




COMPUTER NETWORKS LAB 1



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Part 1:

The sent and received packets:

No.	Time	Source	Destination	Protocol	Length	Info
3647	12.264538	192.168.31.145	93.184.216.34	HTTP	592	GET / HTTP/1.1
3771	12.549503	93.184.216.34	192.168.31.145	HTTP	353	HTTP/1.1 304 Not Modified

1.

The 48 bit address is: 38 00 25 78 d4 58

> Frame 3647: 592 bytes on wire (4736 bits), 592 bytes captured (4736 bits) on 0	0000	64 64 4a 94 d1 3f 38 00 25 78 d4 58 08 00 45 00
▼ Ethernet II, Src: IntelCor_78:d4:58 (38:00:25:78:d4:58), Dst: BeijingX_94:d1:3f (64:64:4a:94:d1:3f)	0010	02 42 81 8f 40 00 80 06 00 00 c0 a8 1f 91 5d b8
> Destination: BeijingX_94:d1:3f (64:64:4a:94:d1:3f)	0020	d8 22 fc 1d 00 50 ce 14 9f 2f 5b c5 9c 07 50 18
> Source: IntelCor_78:d4:58 (38:00:25:78:d4:58)	0030	02 05 18 49 00 00 47 45 54 20 2f 20 48 54 54 56
Type: IPv4 (0x0800)	0040	2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 65 78 61 6c
> Internet Protocol Version 4, Src: 192.168.31.145, Dst: 93.184.216.34	0050	70 6c 65 2e 63 6f 6d 0d 0a 43 6f 6e 6e 65 63 74
> Transmission Control Protocol, Src Port: 64541, Dst Port: 80, Seq: 1, Ack: 1	0060	69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0c
> Hypertext Transfer Protocol	0070	0a 43 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20
	0080	6d 61 78 2d 61 67 65 3d 30 0d 0a 55 70 67 72 61
	0090	64 65 2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75

2.

Ascii "G" is equal to 47 and from the image below we can see that its 55 bytes away from the start point

$$3 \times 16 + 7 = 55$$

> Transmission Control Protocol, Src Port: 64541, Dst Port: 80, Seq: 1	0030	02 05 18 49 00 00 47 45 54 20 2f 20 48 54 54 50	...I..GET / HTTP
▼ Hypertext Transfer Protocol	0040	2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 65 78 61 6d	/1.1..Host: exam
> GET / HTTP/1.1\r\n	0050	70 6c 65 2e 63 6f 6d 0d 0a 43 6f 6e 6e 65 63 74	ple.com. .Connect
▼ [Expert Info (Chat/Sequence): GET / HTTP/1.1\r\n]	0060	69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d	ion: keep-alive.
[GET / HTTP/1.1\r\n]	0070	0a 43 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20	.Cache-Control:
[Severity level: Chat]	0080	6d 61 78 2d 61 67 65 3d 30 0d 0a 55 70 67 72 61	max-age= 0..Upgra
[Group: Sequence]	0090	64 65 2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75	de-Insecure-Requ
Request Method: GET	00a0	65 73 74 73 3a 20 31 0d 0a 55 73 65 72 2d 41 67	ests: 1. .User-Ag
Request URI: /	00b0	65 6e 74 3a 20 4d 6f 7a 69 6c 6c 61 2f 35 2e 30	ent: Mozilla/5.0
	00c0	20 28 57 69 6e 64 6f 77 73 20 4e 54 20 31 30 2e	(Windows NT 10.

3.

Ip address of source: 192.168.31.145

Ip address of dest: 93.184.216.34

4.

TTL is 128

```

> Frame 3647: 592 bytes on wire (4736 bits), 592 bytes captured (4736 bits) on interface \Device\NPF_{D7F2CF94-6B2B-4243-8A4C-C1EC373431C4}, id 0
> Ethernet II, Src: IntelCor_78:d4:58 (38:00:25:78:d4:58), Dst: BeijingX_94:d1:3f (64:64:4a:94:d1:3f)
√ Internet Protocol Version 4, Src: 192.168.31.145, Dst: 93.184.216.34
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 578
    Identification: 0x818f (33167)
    > 010. .... = Flags: 0x2, Don't fragment
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 128
    Protocol: TCP (6)
    Header Checksum: 0x0000 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.31.145
    Destination Address: 93.184.216.34
> Transmission Control Protocol, Src Port: 64541, Dst Port: 80, Seq: 1, Ack: 1, Len: 538
> Hypertext Transfer Protocol

```

5.

