

Assignment 2: UDP Sockets

1. Capture all packets exchanged between the client and server during execution. Show the screenshots.

Sol:

From server to client, with “HELLO” message.

The screenshot shows a Wireshark packet capture of a UDP message. The packet list at the top shows 14 packets. Packet 6 is selected, showing a UDP packet from 127.0.0.1:5000 to 127.0.0.1:44463. The packet details pane shows the User Datagram Protocol section with Source Port: 5000, Destination Port: 44463, Length: 1008, and Checksum: 0x0204. The packet bytes pane shows the raw data, which is a 1000-byte message. The message starts with 'E=' followed by a series of characters, including 'HELLO'.

From client to server, with “WORD1” message.

The screenshot shows a Wireshark packet capture of a UDP message. The packet list at the top shows 14 packets. Packet 7 is selected, showing a UDP packet from 127.0.0.1:44463 to 127.0.0.1:5000. The packet details pane shows the User Datagram Protocol section with Source Port: 44463, Destination Port: 5000, Length: 1008, and Checksum: 0x0204. The packet bytes pane shows the raw data, which is a 1000-byte message. The message starts with 'E=' followed by a series of characters, including 'WORD1'.

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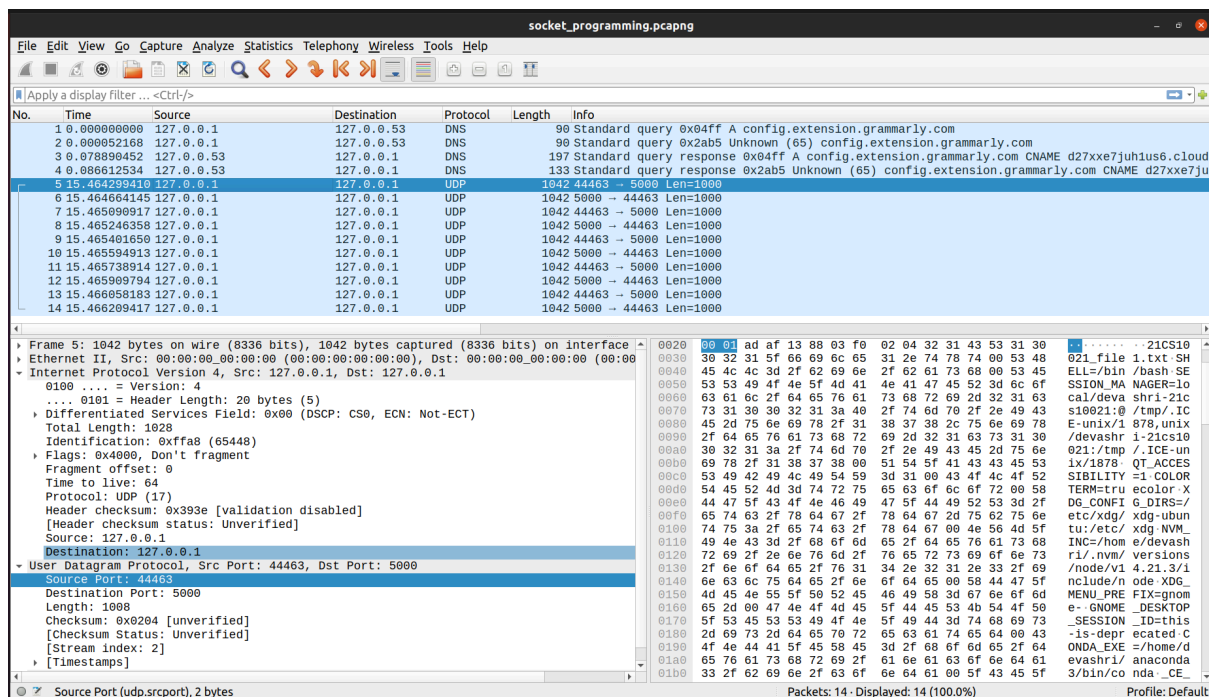
2. What protocol is used for communication?

Sol: UDP protocol is used for communication. We used SOCK_DGRAM in .c file for UDP protocol, so it matches the result.

3. What are the source and destination IP addresses and ports?

Sol: Both IP addresses are the same : 127.0.0.1 as they are on the same machine and it is an Inter-Process-Communication.

Client port = 44463



Server port = 5000

4. What is the size (in bytes) of the FILENAME request sent by the client?

Sol:

UDP "Length" = 1008 bytes (this is the UDP header 8 bytes + client's 1000-byte payload).

Frame size on wire = 1042 bytes (this includes Ethernet/IP/UDP headers, etc.).

The application-layer payload of the filename request is 1000 bytes.

(Wireshark's "Length" field of 1008 includes the 8-byte UDP header.)

5. What is the size of the server's response for HELLO and the first word (WORD)?

Sol:

The server's responses for HELLO and the first WORD1 also show a 1000-byte payload each (1008 bytes including the UDP header). Shown below:

HELLO:

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The screenshot shows a Wireshark packet capture window titled "socket_programming.pcapng". The filter bar at the top is set to "ip.addr == 127.0.0.1". The packet list on the left shows 14 packets. Packet 6 is selected, showing details for an Ethernet II frame, an Internet Protocol Version 4 header, and a User Datagram Protocol header. The packet data is displayed in the bottom pane, showing a series of bytes in hexadecimal and ASCII. The ASCII column shows the text "HELLO" followed by a series of dots and a carriage return.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x04ff A config.extension.grammarly.com
2	0.000052168	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x2ab5 Unknown (65) config.extension.grammarly.com
3	0.078890452	127.0.0.53	127.0.0.1	DNS	197	Standard query response 0x04ff A config.extension.grammarly.com CNAME d27xxe7juh1us6.cloud
4	0.086612534	127.0.0.53	127.0.0.1	DNS	133	Standard query response 0x2ab5 Unknown (65) config.extension.grammarly.com CNAME d27xxe7juh
5	15.464299410	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
6	15.464664145	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
7	15.465090917	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
8	15.465246358	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
9	15.465401650	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
10	15.465594913	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
11	15.465738914	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
12	15.465909794	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
13	15.466058183	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
14	15.466209417	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000

Frame 6: 1042 bytes on wire (8336 bits), 1042 bytes captured (8336 bits) on interface 0
Ethernet II, Src: 00:00:00:00:00:00 (00:00:00:00:00:00), Dst: 00:00:00:00:00:00
Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
User Datagram Protocol, Src Port: 5000, Dst Port: 44463
Source Port: 5000
Destination Port: 44463
Length: 1008
Checksum: 0x0204 [unverified]
[Checksum Status: Unverified]
[Stream index: 2]
[Timestamps]
Data (1000 bytes)
Data: 48454c4c4f00000057f61e19000000004020093d64550000...
[Length: 1000]

WORD1:

The screenshot shows a Wireshark packet capture window titled "socket_programming.pcapng". The filter bar at the top is set to "ip.addr == 127.0.0.1". The packet list on the left shows 14 packets. Packet 7 is selected, showing details for an Ethernet II frame, an Internet Protocol Version 4 header, and a User Datagram Protocol header. The packet data is displayed in the bottom pane, showing a series of bytes in hexadecimal and ASCII. The ASCII column shows the text "WORD1" followed by a series of dots and a carriage return.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x04ff A config.extension.grammarly.com
2	0.000052168	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x2ab5 Unknown (65) config.extension.grammarly.com
3	0.078890452	127.0.0.53	127.0.0.1	DNS	197	Standard query response 0x04ff A config.extension.grammarly.com CNAME d27xxe7juh1us6.cloud
4	0.086612534	127.0.0.53	127.0.0.1	DNS	133	Standard query response 0x2ab5 Unknown (65) config.extension.grammarly.com CNAME d27xxe7juh
5	15.464299410	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
6	15.464664145	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
7	15.465090917	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
8	15.465246358	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
9	15.465401650	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
10	15.465594913	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
11	15.465738914	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
12	15.465909794	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
13	15.466058183	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
14	15.466209417	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000

Frame 7: 1042 bytes on wire (8336 bits), 1042 bytes captured (8336 bits) on interface 0
Ethernet II, Src: 00:00:00:00:00:00 (00:00:00:00:00:00), Dst: 00:00:00:00:00:00
Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
User Datagram Protocol, Src Port: 44463, Dst Port: 5000
Source Port: 44463
Destination Port: 5000
Length: 1008
Checksum: 0x0204 [unverified]
[Checksum Status: Unverified]
[Stream index: 2]
[Timestamps]
Data (1000 bytes)
Data: 574f524431004e44203231435331303032315f66696c6531...
[Length: 1000]

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6. Inspect the payload of packets where the words are transmitted. Show the UDP payloads of those packets.

Sol:

The UDP payloads in the hex/ASCII pane contain the alphanumeric words:

Frame containing CS31206: starts with 43 53 33 31 32 30 in hex (ASCII "CS21206"), followed by padding.

Subsequent frames contain each line from the file (e.g. "CS31206", "CS39006") at the start of the 1000-byte payload.

The image shows a Wireshark packet capture of a UDP stream. The top pane displays a list of 14 packets. Packet 8 is selected, showing details for the User Datagram Protocol (UDP) and the Data field. The Data field contains 1000 bytes of data. The bottom pane shows the hex/ASCII view of the data, where the first few bytes are highlighted in blue, corresponding to the ASCII string "CS31206".

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x04ff A config.extension.grammarly.com
2	0.000052168	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x2ab5 Unknown (65) config.extension.grammarly.com
3	0.078896452	127.0.0.53	127.0.0.1	DNS	197	Standard query response 0x04ff A config.extension.grammarly.com CNAME d27xxe7juhus6.cloud
4	0.086612534	127.0.0.53	127.0.0.1	DNS	133	Standard query response 0x2ab5 Unknown (65) config.extension.grammarly.com CNAME d27xxe7ju
5	15.464299410	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
6	15.464664145	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
7	15.465090917	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
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11	15.465738914	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
12	15.465909794	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
13	15.466058183	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
14	15.466209417	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000

Frame 8: 1042 bytes on wire (8336 bits), 1042 bytes captured (8336 bits) on interface 0
Ethernet II, Src: 00:00:00:00:00:00 (00:00:00:00:00:00), Dst: 00:00:00:00:00:00
Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
User Datagram Protocol, Src Port: 5000, Dst Port: 44463
Source Port: 5000
Destination Port: 44463
Length: 1008
Checksum: 0x0204 [unverified]
[Checksum Status: Unverified]
[Stream index: 2]
[Timestamps]
Data (1000 bytes)
Data: 435333313230360057f61e19000000004020093d64550000...
[Length: 1000]

0020 00 01 13 88 ad af 03 f0 02 04 43 53 33 31 32 30 ... CS31206
0030 36 00 57 f6 1e 19 00 00 00 00 40 20 09 3d 64 55 6 W ... @ :=dU
0040 00 00 0d 00 00 00 00 00 00 00 e0 01 e9 db ff 7f ...
0050 00 00 39 06 e9 db ff 7f 00 00 e0 65 99 85 a6 7f ... 9 ... e ...
0060 00 00 bd 36 09 3d 64 55 00 00 e8 d2 97 85 a6 7f ... :=dU
0070 00 00 70 36 09 3d 64 55 00 00 00 00 00 00 00 00 ... p6 :=dU
0080 00 00 40 32 09 3d 64 55 00 00 b0 02 e9 db ff 7f ... @2 :=dU
0090 00 00 00 20 f2 03 9e 1e db d2 00 00 00 00 00 00 ... { ... P ...
00a0 00 00 83 00 7b 85 a6 7f 00 00 50 00 00 00 00 00 ... :=dU
00b0 00 00 b8 02 e9 db ff 7f 00 00 a0 47 97 85 01 00 ...)3 :=dU
00c0 00 00 29 33 09 3d 64 55 00 00 70 36 09 3d 64 55 ... p6 :=dU
00d0 00 00 f8 6f fe be 4b d3 4a 27 40 32 09 3d 64 55 ... o K J' @2 :=dU
00e0 00 00 b0 02 e9 db ff 7f 00 00 00 00 00 00 00 00 ...
00f0 00 00 00 00 00 00 00 00 00 00 f8 6f 5e bd 99 64 ... o ^ d
0100 b5 d8 f8 6f 90 be bd d9 07 d8 00 00 00 00 00 00 ...
0110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ...
0120 00 00 01 00 00 00 00 00 00 00 b8 02 e9 db ff 7f ...
0130 00 00 c8 02 e9 db ff 7f 00 00 90 31 9c 85 a6 7f ... 1 ...
0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ...
0150 00 00 40 32 09 3d 64 55 00 00 b0 02 e9 db ff 7f ... @2 :=dU
0160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ...
0170 00 00 6e 32 09 3d 64 55 00 00 a8 02 e9 db ff 7f ... n2 :=dU
0180 00 00 1c 00 00 00 00 00 00 00 01 00 00 00 00 00 ...
0190 00 00 85 21 e9 db ff 7f 00 00 00 00 00 00 00 00 ...
01a0 00 00 8e 21 e9 db ff 7f 00 00 9e 21 e9 db ff 7f ...
01b0 00 00 08 22 e9 db ff 7f 00 00 1b 22 e9 db ff 7f ...

7. Measure the total time taken for the file transfer from start to finish.

Sol:

By examining the timestamps of the first UDP packet (the filename request) and the last UDP packet carrying FINISH, the total time on the loopback interface is approximately 0.00191 seconds (≈ 1.91 ms).

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the filename request:

ip.addr == 127.0.0.1

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x04ff A config.extension.grammarly.com
2	0.000052168	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x2ab5 Unknown (65) config.extension.grammarly.com
3	0.078890452	127.0.0.53	127.0.0.1	DNS	197	Standard query response 0x04ff A config.extension.grammarly.com CNAME d27xxe7juh1us6.cloud
4	0.086612534	127.0.0.53	127.0.0.1	DNS	133	Standard query response 0x2ab5 Unknown (65) config.extension.grammarly.com CNAME d27xxe7juh
5	15.464299410	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
6	15.464664145	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
7	15.465090917	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
8	15.465246358	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
9	15.465401650	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
10	15.465594913	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
11	15.465738914	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
12	15.465909794	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
13	15.466058183	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
14	15.466299417	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000

Frame 5: 1042 bytes on wire (8336 bits), 1042 bytes captured (8336 bits) on interface 0
Ethernet II, Src: 00:00:00:00:00:00 (00:00:00:00:00:00), Dst: 00:00:00:00:00:00
Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
User Datagram Protocol, Src Port: 44463, Dst Port: 5000
Source Port: 44463
Destination Port: 5000
Length: 1000
Checksum: 0x0204 [unverified]
[Checksum Status: Unverified]
[Stream index: 2]
[Timestamps]
[Time since first frame: 0.000000000 seconds]
[Time since previous frame: 0.000000000 seconds]
Data (1000 bytes)
Data: 323143531303032315f66696c65312e747874005348454c...
[Length: 1000]

Packets: 14 · Displayed: 14 (100.0%) Profile: Default

Time : 0 sec

FINISH:

ip.addr == 127.0.0.1

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x04ff A config.extension.grammarly.com
2	0.000052168	127.0.0.1	127.0.0.53	DNS	90	Standard query 0x2ab5 Unknown (65) config.extension.grammarly.com
3	0.078890452	127.0.0.53	127.0.0.1	DNS	197	Standard query response 0x04ff A config.extension.grammarly.com CNAME d27xxe7juh1us6.cloud
4	0.086612534	127.0.0.53	127.0.0.1	DNS	133	Standard query response 0x2ab5 Unknown (65) config.extension.grammarly.com CNAME d27xxe7juh
5	15.464299410	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
6	15.464664145	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
7	15.465090917	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
8	15.465246358	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
9	15.465401650	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
10	15.465594913	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
11	15.465738914	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
12	15.465909794	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000
13	15.466058183	127.0.0.1	127.0.0.1	UDP	1042	44463 → 5000 Len=1000
14	15.466299417	127.0.0.1	127.0.0.1	UDP	1042	5000 → 44463 Len=1000

Frame 14: 1042 bytes on wire (8336 bits), 1042 bytes captured (8336 bits) on interface 0
Ethernet II, Src: 00:00:00:00:00:00 (00:00:00:00:00:00), Dst: 00:00:00:00:00:00
Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
User Datagram Protocol, Src Port: 5000, Dst Port: 44463
Source Port: 5000
Destination Port: 44463
Length: 1000
Checksum: 0x0204 [unverified]
[Checksum Status: Unverified]
[Stream index: 2]
[Timestamps]
[Time since first frame: 0.001910007 seconds]
[Time since previous frame: 0.000151234 seconds]
Data (1000 bytes)
Data: 46494e495348000057f61e19000000004020093d64550000...
[Length: 1000]

Packets: 14 · Displayed: 14 (100.0%) Profile: Default

Time: 0.00191 second (1.91 ms)

8. What is the average size of each packet during the communication?

Sol: Each packet is sent with a 1000-byte payload plus (8-bytes) protocol headers. Observing the "Frame length" in Wireshark, the average size on the wire is about 1042 bytes per frame.