

# Lab2 - UDP

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## 1 How many fields there are in the UDP header

Four fields: Source Port, Destination Port, Length, Checksum.

```
No.      Time           Source           Destination      Protocol Length Info
  7 0.114093       35.186.224.9     10.21.191.108    UDP           291    443 → 55323
Len=249
Frame 7: 291 bytes on wire (2328 bits), 291 bytes captured (2328 bits) on interface en0, id 0
Ethernet II, Src: Cisco_c4:c7:82 (f0:4a:02:c4:c7:82), Dst: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a)
Internet Protocol Version 4, Src: 35.186.224.9, Dst: 10.21.191.108
User Datagram Protocol, Src Port: 443, Dst Port: 55323
  Source Port: 443
  Destination Port: 55323
  Length: 257
  Checksum: 0x11c7 [unverified]
  [Checksum Status: Unverified]
  [Stream index: 0]
  [Stream Packet Number: 7]
  [Timestamps]
    [Time since first frame: 0.114093000 seconds]
    [Time since previous frame: 0.000004000 seconds]
  UDP payload (249 bytes)
Data (249 bytes)
0000 53 a2 2d e4 fd d5 2e ca 93 b1 ae e6 b6 47 ff c9  S.-.....G..
0010 83 b9 5d e9 21 4a fe a2 b3 9a 56 82 da c3 bc ab  ..].!J....V....
0020 ae 1c e6 8a 04 1e d4 f8 ba c1 dd da 95 0b 40 0a  .....@.
0030 74 7d d4 93 17 dc d3 7e a9 51 98 a6 40 11 37 80  t}.....~.Q..@.7.
0040 44 a9 87 ae 4a e2 e7 bc 14 25 86 61 35 2a dd 16  D...J....%.a5*..
0050 56 91 de 45 8f aa 40 f3 d5 55 1d 15 3c f1 fc 70  V..E..@..U..<..p
0060 7b ae fd 07 c8 f7 b2 a1 6a 5a 52 e7 62 3f 25 f2  {. ....jZR.b?%.
0070 99 a4 fa 92 86 f2 39 50 15 ab e7 93 9f 8d 67 92  .....9P.....g.
0080 fc 42 0f 9c 5f a4 c1 62 e0 85 eb 04 c0 fc 0b 4c  .B..._.b.....L
0090 f8 36 4e 68 34 7d e1 e3 07 d5 63 1a 18 68 36 4b  .6Nh4}....c...h6K
00a0 d2 92 48 d3 c5 1a 1d 3f 39 4a a8 f7 f9 4e 7e 8d  ..H....?9J...N~.
00b0 9c ad 0b 2d 33 df d1 c0 d3 42 7f 52 5c 2b 25 3c  ...-3....B.R\+%<
00c0 98 27 39 09 40 ef c8 79 ca a5 2b 50 95 18 56 f6  .'9.@..y..+P..V.
00d0 70 4a c2 c4 9e 23 b5 80 72 1f a2 33 31 1f da b8  pJ...#.r..31...
00e0 82 af d6 01 fc 0c 69 eb d1 72 f6 b7 2f d8 4f 90  ....i..r../.0.
00f0 af 79 fa b9 f9 71 9c 04 64  .y...q...d
```

Figure 1: PrintOut for Question 1

## 2 The Length of each field in the UDP header

- Source Port: 2 bytes

- Destination Port: 2 bytes
- Length: 2 bytes
- Checksum: 2 bytes

8 bytes in total. It can be seen in the screenshot below since the length is highlighted in the packet details.

