

Comp9331 Lab4

StudentID: z5184142

StudentName: JiachenLi

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`?

Answer:

The IP address of `gaia.cs.umass.edu` is 128.119.245.12. The port number is 80 which is used to send and receive TCP segments for this connection. The IP address of the client is 192.168.1.102 and the port number is 1161.

The image shows a Wireshark packet capture of a TCP connection. The top pane displays a list of packets. Packet 1 is a SYN segment from 192.168.1.102 to 128.119.245.12 on port 80. The middle pane shows the details of the selected packet (Packet 1), including Ethernet II, Internet Protocol Version 4, and Transmission Control Protocol. The bottom pane shows the raw packet data in hexadecimal and ASCII.

No.	Time	Source	Destination	Protocol	Length	Info
1	2004-08-21 13:44:20.570381	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	2004-08-21 13:44:20.593553	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_PERM=1
3	2004-08-21 13:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=232129013 Ack=883061786 Win=17520 Len=0
4	2004-08-21 13:44:20.596858	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 a reassembled PDU]
5	2004-08-21 13:44:20.612118	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 a reassembled PDU]
6	2004-08-21 13:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232129578 Win=6780 Len=0
7	2004-08-21 13:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232131038 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8	2004-08-21 13:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232132498 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	2004-08-21 13:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232131038 Win=8760 Len=0
10	2004-08-21 13:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232133958 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	2004-08-21 13:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232135418 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
12	2004-08-21 13:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232132498 Win=11680 Len=0
13	2004-08-21 13:44:20.694566	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 a reassembled PDU]
14	2004-08-21 13:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232133958 Win=14600 Len=0
15	2004-08-21 13:44:20.787680	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232135418 Win=17520 Len=0
16	2004-08-21 13:44:20.838183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232136878 Win=28440 Len=0

Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface 0

Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: Linksys_6:da:f7:3 (00:06:25:da:f7:3)

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)
Flags: 0x02 [SYN]
Window size value: 16384
[Calculated window size: 16384]
Checksum: 0xf6e9 [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK permitted
[Timestamps]

0000 00 06 25 da f7 00 20 e0 8a 70 1a 00 00 45 00 ...h.s...p...E
0010 00 30 1e 1d 40 00 00 06 a5 18 c0 a8 01 66 90 77 ...0...f.w
0020 f5 0c 04 89 00 50 0d d6 01 f4 00 00 00 70 82 ...P.....p:
0030 40 00 f6 e9 00 00 02 04 05 b4 01 01 04 02 @.....

Transmission Control Protocol (tcp), 28 bytes

Packets: 213 Displayed: 202 (94.8%)

Profile: Default

The sequence number of the TCP segment containing the HTTP POST command is 232129013.

tcp

Expression...

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No.	Time	A	Source	Destination	Protocol	Length	Info
1	2004-08-21 13:44:20.570381	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	2004-08-21 13:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=883861785 Ack=232129013 Win=5640 Len=0 MSS=1460 SACK_PERM=1	
3	2004-08-21 13:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=232129013 Ack=883861786 Win=17520 Len=0	
4	2004-08-21 13:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=232129013 Ack=883861786 Win=17520 Len=565 [TCP segment of a reassembled PDU]	
5	2004-08-21 13:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=232129578 Ack=883861786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]	
6	2004-08-21 13:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883861786 Ack=232129578 Win=6780 Len=0	
7	2004-08-21 13:44:20.624487	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232131038 Ack=883861786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]	
8	2004-08-21 13:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232132498 Ack=883861786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]	
9	2004-08-21 13:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883861786 Ack=232131038 Win=8760 Len=0	
10	2004-08-21 13:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232133958 Ack=883861786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]	
11	2004-08-21 13:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232135418 Ack=883861786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]	
12	2004-08-21 13:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883861786 Ack=232132498 Win=11680 Len=0	
13	2004-08-21 13:44:20.694566	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=232136878 Ack=883861786 Win=17520 Len=1147 [TCP segment of a reassembled PDU]	
14	2004-08-21 13:44:20.730499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883861786 Ack=232133958 Win=11680 Len=0	
15	2004-08-21 13:44:20.787690	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883861786 Ack=232135418 Win=17520 Len=0	
16	2004-08-21 13:44:20.838183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883861786 Ack=232136878 Win=20440 Len=0	
17	2004-08-21 13:44:20.875188	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883861786 Ack=232138025 Win=23360 Len=0	
18	2004-08-21 13:44:20.875421	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232138025 Ack=883861786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]	

Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits)

II, Src: Actiotech-Ba701a (00:20:e8:ba:70:1a), Dst: LinksysG_dara7f3 (00:06:25:da:a7:f3)

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

Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 232129013, Ack: 883861786, Len: 565

Source Port: 1161

Destination Port: 80

[Stream index: 0]

TCP Segment Len: 565

Sequence number: 232129013

[Next sequence number: 232129578]

Acknowledgment number: 883861786

0101 = Header Length: 20 bytes (5)

P: 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]

0000 00 06 25 da a7 73 00 20 e8 ba 70 1a 00 00 45 00 -%s:p:~E

0010 02 5d 1e 21 40 00 00 06 a2 e7 c0 a8 01 66 80 7f -J|g:~.....f~w

0020 05 f6 04 89 00 50 00 06 01 f5 34 72 01 5a 50 18 -.....P.....4~f~P

0030 44 70 1f ba 00 50 00 a7 53 5a 20 2f 5a 68 65 05 -.....a.....P.....

0040 72 65 61 6c 2d 61 62 73 2f 6c 61 62 33 2d 31 -real~lab s/lab3~u

0050 24 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 2f -r~p~l~t~n HTTP/

0060 31 2e 01 48 48 6f 73 74 3a 20 67 69 61 62 e -1~.~Hos t: gaia

0070 63 73 2e 75 6d 61 73 73 2e 65 64 75 80 05 53 -e~s~u~m~a~s~.e~d~u~

0080 65 72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c -e~r~A~g~e~n~t~:~M~o~z~i~l~

0090 61 25 3e 20 28 28 57 69 6e 64 6f 77 73 3b 20 -a~f~5~b~.~(W~i~n~d~o~w~s~:~

0100 55 3b 20 57 69 6e 64 6f 77 73 20 4e 54 20 3e 2e -U~W~i~n~d~o~w~N~T~S~

0110 31 3b 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 30 -i~e~n~U~S~:~r~v~1~0~

0120 2e 32 29 2d 47 65 63 06 6f 2f 32 30 30 33 32 -~f~G~e~c~k~o~f~2003082

0130 00 3b 20 45 74 73 63 61 70 65 2f 37 2e 30 32 -U~N~e~t~s~c~a~p~e~7~0~2

0140 00 0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 78 -~A~c~c~e~p~t~:~t~e~x~t~x

0150 60 6c 2e 61 70 78 69 69 63 61 74 69 6f 6f 2f 78 -m~l~a~p~p~l~i~c~a~t~i~o~n~x

0160 6c 2e 61 70 78 69 69 63 61 74 69 6f 6f 2f 78 -m~l~a~p~p~l~i~c~a~t~i~o~n~x

data segment (fz) in reassembled of a lower-level protocol (fz segment data). RPS bytes

Packets: 215. Discarded: 207 (94.8%)

Profile: Default

Fifth: 232133958. Sixth: 232135418.

The time each segment sent is

First: 2004-08-21 13:44:20.596858. Second: 2004-08-21 13:44:20.612118.
Third: 2004-08-21 13:44:20.624407. Fourth: 2004-08-21 13:44:20.625071.
Fifth: 2004-08-21 13:44:20.647786. Sixth: 2004-08-21 13:44:20.648538.

The time of ACK for each segment received is

First: 2004-08-21 13:44:20.624318. Second: 2004-08-21 13:44:20.647675.
Third: 2004-08-21 13:44:20.694466. Fourth: 2004-08-21 13:44:20.739499.
Fifth: 2004-08-21 13:44:20.787680. Sixth: 2004-08-21 13:44:20.838183.

The RTT of each segment is

First: 27.460ms. Second: 35.557ms.
Third: 70.059ms. Fourth: 114.428ms.
Fifth: 139.894ms. Sixth: 189.645ms.

The EstimatedRTT value is

First: 27.460ms. Second: 28.472ms.
Third: 33.670ms. Fourth: 43.765ms.
Fifth: 55.781ms. Sixth: 72.514ms.

