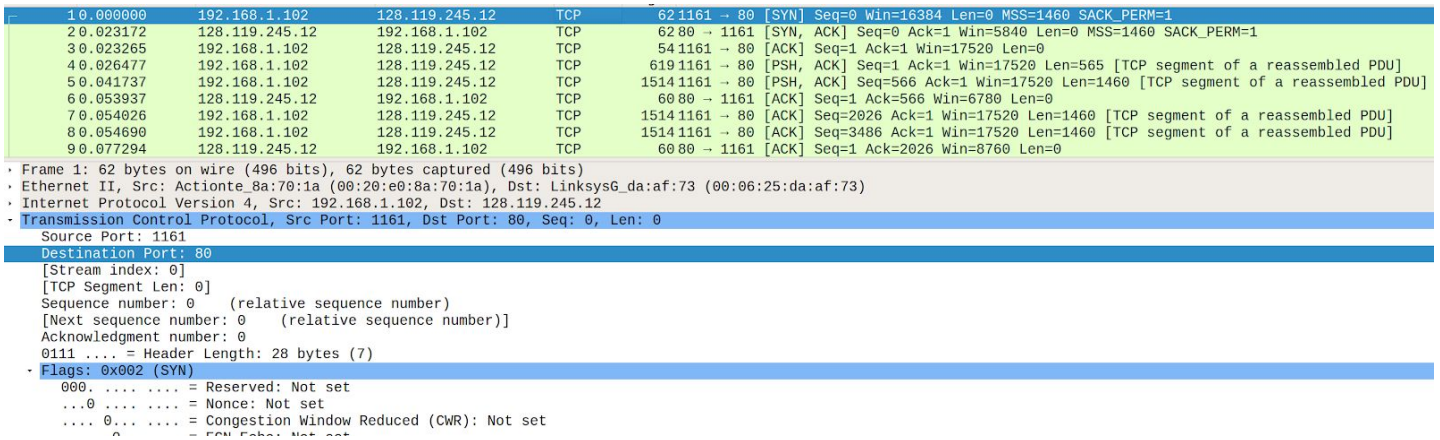
Wireshark TCP

TCP basics

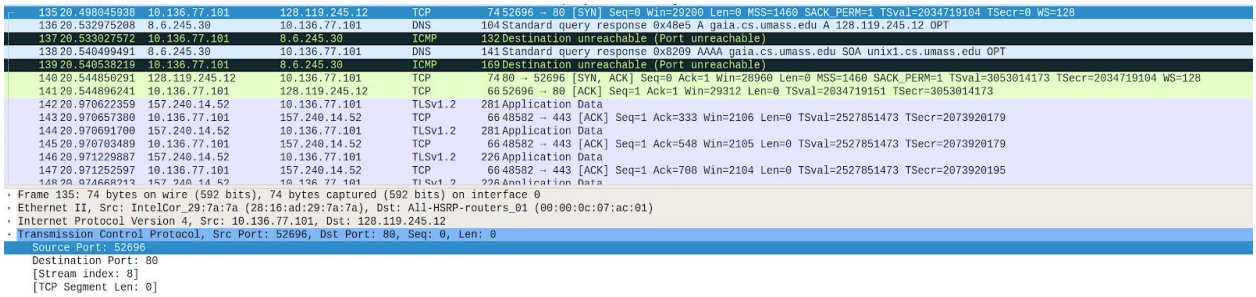


1.
Client computer (source)
IP address: 192.168.1.102
TCP port number: 1161

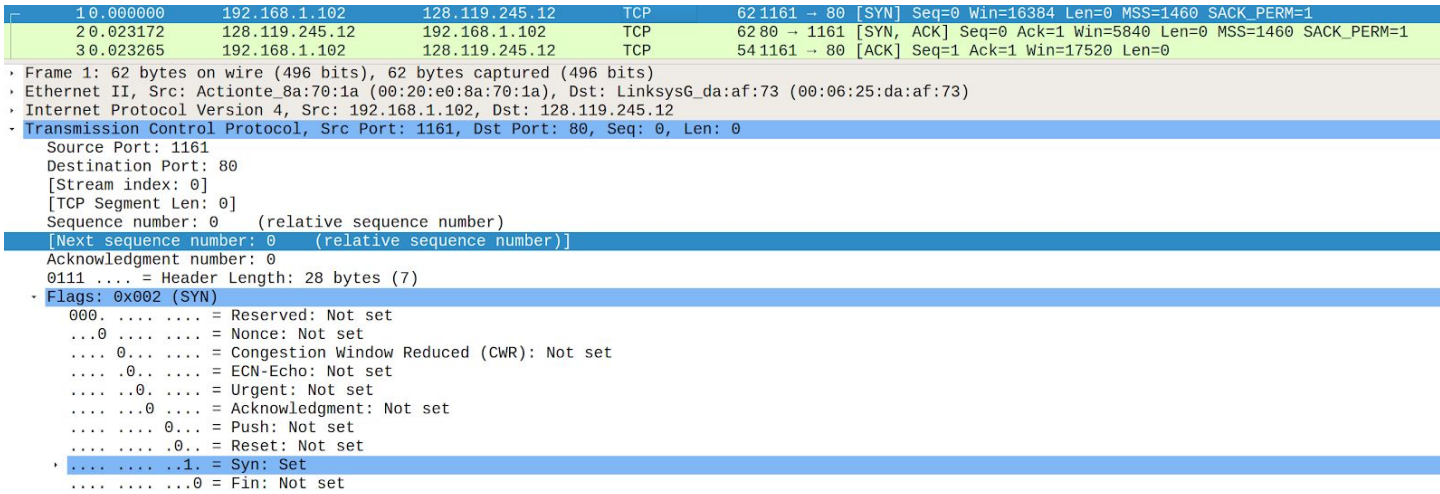
2.
Destination computer: gaia.cs.umass.edu
IP address: 128.119.245.12
TCP port number: 80

3.
Source computer/ Client
IP address: 10.136.77.101
TCP port number: 52696

Destination computer : gaia.cs.umass.edu
IP address: 128.119.245.12