> Frame 7: 291 bytes on wire (2328 bits), 291 bytes captured (2328 bits) on interface en0, id 6	0000	c6 19 77 e6 6b 1a f0 4a 02 c4 c7 82 08 00 45 00	...w.k.J.....E-
> Ethernet II, Src: Cisco_c4:c7:82 (f0:4a:02:c4:c7:82), Dst: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a)	0010	01 15 00 00 40 00 33 11 79 93 23 ba e8 09 0a 15	...@.3.y#.....
> Internet Protocol Version 4, Src: 35.186.224.9, Dst: 10.21.191.108	0020	b f 6c 01 bb d8 1b 01 01 11 c7 53 a2 2d e4 fd d5	...U...S.....
> User Datagram Protocol, Src Port: 443, Dst Port: 55323	0030	2e ca 93 b1 ae e6 b6 47 ff c9 83 b9 5d e9 21 4a	...V...G...J-1J
Source Port: 443	0040	fe a2 83 9a 56 82 da c3 bc ab ae 1c e6 8a 04 1e	...V...g.B.....
Destination Port: 55323	0050	d4 f8 ba c1 dd da 95 0b 40 0a 74 7d d4 93 17 dc	...@.t}.....
Length: 257	0060	d3 7e a9 51 98 a6 40 11 37 80 44 a9 87 ae 4a e2	...Q.@.7.D...J-
Checksum: 0x11c7 [unverified]	0070	e7 bc 14 25 86 61 35 2a dd 16 56 91 de 45 8f aa	...%a\$*...V..E-
[Checksum Status: Unverified]	0080	40 f3 d5 55 1d 15 3c f1 fc 70 7b ae fd 07 c8 f7	@.U<...p{.....
[Stream Index: 0]	0090	b2 a1 6a 5a 52 e7 62 3f 25 f2 99 a4 fa 92 86 f2	j2R.b7%.....
[Stream Packet Number: 7]	00a0	39 50 15 ab e7 93 9f 8d 67 92 fc 42 8f 9c 5f a4	9P...g.B.....
[Timestamps]	00b0	c1 62 e0 85 eb 04 c0 fc 0b 4c f8 36 4e 68 34 7d	b.....L.6Nh4
[Time since first frame: 0.114093000 seconds]	00c0	e1 e3 07 d5 63 1a 18 68 36 4d d2 92 48 d3 c5 1a	...c.h.6K.H...-
[Time since previous frame: 0.000004000 seconds]	00d0	1d 3f 39 4a a8 f7 f9 4e 7e 8d 9c ad 0b 2d 33 df	...79J...N...-3-
UDP payload (249 bytes)	00e0	d1 c0 d3 42 7f 52 5c 2b 25 3c 98 27 39 09 40 ef	...B.RV+<%'9@...
	00f0	c8 79 ca a5 2b 50 95 18 56 f6 70 4a c2 c4 9e 23	...y+P+V.pJ...#
	0100	b5 00 72 1f a2 33 31 1f da b8 82 af d6 01 fc 0c	...r-31.....
	0110	69 eb d1 72 f6 b7 2f d8 4f 90 af 79 fa b9 f9 71	i...r-/...0-y...q
> Data (249 bytes)	0120	9c 04 64	...d