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

Answer:

The length of the first TCP segments is 565bytes.
The length of the second TCP segments is 1460bytes.
The length of the third TCP segments is 1460bytes.
The length of the forth TCP segments is 1460bytes.
The length of the fifth TCP segments is 1460bytes.
The length of the sixth TCP segments is 1460bytes.

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 the available buffer space advertised at the receiver for the entire trace is 5840bytes. Yes, the lack of receiver buffer space will 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?

Answer:

There are no retransmitted segments in the trace file. I have checked SEQ/ACK analysis in order to answer this question.

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 segment (recall the discussion about delayed acks from the lecture notes or Section 3.5 of the text).

Answer:

The receiver typically acknowledge 1460 bytes of data in an ACK.

18	2004-08-21 13:44:20.875421	192.168.1.102	128.119.245.12	TCP	1514	1161	→ 80	[ACK] Seq=232138025 Ack=883061786 Win=17520 Len=1460	[TCP segment of a reassemb
19	2004-08-21 13:44:20.876194	192.168.1.102	128.119.245.12	TCP	1514	1161	→ 80	[ACK] Seq=232139485 Ack=883061786 Win=17520 Len=1460	[TCP segment of a reassemb
20	2004-08-21 13:44:20.877073	192.168.1.102	128.119.245.12	TCP	1514	1161	→ 80	[ACK] Seq=232140945 Ack=883061786 Win=17520 Len=1460	[TCP segment of a reassemb
21	2004-08-21 13:44:20.877952	192.168.1.102	128.119.245.12	TCP	1514	1161	→ 80	[ACK] Seq=232142405 Ack=883061786 Win=17520 Len=1460	[TCP segment of a reassemb
22	2004-08-21 13:44:20.879080	192.168.1.102	128.119.245.12	TCP	1514	1161	→ 80	[ACK] Seq=232143865 Ack=883061786 Win=17520 Len=1460	[TCP segment of a reassemb

Question 8: What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.

Answer:

The throughput for the TCP connection is 30222.75398 bytes per unit time.

The first transfer sequence number from the client to the server is 232129013, and the last acknowledge number from the server to the client is 232293103.

The time of sending the first packet is 13:44:20.596858, the time of receiving the last packet is 13:44:26.026211. So the throughput is $(232293103 - 23219013) / (6.026211 - 0.596858) = 30222.75398$.

First Sequence Number and sending time:

4	2004-08-21 13:44:20.596858	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 a re...
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Last Acknowledge Number and receiving time:

202	2004-08-21 13:44:26.026211	128.119.245.12	192.168.1.102	TCP	60	80	→	1161	[ACK]	Seq=883061786	Ack=232293103	Win=62780	Len=0	
203	2004-08-21 13:44:26.031556	128.119.245.12	192.168.1.102	HTTP	784	HTTP/1.1 200 OK (text/html)								

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?

Answer:

The sequence number of the TCP SYN segment this is used to initiate the TCP connection between the client and server 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?

Answer:

The sequence number of the SYNACK segment sent by the server to the client computer in reply to the SYN is 1247095790. The value of the Acknowledgement field in the SYNACK segment is 2818463619. The server determined this value based on the sequence number that sent from the client and the data length of the packet.

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?

Answer:

The sequence number of the ACK segment sent by the client computer in response to the SYNACK is 2818463619. The value of the Acknowledgement field in this ACK segment is 1247095791. No data is contained in this segment.

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?

Answer:

Both have done the active close, because if the client or the server be the active close, then the sequence number of the packet would plus 1. However, the sequence number of the client and server has not been changed. So, it can be determined that both of them do the active close.

304	10.9.16.201	10.99.6.175	TCP	50045 > 5000 [FIN, ACK] Seq=2818463652 Ack=1247095831 win=65535
305	10.99.6.175	10.9.16.201	TCP	5000 > 50045 [FIN, ACK] Seq=1247095831 Ack=2818463652 win=262144

Simultaneous closure has been performed.

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?

Answer”

33 data bytes have been transferred from the client to the server and 40 data types from the server to the client during the whole duration of the connection. The final ACK received from the other side equals to the amount of data types plus the initial sequence number.