48bit address of dest is: 64 64 4a 94 d1 3f

The device is BeijingX

<pre> > Frame 3647: 592 bytes on wire (4736 bits), 592 bytes captured (4736 b √ Ethernet II, Src: IntelCor_78:d4:58 (38:00:25:78:d4:58), Dst: Beijing > Destination: BeijingX_94:d1:3f (64:64:4a:94:d1:3f) > Source: IntelCor_78:d4:58 (38:00:25:78:d4:58) Type: IPv4 (0x0800) > Internet Protocol Version 4, Src: 192.168.31.145, Dst: 93.184.216.34 > Transmission Control Protocol, Src Port: 64541, Dst Port: 80, Seq: 1, > Hypertext Transfer Protocol </pre>	<pre> 0000 64 64 4a 94 d1 3f 38 00 25 78 d4 58 08 00 45 00 0010 02 42 81 8f 40 00 80 06 00 00 c0 a8 1f 91 5d b8 0020 d8 22 fc 1d 00 50 ce 14 9f 2f 5b c5 9c 07 50 18 0030 02 05 18 49 00 00 47 45 54 20 2f 20 48 54 54 50 0040 2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 65 78 61 6d 0050 70 6c 65 2e 63 6f 6d 0d 0a 43 6f 6e 6e 65 63 74 0060 69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d 0070 0a 43 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 0080 6d 61 78 2d 61 67 65 3d 30 0d 0a 55 70 67 72 61 0090 64 65 2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75 </pre>
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6.

Header size is 20 bytes

<pre> > Frame 3647: 592 bytes on wire (4736 bits), 592 bytes captured (4736 > Ethernet II, Src: IntelCor_78:d4:58 (38:00:25:78:d4:58), Dst: Beiji √ Internet Protocol Version 4, Src: 192.168.31.145, Dst: 93.184.216.3 0100 = Version: 4 0101 = Header Length: 20 bytes (5) > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT) Total Length: 578 Identification: 0x818f (33167) > 010. = Flags: 0x2, Don't fragment ...0 0000 0000 0000 = Fragment Offset: 0 </pre>	<pre> 0000 64 64 4a 94 d1 3f 38 00 25 78 d4 58 08 00 45 00 0010 02 42 81 8f 40 00 80 06 00 00 c0 a8 1f 91 5d b8 0020 d8 22 fc 1d 00 50 ce 14 9f 2f 5b c5 9c 07 50 18 0030 02 05 18 49 00 00 47 45 54 20 2f 20 48 54 54 50 0040 2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 65 78 61 6d 0050 70 6c 65 2e 63 6f 6d 0d 0a 43 6f 6e 6e 65 63 74 0060 69 6f 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d 0070 0a 43 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 0080 6d 61 78 2d 61 67 65 3d 30 0d 0a 55 70 67 72 61 0090 64 65 2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75 00a0 65 73 74 73 3a 20 31 0d 0a 55 73 65 72 2d 41 67 </pre>
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Part 2

1.

```
Interface: 192.168.50.1 --- 0x14
  Internet Address   Physical Address   Type
192.168.50.254      00-50-56-f9-aa-c3   dynamic
192.168.50.255      ff-ff-ff-ff-ff-ff   static
224.0.0.2           01-00-5e-00-00-02   static
224.0.0.22          01-00-5e-00-00-16   static
224.0.0.251         01-00-5e-00-00-fb   static
224.0.0.252         01-00-5e-00-00-fc   static
239.255.255.250     01-00-5e-7f-ff-fa   static
255.255.255.255     ff-ff-ff-ff-ff-ff   static

Interface: 192.168.31.145 --- 0x1e
  Internet Address   Physical Address   Type
192.168.31.1        64-64-4a-94-d1-3f   dynamic
192.168.31.255      ff-ff-ff-ff-ff-ff   static
224.0.0.2           01-00-5e-00-00-02   static
224.0.0.22          01-00-5e-00-00-16   static
224.0.0.251         01-00-5e-00-00-fb   static
224.0.0.252         01-00-5e-00-00-fc   static
239.255.255.250     01-00-5e-7f-ff-fa   static
255.255.255.255     ff-ff-ff-ff-ff-ff   static

Interface: 192.168.80.1 --- 0x1f
  Internet Address   Physical Address   Type
192.168.80.254      00-50-56-f6-bf-55   dynamic
192.168.80.255      ff-ff-ff-ff-ff-ff   static
224.0.0.2           01-00-5e-00-00-02   static
224.0.0.22          01-00-5e-00-00-16   static
224.0.0.251         01-00-5e-00-00-fb   static
224.0.0.252         01-00-5e-00-00-fc   static
239.255.255.250     01-00-5e-7f-ff-fa   static
255.255.255.255     ff-ff-ff-ff-ff-ff   static
```

- Address: This is the IP address of the device that was resolved using ARP.
- Physical Address: This is the MAC address of the device that was resolved using ARP.
- Type: This is the type of address being displayed, which is usually Ethernet for ARP entries.

2.

a)

the values are as the following image:

> Frame 1405: 42 bytes on wire (336 bits), 42 bytes captured (336 bits)	0000	ff ff ff ff ff ff	38 00 25 78 d4 58 08 06 00 01	.....8- %x.X....
✓ Ethernet II, Src: IntelCor_78:d4:58 (38:00:25:78:d4:58), Dst: Broadca	0010	08 00 06 04 00 01	38 00 25 78 d4 58 c0 a8 1f 91	.....8- %x.X....
> Destination: Broadcast (ff:ff:ff:ff:ff:ff)	0020	00 00 00 00 00 00	c0 a8 1f 01	.....
> Source: IntelCor_78:d4:58 (38:00:25:78:d4:58)				
Type: ARP (0x0806)				
> Address Resolution Protocol (request)				

b)

the value of frame type is 0x806

Type: ARP (0x0806)	0000	ff ff ff ff ff ff	38 00 25 78 d4 58 08 06 00 01
✓ Address Resolution Protocol (request)	0010	08 00 06 04 00 01	38 00 25 78 d4 58 c0 a8 1f 91
Hardware type: Ethernet (1)	0020	00 00 00 00 00 00	c0 a8 1f 01
Protocol type: IPv4 (0x0800)			
Hardware size: 6			
Protocol size: 4			
Opcode: request (1)			
Sender MAC address: IntelCor_78:d4:58 (38:00:25:78:d4:58)			
Sender IP address: 192.168.31.145			
Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)			
Target IP address: 192.168.31.1			

c)

The value of opcode is 00 01

d)

Yes, the sender ip address is contained in the Ethernet II field.

e)

The question is contained in ARP field.

The corresponding machine is in the Target query of the ARP field

3.

> Frame 1407: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interfa	0000	38 00 25 78 d4 58	64 64 4a 94 d1 3f 08 06 00 01
✓ Ethernet II, Src: BeijingX_94:d1:3f (64:64:4a:94:d1:3f), Dst: IntelCor_78:d4:58	0010	08 00 06 04 00 02	64 64 4a 94 d1 3f c0 a8 1f 01
> Destination: IntelCor_78:d4:58 (38:00:25:78:d4:58)	0020	38 00 25 78 d4 58	c0 a8 1f 91
> Source: BeijingX_94:d1:3f (64:64:4a:94:d1:3f)			
Type: ARP (0x0806)			
✓ Address Resolution Protocol (reply)			
Hardware type: Ethernet (1)			
Protocol type: IPv4 (0x0800)			
Hardware size: 6			
Protocol size: 4			
Opcode: reply (2)			
Sender MAC address: BeijingX_94:d1:3f (64:64:4a:94:d1:3f)			
Sender IP address: 192.168.31.1			
Target MAC address: IntelCor_78:d4:58 (38:00:25:78:d4:58)			
Target IP address: 192.168.31.145			

a) The opcode is 2 (or 00 02 in the hex section)

