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Course: CMPE 148 – 01

Lab assignment #2: DHCP

Note: Jump to page 8 to view the answers to the questions.

Command Prompt window showing sequence of *ipconfig* commands entered:

```
Microsoft Windows [Version 10.0.17763.437]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\1swet>ipconfig /release

Windows IP Configuration

No operation can be performed on Ethernet while it has its media disconnected.
No operation can be performed on Ethernet 2 while it has its media disconnected.
An error occurred while releasing interface Wi-Fi : An address has not yet been associated with the network endpoint.

No operation can be performed on Bluetooth Network Connection while it has its media disconnected.

Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter Ethernet 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter VirtualBox Host-Only Network:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::5c9a:78a8:444c:f6af%8
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Ethernet adapter Npcap Loopback Adapter:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::50c8:8f9e:9442:b155%3
   Autoconfiguration IPv4 Address. . : 169.254.177.85
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2601:647:5380:2be1::86cd
   IPv6 Address. . . . . . . . . . . : 2601:647:5380:2be1:85d5:649e:f2da:fea2
```

Figure 1. ipconfig /release command to display the current IP address (Host's IP address becomes 0.0.0.0.)

```
   Temporary IPv6 Address. . . . . : 2601:647:5380:2be1:b025:5b8:3ff8:64d6
   Link-local IPv6 Address . . . . . : fe80::85d5:649e:f2da:fea2%11
   Autoconfiguration IPv4 Address. . : 169.254.254.162
   Subnet Mask . . . . . : 255.255.0.0
   Default Gateway . . . . . : fe80::fe51:a4ff:fe1d:5033%11

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

C:\Users\1swet>ipconfig

Windows IP Configuration


Ethernet adapter Ethernet:

   Media State . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter Ethernet 2:

   Media State . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter VirtualBox Host-Only Network:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::5c9a:78a8:444c:f6af%8
   IPv4 Address. . . . . : 192.168.56.1
   Subnet Mask . . . . . : 255.255.255.0
   Default Gateway . . . . . :

Ethernet adapter Npcap Loopback Adapter:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::50c8:8f9e:9442:b155%3
   Autoconfiguration IPv4 Address. . : 169.254.177.85
   Subnet Mask . . . . . : 255.255.0.0
   Default Gateway . . . . . :

Wireless LAN adapter Wi-Fi:
```

Figure 2. ipconfig command to check the interface name

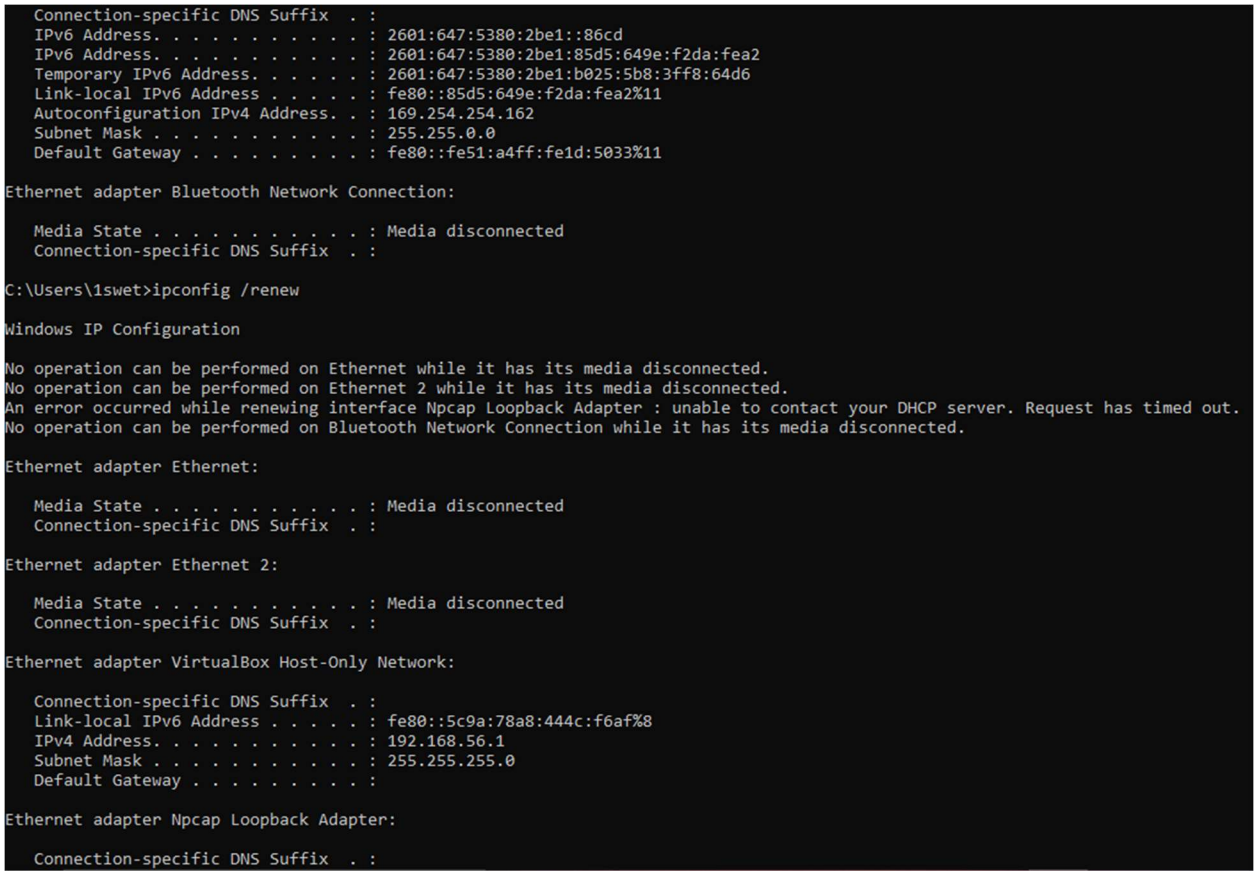


Figure 3. ipconfig /renew command to obtain network configuration, including a new IP address

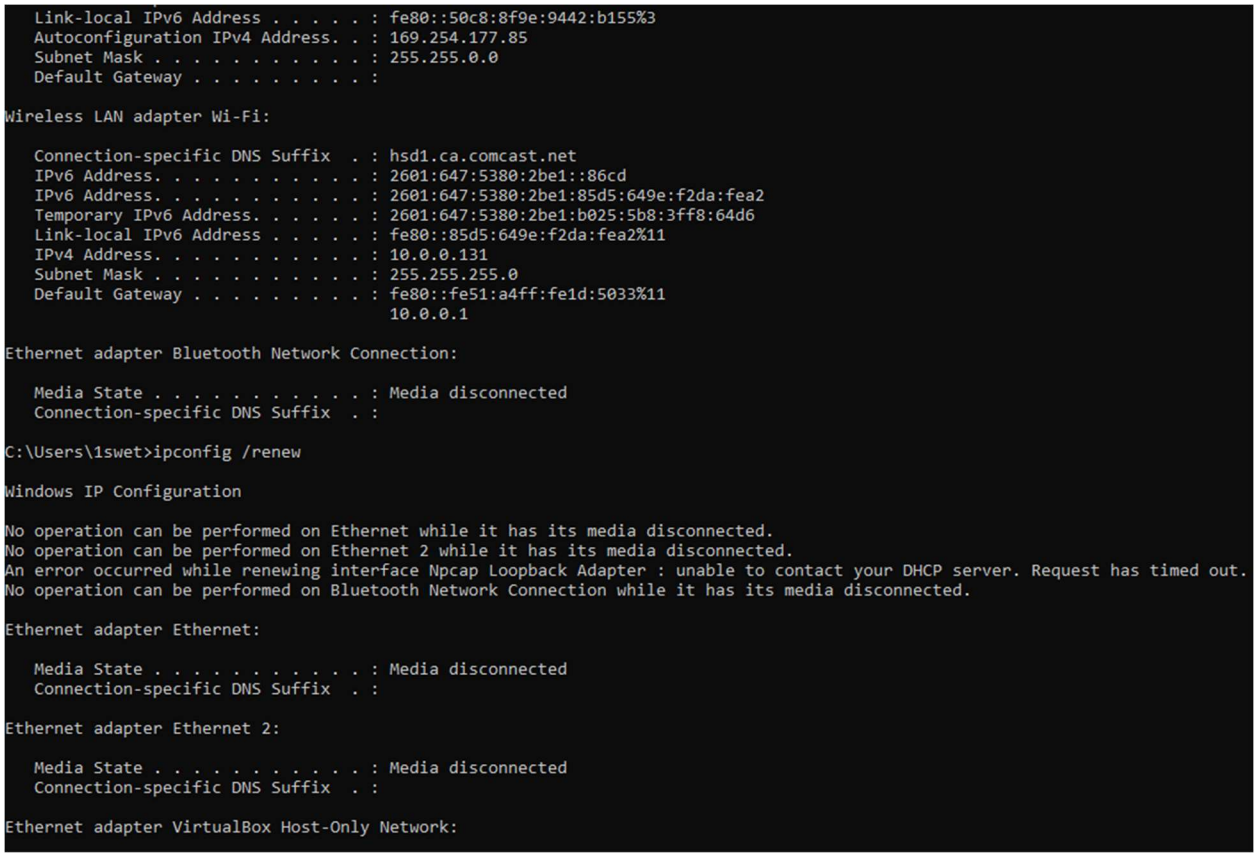


Figure 4. ipconfig /renew command executed again

```
   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::5c9a:78a8:444c:f6af%8
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Ethernet adapter Npcap Loopback Adapter:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::50c8:8f9e:9442:b155%3
   Autoconfiguration IPv4 Address. . : 169.254.177.85
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : hsd1.ca.comcast.net
   IPv6 Address. . . . . . . . . . . : 2601:647:5380:2be1::86cd
   IPv6 Address. . . . . . . . . . . : 2601:647:5380:2be1:85d5:649e:f2da:fea2
   Temporary IPv6 Address. . . . . . : 2601:647:5380:2be1:b025:5b8:3ff8:64d6
   Link-local IPv6 Address . . . . . : fe80::85d5:649e:f2da:fea2%11
   IPv4 Address. . . . . . . . . . . : 10.0.0.131
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::fe51:a4ff:fe1d:5033%11
                                       10.0.0.1

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

C:\Users\1swet>ipconfig /release

Windows IP Configuration

No operation can be performed on Ethernet while it has its media disconnected.
