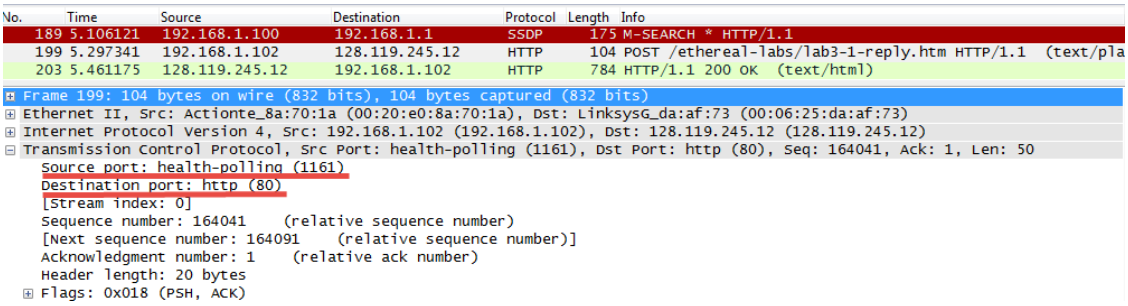
Lab 3

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

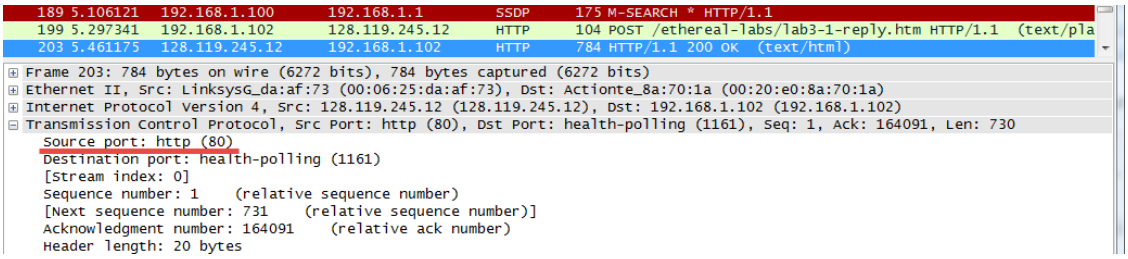
Answer



According to above figure, the client computer (source)'s IP address is 192.168.1.102 and the TPC port number is 1161.

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?

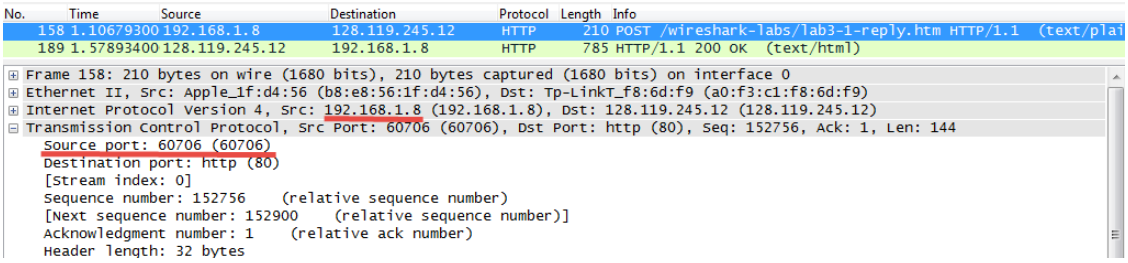
Answer



According to above figure, the IP address of gaia.cs.umass.edu is 128.119.245.12 and the TCP port number 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?

