

COMPUTER NETWORKS LAB

ROLL NO: 19P0012

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SECTION: BS(CS)-5B

LAB NO: 5 TCP



Q1:

Client IP: 192.168.1.17

Port: 51075

✓ Wireshark · Packet 105 · Wi-Fi > Frame 105: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface \Device\NPF_{6C95DF2E-7C0F-4763-8F77-C9A70E9C6508}, id 0 > Ethernet II, Src: IntelCor_eb:35:c5 (08:71:90:eb:35:c5), Dst: zte_de:b8:c8 (24:d3:f2:de:b8:c8) > Internet Protocol Version 4, Src: 192.168.1.17, Dst: 128.119.245.12 ▼ Transmission Control Protocol, Src Port: 51077, Dst Port: 80, Seq: 0, Len: 0 Source Port: 51077 Destination Port: 80 [Stream index: 12] [TCP Segment Len: 0] Sequence Number: 0 (relative sequence number) Sequence Number (raw): 1759647340 [Next Sequence Number: 1 (relative sequence number)] Acknowledgment Number: 0 Acknowledgment number (raw): 0 1000 = Header Length: 32 bytes (8) > Flags: 0x002 (SYN) 0000 24 d3 f2 de b8 c8 08 71 90 eb 35 c5 08 00 45 00 \$.....q ..5...E. -4D-@----w 0010 00 34 44 0b 40 00 80 06 00 00 c0 a8 01 11 80 77 0020 f5 0c c7 85 00 50 68 e2 16 6c 00 00 00 00 80 02 ·····Ph· ·1····· 0030 fa f0 37 64 00 00 02 04 05 b4 01 03 03 08 01 01 · · 7d · · · · · · · · · · · ·

Q2:

Server IP: 128.119.245.12

Port used by server end: 80

✓ Wireshark · Packet 105 · Wi-Fi

```
> Frame 105: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface \Device\NPF_{6C95DF2E-7C0F-4763-8F77-C9A70E9C6508}, id 0
> Ethernet II, Src: IntelCor_eb:35:c5 (08:71:90:eb:35:c5), Dst: zte_de:b8:c8 (24:d3:f2:de:b8:c8)
> Internet Protocol Version 4, Src: 192.168.1.17, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 51077, Dst Port: 80, Seq: 0, Len: 0
    Source Port: 51077
    Destination Port: 80
    [Stream index: 12]
    [TCP Segment Len: 0]
    Sequence Number: 0
                        (relative sequence number)
    Sequence Number (raw): 1759647340
    [Next Sequence Number: 1 (relative sequence number)]
    Acknowledgment Number: 0
    Acknowledgment number (raw): 0
    1000 .... = Header Length: 32 bytes (8)
  > Flags: 0x002 (SYN)
0000 24 d3 f2 de b8 c8 08 71 90 eb 35 c5 08 00 45 00
                                                       $-----q --5---E-
0010 00 34 44 0b 40 00 80 06 00 00 c0 a8 01 11 80 77
                                                       ·····Ph· ·1·····
0020 f5 0c c7 85 00 50 68 e2 16 6c 00 00 00 00 80 02
0030 fa f0 37 64 00 00 02 04 05 b4 01 03 03 08 01 01
0040 04 02
```

Q3:

```
> Internet Protocol Version 4, Src: 192.168.1.17,
> Transmission Control Protocol, Src Port: 51077,
```

Q4:

The Sequence Number is set as 0 since it is the initiating the TCP connection.

The SYN Flag is set as 1 which identifies this segment to be a SYN segment.

```
Source Port: 1161
  Destination Port: 80
  [Stream index: 0]
  [TCP Segment Len: 0]
  Sequence Number: 0
                       (relative sequence number)
  Sequence Number (raw): 232129012
  [Next Sequence Number: 1
                             (relative sequence number)]
  Acknowledgment Number: 0
  Acknowledgment number (raw): 0
  0111 .... = Header Length: 28 bytes (7)

✓ Flags: 0x002 (SYN)
     000. .... = Reserved: Not set
     ...0 .... = Nonce: Not set
     .... 0... = Congestion Window Reduced (CWR): Not set
     .... .0.. .... = ECN-Echo: Not set
     .... ..0. .... = Urgent: Not set
     .... ...0 .... = Acknowledgment: Not set
     .... 0... = Push: Not set
     .... .... .0.. = Reset: Not set
  > .... ..1. = Syn: Set
                     ria. Nat aat
```

Q5:

The sequence of the SYNACK segment sent by gaia is 0.

The Value in the Acknowledgement field is 1.

This is determined by adding 1 to the sequence number sent by the initial sequence number in the SYN segment sent by the client.