No operation can be performed on Ethernet 2 while it has its media disconnected.
No operation can be performed on Bluetooth Network Connection while it has its media disconnected.

Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

Figure 5. ipconfig /release command to release the previously-allocated IP address

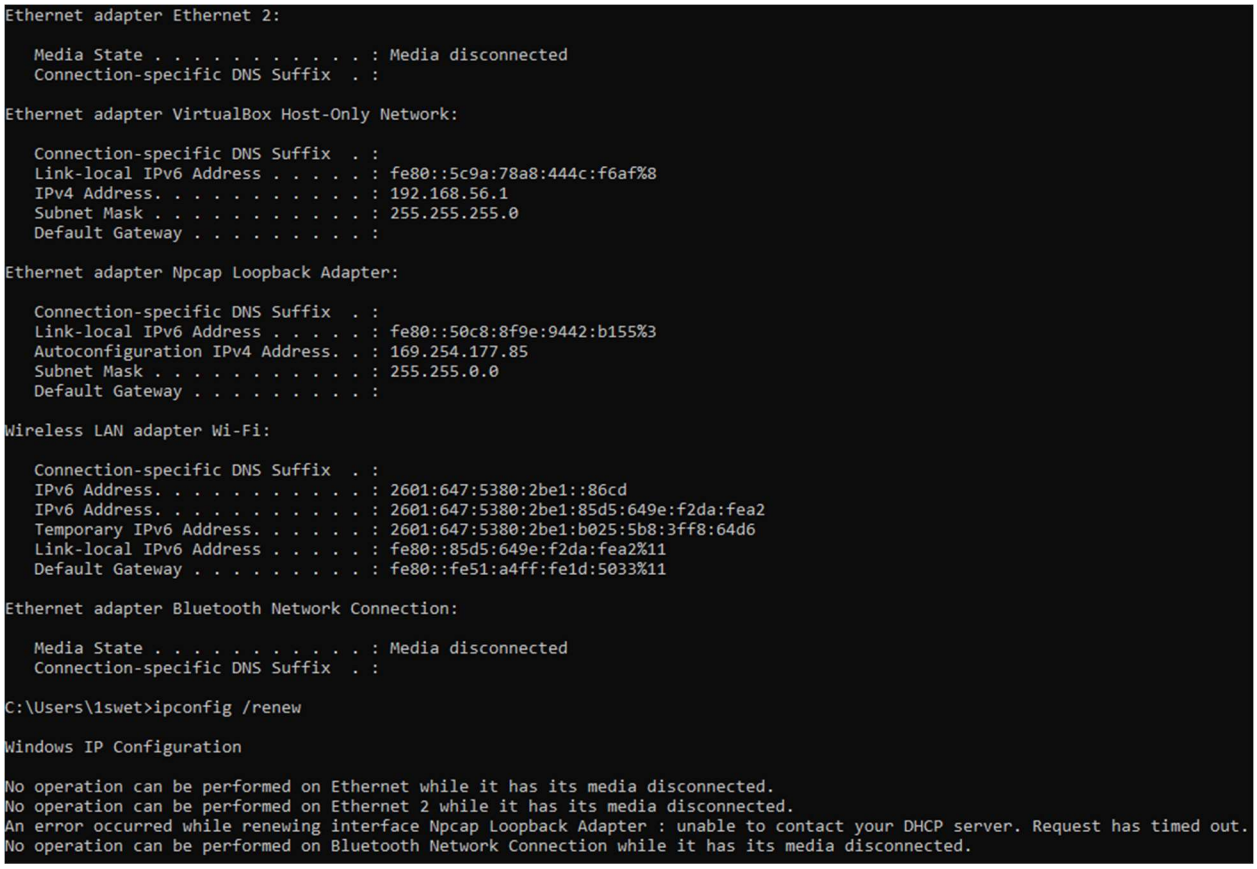


Figure 6. ipconfig /renew command to again be allocated an IP address

```
Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter Ethernet 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter VirtualBox Host-Only Network:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::5c9a:78a8:444c:f6af%8
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Ethernet adapter Npcap Loopback Adapter:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::50c8:8f9e:9442:b155%3