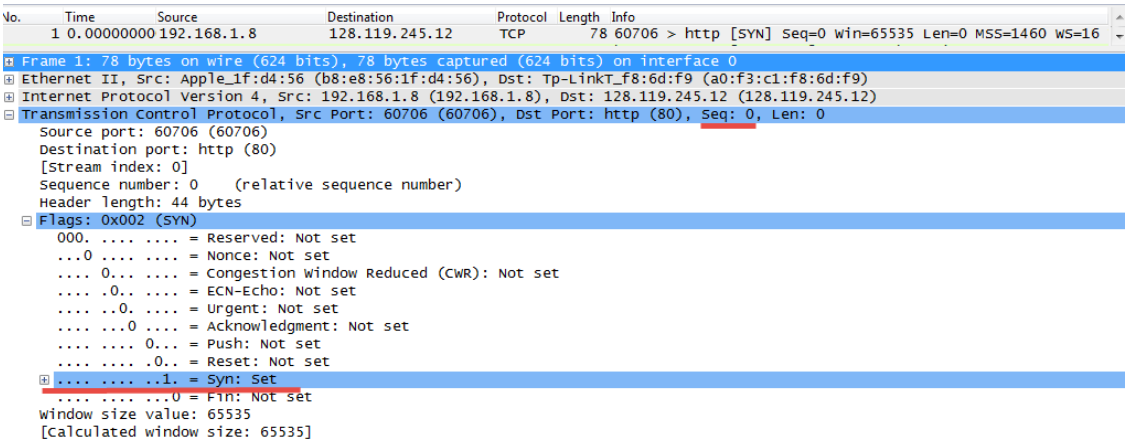
Answer



According to above figure, my client computer's IP address is 192.168.1.8 and the TCP port is 60706.

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

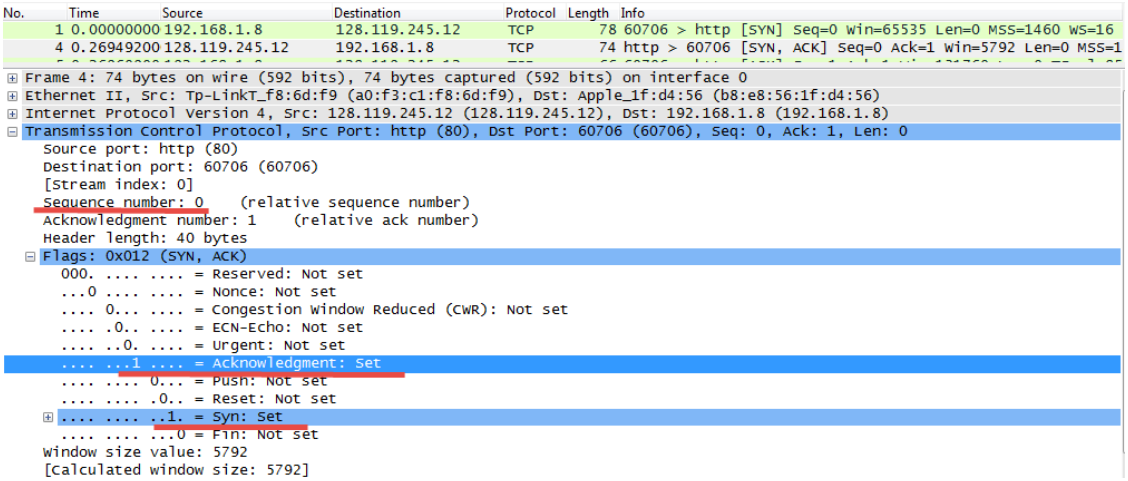


The sequence number of the TCP SYN segment is 0 since it is used to imitate the TCP connection between the client computer and gaia.cs.umass.edu.

According to above figure, in the Flags section, the Syn flag is set to 1 which indicates that this segment is 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



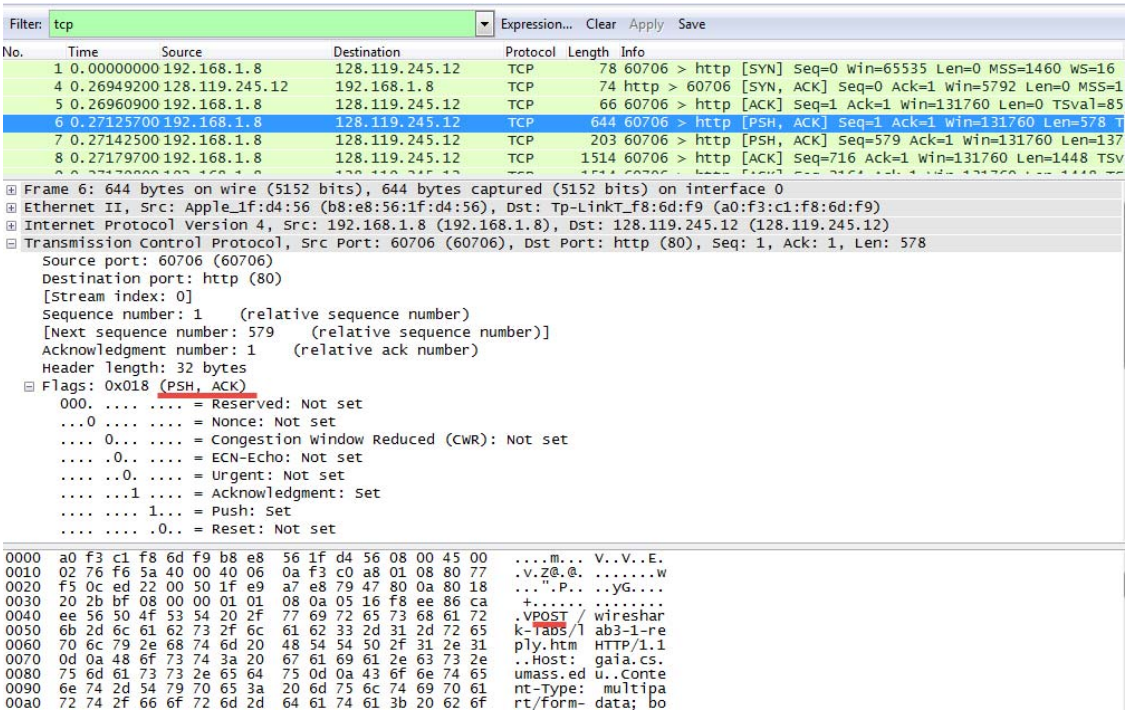
According to the above figure, the sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN is 0.