TCP port number: 80



4.
Sequence number of the TCP SYN segment is used to initiate the TCP connection between the client computer and gaia.cs.umass.edu. The value is 0 in this trace. The SYN flag is set to 1 and it indicates that this segment is a SYN segment.

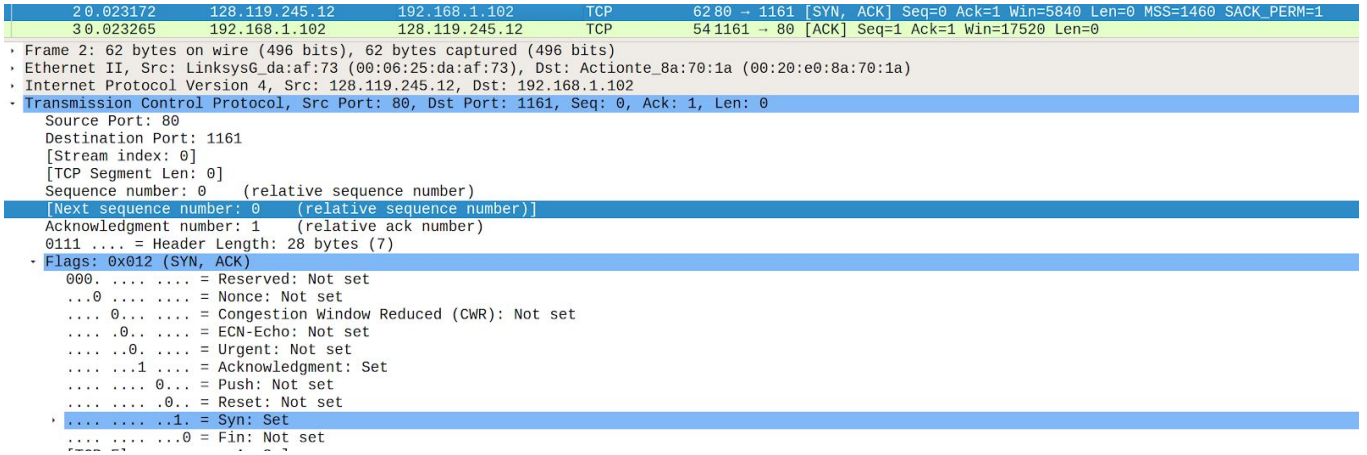


5.

Sequence number of the SYNACK segment from gaia.cs.umass.edu to the client computer in reply to the SYN has the value of 0 in this trace.