> Frame 7: 291 bytes on wire (2328 bits), 291 bytes captured (2328 bits) on interface en0, id 6	0000	c6 19 77 e6 6b 1a f0 4a 02 c4 c7 82 08 00 45 00	...w.k.J.....E-
> Ethernet II, Src: Cisco_c4:c7:82 (f0:4a:02:c4:c7:82), Dst: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a)	0010	01 15 00 00 40 00 33 11 79 93 23 ba e8 09 0a 15	...@.3.y#.....
> Internet Protocol Version 4, Src: 35.186.224.9, Dst: 10.21.191.108	0020	b f 6c 01 bb d8 1b 01 01 11 c7 53 a2 2d e4 fd d5	...U...S.....
> User Datagram Protocol, Src Port: 443, Dst Port: 55323	0030	2e ca 93 b1 ae e6 b6 47 ff c9 83 b9 5d e9 21 4a	...V...G...J-1J
Source Port: 443	0040	fe a2 83 9a 56 82 da c3 bc ab ae 1c e6 8a 04 1e	...V...g.B.....
Destination Port: 55323	0050	d4 f8 ba c1 dd da 95 0b 40 0a 74 7d d4 93 17 dc	...@.t}.....
Length: 257	0060	d3 7e a9 51 98 a6 40 11 37 80 44 a9 87 ae 4a e2	...Q.@.7.D...J-
Checksum: 0x11c7 [unverified]	0070	e7 bc 14 25 86 61 35 2a dd 16 56 91 de 45 8f aa	...%a\$*...V..E-
[Checksum Status: Unverified]	0080	40 f3 d5 55 1d 15 3c f1 fc 70 7b ae fd 07 c8 f7	@.U<...p{.....
[Stream Index: 0]	0090	b2 a1 6a 5a 52 e7 62 3f 25 f2 99 a4 fa 92 86 f2	j2R.b7%.....
[Stream Packet Number: 7]	00a0	39 50 15 ab e7 93 9f 8d 67 92 fc 42 8f 9c 5f a4	9P...g.B.....
[Timestamps]	00b0	c1 62 e0 85 eb 04 c0 fc 0b 4c f8 36 4e 68 34 7d	b.....L.6Nh4
[Time since first frame: 0.114093000 seconds]	00c0	e1 e3 07 d5 63 1a 18 68 36 4d d2 92 48 d3 c5 1a	...c.h.6K.H...-
[Time since previous frame: 0.000004000 seconds]	00d0	1d 3f 39 4a a8 f7 f9 4e 7e 8d 9c ad 0b 2d 33 df	...79J...N...-3-
UDP payload (249 bytes)	00e0	d1 c0 d3 42 7f 52 5c 2b 25 3c 98 27 39 09 40 ef	...B.RV+<%'9@...
	00f0	c8 79 ca a5 2b 50 95 18 56 f6 70 4a c2 c4 9e 23	...y+P+V.pJ...#
	0100	b5 00 72 1f a2 33 31 1f da b8 82 af d6 01 fc 0c	...r-31.....
	0110	69 eb d1 72 f6 b7 2f d8 4f 90 af 79 fa b9 f9 71	i...r-/...0-y...q
> Data (249 bytes)	0120	9c 04 64	...d

> Frame 7: 291 bytes on wire (2328 bits), 291 bytes captured (2328 bits) on interface en0, id 6	0000	c6 19 77 e6 6b 1a f0 4a 02 c4 c7 82 08 00 45 00	...w.k.J.....E-
> Ethernet II, Src: Cisco_c4:c7:82 (f0:4a:02:c4:c7:82), Dst: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a)	0010	01 15 00 00 40 00 33 11 79 93 23 ba e8 09 0a 15	...@.3.y#.....
> Internet Protocol Version 4, Src: 35.186.224.9, Dst: 10.21.191.108	0020	b f 6c 01 bb d8 1b 01 01 11 c7 53 a2 2d e4 fd d5	...U...S.....
> User Datagram Protocol, Src Port: 443, Dst Port: 55323	0030	2e ca 93 b1 ae e6 b6 47 ff c9 83 b9 5d e9 21 4a	...V...G...J-1J
Source Port: 443	0040	fe a2 83 9a 56 82 da c3 bc ab ae 1c e6 8a 04 1e	...V...g.B.....
Destination Port: 55323	0050	d4 f8 ba c1 dd da 95 0b 40 0a 74 7d d4 93 17 dc	...@.t}.....
Length: 257	0060	d3 7e a9 51 98 a6 40 11 37 80 44 a9 87 ae 4a e2	...Q.@.7.D...J-
Checksum: 0x11c7 [unverified]	0070	e7 bc 14 25 86 61 35 2a dd 16 56 91 de 45 8f aa	...%a\$*...V..E-
[Checksum Status: Unverified]	0080	40 f3 d5 55 1d 15 3c f1 fc 70 7b ae fd 07 c8 f7	@.U<...p{.....
[Stream Index: 0]	0090	b2 a1 6a 5a 52 e7 62 3f 25 f2 99 a4 fa 92 86 f2	j2R.b7%.....
[Stream Packet Number: 7]	00a0	39 50 15 ab e7 93 9f 8d 67 92 fc 42 8f 9c 5f a4	9P...g.B.....
[Timestamps]	00b0	c1 62 e0 85 eb 04 c0 fc 0b 4c f8 36 4e 68 34 7d	b.....L.6Nh4
[Time since first frame: 0.114093000 seconds]	00c0	e1 e3 07 d5 63 1a 18 68 36 4d d2 92 48 d3 c5 1a	...c.h.6K.H...-
[Time since previous frame: 0.000004000 seconds]	00d0	1d 3f 39 4a a8 f7 f9 4e 7e 8d 9c ad 0b 2d 33 df	...79J...N...-3-
UDP payload (249 bytes)	00e0	d1 c0 d3 42 7f 52 5c 2b 25 3c 98 27 39 09 40 ef	...B.RV+<%'9@...
	00f0	c8 79 ca a5 2b 50 95 18 56 f6 70 4a c2 c4 9e 23	...y+P+V.pJ...#
	0100	b5 00 72 1f a2 33 31 1f da b8 82 af d6 01 fc 0c	...r-31.....
	0110	69 eb d1 72 f6 b7 2f d8 4f 90 af 79 fa b9 f9 71	i...r-/...0-y...q
> Data (249 bytes)	0120	9c 04 64	...d

