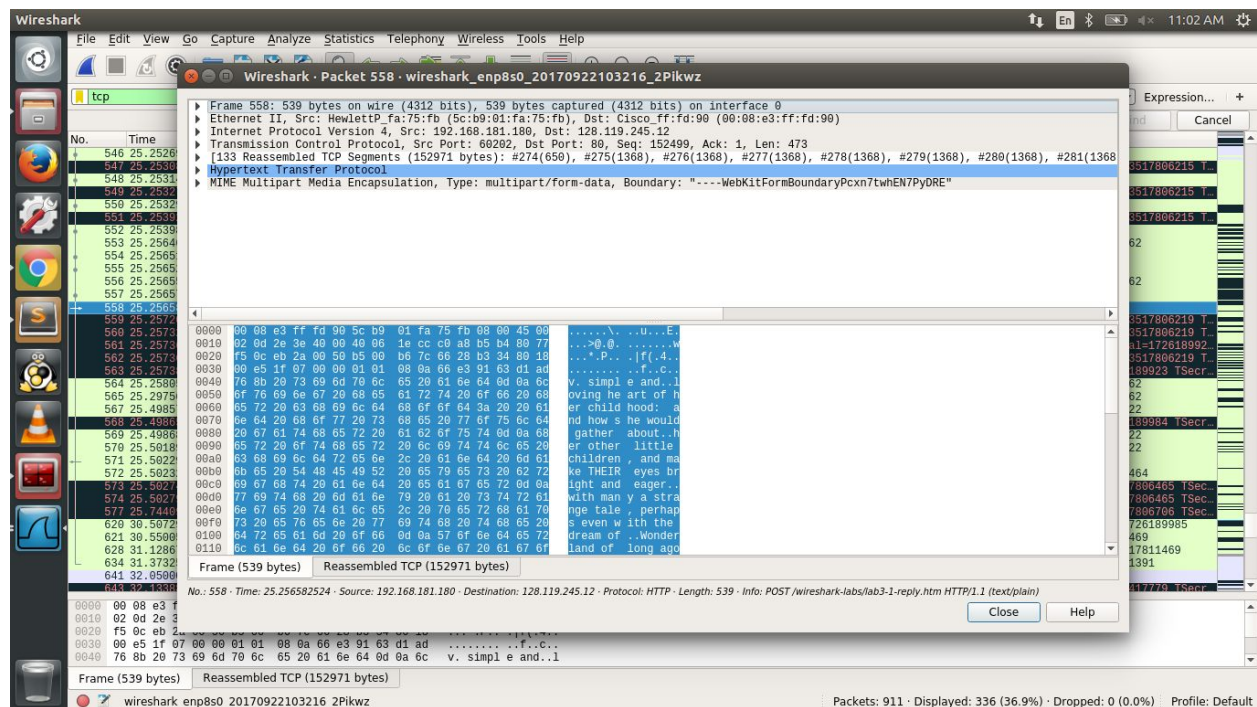


Screenshot for ans 1 -3 :



1. IP address and port no of client: 192.168.181.180:60202
2. IP address and port no of destination: 128.119.245.12
3. IP address and port no of client: 192.168.181.180:60202
4. Screenshot for ans 4 and 5:

a.

265	23.287015688	192.168.181.180	128.119.245.12	TCP	74 60202 → 80 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1726189431 TSecr=0 WS=128
267	23.374370513	157.240.16.16	192.168.181.180	TLSv1.2	341 Application Data
268	23.374447519	192.168.181.180	157.240.16.16	TCP	66 60286 → 443 [ACK] Seq=901 Ack=364 Win=1444 Len=0 TSval=4210583187 TSecr=1203831365
272	23.531843295	128.119.245.12	192.168.181.180	TCP	74 80 → 60202 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len=0 MSS=1380 SACK_PERM=1 TSval=3517804494 TSecr=...
273	23.531931097	192.168.181.180	128.119.245.12	TCP	66 60202 → 80 [ACK] Seq=1 Ack=1 Win=29312 Len=0 TSval=1726189492 TSecr=3517804494

