

Name : Waqar Ahmed

Roll No : P200750

LabTask : 10

Instructor : Maa'm Hurmat

Task : Inspect the three-way handshake and answer the following questions:

1. What is the source and destination port numbers?

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.122	64.238.147.113	TCP	78	60643 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=8 TSval=256679793 TSecr=0 SACK_PERM
2	0.000010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1380 SACK_PERM TSval=4016893437 TSecr=256679793 WS=4
3	0.000000	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0 TSval=256679881 TSecr=4016893437
4	0.000579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0 TSval=4016893527 TSecr=256679881
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245 TSval=4016893528 TSecr=256679881 [TCP segment of a reassembled data stream]
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0 TSval=256679970 TSecr=4016893528
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368 TSval=4016893538 TSecr=256679881 [TCP segment of a reassembled data stream]
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reassembled data stream]
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0 TSval=256680057 TSecr=4016893538
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=2982 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reassembled data stream]
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reassembled data stream]
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0 TSval=256680144 TSecr=4016893615
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reassembled data stream]
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reassembled data stream]
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0 TSval=256680144 TSecr=4016893703

> Frame 1: 78 bytes on wire (624 bits), 78 bytes captured (624 bits) on interface 0
> Ethernet II, Src: Apple_ac:6c:26:10:9a:dd, Dst: CiscoLinksys_e3:e9:8d (00:16:b6:26:10:9a:dd), Protocol: Internet Protocol Version 4, Src: 192.168.1.122, Dst: 64.238.147.113
▼ Transmission Control Protocol, Src Port: 60643, Dst Port: 80, Seq: 0, Len: 0
Source Port: 60643
Destination Port: 80
[Stream index: 0]
> [Conversation completeness: Complete, WITH_DATA (31)]
[TCP Segment Len: 0]
Sequence Number: 0 (relative sequence number)
Sequence Number (raw): 2682012317
[Next Sequence Number: 1 (relative sequence number)]
Acknowledgment Number: 0
Acknowledgment number (raw): 0
1011 = Header Length: 44 bytes (11)
> Flags: 0x002 (SYN)
Window: 65535
[Calculated window size: 65535]

2. What is the sequence number of the TCP SYN segment that is used to initiate the TCP connection? What is it in the segment that identifies the segment as a SYN segment?

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.122	64.238.147.113	TCP	78	60643 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=0 TSval=256679793 TSecr=0 SACK_PERM
2	0.000010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1380 SACK_PERM TSval=4016893437 TSecr=256679793 WS=4
3	0.000080	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0 TSval=256679881 TSecr=4016893437
4	0.000579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0 TSval=4016893527 TSecr=256679881
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245 TSval=4016893528 TSecr=256679881 [TCP segment of a reas
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0 TSval=256679970 TSecr=4016893528
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368 TSval=4016893538 TSecr=256679881 [TCP segment of a reass
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reass
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0 TSval=256680057 TSecr=4016893538
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=2982 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reass
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0 TSval=256680144 TSecr=4016893615
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0 TSval=256680144 TSecr=4016893703

To Identify the segment that is it a SYN Segment check it SYN bit is set to 1 or not. If the SYN bit is set to 1 that means it is a SYN Segment. The segment I am inspecting is SYN because SYN bit is 1.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.122	64.238.147.113	TCP	78	60643 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=0 TSval=256679793 TSecr=0 SACK_PERM
2	0.000010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1380 SACK_PERM TSval=4016893437 TSecr=256679793 WS=4
3	0.000080	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0 TSval=256679881 TSecr=4016893437
4	0.000579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0 TSval=4016893527 TSecr=256679881
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245 TSval=4016893528 TSecr=256679881 [TCP segment of a reas
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0 TSval=256679970 TSecr=4016893528
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368 TSval=4016893538 TSecr=256679881 [TCP segment of a reass
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reass
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0 TSval=256680057 TSecr=4016893538
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=2982 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reass
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0 TSval=256680144 TSecr=4016893615
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0 TSval=256680144 TSecr=4016893703

3. 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 server determine that value? What is it in the segment that identifies the segment as a SYNACK segment?

