

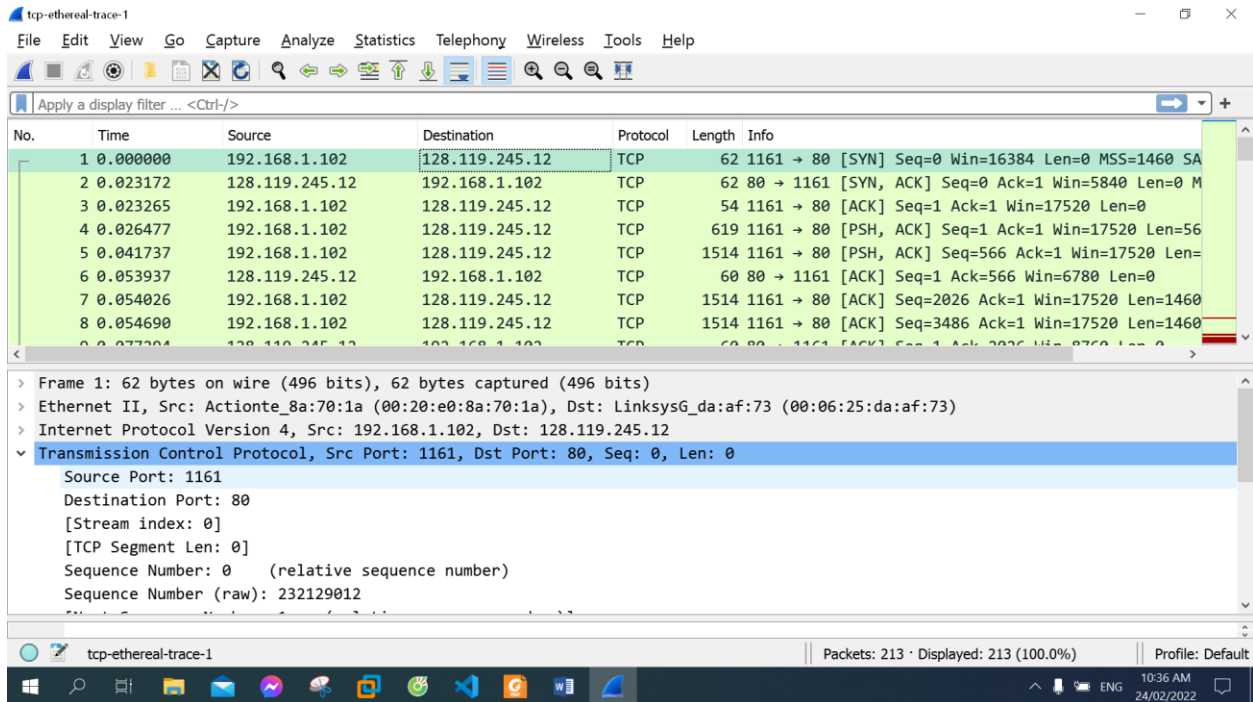
LAB 3A

Wireshark TCP v8.0

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3. 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 address used by the client computer: 192.168.1.102

TCP port number used by the client computer: 1161

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?

tcp-ethereal-trace-1

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Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SA
2	0.023172	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 M
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=56
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=

Acknowledgment number (raw): 0

0111 = Header Length: 28 bytes (7)

Flags: 0x002 (SYN)

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

[TCP Flags:S.]

Congestion Window Reduced (CWR) (tcp.flags.cwr), 1 byte(s)

Packets: 213 · Displayed: 213 (100.0%) Profile: Default

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The sequence number of the TCP SYN segment: 0

The line “....1. = Syn: Set” in the Flags section

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?

tcp-ethereal-trace-1

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Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SA
2	0.023172	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 M
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=56
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=

Acknowledgment number (raw): 232129013

0111 = Header Length: 28 bytes (7)

Flags: 0x012 (SYN, 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
- 0... = Push: Not set
-0.. = Reset: Not set
- >1. = Syn: Set
-0 = Fin: Not set

[TCP Flags:A..S.]

