

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?

- IP and port of my client computer are 192.168.2.13 and 49203.

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?

- IP address of gaia.cs.umass.edu is 173.194.202.125 on port 5222.

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?

- IP and port of my client computer are still 192.168.2.13 and 49203.

149	2.7422	192.168.2.13	128.119.245.12	TCP	78	49225→80 [SYN]
150	2.8309	128.119.245.12	192.168.2.13	TCP	74	80→49225 [SYN,
151	2.8310	192.168.2.13	128.119.245.12	TCP	66	49225→80 [ACK]
152	2.8326	192.168.2.13	128.119.245.12	TCP	647	[TCP segment c
153	2.8333	192.168.2.13	128.119.245.12	TCP	203	[TCP segment c
154	2.8422	192.168.2.13	128.119.245.12	TCP	1514	[TCP segment c
155	2.8422	192.168.2.13	128.119.245.12	TCP	1514	[TCP segment c
156	2.9237	128.119.245.12	192.168.2.13	TCP	66	80→49225 [ACK]
157	2.9238	192.168.2.13	128.119.245.12	TCP	1514	[TCP segment c
158	2.9247	128.119.245.12	192.168.2.13	TCP	66	80→49225 [ACK]
159	2.9322	128.119.245.12	192.168.2.13	TCP	66	80→49225 [ACK]

Ethernet II, Src: Apple_12:fa:2c (2c:f0:ee:12:fa:2c), Dst: BelkinIn_d7:5d:30 (08:86:3b:d7:5d:30)	
Internet Protocol Version 4, Src: 192.168.2.13 (192.168.2.13), Dst: 128.119.245.12 (128.119.245.12)	
Transmission Control Protocol, Src Port: 49225 (49225), Dst Port: 80 (80), Seq: 0, Len: 0	
Source Port: 49225 (49225)	
Destination Port: 80 (80)	
[Stream index: 1]	
[TCP Segment Len: 0]	
Sequence number: 0 (relative sequence number)	
Acknowledgment number: 0	
Header Length: 44 bytes	
... 0000 0000 0010 = Flags: 0x002 (SYN)	
000. = Reserved: Not set	

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?

- The SYN segment is buried in packet 149, but the sequence number was still 1. There is the

SYN flag in the header.

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?

- Relative Sequence Number was 1. The Acknowledgement number is 1. The server determined that value by receiving the previous SYN packet. The header identified the the SYN ACK segment.

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

window size value: 4117		
[Calculated window size: 131744]		
[Window size scaling factor: 32]		
Checksum: 0x5701 [validation disabled]		
[Good Checksum: False]		
0000	08 86 3b d7 5d 30 2c f0 ee 12 fa 2c 08 00 45 00	...]0... ..E.
0010	02 79 e0 61 40 00 40 06 1f e4 c0 a8 02 0d 80 77	.y.a@.w
0020	f5 0c c0 49 00 50 29 25 00 61 9b bd f1 fb 80 18	...I.P)% .a.....
0030	10 15 57 01 00 00 01 01 08 0a 1e 6f ac 48 17 e7	..W.....O.H..
0040	89 ad 50 4f 53 54 20 2f 77 69 72 65 73 68 61 72	..POST / wireshar
0050	6b 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 2d 72 65	k-labs/l ab3-1-re
0060	70 6c 79 2e 68 74 6d 20 48 54 54 50 2f 31 2e 31	ply.htm HTTP/1.1
0070	0d 0a 48 6f 73 74 3a 20 67 61 69 61 2e 63 73 2e	..Host: gaia.cs.
0080	75 6d 61 73 73 2e 65 64 75 0d 0a 43 6f 6e 74 65	umass.ed u..Conte
0090	6e 74 2d 54 79 70 65 3a 20 6d 75 6c 74 69 70 61	nt-Type: multipa
00a0	72 74 2f 66 6f 72 6d 2d 64 61 74 61 3b 20 62 6f	rt/form- data; bo
00b0	75 6e 64 61 72 79 3d 2d 2d 2d 2d 57 65 62 4b 69	undary=- ---WebKi
00c0	74 46 6f 72 6d 42 6f 75 6e 64 61 72 79 5a 35 6d	tFormBou ndaryZ5m
00d0	7a 76 45 64 49 53 4e 6e 46 47 32 47 33 0d 0a 4f	zvEdISNn FG2G3..0
00e0	72 69 67 69 6e 3a 20 68 74 74 70 3a 2f 2f 67 61	rigin: h ttp://ga
00f0	69 61 2e 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d	ia.cs.um ass.edu.
0100	0a 41 63 63 65 70 74 2d 4c 61 6e 67 75 61 67 65	.Accept- Language
0110	3a 20 65 6e 2d 75 73 0d 0a 41 63 63 65 70 74 2d	: en-us. .Accept-
0120	45 6e 63 6f 64 69 6e 67 3a 20 67 7a 69 70 2c 20	Encoding : gzip,
0130	64 65 66 6c 61 74 65 0d 0a 43 6f 6e 6e 65 63 74	deflate. .Connect
0140	69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d	ion: kee p-alive.
0150	0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 68 74	Accept: text/ht