   Autoconfiguration IPv4 Address. . : 169.254.177.85
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : hsd1.ca.comcast.net
   IPv6 Address. . . . . . . . . . . : 2601:647:5380:2be1::86cd
   IPv6 Address. . . . . . . . . . . : 2601:647:5380:2be1:85d5:649e:f2da:fea2
   Temporary IPv6 Address. . . . . . : 2601:647:5380:2be1:b025:5b8:3ff8:64d6
   Link-local IPv6 Address . . . . . : fe80::85d5:649e:f2da:fea2%11
   IPv4 Address. . . . . . . . . . . : 10.0.0.131
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::fe51:a4ff:fe1d:5033%11
                                       10.0.0.1

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

C:\Users\1swet>
```

Figure 7. Continuation of renewed IP address information

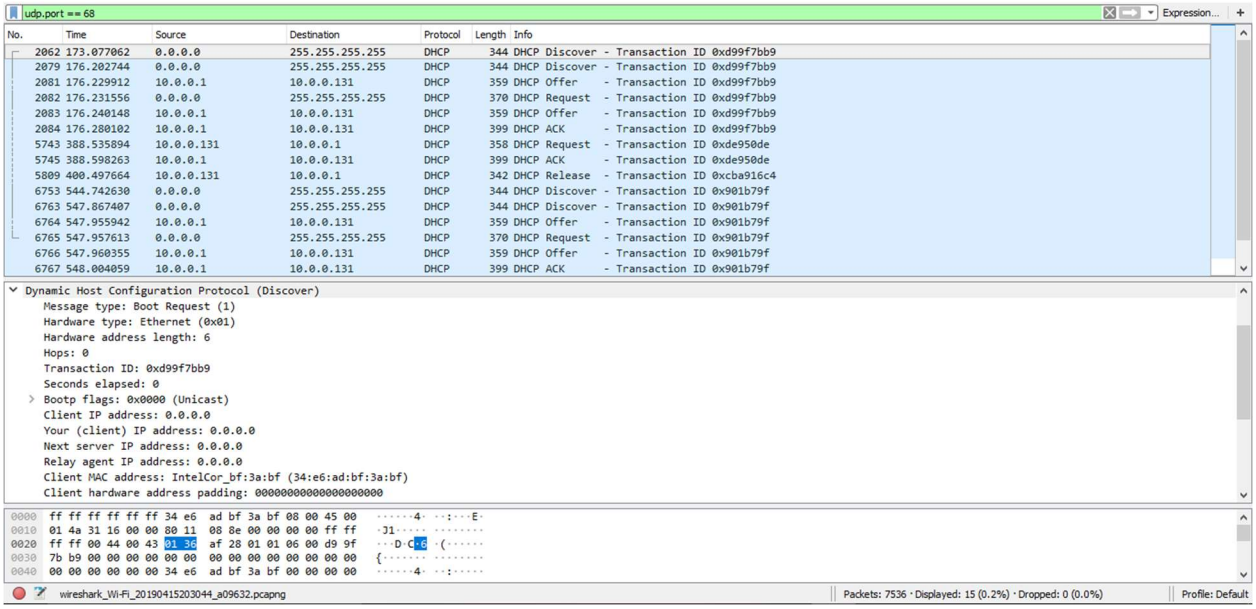


Figure 8. Wireshark window with first DHCP packet - the DHCP Discover packet expanded