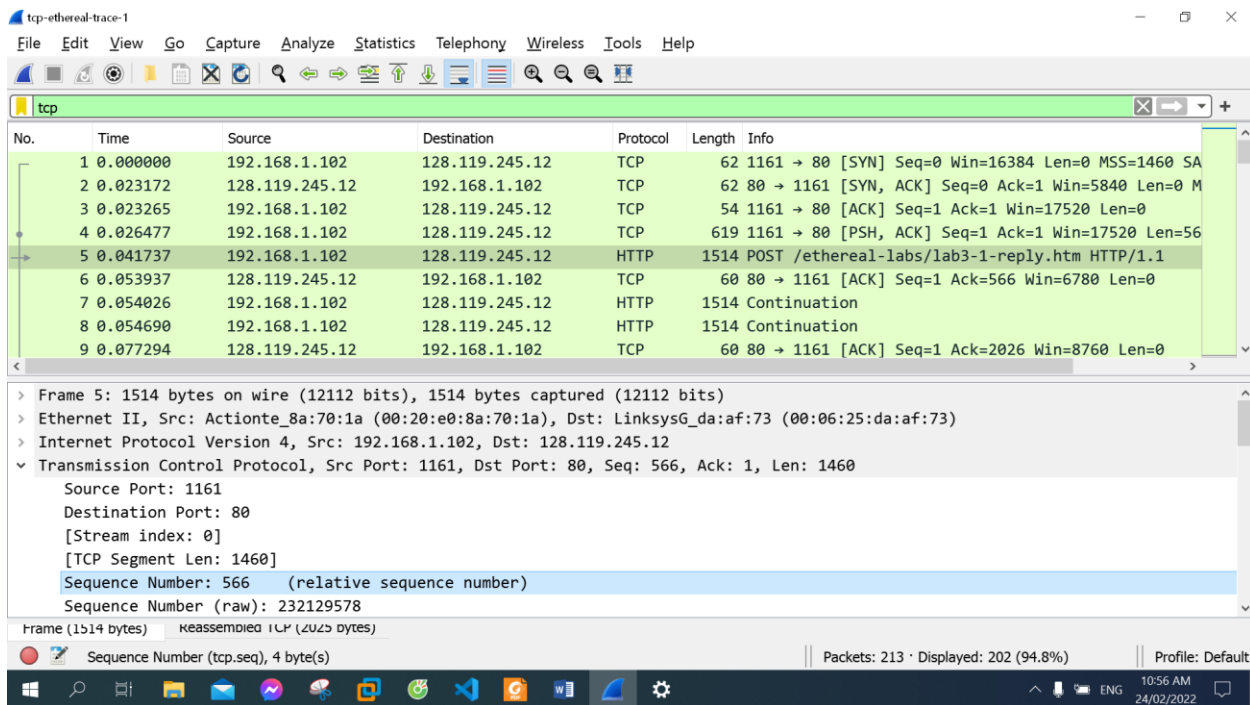
Congestion Window Reduced (CWR) (tcp.flags.cwr), 1 byte(s)

Packets: 213 · Displayed: 213 (100.0%) Profile: Default

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- The sequence number of the TCP SYNACK segment: 0
- The value of the Acknowledgement field: 1
- gaia.cs.umass.edu added 1 to sequence number of the TCP SYN segment and then return to Acknowledgement field
- Syn flag and Acknowledgment flag is set to 1 in Flags section to identify the segment as a SYNACK segment

