

Exercise 1:

- IP address of gaia.cs.umass.edu: 128.119.245.12 , Port: 80
Source IP address: 192.168.1.102, Port: 1161

1 0.000000	192.168.1.102	128.119.245.12	TCP	62 1161 → 80 [SYN]	Seq=232129012 Win=16384 Len=0 MSS=1460 SACK_PERM
2 0.023172	128.119.245.12	192.168.1.102	TCP	62 80 → 1161 [SYN, ACK]	Seq=883061785 Ack=232129013 Win=5840 Len=0 MSS=1460 SACK_PE
3 0.023265	192.168.1.102	128.119.245.12	TCP	54 1161 → 80 [ACK]	Seq=232129013 Ack=883061786 Win=17520 Len=0

- Seqno:232129013

4 0.026477	192.168.1.102	128.119.245.12	TCP	619 1161 → 80 [PSH, ACK]	Seq=232129013 Ack=883061786 Win=17520 Len=565 [TCP segment
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EstimatedRTT = (1-a)*EstimatedRTT + a*SampleRTT

seqno	Time sent	Ack received	RTT	estimatedRTT	length
232129013	0.026477	0.053937	0.02746	0.02746	565
232129578	0.041737	0.077294	0.035557	0.028472	1460
232131038	0.054026	0.124085	0.070059	0.033670	1460
232132498	0.054690	0.169118	0.114428	0.043765	1460
232133958	0.077405	0.217299	0.139894	0.055781	1460
232135418	0.078157	0.267802	0.189645	0.072514	1460

4 0.026477	192.168.1.102	128.119.245.12	TCP	619 1161 → 80 [PSH, ACK]	Seq=232129013 Ack=883061786 Win=17520 Len=565 [TCP segment
5 0.041737	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [PSH, ACK]	Seq=232129578 Ack=883061786 Win=17520 Len=1460 [TCP segment
6 0.053937	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232129578 Win=6780 Len=0
7 0.054026	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232131038 Ack=883061786 Win=17520 Len=1460 [TCP segment
8 0.054690	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232132498 Ack=883061786 Win=17520 Len=1460 [TCP segment
9 0.077294	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232131038 Win=8760 Len=0
10 0.077405	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232133958 Ack=883061786 Win=17520 Len=1460 [TCP segment
11 0.078157	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232135418 Ack=883061786 Win=17520 Len=1460 [TCP segment

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minimum amount of available buffer:5840

No, because it's increased after 5840

1 0.000000	192.168.1.102	128.119.245.12	TCP	62 1161 → 80 [SYN]	Seq=232129012 Win=16384 Len=0 MSS=1460 SACK_PERM
2 0.023172	128.119.245.12	192.168.1.102	TCP	62 80 → 1161 [SYN, ACK]	Seq=883061785 Ack=232129013 Win=5840 Len=0 MSS=1460 SACK
3 0.023265	192.168.1.102	128.119.245.12	TCP	54 1161 → 80 [ACK]	Seq=232129013 Ack=883061786 Win=17520 Len=0
4 0.026477	192.168.1.102	128.119.245.12	TCP	619 1161 → 80 [PSH, ACK]	Seq=232129013 Ack=883061786 Win=17520 Len=565 [TCP segment
5 0.041737	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [PSH, ACK]	Seq=232129578 Ack=883061786 Win=17520 Len=1460 [TCP segment
6 0.053937	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232129578 Win=6780 Len=0
7 0.054026	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232131038 Ack=883061786 Win=17520 Len=1460 [TCP segment
8 0.054690	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232132498 Ack=883061786 Win=17520 Len=1460 [TCP segment
9 0.077294	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232131038 Win=8760 Len=0
10 0.077405	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232133958 Ack=883061786 Win=17520 Len=1460 [TCP segment
11 0.078157	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232135418 Ack=883061786 Win=17520 Len=1460 [TCP segment

- No retransmission segment

I check tcp.analysis.retransmission in filter

No.	Time	Source	Destination	Protocol	Length	Info
tcp.analysis.retransmission						

- 1460

At first receiver will ack each packet and at #60 it ack two segments seq=232165521 and seq=232166981. and after #60 there are many cases it ack two segments.