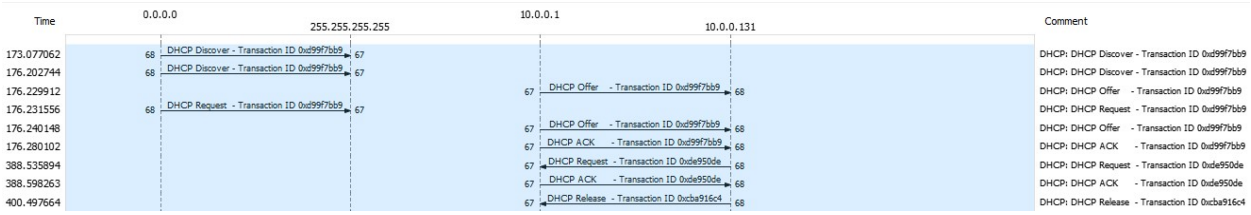
Answers to the questions:

1. First, the host broadcasts "**DHCP discover**" message. Next, DHCP server responds with "**DHCP offer**" message. Then, the host requests IP address: "**DHCP request**" message. Finally, the DHCP server sends the address: "**DHCP ack**" message. The protocol field in the IP header contains assigned protocol numbers. In this case, since DHCP messages are sent over **UDP**, the value in the protocol field would be **17**.

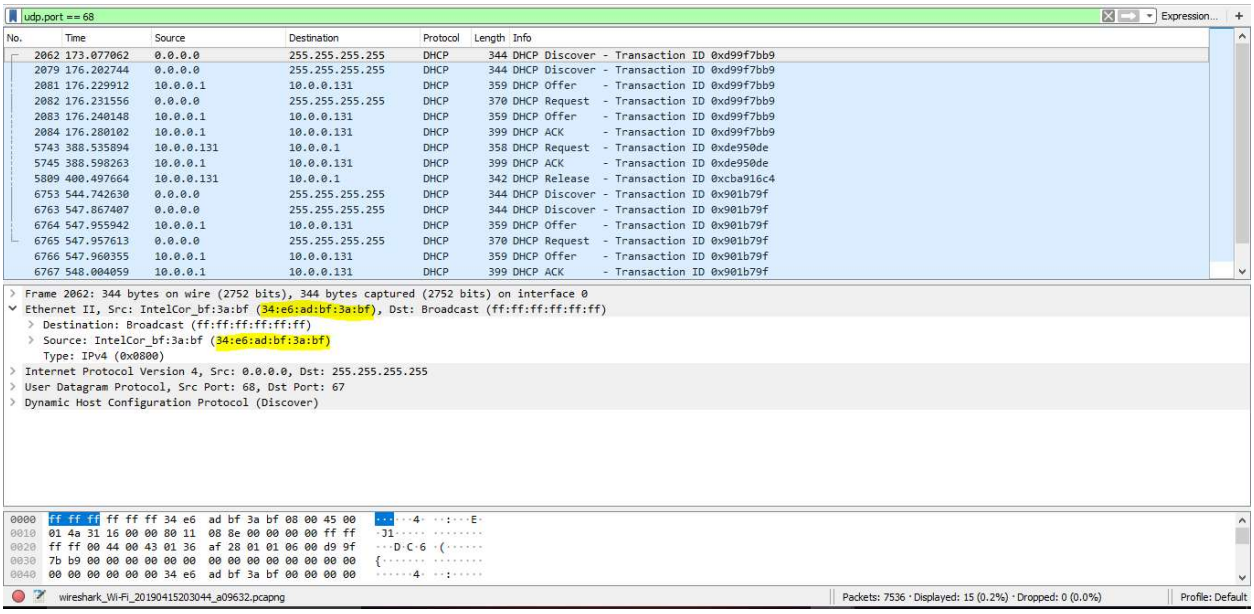
Protocol	Length	Info
DHCP	344	DHCP Discover - Transaction ID 0xd99f7bb9
DHCP	344	DHCP Discover - Transaction ID 0xd99f7bb9
DHCP	359	DHCP Offer - Transaction ID 0xd99f7bb9
DHCP	370	DHCP Request - Transaction ID 0xd99f7bb9
DHCP	359	DHCP Offer - Transaction ID 0xd99f7bb9