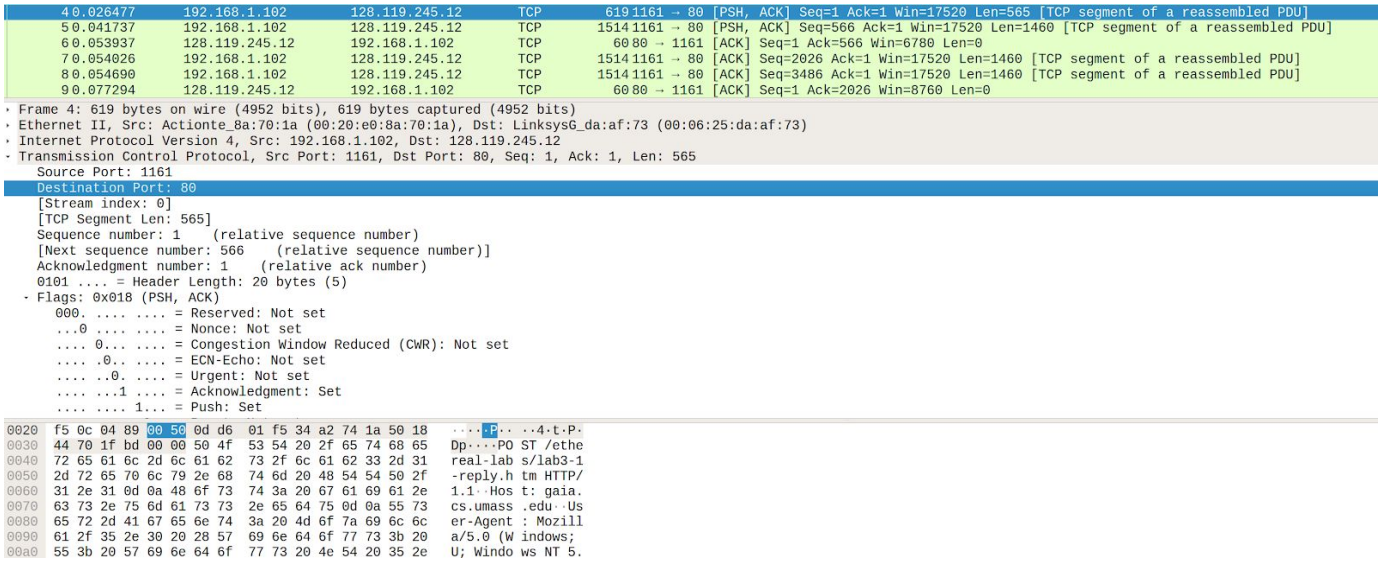
The value of the ACKnowledgement field in the SYNACK segment is 1. The value of the ACKnowledgement field in the SYNACK segment is determined by gaia.cs.umass.edu by adding 1 to the initial sequence number of SYN segment from the client computer (i.e. the sequence number of the SYN segment initiated by the client computer is 0).

The SYN flag and Acknowledgement flag in the segment are set to 1 and they indicate that this segment is a SYNACK segment.

