

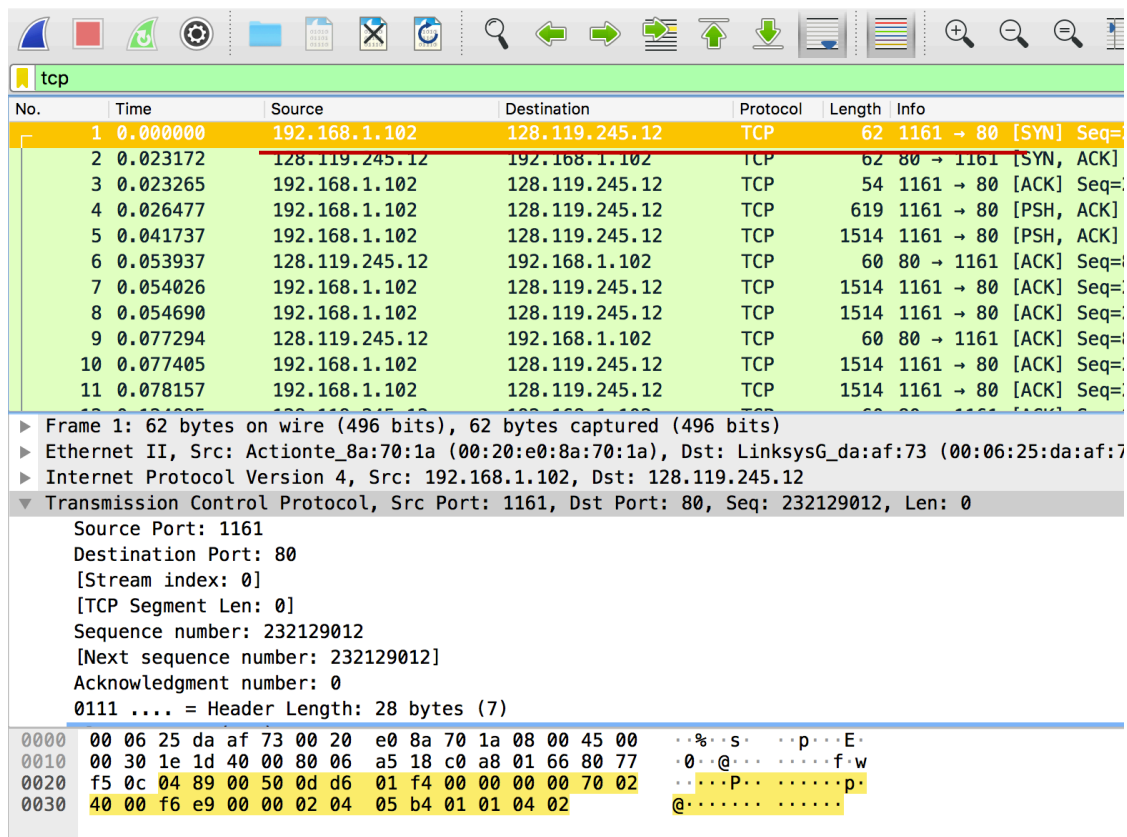
COMP9331 Lab4

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Exercise 1: Understanding TCP using Wireshark

Question 1 . What is the IP address of *gaia.cs.umass.edu*? On what port number is it sending and receiving TCP segments for this connection? 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*?



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=
2	0.023172	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=
4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=

Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)

Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)

Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12

Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 232129012, Len: 0

Source Port: 1161
Destination Port: 80
[Stream index: 0]
[TCP Segment Len: 0]
Sequence number: 232129012
[Next sequence number: 232129012]
Acknowledgment number: 0
0111 = Header Length: 28 bytes (7)

0000 00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00 ..%.s. .p..E.
0010 00 30 1e 1d 40 00 80 06 a5 18 c0 a8 01 66 80 77 .0..@. .f.w
0020 f5 0c 04 89 00 50 0d d6 01 f4 00 00 00 00 70 02P.p.
0030 40 00 f6 e9 00 00 02 04 05 b4 01 01 04 02 @.....

The IP address of *gaia.cs.unmass.edu* is 128.119.245.12.

Sending and receiving TCP segments on port 80.

The IP address and TCP port used by the client computer is 192.186.1.102, port 1161.

Question 2. What is the sequence number of the TCP segment containing the HTTP POST command?

The 4th segment contains the HTTP POST command and the sequence number is 232129013.

