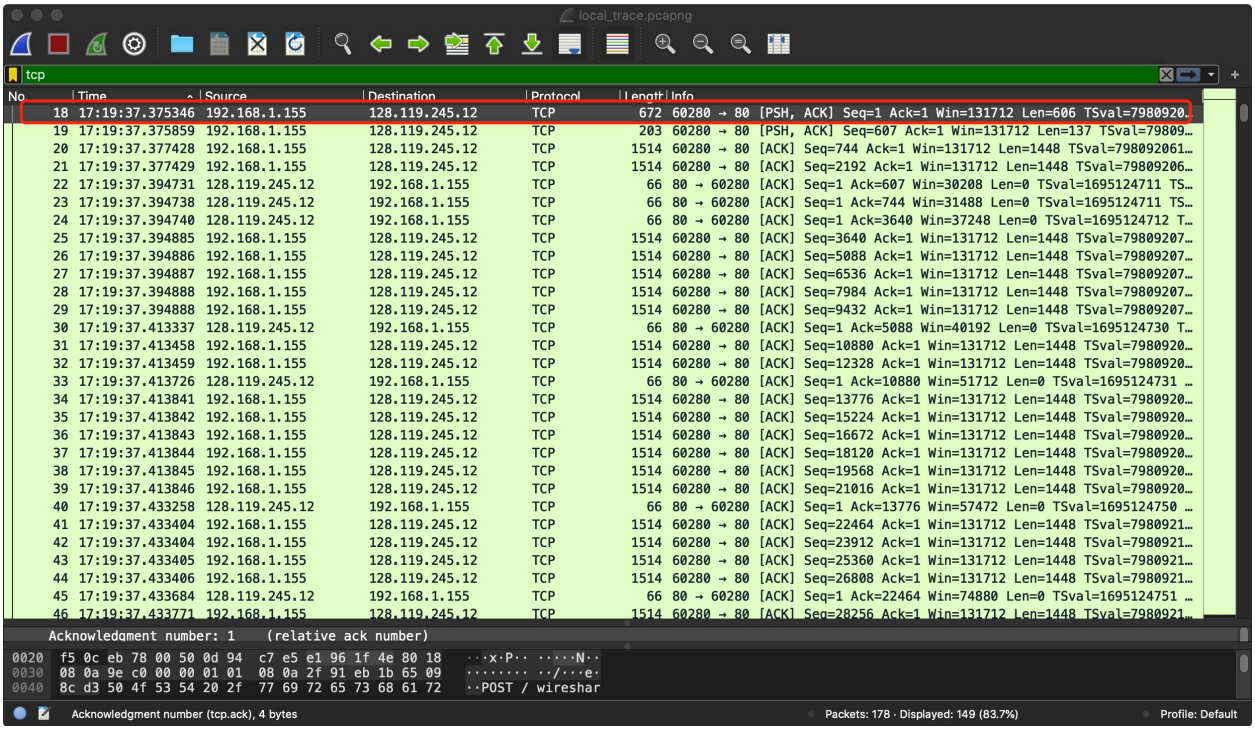


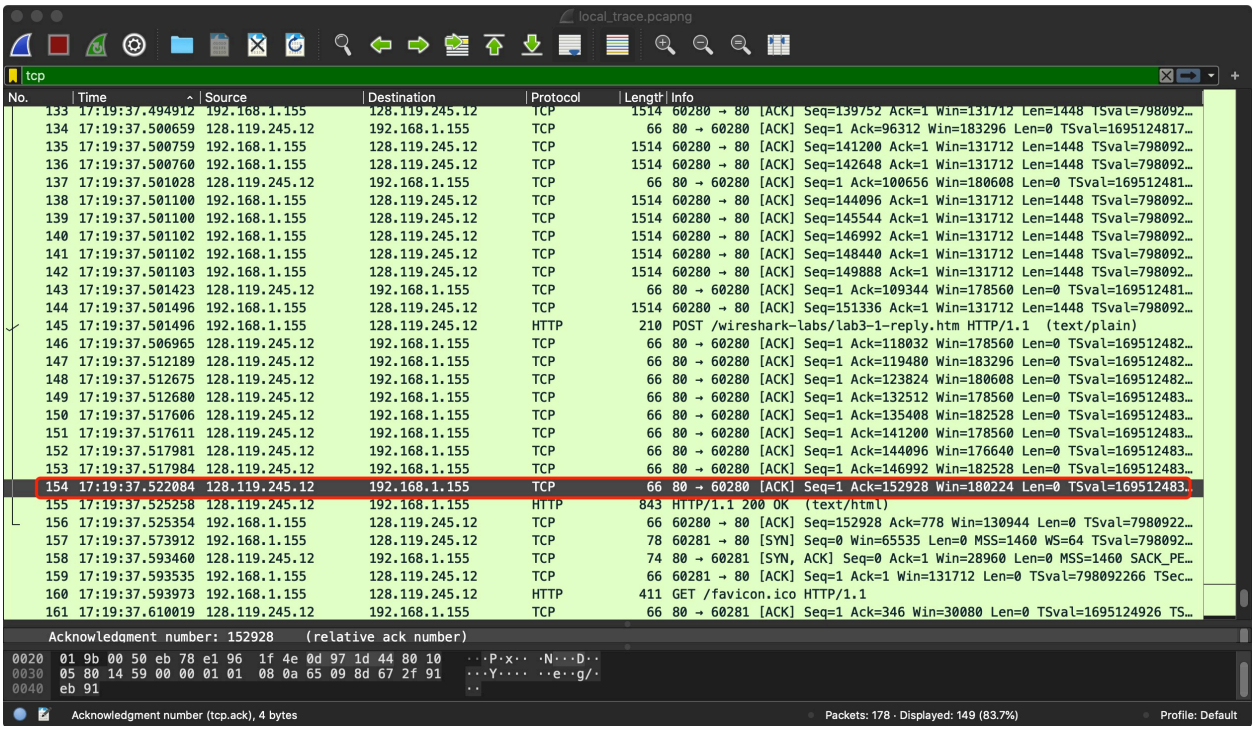


12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.

Answer: Acknowledged sequence number of last ACK is 152928 and the sequence number of the first segment is 1, thus the total data size is 152928 – 1 = 152927 bytes.

The total transmission time is the time from the first TCP segment (No.18 packet) sent to No.154 packet(the last ACK) sent, thus the time is 17:19:37.522084 - 17:19:37.375346 = 0.146738 seconds. Thus, the throughput is 152927/0.146738 = 1042177.2138 bytes/sec = 1.0421772138 Mb/sec