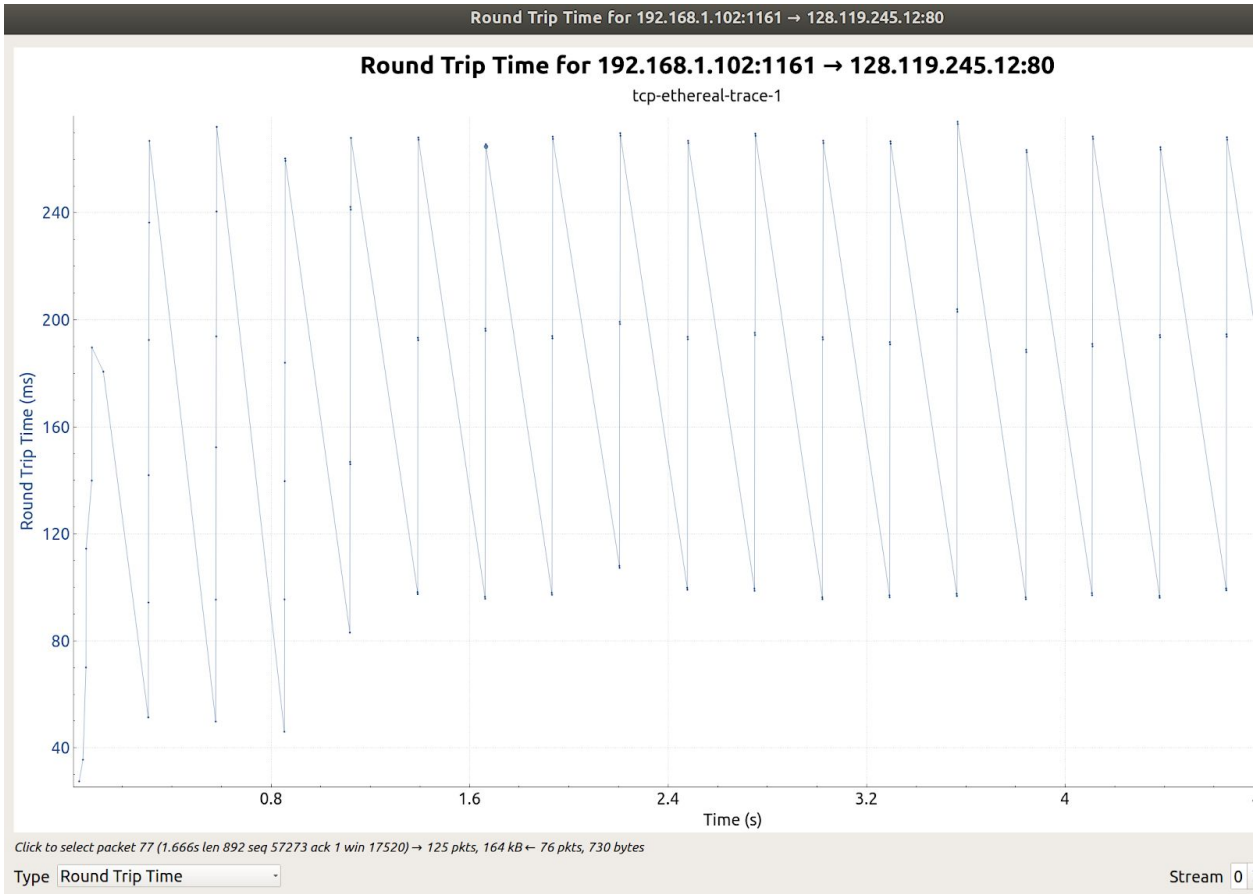


6.

No. 4 segment is the TCP segment containing the HTTP POST command. The sequence number of this segment has the value of 1.



7.



segment	Relative Segment number	Segment number	Time sent	Acknowledgement Received	RTT	Estimated RTT
1	1	0dd601f	.026	.054	.028	.028
2	566	0dd6042	.042	.077	.035	.035
3	2026	0dd609d	.054	.124	.070	.70
4	3486	0dd60f9	.055	.169	.114	.114
5	4946	0dd60f9	.077	.217	.140	.140
6	6406	0dd61af	.078	.268	.190	.190

Estimated RTT packet 1 : 0.875 * .028 + 0.125 * .028= .028
Estimated RTT packet 2 : 0.875 * .042+ 0.125 * .035 = .035
Estimated RTT packet 3 : 0.875 * .054 + 0.125 * .070 = .070
Estimated RTT packet 4 : 0.875 * .055+ 0.125 * .114 = .114
Estimated RTT packet 5 : 0.875 * .077+ 0.125 * .140 = .140
Estimated RTT packet 6 : 0.875 * .078+ 0.125 * .190 = .190

8.

Segment 1 = 565 bytes

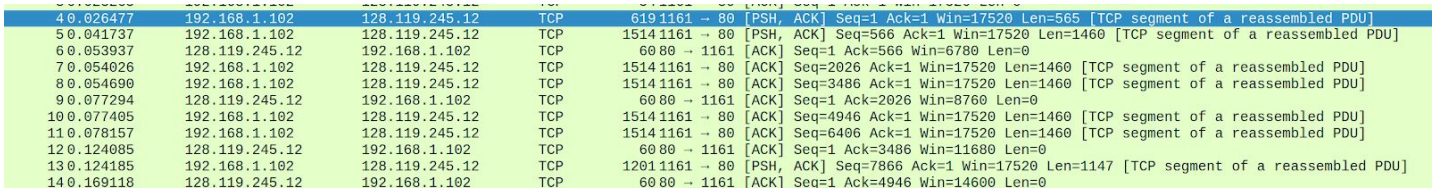
Segment 2 = 1460 bytes

Segment 3 = 1460 bytes

Segment 4 = 1460 bytes

Segment 5 = 1460 bytes

Segment 6 = 1460 bytes



4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565 [TCP segment of a reassembled PDU]
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
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	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
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	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
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	TCP	1201	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
14	0.169118	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0