The value of the acknowledgement field in the SYNACK segment is 1. The value of the ACKnowledgement field in the SYNACK segment is determined by the server gaia.cs.umass.edu. The server adds 1 to the initial sequence number of SYN segment form the client computer. For this case, the initial sequence number of SYN segment from the client computer is 0, thus the value of the ACKnowledgement field in the SYNACK segment is 1.

A segment will be identified as a SYNACK segment if both SYN flag and Acknowledgement in the segment are 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.

Answer

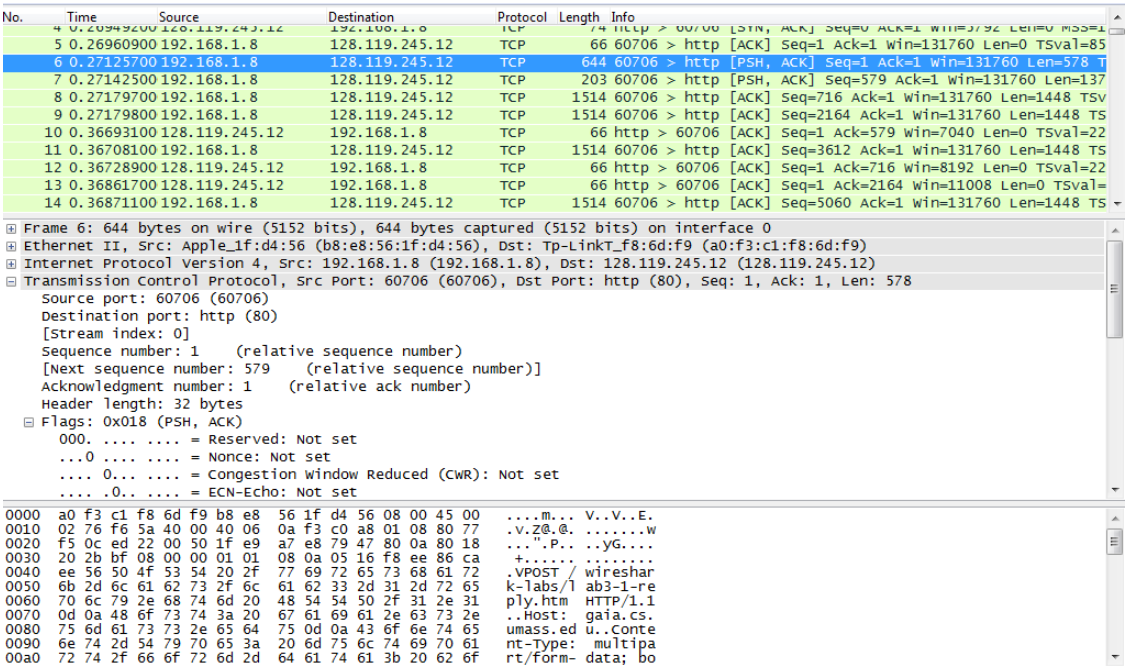


According to above figure, the segment No.6 contains the HTTP POST command, the sequence number of this segment is 1.