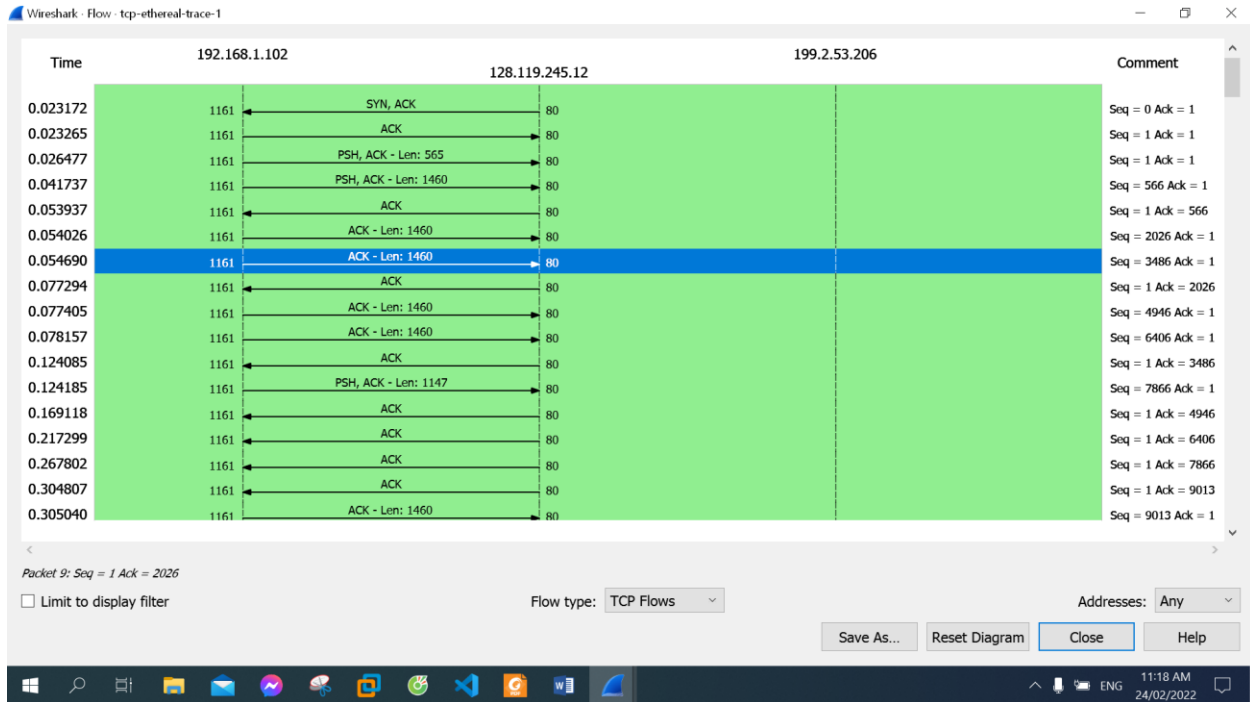
6. What is the sequence number of the TCP segment containing the HTTP POST command? Note that in order to find the POST command, you'll need to dig into the packet content field at the bottom of the Wireshark window, looking for a segment with a "POST" within its DATA field.



The sequence number of the TCP segment containing the HTTP POST command: 566

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?



The sequence numbers of the first six segments: 566 -> 2026 -> 3486 -> 4946 -> 6406 -> 7866

Each segment is sent at: 0.041737 -> 0.054026 -> 0.054690 -> 0.077405 -> 0.078157 -> 0.124185

Each segment receive ACK at: 0.053937 -> 0.077294 -> 0.124085 -> 0.169118 -> 0.217299 -> 0.267802

RTT for each segment: 0.0122-> 0.023268-> 0.069395-> 0.091713-> 0.139142-> 0.143617

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

tcp-ethereal-trace-1

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tcp

No.	Time	Source	Destination	Protocol	Length	Info
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	0.054026	192.168.1.102	128.119.245.12	HTTP	1514	Continuation
8	0.054690	192.168.1.102	128.119.245.12	HTTP	1514	Continuation
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	0.077405	192.168.1.102	128.119.245.12	HTTP	1514	Continuation
11	0.078157	192.168.1.102	128.119.245.12	HTTP	1514	Continuation
12	0.124085	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	0.124185	192.168.1.102	128.119.245.12	HTTP	1201	Continuation
14	0.169118	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
15	0.217299	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	0.267802	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0
17	0.304807	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=9013 Win=23360 Len=0

Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 7866, Ack: 1, Len: 1147

Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 1147]
Sequence Number: 7866 (relative sequence number)
Sequence Number (raw): 232136878

Sequence Number (tcp.seq), 4 byte(s) | Packets: 213 · Displayed: 202 (94.8%) | Profile: Default

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The sixth is 1201, the others are 1514

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?