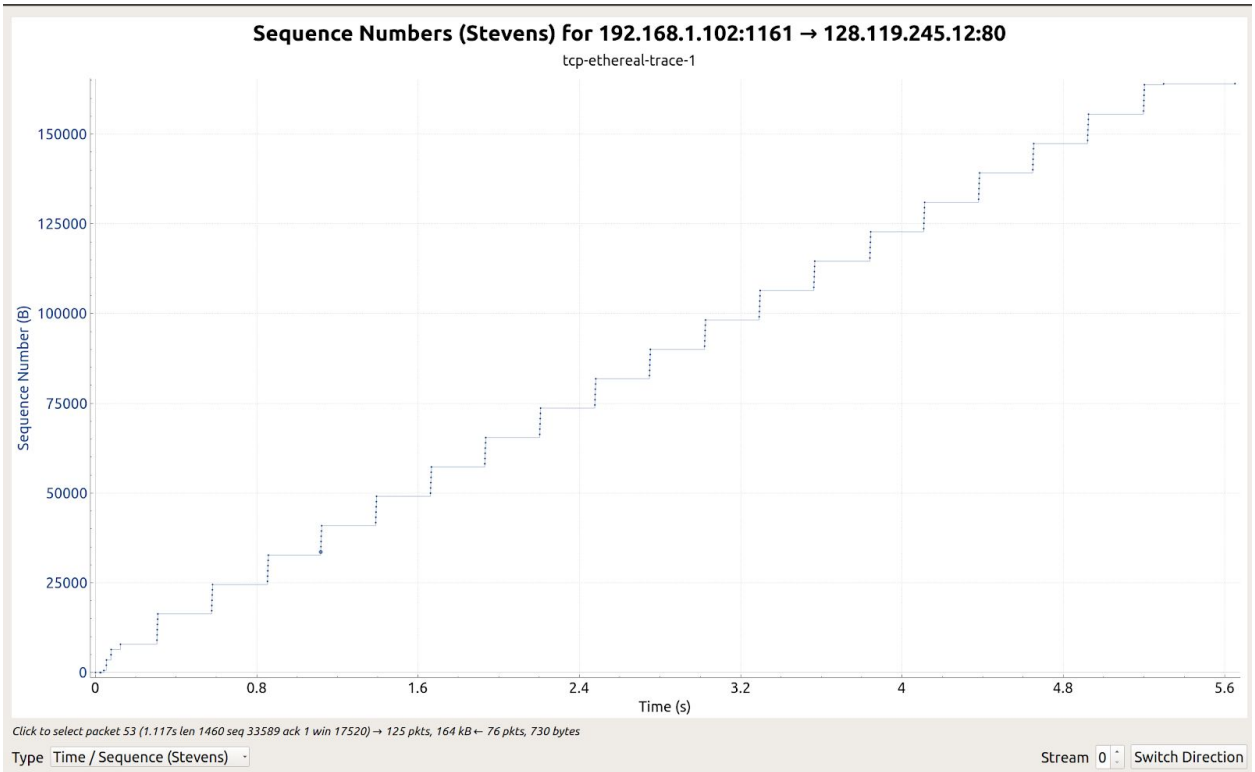
9.

The minimum amount of available buffer space is advertised as 5840 bytes.

The lack of receiver buffer space does not ever throttle the sender.

1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
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 MSS=1460 SACK_PERM=1
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0

10.
There are no retransmitted segments in the trace file. This is verified by checking the sequence numbers of the TCP segments in the trace file.



If there is a retransmitted segment, the sequence number of this retransmitted segment should be smaller than those of its neighboring segments.

11.
The receiver typically acknowledges 1460 bytes in an ack. If the data is doubled then that segement is ACKing every other received segment.
Eg:
Segment 80,87,88…

80	1.930880	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=58165 Win=62780 Len=0
81	1.931099	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=58165 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
82	1.931879	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=59625 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
83	1.932757	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=61085 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
84	1.933636	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=62545 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
85	1.934770	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=64005 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
86	1.935586	192.168.1.102	128.119.245.12	TCP	946	1161 → 80 [PSH, ACK] Seq=65465 Ack=1 Win=17520 Len=892 [TCP segment of a reassembled PDU]
87	2.029069	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=61085 Win=62780 Len=0
88	2.126682	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=64005 Win=62780 Len=0

12.
The total amount data transmitted can be computed by the difference between the sequence number of the first TCP segment (i.e. 1 byte for No. 4 segment) and the acknowledged sequence number of the last ACK (164091 bytes for No. 202 segment).
Therefore, Total data = 164091 - 1 = 164090 bytes.