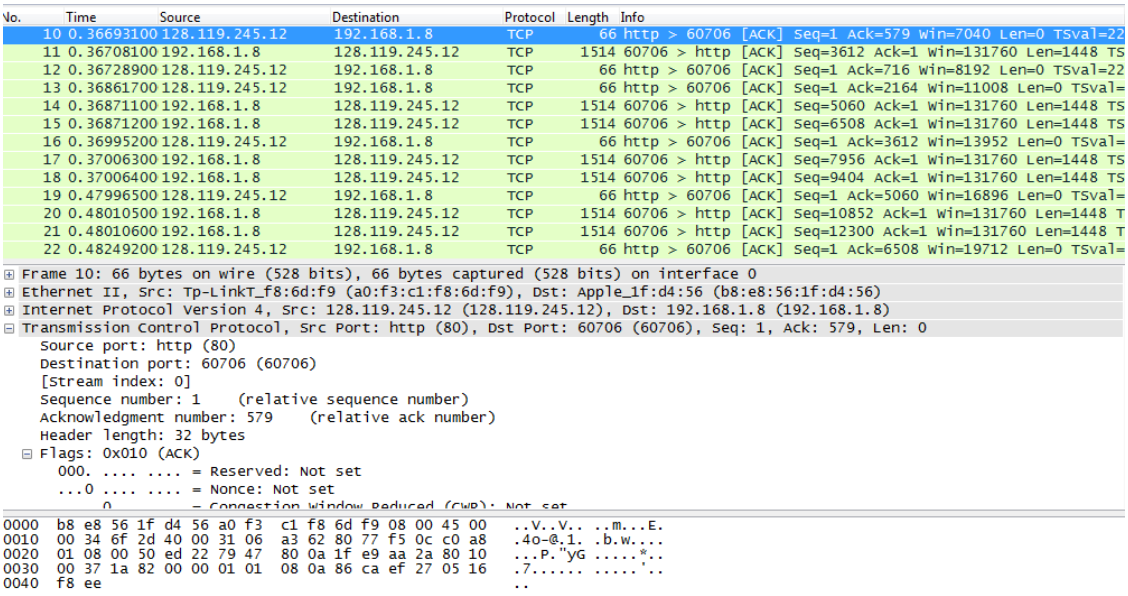
7. Consider the TCP segment containing the HTTP POST as the first segment in the TCP connection. What are the sequence numbers of the first six segments in the TCP connection (including the segment containing the HTTP POST)? At what time was each segment sent? When was the ACK for each segment received? 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 Estimated RTT value (see Section 3.5.3, page 239 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 Estimated RTT 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.

Answer



Segments 1-6



ACK of segments 1-6

According to above figures, the segments 1-6 are No. 6, 7, 8, 9, 11 and 14. The ACK of segments 1-6 are No. 10, 12, 13, 16, 19 and 22.

Segment 1 sequence number is 1

Segment 2 sequence number is 579

Segment 3 sequence number is 716

Segment 4 sequence number is 2164

Segment 5 sequence number is 3612

Segment 6 sequence number is 5060

Recording the sending time and received time of ACKs:

	Sent time	ACK received time	RTT
Segment 1	0.271257000	0.366931000	0.095674
Segment 2	0.271425000	0.367289000	0.095864
Segment 3	0.271797000	0.368617000	0.09682
Segment 4	0.271798000	0.369952000	0.098154
Segment 5	0.367081000	0.479965000	0.112884
Segment 6	0.368711000	0.482492000	0.113781

According to the formula: EstimatedRTT = 0.875 * EstimatedRTT + 0.125 * SampleRTT

EstimatedRTT after the receipt of the ACK of segment 1:

EstimatedRTT = RTT for Segment 1 = 0.095674 s

EstimatedRTT after the receipt of the ACK of segment 2:

EstimatedRTT = 0.875 * 0.095674 + 0.125 * 0.095864= 0.09569775 s

EstimatedRTT after the receipt of the ACK of segment 3:

EstimatedRTT = 0.875 * 0.09569775 + 0.125 * 0.09682= 0.09583803125 s

EstimatedRTT after the receipt of the ACK of segment 4:

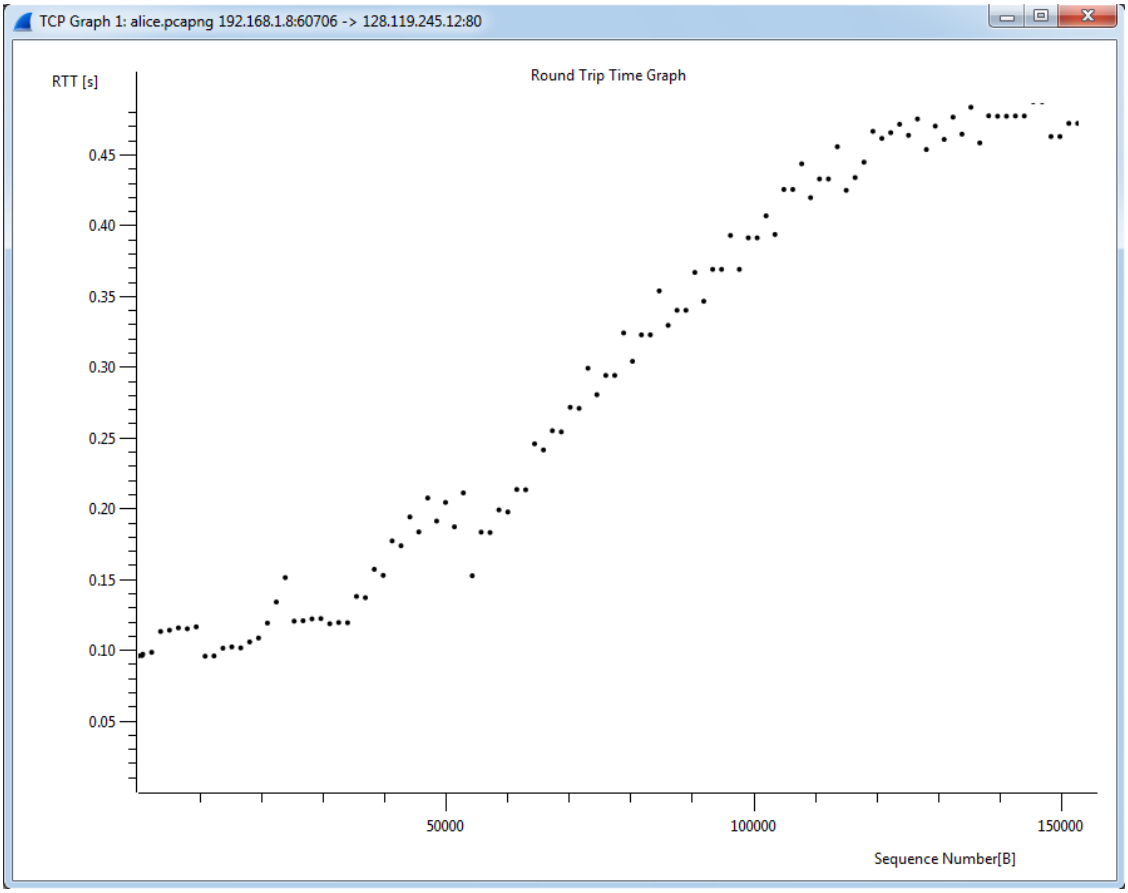
EstimatedRTT = 0.875 * 0.09583803125 + 0.125 * 0.098154= 0.09612752734 s

EstimatedRTT after the receipt of the ACK of segment 5:

EstimatedRTT = 0.875 * 0.09612752734 + 0.125 * 0.112884= 0.09822208642 s

EstimatedRTT after the receipt of the ACK of segment 6:

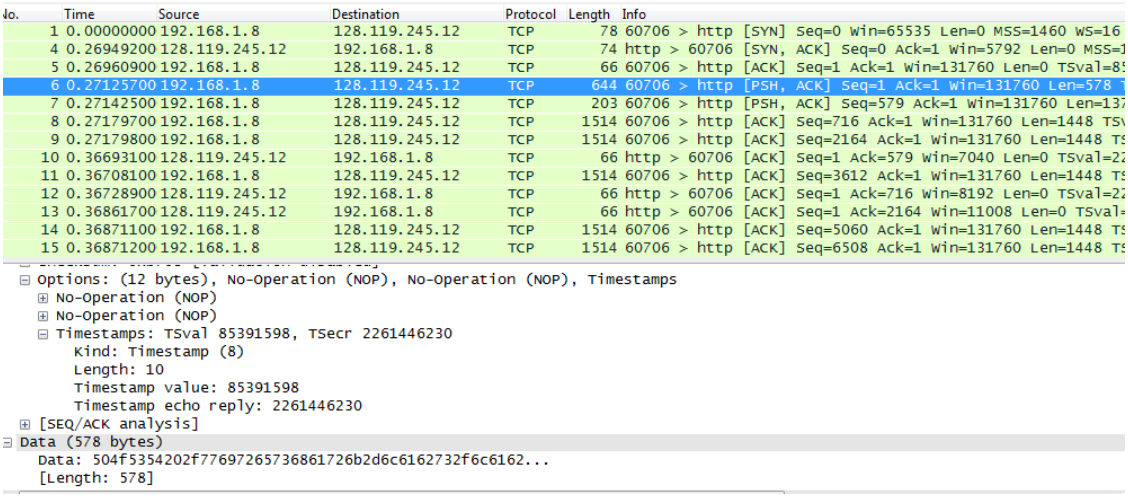
EstimatedRTT = 0.875 *0.09822208642 + 0.125 * 0.113781= 0.10016695061 s