- b. 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
- c. The SYN flag is set to 1 and it indicates that this segment is a SYN segment.
5.
 - a. Sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN: 0
 - b. Value of the ACKnowledgement field in the SYNACK segment: 1
 - c. How did gaia.cs.umass.edu determine that value? : The value of ACKnowledgement field in the SYNACK segment is determined by adding 1 to the initial sequence number of SYN segment from client computer.
 - d. What is it in the segment that identifies the segment as a SYNACK segment? Both the SYN and ACK flags are set to 1 and it indicates that this segment is SYNACK segment.
6. Sequence number of the TCP segment containing the HTTP POST command: 1

7. Estimated RTT

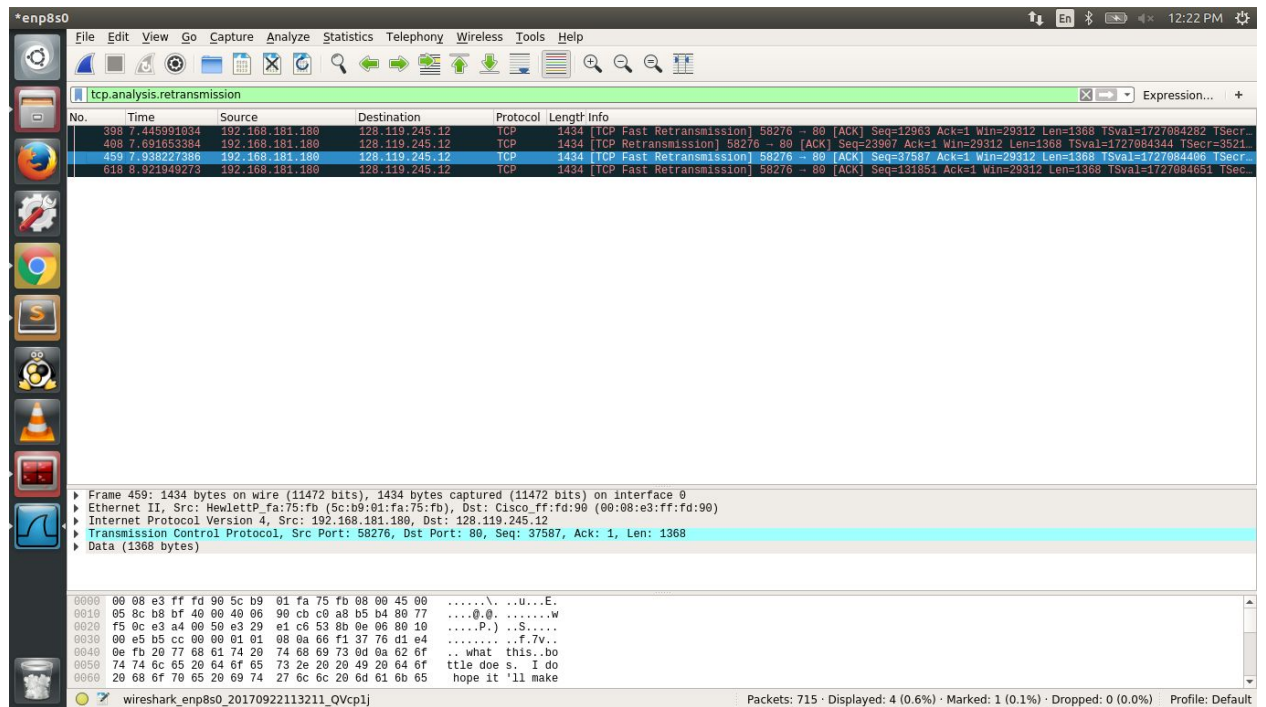
Sequence number	Send Time	ACK receive ti	RTT	Estimated RTT
1	7.198614351	7.443436489	0.244822138	0.244822138
651	7.198928502	7.444116981	0.245188479	0.2448679306
2019	7.198950673	7.444126851	0.245176178	0.2449064615
3387	7.198997762	7.444241569	0.245243807	0.2449486297
4755	7.199006036	7.444303138	0.245297102	0.2449921888
6123	7.199172341	7.444434258	0.245261917	0.2450259048

8. Length of first six TCP segments:

TCP sequence No.	Length
1	650
651	1368
2019	1368
3387	1368
4755	1368
6123	1368

9. The minimum amount of available buffer space advertised at the received for the entire trace is: 28960 bytes. The sender is **Never** throttled for the entire trace due to lack of receiver buffer because minimum window size is > segment size.