No.	Time	Source	Destination	Protocol	Length	Info
50	0.994715	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232158789 Win=61320 Len=0
51	1.039820	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232160249 Win=62780 Len=0
52	1.117097	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232162601 Win=62780 Len=0
53	1.117333	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232162601 Ack=883061786 Win=17520 Len=1460 [TCP segment
54	1.118133	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232164661 Ack=883061786 Win=17520 Len=1460 [TCP segment
55	1.119029	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232165521 Ack=883061786 Win=17520 Len=1460 [TCP segment
56	1.119858	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232166981 Ack=883061786 Win=17520 Len=1460 [TCP segment
57	1.120902	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232168441 Ack=883061786 Win=17520 Len=1460 [TCP segment
58	1.121891	192.168.1.102	128.119.245.12	TCP	946 1161 → 80 [PSH, ACK]	Seq=232169901 Ack=883061786 Win=17520 Len=892 [TCP segment
59	1.200421	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232164061 Win=62780 Len=0
60	1.265026	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232166981 Win=62780 Len=0
61	1.302074	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232169901 Win=62780 Len=0
62	1.389886	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]	Seq=883061786 Ack=232170793 Win=62780 Len=0
63	1.390110	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232170793 Ack=883061786 Win=17520 Len=1460 [TCP segment
64	1.390824	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232172253 Ack=883061786 Win=17520 Len=1460 [TCP segment
65	1.201682	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK]	Seq=232172712 Ack=883061786 Win=17520 Len=1460 [TCP segment

- Throughput = Total amount data / Total transmission time

1	0.000000	192.168.1.102	128.119.245.12	TCP	62 1161 → 80 [SYN] Seq=232129012 Win=16384 Len=0 MSS=1460 SACK_PERM
2	0.023172	128.119.245.12	192.168.1.102	TCP	62 80 → 1161 [SYN, ACK] Seq=883061785 Ack=232129013 Win=5840 Len=0 MSS=1460
3	0.023265	192.168.1.102	128.119.245.12	TCP	54 1161 → 80 [ACK] Seq=232129013 Ack=883061786 Win=17520 Len=0
4	0.026477	192.168.1.102	128.119.245.12	TCP	619 1161 → 80 [PSH, ACK] Seq=232129013 Ack=883061786 Win=17520 Len=565 [TCP segment of data length 565 bytes captured on interface eth0]
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [PSH, ACK] Seq=232129578 Ack=883061786 Win=17520 Len=1460 [TCP segment of data length 1460 bytes captured on interface eth0]
6	0.053937	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232129578 Win=6780 Len=0
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232131038 Ack=883061786 Win=17520 Len=1460 [TCP segment of data length 1460 bytes captured on interface eth0]
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232132498 Ack=883061786 Win=17520 Len=1460 [TCP segment of data length 1460 bytes captured on interface eth0]
9	0.077294	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232131038 Win=8760 Len=0
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232133958 Ack=883061786 Win=17520 Len=1460 [TCP segment of data length 1460 bytes captured on interface eth0]
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232139418 Ack=883061786 Win=17520 Len=1460 [TCP segment of data length 1460 bytes captured on interface eth0]
12	0.124095	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232132498 Win=11680 Len=0
13	0.124185	192.168.1.102	128.119.245.12	TCP	1201 1161 → 80 [PSH, ACK] Seq=232136878 Ack=883061786 Win=17520 Len=1147 [TCP segment of data length 1147 bytes captured on interface eth0]
14	0.169118	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232133958 Win=14600 Len=0
15	0.217299	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232135418 Win=17520 Len=0
197	5.202024	192.168.1.102	128.119.245.12	TCP	326 1161 → 80 [PSH, ACK] Seq=232292781 Ack=883061786 Win=17520 Len=272 [TCP segment of data length 272 bytes captured on interface eth0]
198	5.297257	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232288401 Win=62780 Len=0
199	5.297341	192.168.1.102	128.119.245.12	HTTP	104 POST /etherreal-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
200	5.389471	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232291321 Win=62780 Len=0
201	5.447807	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232293053 Win=62780 Len=0
202	5.455830	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232293103 Win=62780 Len=0
203	5.461175	128.119.245.12	192.168.1.102	HTTP	784 HTTP/1.1 200 OK (text/html)
204	5.598090	192.168.1.100	192.168.1.1	SSDP	174 M-SEARCH * HTTP/1.1
205	5.599082	192.168.1.100	192.168.1.1	SSDP	175 M-SEARCH * HTTP/1.1
206	5.651141	192.168.1.102	128.119.245.12	TCP	54 1161 → 80 [ACK] Seq=232293103 Ack=883062516 Win=16790 Len=0
207	6.101044	192.168.1.100	192.168.1.1	SSDP	174 M-SEARCH * HTTP/1.1
208	6.102069	192.168.1.100	192.168.1.1	SSDP	175 M-SEARCH * HTTP/1.1
209	6.600152	192.168.1.100	192.168.1.1	SSDP	174 M-SEARCH * HTTP/1.1
210	6.601063	192.168.1.100	192.168.1.1	SSDP	175 M-SEARCH * HTTP/1.1
211	7.102852	192.168.1.100	192.168.1.1	SSDP	174 M-SEARCH * HTTP/1.1