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.122	64.238.147.113	TCP	78	60643 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=8 TSval=256679793 TSecr=0 SACK_PERM
2	0.000010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1380 SACK_PERM TSval=4016893437 TSecr=256679793 WS=4
3	0.000000	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0 TSval=256679881 TSecr=4016893437
4	0.000579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0 TSval=4016893527 TSecr=256679881
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245 TSval=4016893528 TSecr=256679881 [TCP segment of a reas
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0 TSval=256679970 TSecr=4016893528
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368 TSval=4016893538 TSecr=256679881 [TCP segment of a reasse
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reasse
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0 TSval=256680057 TSecr=4016893538
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=2982 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reasse
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reasse
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0 TSval=256680144 TSecr=4016893615
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reasse
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reasse
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0 TSval=256680144 TSecr=4016893703

> Frame 2: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) > Ethernet II, Src: CiscoLinksys_e3:e9:8d (00:16:b6:e3:e9:8d), Dst: Apple_ac:6c:26 (10:9a:dd:00:3c:00), Protocol Version 4, Src: 64.238.147.113, Dst: 192.168.1.122						
> Transmission Control Protocol, Src Port: 80, Dst Port: 60643, Seq: 0, Ack: 1, Len: 0 Source Port: 80 Destination Port: 60643 [Stream index: 0] > [Conversation completeness: Complete, WITH_DATA (31)] [TCP Segment Len: 0] Sequence Number: 0 (relative sequence number) Sequence Number (raw): 349487776 [Next Sequence Number: 1 (relative sequence number)] Acknowledgment Number: 1 (relative ack number) Acknowledgment number (raw): 2682012318 1010 = Header Length: 40 bytes (10) > Flags: 0x012 (SYN, ACK)						
0000	10 9a dd ac 6c 26 00 16	b6 e3 e9 8d 00 00 45 2018.....E			
0010	00 3c 00 00 40 00 2d 06	b7 1a 40 ee 93 71 c0 a8	...@...@...@...			
0020	01 7a 00 50 ec e3 14 d4	c2 a0 9f dc 42 9e 00 12	...P...@...B...			
0030	16 a0 67 d7 00 00 02 04	05 64 04 02 08 0a ef 6c	...g....d....1...			
0040	ed fd 0f 4c 9f 71 01 03	03 02	...L;q....			

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.122	64.238.147.113	TCP	78	60643 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=8 TSval=256679793 TSecr=
2	0.000010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1380 SACK_PERM TSval=4
3	0.000000	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0 TSval=256679881 TSecr=4016893
4	0.000579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0 TSval=4016893527 TSecr=256679
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245 TSval=4016893528 TSecr
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0 TSval=256679970 TSecr=401
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368 TSval=4016893538 TSecr=2
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0 TSval=256680057 TSecr=40
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=2982 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0 TSval=256680144 TSecr=40
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0 TSval=256680144 TSecr=40

> [Conversation completeness: Complete, WITH_DATA (31)] [TCP Segment Len: 0] Sequence Number: 0 (relative sequence number) Sequence Number (raw): 349487776 [Next Sequence Number: 1 (relative sequence number)] Acknowledgment Number: 1 (relative ack number) Acknowledgment number (raw): 2682012318 1010 = Header Length: 40 bytes (10) > Flags: 0x012 (SYN, ACK) Window: 5792 [Calculated window size: 5792] Checksum: 0x6d7 [unverified] [Checksum Status: Unverified]						
0000	10 9a dd ac 6c 26 00 16	b6 e3 e9 8d 00 00 45 2018.....E			
0010	00 3c 00 00 40 00 2d 06	b7 1a 40 ee 93 71 c0 a8	...@...@...@...			
0020	01 7a 00 50 ec e3 14 d4	c2 a0 9f dc 42 9e a0 12	...P...@...B...			
0030	16 a0 67 d7 00 00 02 04	05 64 04 02 08 0a ef 6c	...g....d....1...			
0040	ed fd 0f 4c 9f 71 01 03	03 02	...L;q....			

Server determines the value of Acknowledgement field by adding 1 in the previous segment sequence number.