Round Trip Time Graph

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

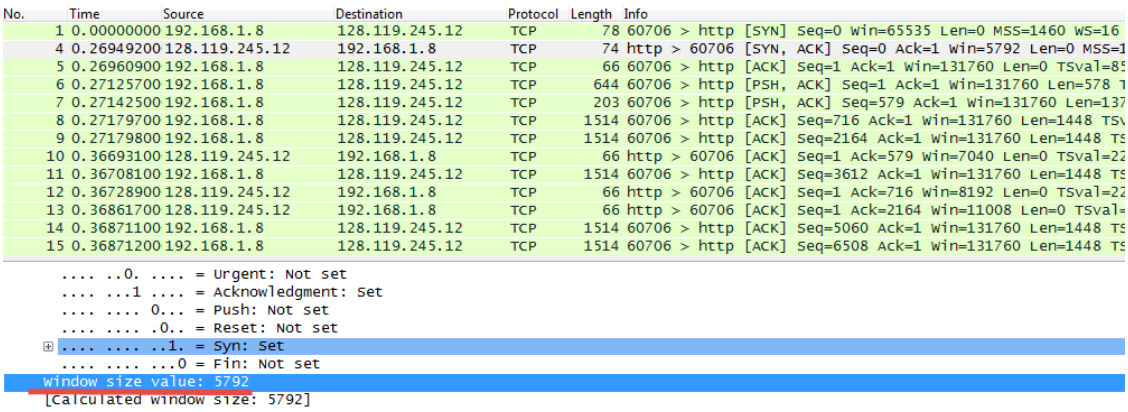
Answer



The length of the first TCP segment is 578 bytes, the length of the second TCP segment is 137 bytes. The length of each of the following five 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?