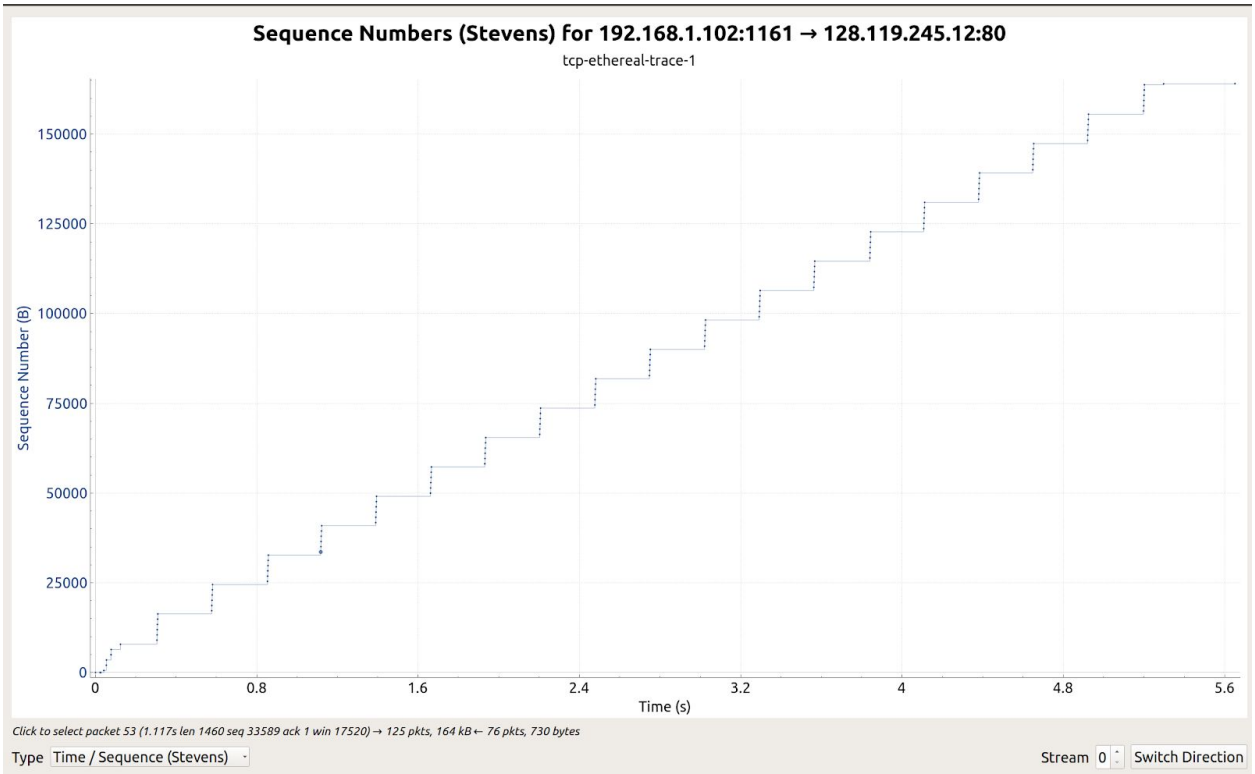
The whole transmission time is the difference of the time instant of the first TCP segment (i.e., 0.026477 second for No.4 segment) and the time instant of the last ACK (i.e., 5.455830 second for No. 202 segment).
Therefore, Total transmission time is 5.455830 - 0.026477 = 5.4294 seconds

The average throughput for this TCP connection is computed as the ratio between the total amount data and the total transmission time.

Throughput for the TCP connection = 164090/5.4294 = 30.222 KByte/sec.

TCP congestion control in action

13.
The slowstart phase begins at about zero and ends at about .15 seconds according to the graph then congestion avoidance takes over. The measured data is only using a fraction of the window size instead of the idealized 1/3 to a half.



14.

The slowstart phase begins at about zero and ends at about 2.8 seconds according to the graph then congestion avoidance takes over.

In this case, we observe the expected linear increase behavior, i.e. the TCP transmit window does grows linearly during this phase.