

## Wireshark explanation

In the first screenshot, Wireshark shows a TCP segment sent from the server (port 1337) to the client (port 61259).

The payload at the bottom contains the ASCII bytes: Welcome! Please log in

This confirms that our application-layer protocol messages are transmitted as raw text inside the TCP payload.

10	32.843021	127.0.0.1	127.0.0.1	TCP	79	1337 → 61259	[PSH, ACK] Seq=1 Ack=1 Win=408256 Len=23 TSval=1236289250 TSecr=2550585863
11	32.843047	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=1 Ack=24 Win=408256 Len=0 TSval=2550585863 TSecr=1236289250
12	38.018660	127.0.0.1	127.0.0.1	TCP	67	61259 → 1337	[PSH, ACK] Seq=1 Ack=24 Win=408256 Len=11 TSval=2550591039 TSecr=1236289250
13	38.018717	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=24 Ack=12 Win=408256 Len=0 TSval=1236294426 TSecr=2550591039
14	38.018747	127.0.0.1	127.0.0.1	TCP	77	61259 → 1337	[PSH, ACK] Seq=12 Ack=24 Win=408256 Len=21 TSval=2550591039 TSecr=1236294426
15	38.018755	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=24 Ack=33 Win=408256 Len=0 TSval=1236294426 TSecr=2550591039
16	38.019119	127.0.0.1	127.0.0.1	TCP	81	1337 → 61259	[PSH, ACK] Seq=24 Ack=33 Win=408256 Len=25 TSval=1236294426 TSecr=2550591039
17	38.019140	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=33 Ack=49 Win=408192 Len=0 TSval=2550591039 TSecr=1236294426
30	53.605207	127.0.0.1	127.0.0.1	TCP	82	61259 → 1337	[PSH, ACK] Seq=33 Ack=49 Win=408192 Len=26 TSval=2550606625 TSecr=1236294426
31	53.605263	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=49 Ack=59 Win=408192 Len=0 TSval=1236310012 TSecr=2550606625
32	53.605909	127.0.0.1	127.0.0.1	TCP	90	1337 → 61259	[PSH, ACK] Seq=49 Ack=59 Win=408192 Len=34 TSval=1236310012 TSecr=2550606625
33	53.605937	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=59 Ack=83 Win=408192 Len=0 TSval=2550606625 TSecr=1236310012
34	53.606258	127.0.0.1	127.0.0.1	TCP	66	61259 → 1337	[PSH, ACK] Seq=59 Ack=83 Win=408192 Len=10 TSval=2550606626 TSecr=1236310012
35	53.606276	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=83 Ack=69 Win=408192 Len=0 TSval=1236310013 TSecr=2550606626
36	53.607536	127.0.0.1	127.0.0.1	TCP	71	1337 → 61259	[PSH, ACK] Seq=83 Ack=69 Win=408192 Len=15 TSval=1236310015 TSecr=2550606626
37	53.607564	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=69 Ack=98 Win=408192 Len=0 TSval=2550606628 TSecr=1236310015
38	53.607684	127.0.0.1	127.0.0.1	TCP	72	61259 → 1337	[PSH, ACK] Seq=69 Ack=98 Win=408192 Len=16 TSval=2550606628 TSecr=1236310015
39	53.607700	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=98 Ack=85 Win=408192 Len=0 TSval=1236310015 TSecr=2550606628
40	53.607840	127.0.0.1	127.0.0.1	TCP	81	1337 → 61259	[PSH, ACK] Seq=98 Ack=85 Win=408192 Len=25 TSval=1236310015 TSecr=2550606628
41	53.607855	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=85 Ack=123 Win=408128 Len=0 TSval=2550606628 TSecr=1236310015
42	53.607908	127.0.0.1	127.0.0.1	TCP	61	61259 → 1337	[PSH, ACK] Seq=85 Ack=123 Win=408128 Len=5 TSval=2550606628 TSecr=1236310015
43	53.607922	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=123 Ack=90 Win=408192 Len=0 TSval=1236310015 TSecr=2550606628
44	53.608053	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[FIN, ACK] Seq=123 Ack=90 Win=408192 Len=0 TSval=1236310015 TSecr=2550606628
45	53.608054	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[FIN, ACK] Seq=90 Ack=123 Win=408128 Len=0 TSval=2550606628 TSecr=1236310015
46	53.608072	127.0.0.1	127.0.0.1	TCP	56	[TCP Retransmission] 61259 → 1337	[FIN, ACK] Seq=90 Ack=124 Win=408128 Len=0 TSval=2550606628 TSecr...
47	53.608076	127.0.0.1	127.0.0.1	TCP	56	[TCP Retransmission] 1337 → 61259	[FIN, ACK] Seq=123 Ack=91 Win=408192 Len=0 TSval=1236310015 TSecr...

> Frame 10: Packet, 79 bytes on wire (632 bits), 79 bytes captured (632 bits)  
> Null/Loopback  
> Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1  
> Transmission Control Protocol, Src Port: 1337, Dst Port: 61259, Seq: 1, Ack: 1, Len: 23  
> Data (23 bytes)

0000 02 00 00 00 45 00 00 4b 00 00 40 00 40 06 00 00 .....E..K..@..  
0010 7f 00 00 01 7f 00 00 01 05 39 ef 4b 58 58 8e d5 .....9.KXX..  
0020 39 2b ed f9 80 18 18 eb fe 3f 00 00 01 01 08 0a 9+.....?.....  
0030 49 b0 46 e2 98 06 da 07 57 65 6c 63 6f 6d 65 21 I:F.....Welcme!  
0040 20 50 6c 65 61 73 65 20 6c 6f 67 20 69 6e 0a Please log in

In the second screenshot, the TCP connection is now carrying data **from the client to the server**.

The selected packet (client port 61259 → server port 1337) contains:

User: maoz

This matches the client-side behavior defined in the assignment:

12	38.018660	127.0.0.1	127.0.0.1	TCP	67	61259 → 1337	[PSH, ACK] Seq=1 Ack=24 Win=408256 Len=11 TSval=2550591039 TSecr=1236289250
13	38.018717	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=24 Ack=12 Win=408256 Len=0 TSval=1236294426 TSecr=2550591039
14	38.018747	127.0.0.1	127.0.0.1	TCP	77	61259 → 1337	[PSH, ACK] Seq=12 Ack=24 Win=408256 Len=21 TSval=2550591039 TSecr=1236294426
15	38.018755	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=24 Ack=33 Win=408256 Len=0 TSval=1236294426 TSecr=2550591039
16	38.019119	127.0.0.1	127.0.0.1	TCP	81	1337 → 61259	[PSH, ACK] Seq=24 Ack=33 Win=408256 Len=25 TSval=1236294426 TSecr=2550591039
17	38.019140	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=33 Ack=49 Win=408192 Len=0 TSval=2550591039 TSecr=1236294426
30	53.605207	127.0.0.1	127.0.0.1	TCP	82	61259 → 1337	[PSH, ACK] Seq=33 Ack=49 Win=408192 Len=26 TSval=2550606625 TSecr=1236294426
31	53.605263	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=49 Ack=59 Win=408192 Len=0 TSval=1236310012 TSecr=2550606625
32	53.605909	127.0.0.1	127.0.0.1	TCP	90	1337 → 61259	[PSH, ACK] Seq=49 Ack=59 Win=408192 Len=34 TSval=1236310012 TSecr=2550606625
33	53.605937	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=59 Ack=83 Win=408192 Len=0 TSval=2550606625 TSecr=1236310012
34	53.606258	127.0.0.1	127.0.0.1	TCP	66	61259 → 1337	[PSH, ACK] Seq=59 Ack=83 Win=408192 Len=10 TSval=2550606626 TSecr=1236310012
35	53.606276	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=83 Ack=69 Win=408192 Len=0 TSval=1236310013 TSecr=2550606626
36	53.607536	127.0.0.1	127.0.0.1	TCP	71	1337 → 61259	[PSH, ACK] Seq=83 Ack=69 Win=408192 Len=15 TSval=1236310015 TSecr=2550606626
37	53.607564	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=69 Ack=98 Win=408192 Len=0 TSval=2550606628 TSecr=1236310015
38	53.607684	127.0.0.1	127.0.0.1	TCP	72	61259 → 1337	[PSH, ACK] Seq=69 Ack=98 Win=408192 Len=16 TSval=2550606628 TSecr=1236310015
39	53.607700	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=98 Ack=85 Win=408192 Len=0 TSval=1236310015 TSecr=2550606628
40	53.607840	127.0.0.1	127.0.0.1	TCP	81	1337 → 61259	[PSH, ACK] Seq=98 Ack=85 Win=408192 Len=25 TSval=1236310015 TSecr=2550606628
41	53.607855	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[ACK] Seq=85 Ack=123 Win=408128 Len=0 TSval=2550606628 TSecr=1236310015
42	53.607908	127.0.0.1	127.0.0.1	TCP	61	61259 → 1337	[PSH, ACK] Seq=85 Ack=123 Win=408128 Len=5 TSval=2550606628 TSecr=1236310015
43	53.607922	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[ACK] Seq=123 Ack=90 Win=408192 Len=0 TSval=1236310015 TSecr=2550606628
44	53.608053	127.0.0.1	127.0.0.1	TCP	56	1337 → 61259	[FIN, ACK] Seq=123 Ack=90 Win=408192 Len=0 TSval=1236310015 TSecr=2550606628
45	53.608054	127.0.0.1	127.0.0.1	TCP	56	61259 → 1337	[FIN, ACK] Seq=90 Ack=123 Win=408128 Len=0 TSval=2550606628 TSecr=1236310015
46	53.608072	127.0.0.1	127.0.0.1	TCP	56	[TCP Retransmission] 61259 → 1337	[FIN, ACK] Seq=90 Ack=124 Win=408128 Len=0 TSval=2550606628 TSecr=1236310015
47	53.608076	127.0.0.1	127.0.0.1	TCP	56	[TCP Retransmission] 1337 → 61259	[FIN, ACK] Seq=123 Ack=91 Win=408192 Len=0 TSval=1236310015 TSecr=1236310015

Frame 12: Packet, 67 bytes on wire (536 bits), 67 bytes captured (536 bits)  
 Null/Loopback  
 Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1  
 Transmission Control Protocol, Src Port: 61259, Dst Port: 1337, Seq: 1, Ack: 24, Len: 11  
 Data (11 bytes)

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0000 02 00 00 00 45 00 00 3f 00 00 40 00 06 00 00  ....E...?..@.@...
0010 7f 00 00 01 7f 00 00 01 ef 4b 05 39 39 2b ed f9  .......K.99+...
0020 58 58 8e ec 80 18 18 eb fe 33 00 00 01 01 08 0a  XX.....3.....
0030 98 06 ee 3f 49 b0 46 e2 55 73 65 72 3a 20 6d 61  ...?I..F User: ma
0040 6f 7a 0a                                     oz

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