Answer

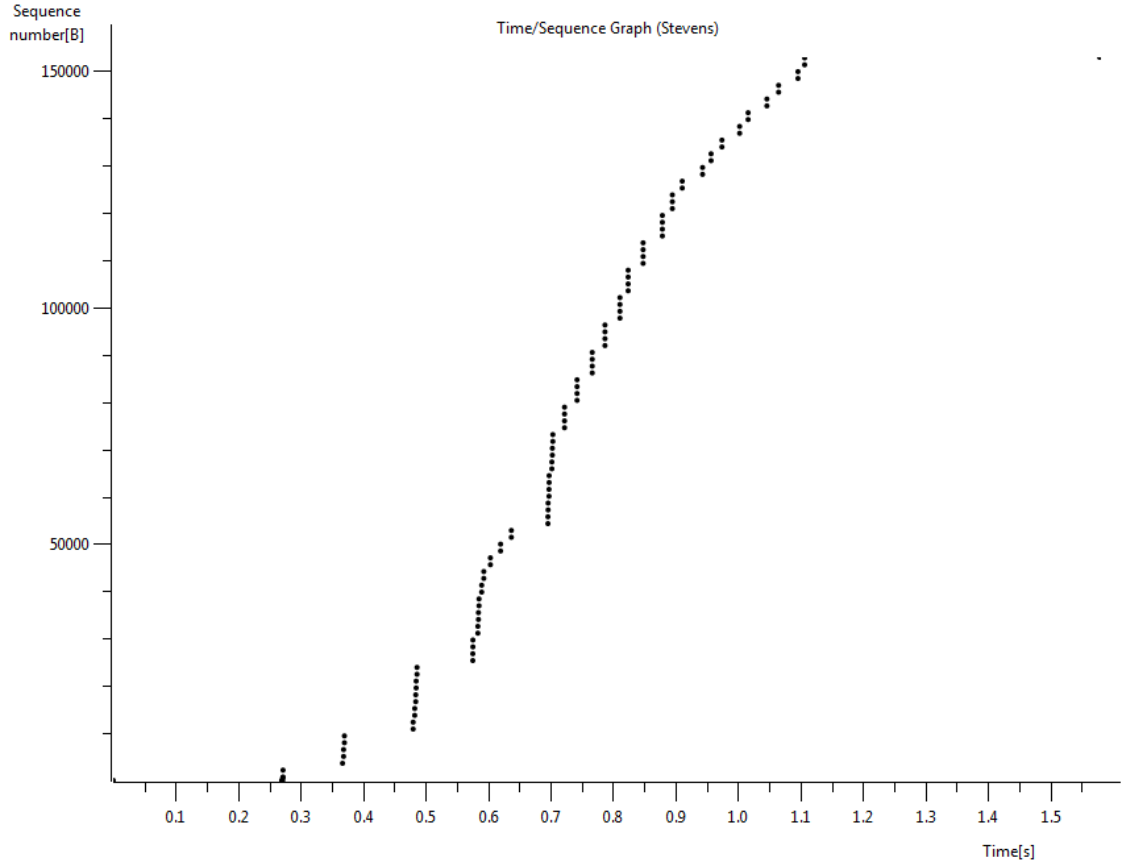


The minimum amount of available buffer space advertised at the received for the entire trace is indicated first ACK from the server, its value is 5792 bytes (shown in above figure).

This reviver window grows until it reaches the maximum receiver buffer size of 62780 bytes. According to the trace, the sender is never throttled due to lacking 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?

Answer



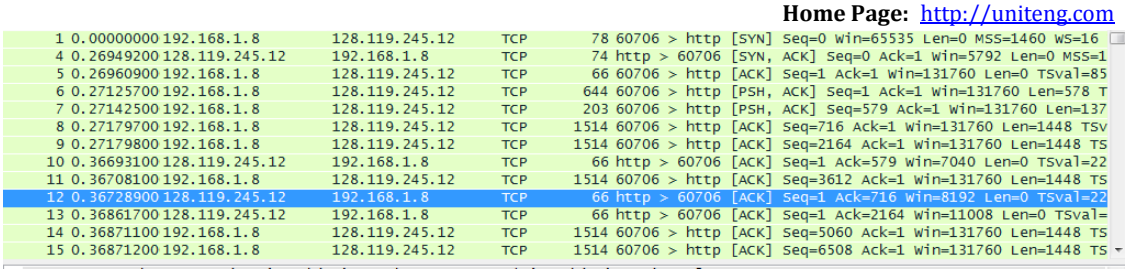
There is no retransmitted segments in the trace file since in the time sequence graph (stevens), all sequence numbers are monotonically increasing.

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).

Answer

The difference between the acknowledged sequence numbers of two consecutive ACKs indicates the data received by the server between these two ACKs.

The receiver is ACKing every other segment. For example, segment of No. 13 acknowledged data with 1430 bytes.



1	0.00000000	192.168.1.8	128.119.245.12	TCP	78 60706 > http [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=16
4	0.26949200	128.119.245.12	192.168.1.8	TCP	74 http > 60706 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1
5	0.26960900	192.168.1.8	128.119.245.12	TCP	66 60706 > http [ACK] Seq=1 Ack=1 Win=131760 Len=0 TSval=85
6	0.27125700	192.168.1.8	128.119.245.12	TCP	644 60706 > http [PSH, ACK] Seq=1 Ack=1 Win=131760 Len=578 T
7	0.27142500	192.168.1.8	128.119.245.12	TCP	203 60706 > http [PSH, ACK] Seq=579 Ack=1 Win=131760 Len=137
8	0.27179700	192.168.1.8	128.119.245.12	TCP	1514 60706 > http [ACK] Seq=716 Ack=1 Win=131760 Len=1448 TSv
9	0.27179800	192.168.1.8	128.119.245.12	TCP	1514 60706 > http [ACK] Seq=2164 Ack=1 Win=131760 Len=1448 TS
10	0.36693100	128.119.245.12	192.168.1.8	TCP	66 http > 60706 [ACK] Seq=1 Ack=579 Win=7040 Len=0 TSval=22
11	0.36708100	192.168.1.8	128.119.245.12	TCP	1514 60706 > http [ACK] Seq=3612 Ack=1 Win=131760 Len=1448 TS
12	0.36728900	128.119.245.12	192.168.1.8	TCP	66 http > 60706 [ACK] Seq=1 Ack=716 Win=8192 Len=0 TSval=22
13	0.36861700	128.119.245.12	192.168.1.8	TCP	66 http > 60706 [ACK] Seq=1 Ack=2164 Win=11008 Len=0 TSval=
14	0.36871100	192.168.1.8	128.119.245.12	TCP	1514 60706 > http [ACK] Seq=5060 Ack=1 Win=131760 Len=1448 TS
15	0.36871200	192.168.1.8	128.119.245.12	TCP	1514 60706 > http [ACK] Seq=6508 Ack=1 Win=131760 Len=1448 TS