10. Yes, there are retransmitted segments in the trace file. I checked for it using the filter tcp.analysis.retransmit .



11. Following is the data for acknowledgements:

351	7.197657862	128.119.245.12	192.168.181.180	TCP	74	80	-	58276	[SYN, ACK]	Seq=0	Ack=1	Win=28960	Len=0	MSS=1380	SACK_PERM=1	TSval=3521383448	TSecr=...		
364	7.442762718	128.119.245.12	192.168.181.180	TCP	74	80	-	58278	[SYN, ACK]	Seq=0	Ack=1	Win=28960	Len=0	MSS=1380	SACK_PERM=1	TSval=3521383693	TSecr=...		
366	7.443436489	128.119.245.12	192.168.181.180	TCP	66	80	-	58276	[ACK]	Seq=1	Ack=651	Win=30336	Len=0	TSval=3521383694	TSecr=1727084221				
368	7.444116981	128.119.245.12	192.168.181.180	TCP	66	80	-	58276	[ACK]	Seq=1	Ack=2019	Win=33280	Len=0	TSval=3521383694	TSecr=1727084221				
370	7.444126951	128.119.245.12	192.168.181.180	TCP	66	80	-	58276	[ACK]	Seq=1	Ack=3387	Win=36608	Len=0	TSval=3521383694	TSecr=1727084221				
372	7.444241569	128.119.245.12	192.168.181.180	TCP	66	80	-	58276	[ACK]	Seq=1	Ack=4755	Win=39040	Len=0	TSval=3521383694	TSecr=1727084221				
374	7.444303138	128.119.245.12	192.168.181.180	TCP	66	80	-	58276	[ACK]	Seq=1	Ack=6123	Win=41856	Len=0	TSval=3521383695	TSecr=1727084221				
376	7.444343258	128.119.245.12	192.168.181.180	TCP	66	80	-	58276	[ACK]	Seq=1	Ack=7491	Win=44800	Len=0	TSval=3521383695	TSecr=1727084221				
477	7.944026949	128.119.245.12	192.168.181.180	TCP	78	80	-	58276	[TCP Dup ACK 472#3]	80	-	58276	[PSH, ACK]	Seq=1	Ack=45795	Win=125056	Len=0	TSval=3521384193	TSecr=...
482	8.182698225	128.119.245.12	192.168.181.180	TCP	66	80	-	58276	[ACK]	Seq=1	Ack=47163	Win=128000	Len=0	TSval=3521384433	TSecr=1727084405				
485	8.182779864	128.119.245.12	192.168.181.180	TCP	66	80	-	58276	[ACK]	Seq=1	Ack=49899	Win=133504	Len=0	TSval=3521384433	TSecr=1727084405				

	ACK number	Acknowledged data
ACK 1	651	651
ACK 2	2019	1368
ACK 3	3387	1368
ACK 4	4755	1368
ACK 5	6123	1368
.		
.		
.		

ACK 24	47163	1368
ACK 25	49899	2736

So, typically an ACK acknowledges 1368 bytes(i.e. 1 Segment size) of data. But there are cases where receiver is ACKing more than one segment at a time (eg ACK 25).

12.

Total data transmitted = **Last acknowledge no. - First sequence no.** = $152973 - 1 = 152392$ B

Total transmission Data = receive time of last ACK - Sending time of first segment
 $= 15.068796922 - 7.198614341 = 7.87018258$ s

Throughput = $152392 \text{ Bytes} / 7.87018258 \text{ s} = 19.3632102 \text{ KB/sec}$

Note: Whole trace is in zip file.