> Frame 7: 291 bytes on wire (2328 bits), 291 bytes captured (2328 bits) on interface en0, id 6	0000	c6 19 77 e6 6b 1a f0 4a 02 c4 c7 82 08 00 45 00	...w.k.J.....E-
> Ethernet II, Src: Cisco_c4:c7:82 (f0:4a:02:c4:c7:82), Dst: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a)	0010	01 15 00 00 40 00 33 11 79 93 23 ba e8 09 0a 15	...@.3.y#.....
> Internet Protocol Version 4, Src: 35.186.224.9, Dst: 10.21.191.108	0020	b f 6c 01 bb d8 1b 01 01 11 c7 53 a2 2d e4 fd d5	...U...S.....
> User Datagram Protocol, Src Port: 443, Dst Port: 55323	0030	2e ca 93 b1 ae e6 b6 47 ff c9 83 b9 5d e9 21 4a	...V...G...J-1J
Source Port: 443	0040	fe a2 83 9a 56 82 da c3 bc ab ae 1c e6 8a 04 1e	...V...g.B.....
Destination Port: 55323	0050	d4 f8 ba c1 dd da 95 0b 40 0a 74 7d d4 93 17 dc	...@.t}.....
Length: 257	0060	d3 7e a9 51 98 a6 40 11 37 80 44 a9 87 ae 4a e2	...Q.@.7.D...J-
Checksum: 0x11c7 [unverified]	0070	e7 bc 14 25 86 61 35 2a dd 16 56 91 de 45 8f aa	...%a\$*...V..E-
[Checksum Status: Unverified]	0080	40 f3 d5 55 1d 15 3c f1 fc 70 7b ae fd 07 c8 f7	@.U<...p{.....
[Stream Index: 0]	0090	b2 a1 6a 5a 52 e7 62 3f 25 f2 99 a4 fa 92 86 f2	j2R.b7%.....
[Stream Packet Number: 7]	00a0	39 50 15 ab e7 93 9f 8d 67 92 fc 42 8f 9c 5f a4	9P...g.B.....
[Timestamps]	00b0	c1 62 e0 85 eb 04 c0 fc 0b 4c f8 36 4e 68 34 7d	b.....L.6Nh4
[Time since first frame: 0.114093000 seconds]	00c0	e1 e3 07 d5 63 1a 18 68 36 4d d2 92 48 d3 c5 1a	...c.h.6K.H...-
[Time since previous frame: 0.000004000 seconds]	00d0	1d 3f 39 4a a8 f7 f9 4e 7e 8d 9c ad 0b 2d 33 df	...79J...N...-3-
UDP payload (249 bytes)	00e0	d1 c0 d3 42 7f 52 5c 2b 25 3c 98 27 39 09 40 ef	...B.RV+<%'9@...
	00f0	c8 79 ca a5 2b 50 95 18 56 f6 70 4a c2 c4 9e 23	...y+P+V.pJ...#
	0100	b5 00 72 1f a2 33 31 1f da b8 82 af d6 01 fc 0c	...r-31.....
	0110	69 eb d1 72 f6 b7 2f d8 4f 90 af 79 fa b9 f9 71	i...r-/...0-y...q
> Data (249 bytes)	0120	9c 04 64	...d