Window: 17520

[Calculated window size: 17520]

- 17520 bytes

- No, it does not

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

No, no segments were ever retransmitted. This is shown by the fact that an old Acknowledgement number was never resent in order to re-request former packets.

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

tcp-ethereal-trace-1

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tcp

No.	Source	Destination	Protocol	Length	Info
0000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
3172	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK...
3265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
6477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565 [TCP segme...
1737	192.168.1.102	128.119.245.12	HTTP	1514	POST /ethereal-labs/lab3-1-reply.htm HTTP/1.1
3937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
4026	192.168.1.102	128.119.245.12	HTTP	1514	Continuation
4690	192.168.1.102	128.119.245.12	HTTP	1514	Continuation
7294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
7405	192.168.1.102	128.119.245.12	HTTP	1514	Continuation
8157	192.168.1.102	128.119.245.12	HTTP	1514	Continuation
4085	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
4185	192.168.1.102	128.119.245.12	HTTP	1201	Continuation
9118	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
7299	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
7802	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0
4807	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=9013 Win=23360 Len=0
5040	192.168.1.102	128.119.245.12	HTTP	1514	Continuation

Sequence Number: 1 (relative sequence number)

Sequence Number (tcp.seq), 4 byte(s)

Packets: 213 · Displayed: 202 (94.8%)

Profile: Default

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From the screenshot above, we see that the ACK numbers increase in the sequence 566, 2026, 3486, 4946

Note that the ACK numbers increase by 1460 each time, indicating that the receiver is acknowledging 1460 bytes.

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

tcp-ethereal-trace-1

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tcp

No.	Time	Source	Destination	Protocol	Length	Info
193	5.198388	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=157929 Ack=1 Win=17520 Len=14
194	5.199275	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=159389 Ack=1 Win=17520 Len=14
195	5.200252	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=160849 Ack=1 Win=17520 Len=14
196	5.201150	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=162309 Ack=1 Win=17520 Len=14
197	5.202024	192.168.1.102	128.119.245.12	TCP	326	1161 → 80 [PSH, ACK] Seq=163769 Ack=1 Win=17520 L
198	5.297257	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=159389 Win=62780 Len=0
199	5.297341	192.168.1.102	128.119.245.12	HTTP	104	POST /ethereal-labs/lab3-1-reply.htm HTTP/1.1 (t
200	5.389471	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=162309 Win=62780 Len=0
201	5.447887	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=164041 Win=62780 Len=0
202	5.455830	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0
203	5.461175	128.119.245.12	192.168.1.102	HTTP	784	HTTP/1.1 200 OK (text/html)
206	5.651141	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=164091 Ack=731 Win=16790 Len=
213	7.595557	192.168.1.102	199.2.53.206	TCP	62	1162 → 631 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 S

Sequence Number: 1 (relative sequence number)

Sequence Number (raw): 883061786

[Next Sequence Number: 1 (relative sequence number)]

Acknowledgment Number: 164091 (relative ack number)

Acknowledgment number (raw): 232293103

Acknowledgment Number (tcp.ack), 4 byte(s)

Packets: 213 · Displayed: 202 (94.8%)

Profile: Default

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Amount of data transmitted: 164091 bytes

Time incurred: 5.455830 second

Throughput = Amount of data transmitted / Time incurred

$$= 164091 / 5.455830 = 30076.2670391 \text{ bytes/second}$$