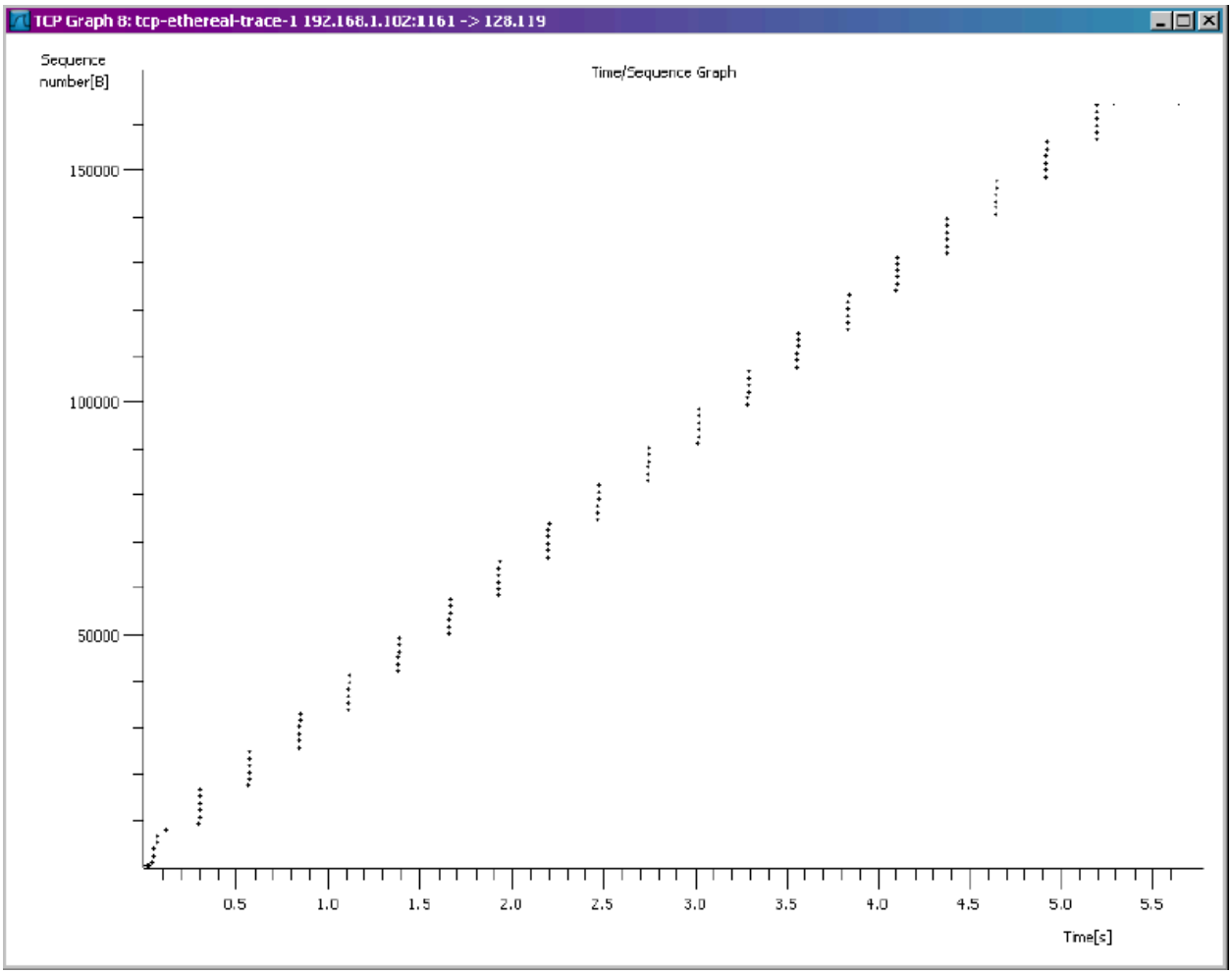




13. Use the Time-Sequence-Graph(Stevens) plotting tool to view the sequence

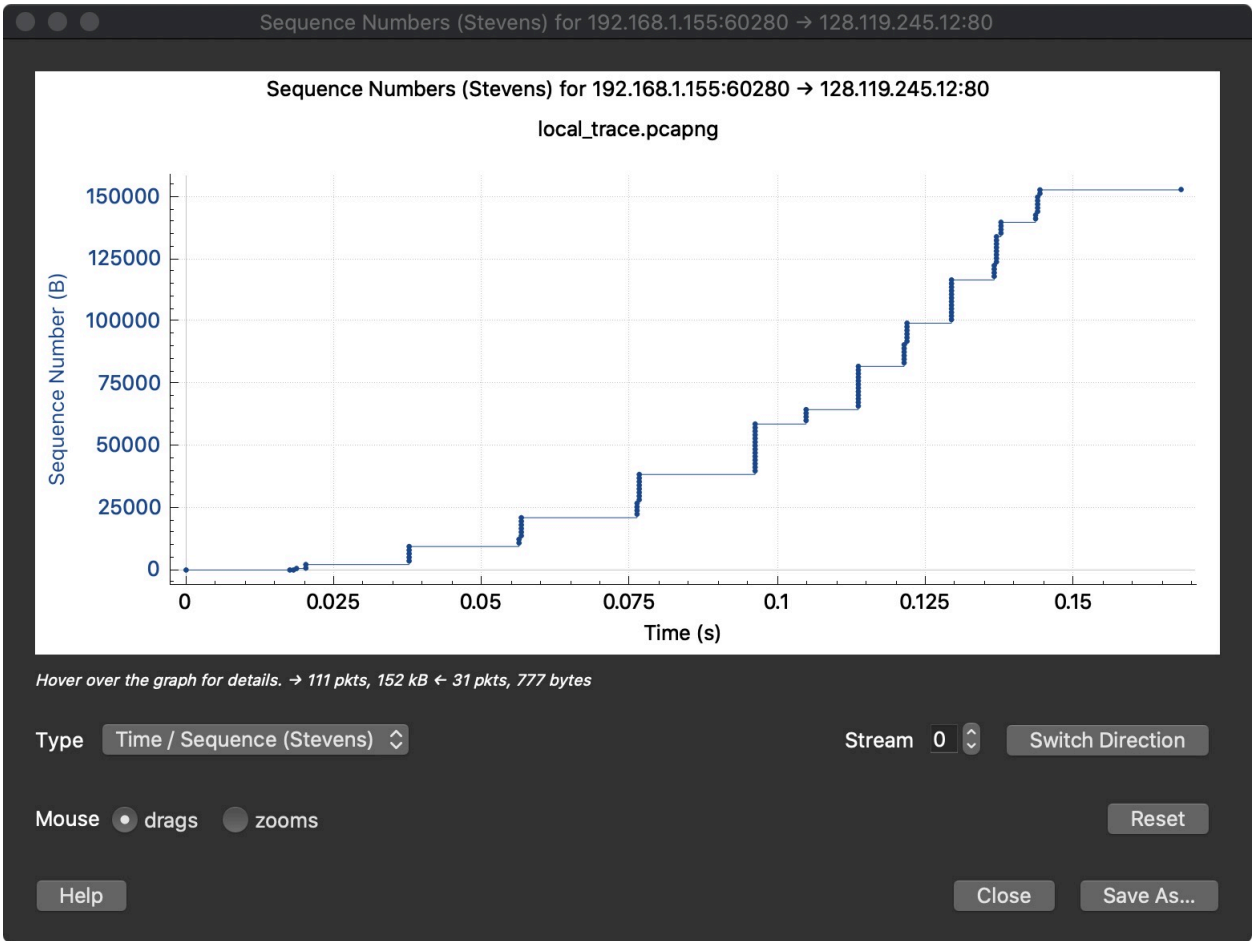
number versus time plot of segments being sent from the client to the gaia.cs.umass.edu server. Can you identify where TCP's slowstart phase begins and ends, and where congestion avoidance takes over? Comment on ways in which the measured data differs from the idealized behavior of TCP that we've studied in the text.