Previous segment sequence number:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.122	64.238.147.113	TCP	78	60643 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=0 TSval=256679793 TSecr=0 SACK_PERM
2	0.000010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1380 SACK_PERM TSval=4016893437 TSecr=256679793 WS=4
3	0.000000	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0 TSval=256679881 TSecr=4016893437
4	0.000579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0 TSval=4016893527 TSecr=256679881
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245 TSval=4016893528 TSecr=256679881 [TCP segment of a reas
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0 TSval=256679970 TSecr=4016893528
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368 TSval=4016893538 TSecr=256679881 [TCP segment of a reass
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=256679970 [TCP segment of a reass
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0 TSval=256680057 TSecr=4016893538
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12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0 TSval=256680144 TSecr=4016893615
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=256680057 [TCP segment of a reass
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0 TSval=256680144 TSecr=4016893703

> Frame 1: 78 bytes on wire (624 bits), 78 bytes captured (624 bits)

> Ethernet II, Src: Apple_ac:6c:26 (10:9a:dd:ac:6c:26), Dst: CiscoLinksys_e3:e9:8d (00:16:b6:00:00:00)

> Internet Protocol Version 4, Src: 192.168.1.122, Dst: 64.238.147.113

> Transmission Control Protocol, Src Port: 60643, Dst Port: 80, Seq: 0, Len: 0

Source Port: 60643

Destination Port: 80

[Stream index: 0]

> [Conversation completeness: Complete, WITH_DATA (31)]

[TCP Segment Len: 0]

Sequence Number: 0 (relative sequence number)

Sequence Number (raw): 2682012317

[Next Sequence Number: 1 (relative sequence number)]

Acknowledgment Number: 0

Acknowledgment number (raw): 0

1011 = Header Length: 44 bytes (11)

> Flags: 0x002 (SYN)

Window: 65535

[Calculated window size: 65535]

0000 00 16 b6 e3 e9 8d 10 9a dd ac 6c 26 00 00 45 0018..E-

0010 00 40 9f 8a 40 00 40 06 04 ac c0 a8 01 7a 40 ee ..@...@...z@

0020 93 71 ec e3 00 50 9f dc 42 9d 00 00 00 b0 02 ..q..B.....

0030 ff ff 22 12 00 00 02 04 05 b4 01 03 03 01 01L-q.....

0040 08 0a 0f 4c 9f 71 00 00 00 00 04 02 00 00

Acknowledgement number of the second Segment

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.122	64.238.147.113	TCP	78	60643 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=8 TSval=256679793
2	0.088010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1380 SACK_PERM
3	0.088080	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0 TSval=256679881 TSecr=
4	0.088579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0 TSval=4016893527 TSecr=
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245 TSval=4016893528 TSecr=
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0 TSval=256679970 TSecr=
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368 TSval=4016893538 TSecr=
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0 TSval=256680057 TSecr=
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=2982 Ack=192 Win=6864 Len=1368 TSval=4016893615 TSecr=
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0 TSval=256680144 TSecr=
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368 TSval=4016893703 TSecr=
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0 TSval=256680144 TSecr=

> Frame 4: 257 bytes on wire (2056 bits), 257 bytes captured (2056 bits)	0000 00 16 b6 e3 e9 8d 10 9a dd ac 6c 26 08 00
> Ethernet II, Src: Apple_ac:6c:26 (10:9a:dd:ac:6c:26), Dst: CiscoLinksys_e3:e9:8d (00:16:b6:00:02:00)	0010 00 f3 3c d9 40 00 00 06 66 aa c0 a8 01 7a
> Internet Protocol Version 4, Src: 192.168.1.122, Dst: 64.238.147.113	0020 93 71 ec e3 00 50 9f dc 42 9e 14 d4 c2 a1
> Transmission Control Protocol, Src Port: 60643, Dst Port: 80, Seq: 1, Ack: 1, Len: 191	0030 ff ff 2f 5f 00 00 01 01 08 0a 0f 4c 9f c9
Source Port: 60643	0040 ed fd 47 45 54 20 2f 73 69 67 63 6f 6d 6d
Destination Port: 80	0050 30 31 31 2f 70 61 70 65 72 73 2f 73 69 67
[Stream index: 0]	0060 6d 6d 2f 70 32 2e 70 64 66 20 48 54 5a 50
> [Conversation completeness: Complete, WITH_DATA (31)]	0070 2e 31 0d 0a 55 73 65 72 2d 41 67 65 6e 74
[TCP Segment Len: 191]	0080 63 75 72 6c 2f 37 2e 32 31 2e 34 20 28 75
Sequence Number: 1 (relative sequence number)	0090 76 65 72 73 61 6c 2d 61 70 70 6c 65 2d 64
Sequence Number (raw): 2682012318	00a0 77 69 6e 31 31 2e 30 29 20 6c 69 62 63 75
[Next Sequence Number: 192 (relative sequence number)]	00b0 2f 37 2e 32 31 2e 34 20 4f 70 65 6e 53 53
Acknowledgment Number: 1 (relative ack number)	00c0 30 2e 39 2e 38 72 20 7a 6c 69 62 2f 31 2e
Acknowledgment number (raw): 349487777	00d0 35 0d 0a 48 6f 73 74 3a 20 63 6f 6e 66 65
1000 = Header Length: 32 bytes (8)	00e0 6e 63 65 73 2e 73 69 67 63 6f 6d 6d 2e 6f
> Flags: 0x018 (PSH, ACK)	00f0 0d 0a 41 63 63 65 70 74 3a 20 2a 2f 2a 0d
	0100 0a