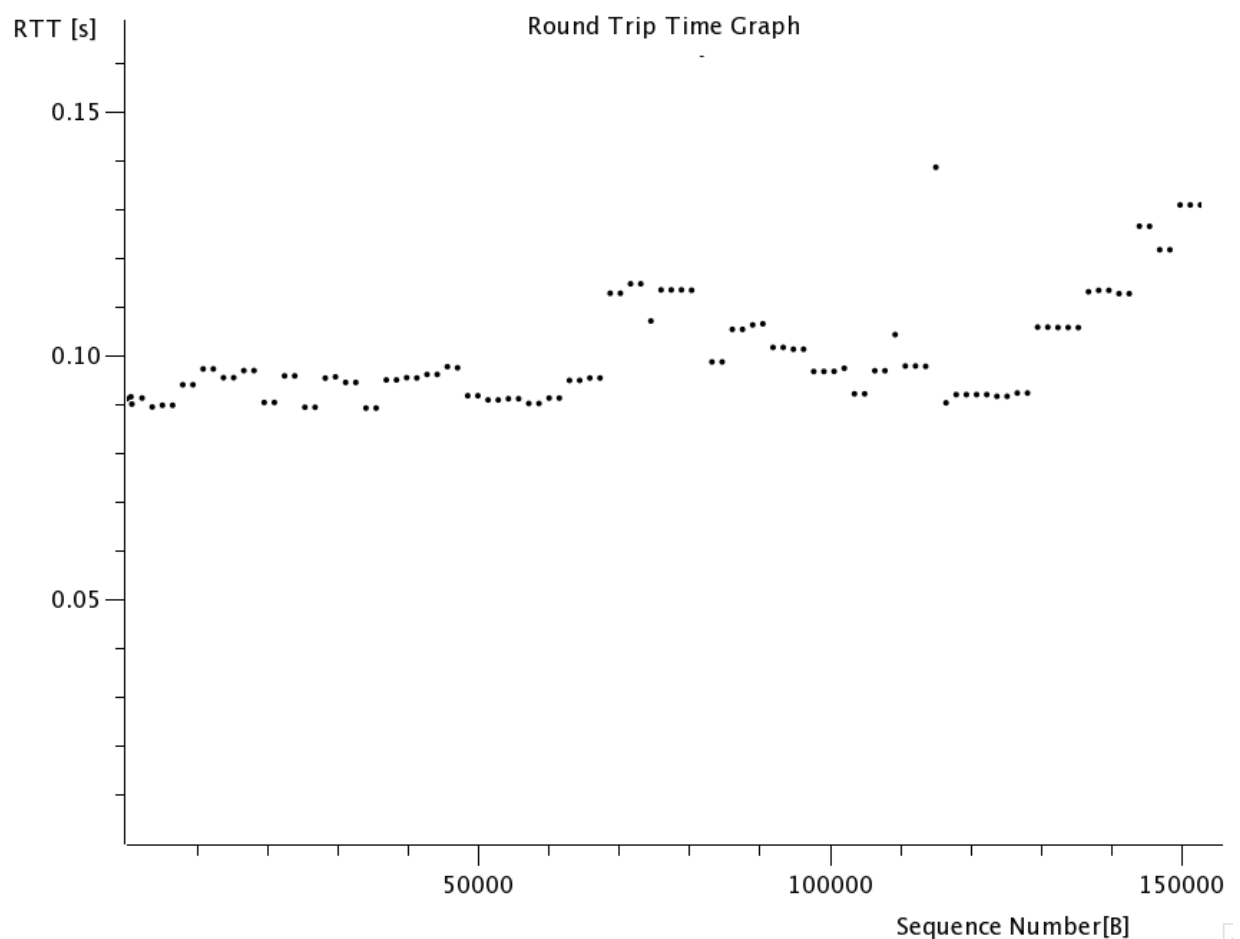
The window size scaling fac... Packets: 339 · Displayed: 33... Profile: Default