### 3 Length Field

The value of the Length field indicates the length of the UDP header and the data(payload) in bytes. The header length is 8 (2\*4) bytes, and the data is 249 bytes. Therefore, the total length is 257 bytes. It can be seen in the screenshot below.

```

No.      Time      Source      Destination      Protocol Length Info
 7 0.114093    35.186.224.9    10.21.191.108    UDP        291    443 → 55323
Len=249
Frame 7: 291 bytes on wire (2328 bits), 291 bytes captured (2328 bits) on interface en0, id 0
Ethernet II, Src: Cisco_c4:c7:82 (f0:4a:02:c4:c7:82), Dst: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a)
Internet Protocol Version 4, Src: 35.186.224.9, Dst: 10.21.191.108
User Datagram Protocol, Src Port: 443, Dst Port: 55323
  Source Port: 443
  Destination Port: 55323
  Length: 257
  Checksum: 0x11c7 [unverified]
  [Checksum Status: Unverified]
  [Stream index: 0]
  [Stream Packet Number: 7]
  [Timestamps]
    [Time since first frame: 0.114093000 seconds]
    [Time since previous frame: 0.000004000 seconds]
  UDP payload (249 bytes)
    Data (249 bytes)
0000 53 a2 2d e4 fd d5 2e ca 93 b1 ae e6 b6 47 ff c9  S.-.....G..
0010 83 b9 5d e9 21 4a fe a2 b3 9a 56 82 da c3 bc ab  ..].!J....V....
0020 ae 1c e6 8a 04 1e d4 f8 ba c1 dd da 95 0b 40 0a  .....@.
0030 74 7d d4 93 17 dc d3 7e a9 51 98 a6 40 11 37 80  t}....~.Q..@.7.
0040 44 a9 87 ae 4a e2 e7 bc 14 25 86 61 35 2a dd 16  D...J....%.a5*..
0050 56 91 de 45 8f aa 40 f3 d5 55 1d 15 3c f1 fc 70  V..E..@..U..<..p
0060 7b ae fd 07 c8 f7 b2 a1 6a 5a 52 e7 62 3f 25 f2  {. ....jZR.b?%.
0070 99 a4 fa 92 86 f2 39 50 15 ab e7 93 9f 8d 67 92  .....9P.....g.
0080 fc 42 0f 9c 5f a4 c1 62 e0 85 eb 04 c0 fc 0b 4c  .B..._.b.....L
0090 f8 36 4e 68 34 7d e1 e3 07 d5 63 1a 18 68 36 4b  .6Nh4}....c..h6K
00a0 d2 92 48 d3 c5 1a 1d 3f 39 4a a8 f7 f9 4e 7e 8d  ..H....?9J...N~.
00b0 9c ad 0b 2d 33 df d1 c0 d3 42 7f 52 5c 2b 25 3c  ...-3....B.R\+%<
00c0 98 27 39 09 40 ef c8 79 ca a5 2b 50 95 18 56 f6  .'9.@..y...+P..V.
00d0 70 4a c2 c4 9e 23 b5 80 72 1f a2 33 31 1f da b8  pJ...#...r...31...
00e0 82 af d6 01 fc 0c 69 eb d1 72 f6 b7 2f d8 4f 90  .....i...r.../.0.
00f0 af 79 fa b9 f9 71 9c 04 64  .....y...q...d
    Data [...]:
53a22de4fdd52eca93b1aee6b647ffc983b95de9214afea2b39a5682dac3bcabae1ce68a041ed4f8bac1ddda950b400a74
[Length: 249]

```

Figure 2: PrintOut for Question 3

## 4 Max Length of the UDP Payload

The maximum length of the UDP payload is 65527 bytes. In the second question, we knew that the length field is 2 bytes, which means the maximum value is  $2^{16} - 1 = 65535$ . And the 8 bytes of the header should always be included. Therefore, the maximum length of the UDP payload is 65527 bytes.