The **SYN** and **ACK** bit is set to 1. This identify the segment as **SYNACK** segment.

2	0.088010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0
3	0.088080	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0
4	0.088579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=2982 Ack=192 Win=6864 Len=1368
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0

Acknowledgment Number: 1 (relative ack number)	0000 10 9a dd ac 6c 26 08
Acknowledgment number (raw): 2682012318	0010 00 3c 00 00 40 00 2
1010 = Header Length: 40 bytes (10)	0020 01 7a 00 50 ec e3 1
> Flags: 0x012 (SYN, ACK)	0030 16 a0 67 d7 00 00 0
000. = Reserved: Not set	0040 ed fd 0f 4c 9f 71 0
...0 = Accurate ECN: Not set	
....0... = Congestion Window Reduced: Not set	
....0.. = ECN-Echo: Not set	
....0. = Urgent: Not set	
....1... = Acknowledgment: Set	
....0... = Push: Not set	
....0.. = Reset: Not set	
>1. = Syn: Set	
....0 = Fin: Not set	
TCP Flags:A..S..	

What is the length of each of the first six TCP segments?

After Handshaking first http length:

tcp						
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.122	64.238.147.113	TCP	78	60643 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=8 TSval=256679793
2	0.088010	64.238.147.113	192.168.1.122	TCP	74	80 → 60643 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1380 SACK_PERM
3	0.088080	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=1 Ack=1 Win=524280 Len=0 TSval=256679881 TSecr=
4	0.088579	192.168.1.122	64.238.147.113	HTTP	257	GET /sigcomm/2011/papers/sigcomm/p2.pdf HTTP/1.1
5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643 [ACK] Seq=1 Ack=192 Win=6864 Len=0 TSval=4016893527 TSecr=
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643 [PSH, ACK] Seq=1 Ack=192 Win=6864 Len=245 TSval=4016893521
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=246 Win=524280 Len=0 TSval=256679970 TS
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=246 Ack=192 Win=6864 Len=1368 TSval=4016893538
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=1614 Ack=192 Win=6864 Len=1368 TSval=4016893615
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=2982 Win=523944 Len=0 TSval=256680057 TS
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=2982 Ack=192 Win=6864 Len=1368 TSval=4016893615
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=4350 Ack=192 Win=6864 Len=1368 TSval=4016893703
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=5718 Win=523944 Len=0 TSval=256680144 TS
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=5718 Ack=192 Win=6864 Len=1368 TSval=4016893703
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643 [ACK] Seq=7086 Ack=192 Win=6864 Len=1368 TSval=4016893703
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80 [ACK] Seq=192 Ack=8454 Win=523944 Len=0 TSval=256680144 TS

> Frame 4: 257 bytes on wire (2056 bits), 257 bytes captured (2056 bits)
> Ethernet II, Src: Apple_ac:6c:26 (10:9a:dd:ac:6c:26), Dst: CiscoLinksys_e3:e9:8d (00:16:b6:
> Internet Protocol Version 4, Src: 192.168.1.122, Dst: 64.238.147.113
▼ Transmission Control Protocol, Src Port: 60643, Dst Port: 80, Seq: 1, Ack: 1, Len: 191
 Source Port: 60643
 Destination Port: 80
 [Stream index: 0]
 > [Conversation completeness: Complete, WITH_DATA (31)]
 [TCP Segment Len: 191]
 Sequence Number: 1 (relative sequence number)
 Sequence Number (raw): 2682012318
 [Next Sequence Number: 192 (relative sequence number)]
 Acknowledgment Number: 1 (relative ack number)
 Acknowledgment number (raw): 349487777
 1000 = Header Length: 32 bytes (8)
 > Flags: 0x018 (PSH, ACK)