Total amount data = 232293103 - 232129013 = 164090 bytes

Total transmission time = 5.455830 - 0.026477 = 5.429353 seconds

Throughout = 164090 / 5.429353 = 30.223 KByte/s

Exercise 2:

No	Source IP	Destination IP	Protocol	Info
295	10.9.16.201	10.9.6.175	TCP	50045 > 5000 [SYN] Seq=2818463618 win=8192 MSS=1460
296	10.9.6.175	10.9.16.201	TCP	5000 > 50045 [SYN, ACK] Seq=1247095790 Ack=2818463619 win=262144 MSS=1460
297	10.9.16.201	10.9.6.175	TCP	50045 > 5000 [ACK] Seq=2818463619 Ack=1247095791 win=65535
298	10.9.16.201	10.9.6.175	TCP	50045 > 5000 [PSH, ACK] Seq=2818463619 Ack=1247095791 win=65535
301	10.9.6.175	10.9.16.201	TCP	5000 > 50045 [ACK] Seq=1247095791 Ack=2818463652 win=262096
302	10.9.6.175	10.9.16.201	TCP	5000 > 50045 [PSH, ACK] Seq=1247095791 Ack=2818463652 win=262144
303	10.9.16.201	10.9.6.175	TCP	50045 > 5000 [ACK] Seq=2818463652 Ack=1247095831 win=65535
304	10.9.16.201	10.9.6.175	TCP	50045 > 5000 [FIN, ACK] Seq=2818463652 Ack=1247095831 win=65535
305	10.9.6.175	10.9.16.201	TCP	5000 > 50045 [FIN, ACK] Seq=1247095831 Ack=2818463652 win=262144
306	10.9.16.201	10.9.6.175	TCP	50045 > 5000 [ACK] Seq=2818463652 Ack=1247095832 win=65535
308	10.9.6.175	10.9.16.201	TCP	5000 > 50045 [ACK] Seq=1247095831 Ack=2818463653 win=262144

1.2818463618

2.1247095790 2818463619 ensure the seqno from client is seqno + 1

3.2818463619 1247095791 No data contained

4. Both client and server do the active close. Because they both send FIN to each other and receive the ack which ACK is previous seqno +1. then close the connection. simultaneous close.

5. client->server = 2818463652 - 2818463619 = 33 bytes

server->client = 1247095831 - 1247095791 = 40 bytes

Final ack - initial seqno - 2 = total transferred data bytes

Like 2818463653 - 2818463618 - 2 = 33 bytes = client->server

This is because the SYN, FIN segments will +1 for ack. And for data segments the ack num is depends on the previous data amount, the ack num is always equal to the previous number + previous data amount.