DHCP	399	DHCP ACK - Transaction ID 0xd99f7bb9
DHCP	358	DHCP Request - Transaction ID 0xde950de
DHCP	399	DHCP ACK - Transaction ID 0xde950de
DHCP	342	DHCP Release - Transaction ID 0xcba916c4
DHCP	344	DHCP Discover - Transaction ID 0x901b79f
DHCP	344	DHCP Discover - Transaction ID 0x901b79f
DHCP	359	DHCP Offer - Transaction ID 0x901b79f
DHCP	370	DHCP Request - Transaction ID 0x901b79f
DHCP	359	DHCP Offer - Transaction ID 0x901b79f
DHCP	399	DHCP ACK - Transaction ID 0x901b79f

```
▼ User Datagram Protocol, Src Port: 68, Dst Port: 67
    Source Port: 68
    Destination Port: 67
    Length: 310
    Checksum: 0xaf28 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 235]
  ▼ [Timestamps]
      [Time since first frame: 0.000000000 seconds]
      [Time since previous frame: 0.000000000 seconds]
▶ Dynamic Host Configuration Protocol (Discover)
```

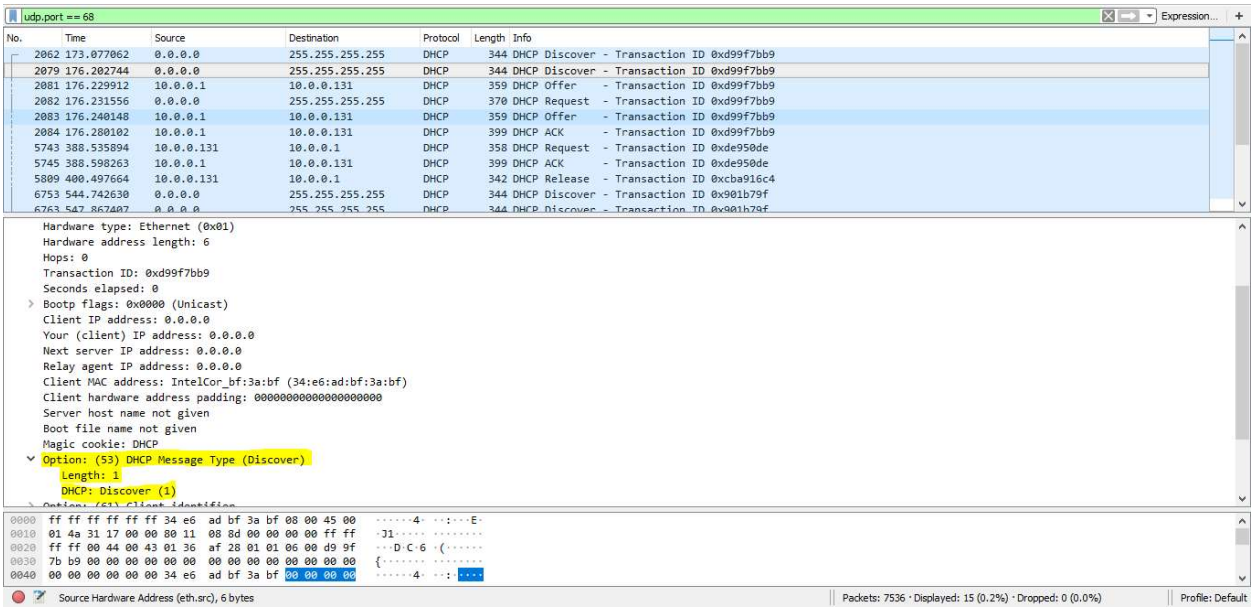
2. Timing datagram illustrating the sequence of the first four-packet Discover/Offer/Request/ACK DHCP exchange between the client and the server:

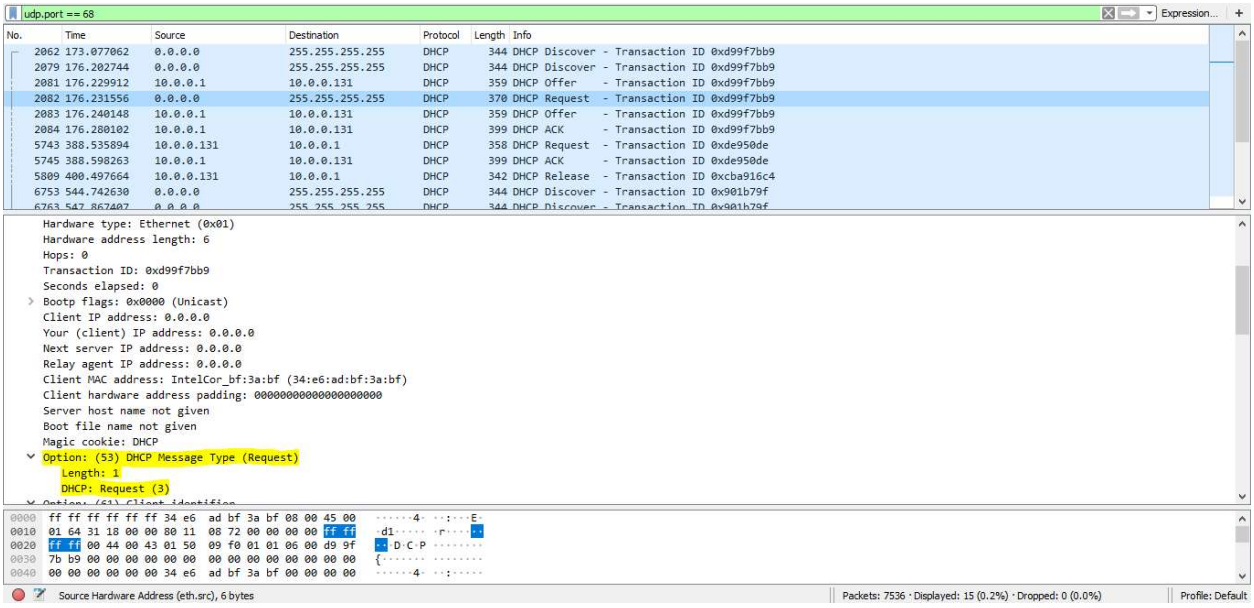


3. The link layer (e.g., Ethernet) address of my DHCP server is **(34:e6:ad:bf:3a:bf)**.

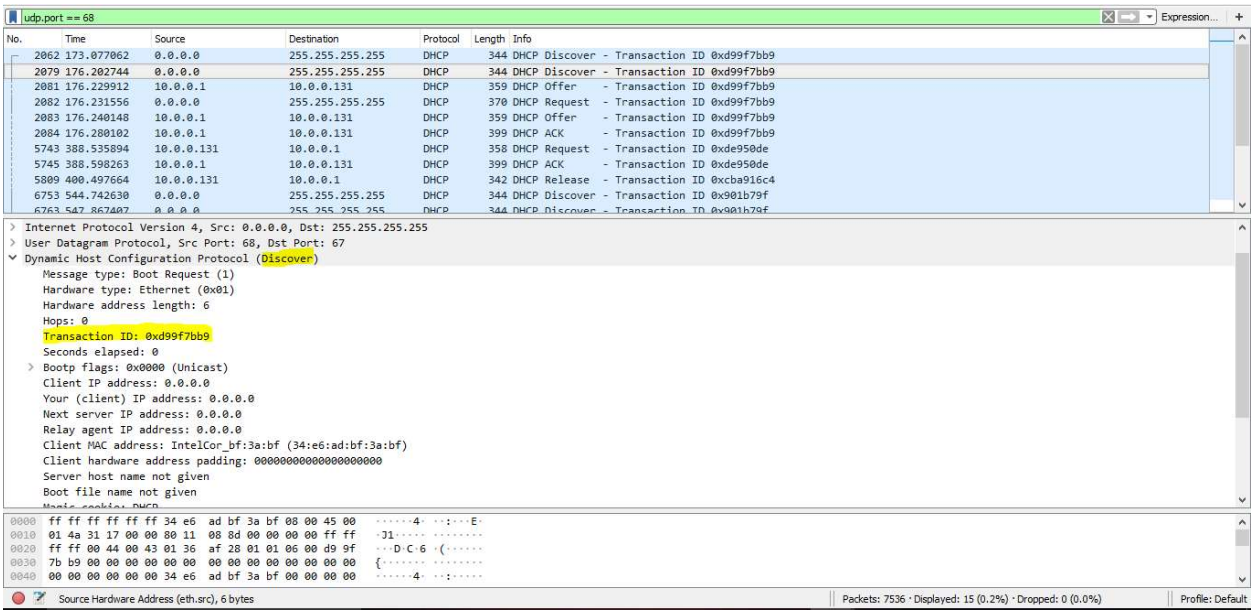


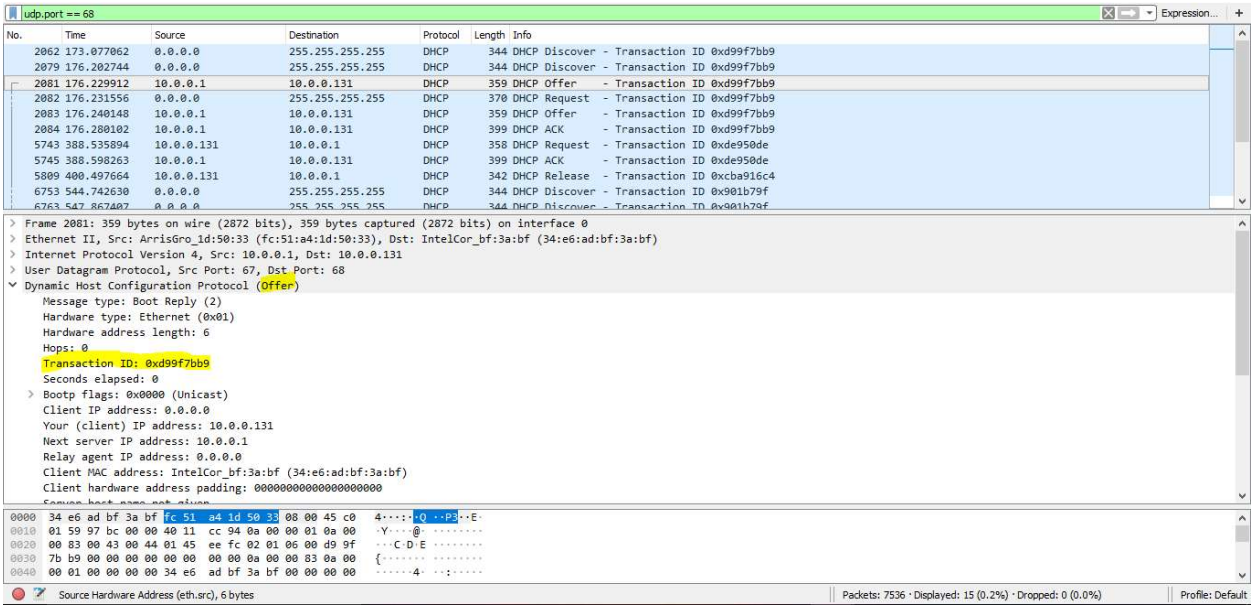
4. As shown in the figures below, the value in the DHCP discover message that differentiates this message from the DHCP request message is **option 53**, more specifically, in the DHCP discover message, it's **DHCP: discover (1)** and in the DHCP request message, it's **DHCP: request (3)**.

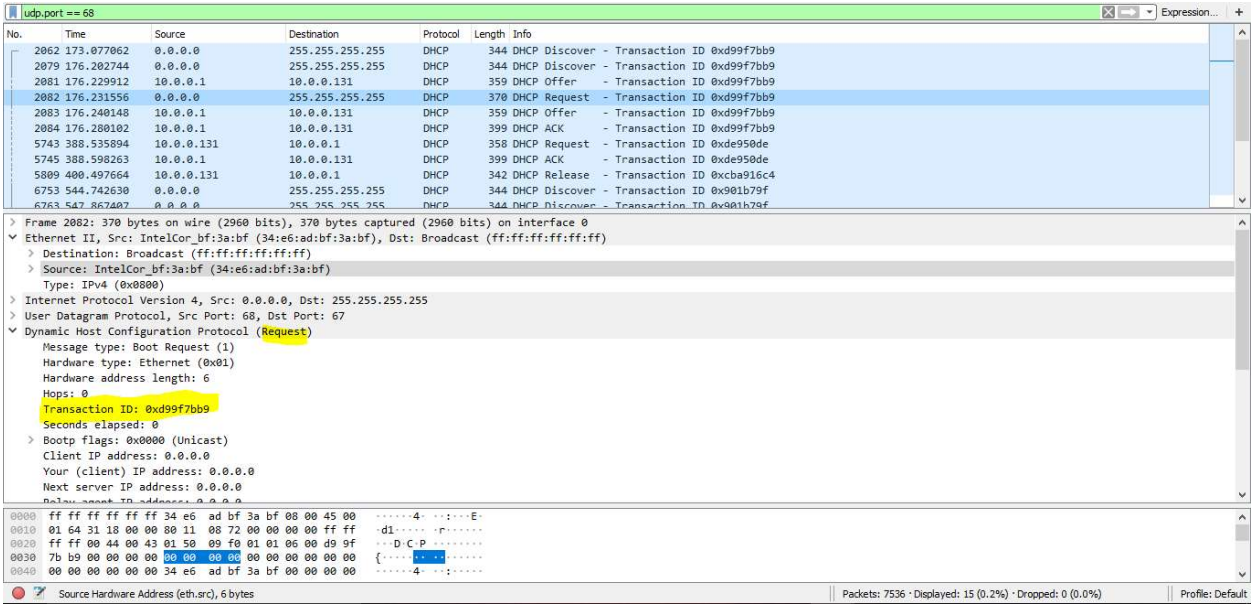


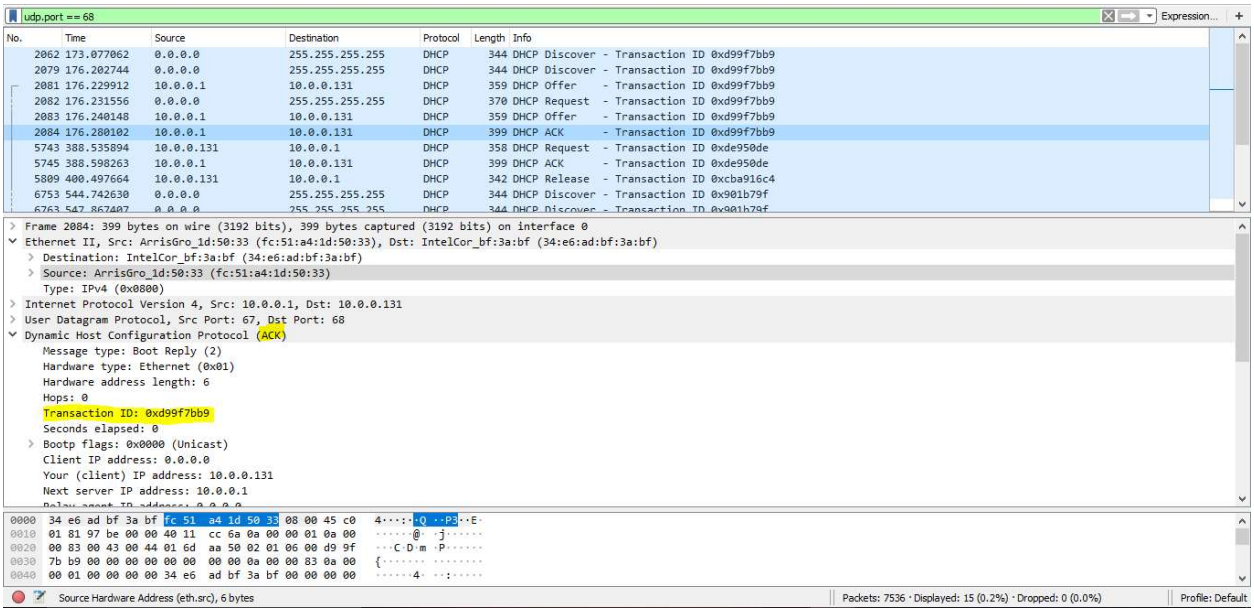