Since the initial sequence number was 0. So, 0+1=1

The SYN and ACK flags are set to be 1, identifying this segment as a SYNACK segment.

```
▼ Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 0, Ack: 1, Len: 0
     Source Port: 80
     Destination Port: 1161
     [Stream index: 0]
     [TCP Segment Len: 0]
     Sequence Number: 0 (relative sequence number)
Sequence Number (raw): 883061785
     [Next Sequence Number: 1 (relative sequence number)]
     Acknowledgment Number: 1
                                 (relative ack number)
     Acknowledgment number (raw): 232129013
     0111 .... = Header Length: 28 bytes (7)

✓ Flags: 0x012 (SYN, ACK)

        000. .... = Reserved: Not set
        ...0 .... = Nonce: Not set
        .... 0... = Congestion Window Reduced (CWR): Not set
        .... .0.. .... = ECN-Echo: Not set
        .....0. ... = Urgent: Not set
.....1 ... = Acknowledgment:
        .... 0... = Push: Not set
         .... .... .0.. = Reset: Not set
      > .... .... .<mark>.1. = Syn:</mark>
        .... Not set
```

Q6:

The sequence number for the segment containing the POST command is 1.

```
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
     Source Port: 1161
     Destination Port: 80
     [Stream index: 0]
     [TCP Segment Len: 565]
    Sequence Number: 1
                         (relative sequence number)
     Sequence Number (raw): 232129013
     [Next Sequence Number: 566
                                  (relative sequence number)]
     Acknowledgment Number: 1
                                (relative ack number)
     Acknowledgment number (raw): 883061786
     0101 .... = Header Length: 20 bytes (5)

✓ Flags: 0x018 (PSH, ACK)

0000 00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00
                                                       --%--s- --p---E-
                                                       -]-!@----f-w
0010 02 5d 1e 21 40 00 80 06 a2 e7 c0 a8 01 66 80 77
0020 f5 0c 04 89 00 50 0d d6 01 f5 34 a2 74 1a 50 18
                                                       .....<u>P...</u>..4.t.P.
                                                       Dp --- PO ST /ethe
0030 44 70 1f bd 00 00 50 4f 53 54 20 2f 65 74 68 65
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 54 50 2f
                                                       -reply.h tm HTTP/
2050 21 20 21 Ad 00 40 CF 72 74 20 20 C7 C1 C0 C1 20
```

Q7:

The first 6 segments are 4,5,7,8,10 and 11

3 0.023265	192.168.1.102	128.119.245.12	TCP	54 1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
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 12/025	128 119 2//5 12	192 168 1 102	TCP	60 80 → 1161 [ΔCK] Sea-1 Δck-3/86 Win-11680 Len-0

The first 6 Acknowledgments are 6, 9, 12, 14, 15, 16

J U.U-1/J/	172.100.1.102	120.117.277.12	101	THE THOE YOU FIND SENT SENT SENT MENT THE THE TOTAL FENT TOO FIND SERVICE OF A FEAST MENT OF A FEAST MENT OF A
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
15 0.217299	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16 0.267802	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0

Segment No.	Sequence No.	Sent time	ACK received	RTT
			time	
1	1	0.026477	0.053937	0.027460
2	566	0.041737	0.077294	0.035557
3	2026	0.054026	0.124085	0.070059
4	3486	0.054690	0.169118	0.114428
5	4946	0.077405	0.217299	0.139894
6	6406	0.078157	0.267802	0.189645

Estimated RTT Formula: 0.875 * Estimated RTT + 0.125 * Sample RTT

Estimated RTT after ACK of segment 1:

Estimated RTT = RTT for segment 1 = 0.027460

Estimated RTT after ACK of segment 2:

Estimated RTT = 0.875*0.027460 + 0.125*0.035557 = 0.028472125

Estimated RTT after ACK of segment 3:

Estimated RTT = 0.875*0.028472125 + 0.125*0.070059 = 0.03367048438

Estimated RTT after ACK of segment 4:

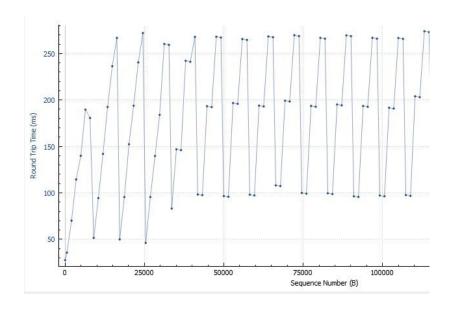
Estimated RTT = 0.875*0.03367048438 + 0.125*0.114428 = 0.04376517383

Estimated RTT after ACK of segment 5:

Estimated RTT = 0.875*0.04376517383 + 0.125*0.139894 = 0.0557812771

Estimated RTT after ACK of segment 6:

Estimated RTT = 0.875*0.0557812771 + 0.125*0.189645 = 0.07251424246



Q8:

4 0.024265 192.168.1.102 128.119.245.12 TCP 54 1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=166 [TCP segment of a reassembled PDU] 5 0.041737 192.168.1.102 128.119.245.12 TCP 1514 1161 → 80 [PSH, ACK] Seq=666 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 [TCP segment of a reassembled PDU] 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=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU] 12 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] 12 0.078157 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] 12 0.078405 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] 12 0.078405 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=4046 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU] 12 0.078405 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=4046 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU] 12 0.078405 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=4046 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU] 12 0.078405 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=4046 Ack=1 Win=17520 [ACK] Seq=4046 Ack=1					
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=4946 Ack=2026 Win=8760 Len=0 1460 [TCP segment of a reassembled PDU] 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] 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]	3 0.023265	192.168.1.102	128.119.245.12	TCP	54 1161 → 80 [ACK] Seq=1 Ack=1 Win=1/520 Len=0
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]	4 0.026477	192.168.1.102	128.119.245.12	TCP	
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= 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]	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]
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]	6 0.053937	128.119.245.12	192.168.1.102	TCP	
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]	7 0.054026	192.168.1.102	128.119.245.12	TCP	
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]	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]
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]	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]
12 0 12/085 128 110 2/5 12 102 168 1 102 TCP 60 80 → 1161 [ΔCK] Sen-1 Δck-3/086 Win-11680 len-0	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 12/025	128 119 2/15 12	192 168 1 102	TCP	60 80 → 1161 [ΔCK] Seg-1 Δck-3/86 Win-11680 Len-0

Q9:

Minimum amount of available buffer space advertised is 5840, which can be seen in the first ACK segment sent by the server.

Receiving window grows until it reaches the maximum receiver buffer size of 62780 bytes. According to the trace, the sender is never throttled due to the lack of receiver buffer space.

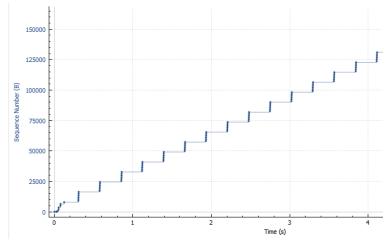
```
✓ Flags: 0x012 (SYN, ACK)

    000. .... = Reserved: Not set
     ...0 .... = Nonce: Not set
     .... 0... = Congestion Window Reduced (CWR): Not set
     .... .0.. .... = ECN-Echo: Not set
    .... ..0. .... = Urgent: Not set
    .... = Acknowledgment: Set
     .... 0... = Push: Not set
     .... .... .0.. = Reset: Not set
    .... .... ..1. = Syn: Set
     > [Expert Info (Chat/Sequence): Connection establish acknowledge (SYN+ACK): server port 80]
     .... .... 0 = Fin: Not set
    [TCP Flags: ······A··S·]
 Window: 5840
  [Calculated window size: 5840]
 Checksum: 0x774d [unverified]
```

Q10:

No, there are no retransmitted segments in this trace file. There are two ways to find retransmitted packets.

- 1. Packet tracer tells you if a packet is retransmitted.
- 2. By plotting a time-sequence graph, we can see that if there is a point where the sequence number drops, then a packet has been retransmitted, but as you can see in the graph below, sequence numbers are continuously increasing.



Q11:

By subtracting the acknowledgment numbers between 2 messages, we can know how much data has been received between the two acknowledgement segments. An example of acknowledging every other segment is given below and the data received between this is (2026-566) = 1460.

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=
8 0.054690	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=34 <mark>86 Ack=1</mark> Win=17520 Len=
9 0.077294	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 <mark>Ack=2026</mark> Win=8760 Len=0
				and a second control of the second control o

Q12:

The size of the alice.txt file is 152,138 bytes.

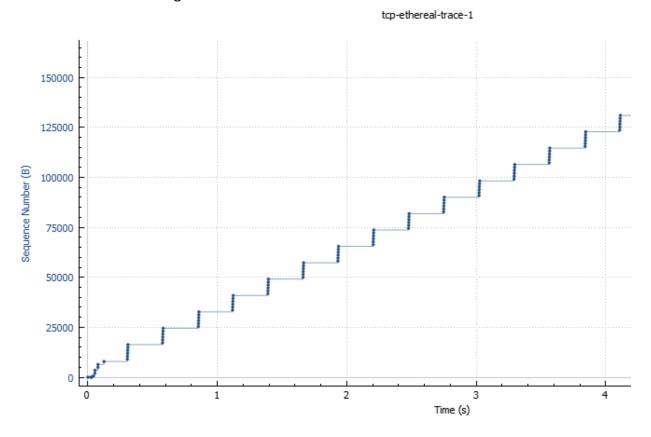
The time taken to download the file = Time for the first TCP segment - Time for the last ACK segment.

So, download time => 5.455830 - 0.026477 = 5.429353.

Throughput = total bytes/total time taken => 152,138/5.429353 = 28021.3867 bytes/second.

Q13:

As we can see from this graph, the slow start phase starts from 0 seconds and lasts till about 0.17 seconds. There is no congestion avoidance seen here since the size of the segments remains the same throughout.



Q14:

Uploading alice.txt from my own pc:

Throughput:

Total size of file = 152,138 bytes.

Time for first segment = 3.446536

67 3.446536 192.168.1.6 128.119.245.12 TCP 776 61886 → 80 [PSH, ACK]

Time for last ack = 5.430754

292 5.430754 192.168.1.6 128.119.245.12 TCP 54 61886 + 80 [ACK]

Total time taken to upload: 5.430754 - 3.446536 = 1.984218Throughput = 152,138/1.984218 = 76,674.0348 bytes/second.

Time Sequence Graph:

