

1. What is the IP address and TCP port number used by the client computer?
 - a. Source IP address is 192.168.1.102 and the TCP 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?
 - a. The IP address of gaia.cs.umass.edu is 128.119.245.12 and is sending and receiving TCP segments on port 80
3. What is the IP address and TCP port number used by your client computer to transfer the file to gaia.cs.umass.edu?
 - a. My client IP address is 10.0.0.6 and the TCP port number is 40308

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►Internet Protocol Version 4, Src: 10.0.0.6 (10.0.0.6), Dst: 128.119.245.12 (128.119.245.12)  
▼Transmission Control Protocol, Src Port: 40308 (40308), Dst Port: 80 (80), Seq: 152688, Ack: 1, Len: 281
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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?
 - a. The SYN segment is 0000 0000 0010 = FFlags: 0x002 (SYN)
 - b. The 1 in the sequence is what identifies the 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?
 - a. The sequence is 0000 0001 0010 = Flags: 0x012 (SYN, ACK)
 - b. The value of the acknowledgement field is set to 1
 - c. The server adds 1 to the initial sequence number of SYN segment from the client computer which was initially zero, causing the the ACK number to be 1
 - d. A segment is identified as a SYNACK segment if both the SYN flag and ACK flag in the segment are set to 1

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

1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161-80	[SYN]	Seq=0 Win=16384 Len=0 M
2	0.023172	128.119.245.12	192.168.1.102	TCP	62	80-1161	[SYN, ACK]	Seq=0 Ack=1 Win=58
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161-80	[ACK]	Seq=1 Ack=1 Win=17520 L
4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161-80	[PSH, ACK]	Seq=1 Ack=1 Win=17
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[PSH, ACK]	Seq=566 Ack=1 Win=
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=566 Win=6780
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=2026 Ack=1 Win=1752
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=3486 Ack=1 Win=1752
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=2026 Win=8760
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=4946 Ack=1 Win=1752
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=6406 Ack=1 Win=1752
12	0.124085	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=3486 Win=1168
13	0.124185	192.168.1.102	128.119.245.12	TCP	1201	1161-80	[PSH, ACK]	Seq=7866 Ack=1 Win=
14	0.169118	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=4946 Win=1460
15	0.217299	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=6406 Win=1752
16	0.267802	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=7866 Win=2044
17	0.304807	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=9013 Win=2336
18	0.305040	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=9013 Ack=1 Win=1752
19	0.305813	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=10473 Ack=1 Win=1752
20	0.306692	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=11933 Ack=1 Win=1752
21	0.307571	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=13393 Ack=1 Win=1752
22	0.308699	192.168.1.102	128.119.245.12	TCP	1514	1161-80	[ACK]	Seq=14853 Ack=1 Win=1752
23	0.309553	192.168.1.102	128.119.245.12	TCP	946	1161-80	[PSH, ACK]	Seq=16313 Ack=1 Win=
24	0.356437	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=10473 Win=267
25	0.400164	128.119.245.12	192.168.1.102	TCP	60	80-1161	[ACK]	Seq=1 Ack=11933 Win=292

Transmission Control Protocol, Src Port: 1161 (1161), Dst Port: 80 (80), Seq: 1, Ack: 1, Len: 565

Source Port: 1161 (1161)
Destination Port: 80 (80)
[Stream index: 0]
[TCP Segment Len: 565]
Sequence number: 1 (relative sequence number)
[Next sequence number: 566 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
Header Length: 20 bytes

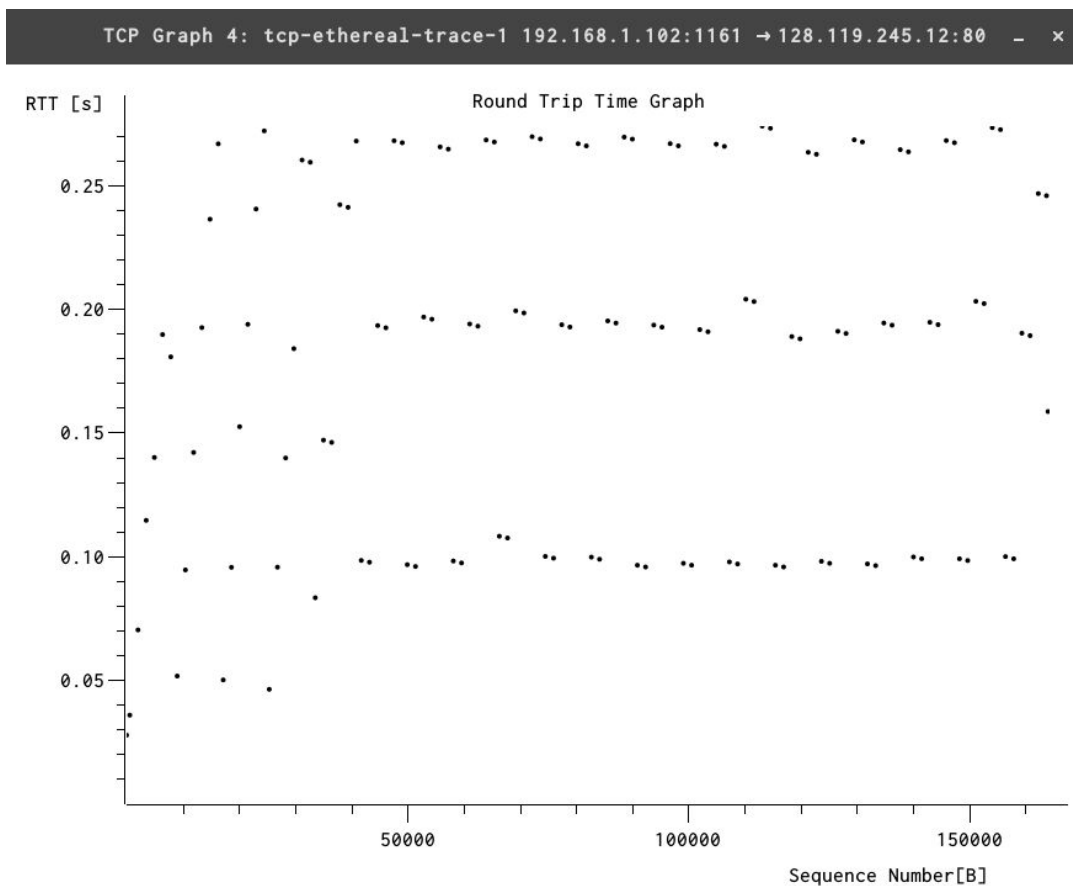
... 0000 0001 1000 = Flags: 0x018 (PSH, ACK)

000. = Reserved: Not set
...0 = Nonce: Not set
.... 0... = Congestion Window Reduced (CWR): Not set
.... .0.. = ECN-Echo: Not set
.... ..0. = Urgent: Not set
.... ...1 = Acknowledgment: Set
.... 1... = Push: Set
....0.. = Reset: Not set
....0 = Syn: Not set
....0 = Fin: Not set

0020 f5 0c 04 89 00 50 0d d6 01 f5 34 a2 74 1a 50 18P...4.t.P.
0030 44 70 1f bd 00 00 50 4f 53 54 20 2f 65 74 68 65 ..P...PO ST /ethe
0040 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 real-lab s/lab3-1
0050 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 2f -reply.htm HTTP/
0060 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 2e 1.1..Host: gaia.
0070 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 55 73 cs.umass.edu..Us
0080 65 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 55 73 cs.umass.edu..Us