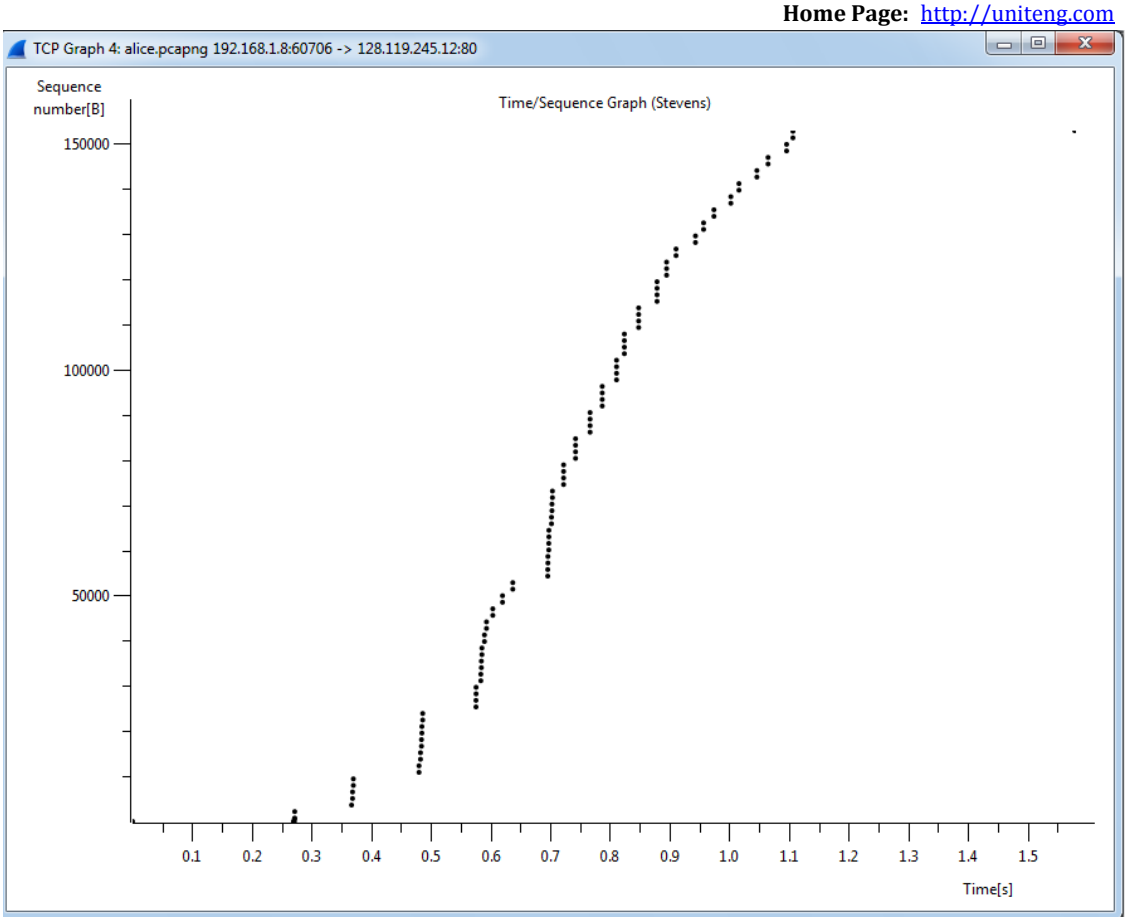
12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.

Answer

The alice.txt on the hard drive is 152,138 bytes, and the download time is 1.578736000 (First TCP segment) - 0.271257000 (last ACK) = 1.307479 second. Therefore, the throughput for the TCP connection is computed as 152,138/1.307479=116359.803867 bytes/second.

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



The slow start of the TCP seems to begin at about 0.27 seconds and then ends at about 0.35 seconds. Congestion avoidance takes over at about 0.7 seconds because it cut down the amount being sent.

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

The questions had been answered .