0000 00 16 b6 e3 e9 8d 10 9a dd ac 6c 26 08 00
0010 00 f3 3c d9 40 00 00 06 66 aa c0 a8 01 7a
0020 93 71 ec e3 00 50 9f dc 42 9e 14 d4 c2 a1
0030 ff ff 2f 5f 00 00 01 01 08 0a 0f 4c 9f c9
0040 ed fd 47 45 54 20 2f 73 69 67 63 6f 6d 6d
0050 30 31 31 2f 70 61 70 65 72 73 2f 73 69 67
0060 6d 6d 2f 70 32 2e 70 64 66 20 48 54 54 50
0070 2e 31 0d 0a 55 73 65 72 2d 41 67 65 6e 74
0080 63 75 72 6c 2f 37 2e 32 31 2e 34 20 28 75
0090 76 65 72 73 61 6c 2d 61 70 70 6c 65 2d 64
00a0 77 69 6e 31 31 2e 30 29 20 6c 69 62 63 75
00b0 2f 37 2e 32 31 2e 34 20 4f 70 65 6e 53 53
00c0 30 2e 39 2e 38 72 20 7a 6c 69 62 2f 31 2e
00d0 35 0d 0a 48 6f 73 74 3a 20 63 6f 6e 66 65
00e0 6e 63 65 73 2e 73 69 67 63 6f 6d 6d 2e 6f
00f0 0d 0a 41 63 63 65 70 74 3a 20 2a 2f 2a 0d
0100 0a

Second Tcp Segment Length :


```

> Frame 6: 311 bytes on wire (2488 bits), 311 bytes captured (2488 bits)
> Ethernet II, Src: CiscoLinksys_e3:e9:8d (00:16:b6:e3:e9:8d), Dst: Apple_ac:6c:26 (10:9a:dc:
> Internet Protocol Version 4, Src: 64.238.147.113, Dst: 192.168.1.122
✓ Transmission Control Protocol, Src Port: 80, Dst Port: 60643, Seq: 1, Ack: 192, Len: 245
    Source Port: 80
    Destination Port: 60643
    [Stream index: 0]
    > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 245]
    Sequence Number: 1 (relative sequence number)
    Sequence Number (raw): 349487777
    [Next Sequence Number: 246 (relative sequence number)]
    Acknowledgment Number: 192 (relative ack number)
    Acknowledgment number (raw): 2682012509
    1000 .... = Header Length: 32 bytes (8)
    1000 .... = Window Length: 65535 bytes (16)

```

Third TCP Segment Length :

```

> Frame 7: 66 bytes on wire (528 bits), 66 bytes captured (528 bits)
> Ethernet II, Src: Apple_ac:6c:26 (10:9a:dd:ac:6c:26), Dst: CiscoLinksys_e3:e9:8d (00:16:b6:
> Internet Protocol Version 4, Src: 192.168.1.122, Dst: 64.238.147.113
✓ Transmission Control Protocol, Src Port: 60643, Dst Port: 80, Seq: 192, Ack: 246, Len: 0
    Source Port: 60643
    Destination Port: 80
    [Stream index: 0]
    > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 0]
    Sequence Number: 192 (relative sequence number)
    Sequence Number (raw): 2682012509
    [Next Sequence Number: 192 (relative sequence number)]
    Acknowledgment Number: 246 (relative ack number)
    Acknowledgment number (raw): 349488022
    1000 .... = Header Length: 32 bytes (8)

```

4th TCP Segment Length:


```

> Frame 8: 1434 bytes on wire (11472 bits), 1434 bytes captured (11472 bits)
> Ethernet II, Src: CiscoLinksys_e3:e9:8d (00:16:b6:e3:e9:8d), Dst: Apple_ac:6c:26 (10:9a:dd:
> Internet Protocol Version 4, Src: 64.238.147.113, Dst: 192.168.1.122
▼ Transmission Control Protocol, Src Port: 80, Dst Port: 60643, Seq: 246, Ack: 192, Len: 1368
    Source Port: 80
    Destination Port: 60643
    [Stream index: 0]
    > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 1368]
    Sequence Number: 246      (relative sequence number)
    Sequence Number (raw): 349488022
    [Next Sequence Number: 1614      (relative sequence number)]
    Acknowledgment Number: 192      (relative ack number)
    Acknowledgment number (raw): 2682012509
    1000 .... = Header Length: 32 bytes (8)