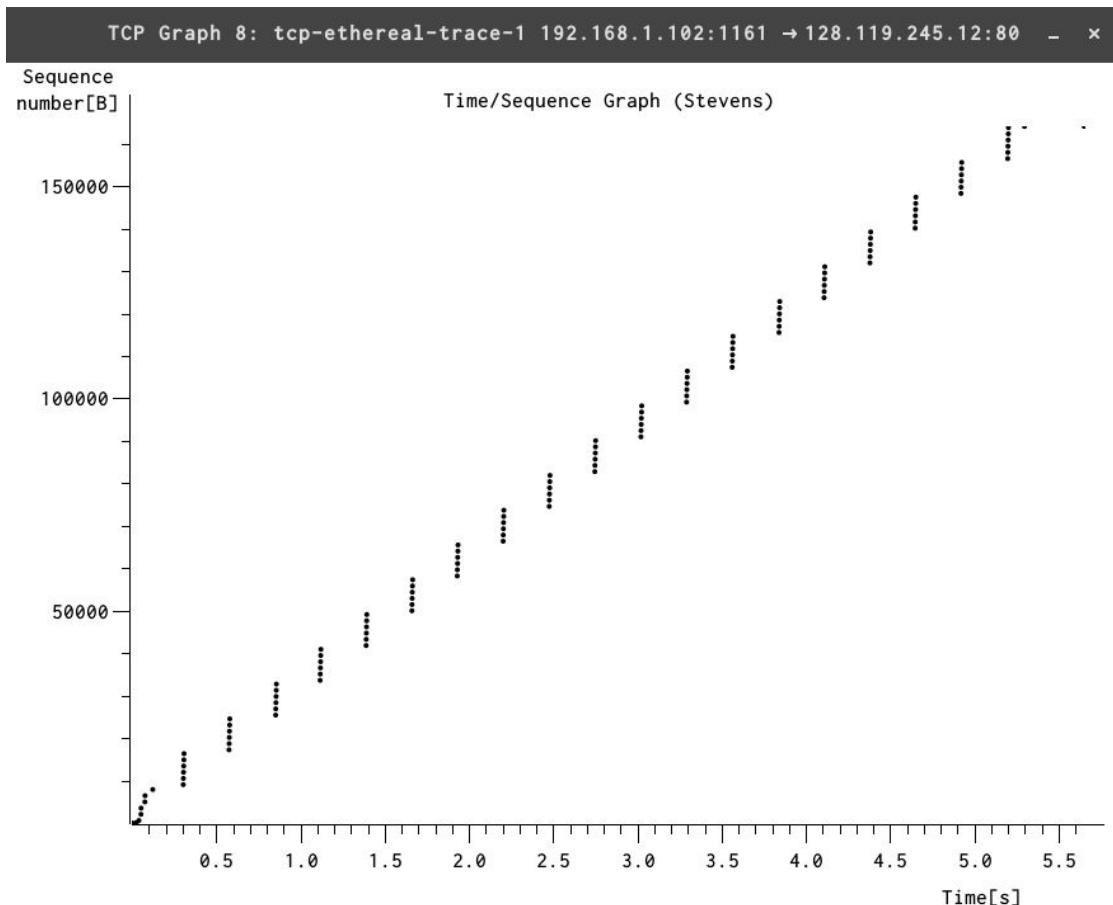
- a. The sequence number is set to 1 in this segment which contains the HTTP POST command
7. Consider the TCP segment containing the HTTP POST as the first segment in the TCP connection. What are the sequence numbers of the first six segments in the TCP Connection? At what time was each segment sent? When was the ACK for each segment received?
- a. The first six sequence numbers are: 1, 566, 1, 2026, 3486, 1

	Sent Time:	ACK Received Time:	RTT:
Segment 1:	.026477		.023265
Segment 2:	.041737		.023265
Segment 3:	.053937		.02746
Segment 4:	.054026		.023265
Segment 5:	.054690		.023265
Segment 6:	.077294		.035557



8. What is the length of each of the first six TCP segments?
 - a. 619, 1514, 60, 1514, 1514, 60
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?
 - a. The minimum amount of buffer space is 5840 from the very first ACK
 - b. The max buffer size is 60k bytes so it should never be throttled due to a lack of buffer space

10. Are there any retransmitted segments in the trace file? What did you check for in order to answer this question?
- No there are no retransmitted segments in the trace file. I checked the time sequence graph (stevens) and all the sequence numbers are 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?
- The receiver typically acknowledges 1460 bytes and it looks like it ACKs every received segment
12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.
- The alice.txt is 152,138 bytes and the download time is 1.487253000 (First TCP segment) - 0.271257000 = 1.215996 seconds.
 - $152,138 / 1.215996 = 125113.898401$ bytes/second
13. Use the time sequence graph. Can you identify where TCP's slow start phase begins and ends, and where congestion avoidance takes over?



- It looks like the slow start of the TCP seems to begin around .15 seconds and ends around .3 seconds. Congestion avoidance takes over around .3 seconds because it cut down the amount being sent.