- POST had a sequence number of 1.

7. Consider the TCP segment containing the HTTP POST as the first segment in the TCP connection.

- The sequence numbers of the first six segments are 1, 582, 719, 2167, 582, and 3615
- At what time was each segment sent? Segments were sent at 2.7306, 2.8333, 2.8422, 2.9238, 2.2323, and 2.9323
- When was the ACK for each segment received? ACKs were received at 2.8310, 2.9237, 2.9247, 2.9322, 2.9334 and 3.0133.

- 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?
- The RTT times were 0.1004, .0904, 0.825, 0.840, 0.7011, and 0.081
- What is the `EstimatedRTT` value 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.



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

- The lengths of the first six TCP segments are 647, 203, 1514, 1514, 1514, and 1514.

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

- Minimum available buffer space was 65535. Lack of buffer space did not throttle the sender because our sizes did not exceed 1514.

No.	Time	Source	Destination	Protocol	Length	Info
149	2.7422	192.168.2.13	128.119.245.12	TCP	78	49225->80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=32 TSval=510634991 TSecr=0 SACK_PERM=1
150	2.8309	128.119.245.12	192.168.2.13	TCP	74	80->49225 [SYN, ACK] Seq=0 Ack=1 Win=14480 Len=0 MSS=1460 SACK_PERM=1 TSval=401050029 TSecr=
151	2.8310	192.168.2.13	128.119.245.12	TCP	66	49225->80 [ACK] Seq=1 Ack=1 Win=131744 Len=0 TSval=510635079 TSecr=401050029
152	2.8326	192.168.2.13	128.119.245.12	TCP	647	[TCP segment of a reassembled PDU]
153	2.8333	192.168.2.13	128.119.245.12	TCP	203	[TCP segment of a reassembled PDU]
154	2.8422	192.168.2.13	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]

Packet 150 details:

-1. = Syn: Set
- [Expert Info (Chat/Sequence): Connection establish request (SYN): server port 80]
- [Connection establish request (SYN): server port 80]
- [Severity level: Chat]
- [Group: Sequence]
-0 = Fin: Not set
- Window size value: 65535
- Checksum: 0x4a46 [validation disabled]
- [Good Checksum: False]
- [Bad Checksum: False]
- Urgent pointer: 0

Packet bytes:

```

0000  08 86 3b d7 5d 30 2c f0 ee 12 fa 2c 08 00 45 00  ...J0...E.
0010  00 40 46 84 40 00 00 06 bb fa c0 a8 02 0d 80 77  .@F.@...w
0020  f5 0c c0 49 00 50 29 25 00 60 00 00 00 00 b0 02  ..I.P)%
0030  4a 46 00 00 02 04 05 b4 01 03 03 05 01 01 01  .JF.....
0040  08 0a 1e 6f ab ef 00 00 00 00 04 02 00 00 00  .0.....

```

- Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?
 - No segments were retransmitted because none of the ACK messages were duplicated.
- 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).
- What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.
 - Total throughput of the transfer is $534,710 / (8.6301 - 2.742)$. That's the file size divided by the end time minus the start time.
- 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.
 - Congestion control did no need to take over. We know this because we learned in class that the rate grows exponentially, as shown below, and if needed, it would drop. There are no sudden drops in our graph.