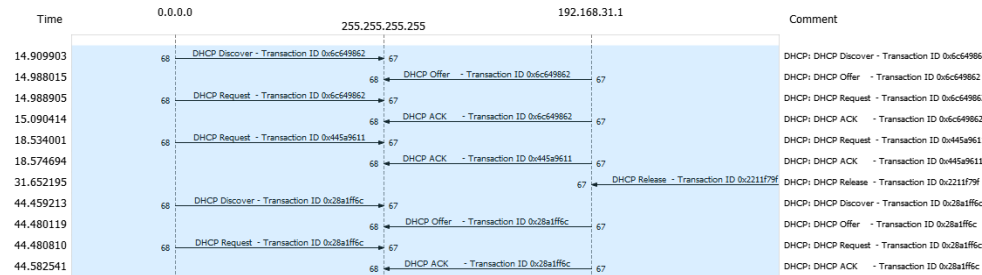
b) The value is contained in ARP field as “target”.

c) The hexadecimal address of the destination is “38 00 25 78 d4 58” in this particular example.

Part 3

1)

the timing diagram is as below:



2)

Discover:

144 14.909903	0.0.0.0	255.255.255.255	DHCP	342 DHCP Discover - Transaction ID 0x6c49862
146 14.988015	192.168.31.1	255.255.255.255	DHCP	371 DHCP Offer - Transaction ID 0x6c49862
147 14.988905	0.0.0.0	255.255.255.255	DHCP	352 DHCP Request - Transaction ID 0x6c49862
148 15.090414	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK - Transaction ID 0x6c49862
153 15.534001	0.0.0.0	255.255.255.255	DHCP	346 DHCP Request - Transaction ID 0x445a9611
158 18.574694	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK - Transaction ID 0x445a9611
18.574694	192.168.31.145	192.168.31.1	DHCP	342 DHCP Release - Transaction ID 0x2211f79f
31.652195	0.0.0.0	255.255.255.255	DHCP	342 DHCP Discover - Transaction ID 0x28a1ffc
44.459213	192.168.31.1	255.255.255.255	DHCP	371 DHCP Offer - Transaction ID 0x28a1ffc
44.480119	0.0.0.0	255.255.255.255	DHCP	352 DHCP Request - Transaction ID 0x28a1ffc
44.480810	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK - Transaction ID 0x28a1ffc
44.582541	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK - Transaction ID 0x28a1ffc

Message type: Boot Request (1)	0000 ff ff ff ff ff 38 00 25 78 d4 58 00 00 45 00	.....B.X.X.E
Hardware type: Ethernet (0x01)	0010 01 48 41 e6 00 00 11 00 00 00 00 00 ff ff	..HA.....
Hardware address length: 6	0020 ff ff 00 44 00 43 01 34 77 5d 01 01 06 00 28 a1	....D.C.4.u)....
Hops: 0	0030 ff 6c 00 00 00 00 00 00 00 00 00 00 00 00	.....1.....
Transaction ID: 0x28a1ffc	0040 00 00 00 00 00 38 00 25 78 d4 58 00 00 00	.....B.X.X.....
Seconds elapsed: 0	0050 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Bootp flags: 0x0000, Broadcast flag (Broadcast)	0060 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client IP address: 0.0.0.0	0070 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Your (client) IP address: 0.0.0.0	0080 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Next server IP address: 0.0.0.0	0090 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Relay agent IP address: 0.0.0.0	00a0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client MAC address: IntelCor_78:d4:58 (38:00:25:78:d4:58)	00b0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client hardware address padding: 0000000000000000	00c0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Server host name not given	00d0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Boot file name not given	00e0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Magic cookie: DHCP	00f0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Option: (53) DHCP Message Type (Discover)	0100 00 00 00 00 00 63 82 53 63 35 01 01 00 78 d4	.....c. Sc5.....
Option: (61) Client Identifier	0110 00 00 00 00 00 12 04 c0 a8 1f 01 36 04 c0 a8	.....Drax.usQ.....
Option: (54) Requested IP Address (192.168.31.1)	0120 72 61 78 75 73 c0 08 4d 53 46 54 20 35 2e 30 37	.....rauxus<R SET 5.0.....
Option: (12) Host Name	0130 0e 01 03 06 0f 1f 21 2b 2c 2e 2f 77 79 f9 fc ff	.....le.../ag.....
Option: (60) Vendor class identifier	0140 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Option: (55) Parameter Request List	0150 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Option: (255) End	0160 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Padding: 0000000000000000	0170 00 00 00 00 00 00 00 00 00 00 00 00 00	.....