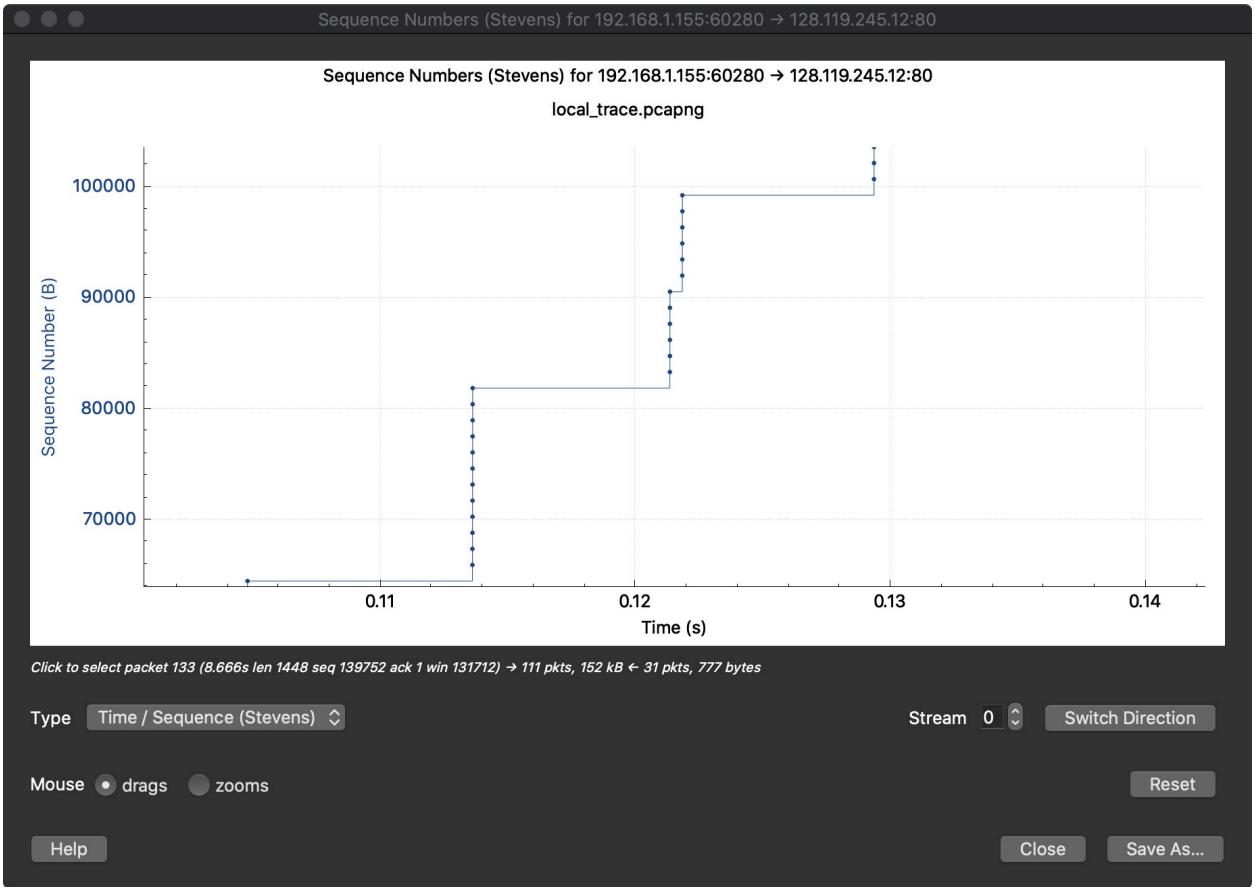
Answer: As we can see from the graph, the slow start phase is around 0 second and ends around 0.15 second. After the slow start phase, congestion tasks over. The measured data uses only a fraction of the window size, rather than 1/3 to 1/2.



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

Answer: As we can see from the graph below, the slow start phase is around 0.017 second and ends around 0.021 second. After the slow start phase, congestion tasks over. Here we can't see the expected linear increase behavior. Instead, it appear the repeated behavior pattern, and it seems that that the sender transmits packets in batches of around 12. The reason for this behavior might be due to the fact that the HTTP server has enforced a rate-limit of some sort.


Sequence Numbers (Stevens) for 192.168.1.155:60280 → 128.119.245.12:80
Sequence Numbers (Stevens) for 192.168.1.155:60280 → 128.119.245.12:80
local_trace.pcapng
Sequence Number (B)
150000
125000
100000
75000
50000
25000
0
0
0.025
0.05
0.075
0.1
0.125
0.15
Time (s)
Hover over the graph for details. → 111 pkts, 152 kB ← 31 pkts, 777 bytes
Type
Time / Sequence (Stevens)
Stream
0
Switch Direction
Mouse
drags
zooms
Reset
Help
Close
Save As...


Sequence Numbers (Stevens) for 192.168.1.155:60280 → 128.119.245.12:80
Sequence Numbers (Stevens) for 192.168.1.155:60280 → 128.119.245.12:80
local_trace.pcapng
Sequence Number (B)
100000
90000
80000
70000
0.11
0.12
0.13
0.14
Time (s)
Click to select packet 133 (8.666s len 1448 seq 139752 ack 1 win 131712) → 111 pkts, 152 kB ← 31 pkts, 777 bytes
Type
Time / Sequence (Stevens)
Stream
0
Switch Direction
Mouse
drags
zooms
Reset
Help
Close
Save As...