

Lab 4

Exercise 1: Understanding TCP using Wireshark

Question 1:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161→80
2	0.023172	128.119.245.12	192.168.1.102	TCP	62	80→1161

The IP address of gaia.cs.umass.edu is 128.119.245.12, port number is 80. The IP address and TCP port number of the client is 192.168.1.102 and 1161 respectively.

Question 2:

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

The sequence number of the TCP segment containing HTTP POST command is 232129013 which is the same as the previous ACK number.

Question 3:

4	0.026477	192.168.1.102	128.119.245.12	TCP	619	[TCP segment of a reassembled PDU]
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80→1161 [ACK] Seq=883061786 Ack=232129013 Win=17520 Len=0
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80→1161 [ACK] Seq=883061786 Ack=232129013 Win=17520 Len=0
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]

$$\text{EstimatedRTT} = 0.875 * \text{EstimatedRTT} + 0.125 * \text{SampleRTT}$$

Seq.No	Time sent	Time ACK received	SampleRTT	EstimatedRTT
1. 232129013	0.026477	0.053937	0.02746	0.02746
2. 232129578	0.041737	0.077294	0.035557	0.028472
3. 232131038	0.054026	0.124085	0.0070059	0.03367
4. 232132498	0.054690	0.169118	0.114428	0.043765
5. 232133958	0.077405	0.217299	0.139894	0.055781
6. 232135418	0.078157	0.267802	0.189645	0.072514

Question 4:

▶ Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
▼ Transmission Control Protocol, Src Port: 1161, Dst Port: 80
Source Port: 1161 (1161)
Destination Port: 80 (80)
[Stream index: 0]
[TCP Segment Len: 1460]
Sequence number: 232135418
[Next sequence number: 232136878]

The length of each of the first six segments can be find in [TCP Segment Len] which are 565, 1460, 1460, 1460, 1460, 1460 respectively.

Question 5:

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▼ Transmission Control Protocol, Src Port: 80 (80)
  Source Port: 80 (80)
  Destination Port: 1161 (1161)
  [Stream index: 0]
  [TCP Segment Len: 0]
  Sequence number: 883061785
  Acknowledgment number: 232129013
  Header Length: 28 bytes
  ▶ ... 0000 0001 0010 = Flags: 0x012 (SYN, ACK)
  Window size value: 5840
  [Calculated window size: 5840]
  ▶ Checksum: 0x774d [validation disabled]
  Urgent pointer: 0
  ▶ Options: (8 bytes), Maximum segment size, No-
  ▶ [SEQ/ACK analysis]
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The minimum window size value is 5840 and this is advertised in the [SYN, ACK] segment. The lack of receiver buffer space does not throttle the sender because the sender is constrained by congestion window.

Question 6:

There are no retransmitted segments in the trace file because no sequence number occurs more than once. If a packet is retransmitted it should have the same sequence number as before but there is no such case.

Question 7:

We can know from the trace file that some packets are being ACKed by the receiver individually. However, the receiver also sends ACK for every other received segment because TCP uses delayed ACKs where the receiver waits up to 500ms for the arrival of another in-order segment and then sends a cumulative ACK for both of the received segments.

Question 8:

Throughput = total amount data / transmission time

The first TCP segment starts at 0.026477, the last segment ends at 5.455830, thus the total transmission time is $5.455830 - 0.026477 = 5.429353$ s.

The ACK number of the first TCP segment is 232129013, the ACK number of the last TCP segment is 232293103, thus the total amount data is $232293103 - 232129013 = 164090$.

Throughput is computed as $164090 / 5.429353 = 30.222$ kb/s.

Exercise 2: TCP Connection Management

Question 1:

The sequence number of the TCP SYN segment is 2818463618.

Question 2:

The sequence number of the SYNACK segment sent by the server is 1247095790. ACK is 2818463619. Server has added 1 from client to arrive at the ACK value.

Question 3:

The sequence number sent by the client is 2818463619, ACK is 1247095791. This segment does not contain any data because the sequence number is the same as the later segment 298.

Question 4:

Both the client and server did the active close, because according to segment 304 and 305, both client and server have sent a FIN ACK segment to the other side as their last segment. It indicates that this is a simultaneous close.

Question 5:

The amount of data transferred between the server and the client can be determined by the first file-sending sequence number and the last file-sending ACK for both sides.

$2818463652 - 2818463619 = 33$ bytes data was transferred from client to server.

$1247095831 - 1247095791 = 40$ bytes was transferred from server to client.

The Ack numbers keep track of the length of the data being transferred, so the result of having final ACK from the other side subtract the initial sequence number is the amount of data have been transferred. This result has excluded the SYN and FIN flag because these segments do not contain any data.