tcp							
No.	Time	Source	Destination	Protocol	Length	Info	
1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80	[SYN] Seq=232129012 Win=16
2	0.023172	128.119.245.12	192.168.1.102	TCP	62	80 → 1161	[SYN, ACK] Seq=883061785 Ac
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80	[ACK] Seq=232129013 Ack=88
4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80	[PSH, ACK] Seq=232129013 A
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80	[PSH, ACK] Seq=232129578 A
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161	[ACK] Seq=883061786 Ack=23
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80	[ACK] Seq=232131038 Ack=88
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80	[ACK] Seq=232132498 Ack=88
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161	[ACK] Seq=883061786 Ack=23
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80	[ACK] Seq=232133958 Ack=88
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80	[ACK] Seq=232135418 Ack=88
▶ Flags: 0x018 (PSH, ACK) Window size value: 17520 [Calculated window size: 17520] [Window size scaling factor: -2 (no window scaling used)] Checksum: 0x1fbd [unverified] [Checksum Status: Unverified] Urgent pointer: 0 ▶ [SEQ/ACK analysis] ▶ [Timestamps]							
TCP payload (565 bytes)							
[Reassembled PDU in frame: 199]							
TCP segment data (565 bytes)							
0030	44 70 1f bd 00 00 50 4f	53 54 20 2f 65 74 68 65	Dp...P0 ST /ethe				
0040	72 65 61 6c 2d 6c 61 62	73 2f 6c 61 62 33 2d 31	real-lab s/lab3-1				
0050	2d 72 65 70 6c 79 2e 68	74 6d 20 48 54 50 2f	-reply.htm HTTP/				
0060	31 2e 31 0d 0a 48 6f 73	74 3a 20 67 61 69 61 2e	1.1..Host: gaia.				
0070	63 73 2e 75 6d 61 73 73	2e 65 64 75 0d 0a 55 73	cs.umass .edu..Us				
0080	65 72 2d 41 67 65 6e 74	3a 20 4d 6f 7a 69 6c 6c	er-Agent : Mozill				

Question 3. 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 from the client to the web server? 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 after the receipt of each ACK?

Seq number	TCP segment sent	ACK received	RTT	Estimated RTT
232129013	0.026477	0.053937	0.027460	0.027460
232129578	0.041737	0.077294	0.035557	0.028472
232131038	0.054026	0.124085	0.070059	0.033670
232132498	0.054690	0.169118	0.114428	0.043765
232133958	0.077405	0.217299	0.139894	0.055781
232135418	0.078157	0.267802	0.189645	0.072514

Time	Source	Destination	Protocol	Length	Info
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=1
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=
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
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
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
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
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
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
12 0.124085	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
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
16 0.267802	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232136878 Win=20440 Len=0
17 0.304807	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232138025 Win=23360 Len=0
18 0.305040	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232138025 Ack=883061786 Win=17520 Len=1460 [TCP

Question 4. What is the length of each of the first six TCP segments?

Seq number	TCP segment length
232129013	565
232129578	1460
232131038	1460
232132498	1460
232133958	1460
232135418	1460

Question 5. 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?

The minimum amount of available buffer space is 5840 bytes.
As the buffer space is always larger than segment size, there is no lack of receiver buffer space ever throttle the sender.

Question 6. Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?

I check if there are different packets with same sequence number.
And there is no retransmitted segment.

Question 7. How much data does the receiver typically acknowledge in an ACK? Can you identify cases where the receiver is ACKing every other received segments.

Typically, the receiver acknowledge that data length is 0 bytes.

Question 8. What is the throughput (bytes transferred per unit time) for the TCP connection?

The transfer time is $5.455830 - 0.026477 = 5.429353$ sec

The total data is $232293103 - 232129013 = 164090$ byte.

So the throughput is $164090 / 5.429353 = 30222.754$ byte/sec

Exercise 2: TCP Connection Management

Question 1. What is the sequence number of the TCP SYN segment that is used to initiate the TCP connection between the client computer and server?

The sequence number is 2818463618.

Question 2. What is the sequence number of the SYNACK segment sent by the server to the client computer in reply to the SYN? What is the value of the Acknowledgement field in the SYNACK segment? How did the server determine that value?

The sequence number is 1247095790.

The value of the ACK field is 2818463619.

The sequence number of the SYN segment sent by the client is 2818463618, so the ACK of SYNACK should be $2818463618 + 1 = 2818463619$

Question 3. What is the sequence number of the ACK segment sent by the client computer in response to the SYNACK? What is the value of the Acknowledgment field in this ACK segment? Does this segment contain any data?

The sequence number is 2818463619.

The value of the ACK field is 1247095791.

This segment doesn't contain any data.

Question 4. Who has done the active close? client or the server? how you have determined this? What type of closure has been performed? 3 Segment (FIN/FINACK/ACK), 4 Segment (FIN/ACK/FIN/ACK) or Simultaneous close?

The client and the server both close the connection.

The first FINACK is sent by the client.

The closure type is simultaneous close.

Question 5. *How many data bytes have been transferred from the client to the server and from the server to the client during the whole duration of the connection? What relationship does this have with the Initial Sequence Number and the final ACK received from the other side?*

The data transfer period is NO.298, 301, 302 and 303.

The sequence number of 298 is 2818463619 while ACK is 1247095791.

The sequence number of 303 is 2818463652 while ACK is 1274095831.

The data transfer from the client to the server is $2818463652 - 2818463619 = 33$.

The data transfer from the server to the client is $1274095831 - 1247095791 = 40$.

From the client to the server, the initial sequence number is 2818463618, and final ACK received from the other side is 2818463652. It is the data transferred add 1 byte SYN.

From the server to the client, the initial sequence number is 1247095790, and final ACK received from the other side is 1274095831. It is the data transferred add 1 byte SYN.