```

5th TCP Segment Length:

```

> Frame 9: 1434 bytes on wire (11472 bits), 1434 bytes captured (11472 bits)
> Ethernet II, Src: CiscoLinksys_e3:e9:8d (00:16:b6:e3:e9:8d), Dst: Apple_ac:6c:26 (10:9a:dd:
> Internet Protocol Version 4, Src: 64.238.147.113, Dst: 192.168.1.122
▼ Transmission Control Protocol, Src Port: 80, Dst Port: 60643, Seq: 1614, Len: 1368
    Source Port: 80
    Destination Port: 60643
    [Stream index: 0]
    > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 1368]
    Sequence Number: 1614      (relative sequence number)
    Sequence Number (raw): 349489390
    [Next Sequence Number: 2982      (relative sequence number)]
    Acknowledgment Number: 192      (relative ack number)
    Acknowledgment number (raw): 2682012509

```

6th TCP Segment Length:

```

> Frame 10: 66 bytes on wire (528 bits), 66 bytes captured (528 bits)
> Ethernet II, Src: Apple_ac:6c:26 (10:9a:dd:ac:6c:26), Dst: CiscoLinksys_e3:e9
> Internet Protocol Version 4, Src: 192.168.1.122, Dst: 64.238.147.113
▼ Transmission Control Protocol, Src Port: 60643, Dst Port: 80, Seq: 192, Ack:
    Source Port: 60643
    Destination Port: 80
    [Stream index: 0]
    > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 0]
    Sequence Number: 192      (relative sequence number)
    Sequence Number (raw): 2682012509
    [Next Sequence Number: 192      (relative sequence number)]
    Acknowledgment Number: 2982      (relative ack number)
    Acknowledgment number (raw): 349490758

```

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

Ans: Yes, there are re-transmitted segments in the trace file.

- Segment 7 has the sequence number = **192** (relative sequence number) and it has raw sequence number = **2682012509** source and destination are also same. ACK is also 1.

5	0.177819	64.238.147.113	192.168.1.122	TCP	66	80 → 60643	[ACK]	Seq=1 Ack=192 Wi
6	0.178321	64.238.147.113	192.168.1.122	TCP	311	80 → 60643	[PSH, ACK]	Seq=1 Ack=1
7	0.178388	192.168.1.122	64.238.147.113	TCP	66	60643 → 80	[ACK]	Seq=192 Ack=246
8	0.189114	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643	[ACK]	Seq=246 Ack=192
9	0.266705	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643	[ACK]	Seq=1614 Ack=192
10	0.266787	192.168.1.122	64.238.147.113	TCP	66	60643 → 80	[ACK]	Seq=192 Ack=2982
11	0.267657	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643	[ACK]	Seq=2982 Ack=192
12	0.354612	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643	[ACK]	Seq=4350 Ack=192
13	0.354647	192.168.1.122	64.238.147.113	TCP	66	60643 → 80	[ACK]	Seq=192 Ack=5718
14	0.355174	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643	[ACK]	Seq=5718 Ack=192
15	0.355561	64.238.147.113	192.168.1.122	TCP	1434	80 → 60643	[ACK]	Seq=7086 Ack=192
16	0.355579	192.168.1.122	64.238.147.113	TCP	66	60643 → 80	[ACK]	Seq=192 Ack=8454

> Frame 7: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) > Ethernet II, Src: Apple_ac:6c:26 (10:9a:dd:ac:6c:26), Dst: CiscoLinksys_e3:e9:8d (00:16:b6: > Internet Protocol Version 4, Src: 192.168.1.122, Dst: 64.238.147.113 > Transmission Control Protocol, Src Port: 60643, Dst Port: 80, Seq: 192, Ack: 246, Len: 0		0000 00 16 b6 0010 00 34 51 0020 93 71 ec 0030 ff ff a2 0040 ee 58
---	--	--

Source Port: 60643 Destination Port: 80 [Stream index: 0] > [Conversation completeness: Complete, WITH_DATA (31)] [TCP Segment Len: 0] Sequence Number: 192 (relative sequence number) Sequence Number (raw): 2682012509 [Next Sequence Number: 192 (relative sequence number)] Acknowledgment Number: 246 (relative ack number) Acknowledgment number (raw): 349488022 1000 = Header Length: 32 bytes (8) > Flags: 0x010 (ACK) Window: 65535
--

The packet is retransmitted due to these reasons.