Request:

144 14.909903	0.0.0.0	255.255.255.255	DHCP	342 DHCP Discover - Transaction ID 0x6c49862
146 14.988015	192.168.31.1	255.255.255.255	DHCP	371 DHCP Offer - Transaction ID 0x6c49862
147 14.988905	0.0.0.0	255.255.255.255	DHCP	352 DHCP Request - Transaction ID 0x6c49862
148 15.090414	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK - Transaction ID 0x6c49862
153 15.534001	0.0.0.0	255.255.255.255	DHCP	346 DHCP Request - Transaction ID 0x445a9611
158 18.574694	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK - Transaction ID 0x445a9611
18.574694	192.168.31.145	192.168.31.1	DHCP	342 DHCP Release - Transaction ID 0x2211f79f
31.652195	0.0.0.0	255.255.255.255	DHCP	342 DHCP Discover - Transaction ID 0x28a1ffc
44.459213	192.168.31.1	255.255.255.255	DHCP	371 DHCP Offer - Transaction ID 0x28a1ffc
44.480119	0.0.0.0	255.255.255.255	DHCP	352 DHCP Request - Transaction ID 0x28a1ffc
44.480810	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK - Transaction ID 0x28a1ffc
44.582541	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK - Transaction ID 0x28a1ffc

Message type: Boot Request (1)	0000 ff ff ff ff ff 38 00 25 78 d4 58 00 00 45 00	.....B.X.X.E
Hardware type: Ethernet (0x01)	0010 01 52 41 e7 00 00 11 00 00 00 00 00 ff ff	..RA.....
Hardware address length: 6	0020 ff ff 00 44 00 43 01 3e cc 5a 01 01 06 00 28 a1	....D.C.9.....
Hops: 0	0030 ff 6c 00 00 00 00 00 00 00 00 00 00 00 00	.....1.....
Transaction ID: 0x28a1ffc	0040 00 00 00 00 00 38 00 25 78 d4 58 00 00 00	.....B.X.X.....
Seconds elapsed: 0	0050 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Bootp flags: 0x0000, Broadcast flag (Broadcast)	0060 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client IP address: 0.0.0.0	0070 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Your (client) IP address: 0.0.0.0	0080 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Next server IP address: 0.0.0.0	0090 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Relay agent IP address: 0.0.0.0	00a0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client MAC address: IntelCor_78:d4:58 (38:00:25:78:d4:58)	00b0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client hardware address padding: 0000000000000000	00c0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Server host name not given	00d0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Boot file name not given	00e0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Magic cookie: DHCP	00f0 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Option: (53) DHCP Message Type (Request)	0100 00 00 00 00 00 63 82 53 63 35 01 01 00 78 d4	.....c. Sc5.....
Option: (61) Client Identifier	0110 00 00 00 00 00 12 04 c0 a8 1f 01 36 04 c0 a8	.....Drax.usQ.....
Option: (54) Requested IP Address (192.168.31.1)	0120 72 61 78 75 73 c0 08 4d 53 46 54 20 35 2e 30 37	.....rauxus<R SET 5.0.....
Option: (54) DHCP Server Identifier (192.168.31.1)	0130 0e 01 03 06 0f 1f 21 2b 2c 2e 2f 77 79 f9 fc ff	.....le.../ag.....
Option: (12) Host Name	0140 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Option: (81) Client Fully Qualified Domain Name	0150 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Option: (60) Vendor class identifier	0160 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Option: (55) Parameter Request List	0170 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Option: (255) End	0180 00 00 00 00 00 00 00 00 00 00 00 00 00	.....

As we can see the entries in DHCP field differ a lot and the request query has even extra entries like client fully qualified domain name.

The value of "Message type" is different as well.

3)

As we can see in the picture the transaction ID of the first four messages is 0x6c649862 and for the 2nd four messages is 0x28a1ff6c

144	14.909903	0.0.0.0	255.255.255.255	DHCP	342 DHCP Discover	- Transaction ID 0x6c649862
146	14.988015	192.168.31.1	255.255.255.255	DHCP	371 DHCP Offer	- Transaction ID 0x6c649862
147	14.988905	0.0.0.0	255.255.255.255	DHCP	352 DHCP Request	- Transaction ID 0x6c649862
148	15.090414	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK	- Transaction ID 0x6c649862
193	18.534001	0.0.0.0	255.255.255.255	DHCP	346 DHCP Request	- Transaction ID 0x445a9611
198	18.574694	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK	- Transaction ID 0x445a9611
996	31.652195	192.168.31.145	192.168.31.1	DHCP	342 DHCP Release	- Transaction ID 0x2211f79f
1330	44.459213	0.0.0.0	255.255.255.255	DHCP	342 DHCP Discover	- Transaction ID 0x28a1ff6c
1331	44.480119	192.168.31.1	255.255.255.255	DHCP	371 DHCP Offer	- Transaction ID 0x28a1ff6c
1332	44.480810	0.0.0.0	255.255.255.255	DHCP	352 DHCP Request	- Transaction ID 0x28a1ff6c
1333	44.582541	192.168.31.1	255.255.255.255	DHCP	382 DHCP ACK	- Transaction ID 0x28a1ff6c

The transaction ID in DHCP is used to uniquely identify a DHCP transaction between a DHCP client and a DHCP server. DHCP clients and servers use a four-byte transaction ID field in their messages to ensure that each DHCP message is associated with the correct DHCP transaction.

When a DHCP client sends out a DHCP request message, it includes a random transaction ID in the message. The DHCP server that receives the message then uses this transaction ID to match the request to the appropriate DHCP transaction. This helps to ensure that the DHCP client receives the correct IP address configuration information and that the DHCP server hands out the correct information.

4)

For the discover and request

- Source ip is 0.0.0.0
- Destination ip is 255.255.255.255 which means the message is sent as broadcast.

For ACK and offer:

- Source ip is 192.168.31.1
- Destination ip is 255.255.255.255 which means the message is sent as broadcast.

5)

The Ip address of the server is the same as source of the DHCP Offer and request and also is contained in the frame itself (which is 192.168.31.1):

```
Next server IP address: 192.168.31.1
Relay agent IP address: 0.0.0.0
Client MAC address: IntelCor_78:d4:58 (38:00:25:78:d4:58)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
> Option: (53) DHCP Message Type (Offer)
✓ Option: (54) DHCP Server Identifier (192.168.31.1)
```

6)

The offered IP by the server is included in DHCP offer message which is 192.168.31.145

7)

The requested IP address is contained in the request message and is equal to 192.168.31.145

```
Server host name not given
Boot file name not given
Magic cookie: DHCP
> Option: (53) DHCP Message Type (Request)
> Option: (61) Client identifier
> Option: (50) Requested IP Address (192.168.31.145)
> Option: (54) DHCP Server Identifier (192.168.31.1)
> Option: (12) Host Name
> Option: (81) Client Fully Qualified Domain Name
> Option: (60) Vendor class identifier
> Option: (55) Parameter Request List
> Option: (255) End
```

8)

The purpose of the lease time is to ensure that IP addresses are not unnecessarily tied up with devices that are no longer using them. By allowing for addresses to be freed up after a certain period of time, DHCP helps to ensure that IP addresses are used efficiently and effectively.

Wireless LAN adapter Wi-Fi:

```
Connection-specific DNS Suffix . :  
Description . . . . . : Intel(R) Wireless-AC 9560 160MHz  
Physical Address. . . . . : 38-00-25-78-D4-58  
DHCP Enabled. . . . . : Yes  
Autoconfiguration Enabled . . . . : Yes  
IPv4 Address. . . . . : 192.168.31.145(Preferred)  
Subnet Mask . . . . . : 255.255.255.0  
Lease Obtained. . . . . : Friday, May 12, 2023 4:28:04 PM  
Lease Expires . . . . . : Saturday, May 13, 2023 4:28:00 AM  
Default Gateway . . . . . : 192.168.31.1  
DHCP Server . . . . . : 192.168.31.1  
DNS Servers . . . . . : 178.22.122.100  
                        185.51.200.2  
NetBIOS over Tcpip. . . . . : Enabled
```

As we can see in the ipconfig section lease time is equal to the interval between lease obtained and lease expires which is equal to 12 hours.