## 5 Largest possible source port number

The largest possible source port number is  $2^{16} - 1 = 65535$ .

## 6 Protocol number for UDP

The protocol number for UDP is 17 and 0x11 in hexadecimal.

```

Frame 5: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface en0, id 0
Ethernet II, Src: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a), Dst: IETF-VRRP-VRID_32 (00:00:5e:
00:01:32)
Internet Protocol Version 4, Src: 10.21.191.108, Dst: 35.186.224.9
 0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
 0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 60
Identification: 0x0000 (0)
010. .... = Flags: 0x2, Don't fragment
0... .... = Reserved bit: Not set
.1.. .... = Don't fragment: Set
..0. .... = More fragments: Not set
...0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 64
Protocol: UDP (17)
Header Checksum: 0x6d6c [validation disabled]
[Header checksum status: Unverified]
Source Address: 10.21.191.108
Destination Address: 35.186.224.9
[Stream index: 0]
User Datagram Protocol, Src Port: 55323, Dst Port: 443
Data (32 bytes)
0000 46 eb 0a 53 e7 db 7a 97 55 c3 32 8a 4a 3a 60 46   F..S..z.U.2.J:~F
0010 84 4d e1 4c d4 15 13 99 d8 42 f3 19 69 33 84 e2   .M.L.....B...i3..
Data: 46eb0a53e7db7a9755c3328a4a3a6046844de14cd4151399d842f319693384e2
[Length: 32]

```

Figure 3: PrintOut for Question 6

## 7 Pair Packets

The Source Port and Destination Port of the two packets are exchanged. In the first packet, the Source Port is 55323 and the Destination Port is 443, while in the second packet, the Source Port is 443 and the Destination Port is 55323. The two hosts are using the same ports to communicate with each other.

No.	Time	Source	Destination	Protocol	Length	Info
5	0.035681	10.21.191.108	35.186.224.9	UDP	74	55323 → 443

```

Len=32
Frame 5: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface en0, id 0
Ethernet II, Src: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a), Dst: IETF-VRRP-VRID_32 (00:00:5e:
00:01:32)
Internet Protocol Version 4, Src: 10.21.191.108, Dst: 35.186.224.9
User Datagram Protocol, Src Port: 55323, Dst Port: 443
Data (32 bytes)
0000 46 eb 0a 53 e7 db 7a 97 55 c3 32 8a 4a 3a 60 46   F..S..z.U.2.J:~F
0010 84 4d e1 4c d4 15 13 99 d8 42 f3 19 69 33 84 e2   .M.L.....B...i3..
Data: 46eb0a53e7db7a9755c3328a4a3a6046844de14cd4151399d842f319693384e2
[Length: 32]

```

No.	Time	Source	Destination	Protocol	Length	Info
6	0.114089	35.186.224.9	10.21.191.108	UDP	66	443 → 55323

```

Len=24
Frame 6: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface en0, id 0
Ethernet II, Src: Cisco_c4:c7:82 (f0:4a:02:c4:c7:82), Dst: c6:19:77:e6:6b:1a (c6:19:77:e6:6b:1a)
Internet Protocol Version 4, Src: 35.186.224.9, Dst: 10.21.191.108
User Datagram Protocol, Src Port: 443, Dst Port: 55323
Data (24 bytes)
0000 44 24 7a 46 f8 1c 1f 0c af 99 40 18 d2 19 58 85   D$zF.....@...X.
0010 cd 48 e6 6b e0 2f 3a f8                           .H.k./:..
Data: 44247a46f81c1f0caf994018d2195885cd48e66be02f3af8
[Length: 24]

```

Figure 4: PrintOut for Question 7