5. As shown and highlighted in the figures below, the value of the Transaction-ID in each of the first four (Discover/Offer/Request/ACK) DHCP messages is **0xd99f7bb9**.

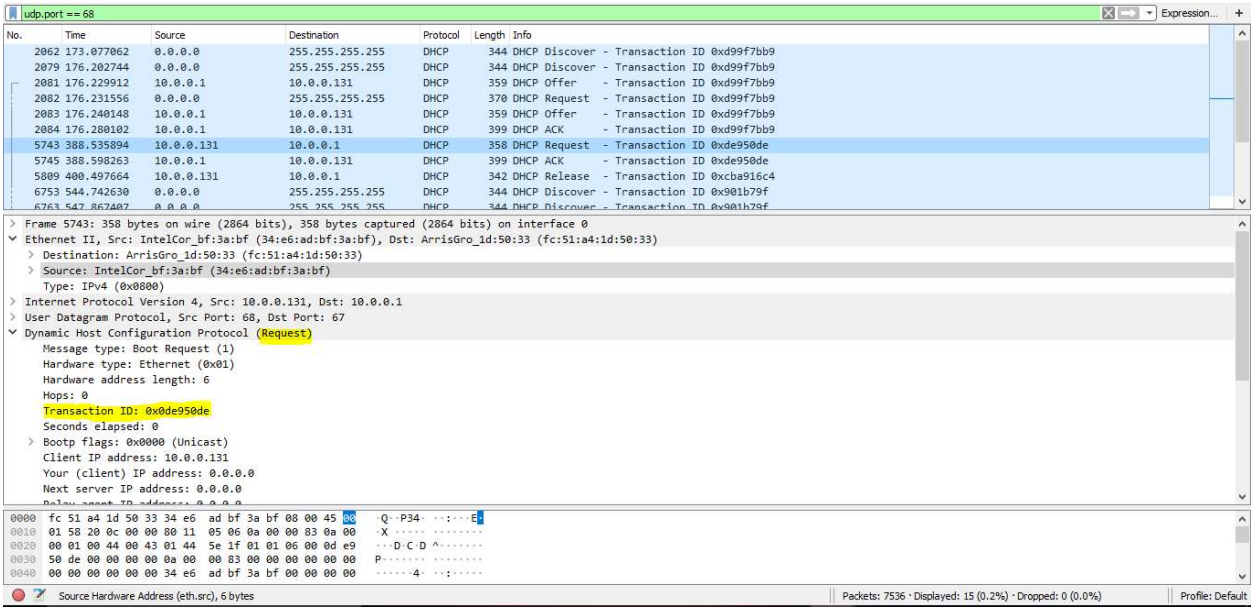

udp.port == 68
Expression...
No. Time Source Destination Protocol Length Info
2062 173.077062 0.0.0.0 255.255.255.255 DHCP 344 DHCP Discover - Transaction ID 0xd99f7bb9
2079 176.202744 0.0.0.0 255.255.255.255 DHCP 344 DHCP Discover - Transaction ID 0xd99f7bb9
2081 176.229912 10.0.0.1 10.0.0.131 DHCP 359 DHCP Offer - Transaction ID 0xd99f7bb9
2082 176.231556 0.0.0.0 255.255.255.255 DHCP 370 DHCP Request - Transaction ID 0xd99f7bb9
2083 176.240148 10.0.0.1 10.0.0.131 DHCP 359 DHCP Offer - Transaction ID 0xd99f7bb9
2084 176.280102 10.0.0.1 10.0.0.131 DHCP 399 DHCP ACK - Transaction ID 0xd99f7bb9
5743 388.535894 10.0.0.131 10.0.0.1 DHCP 358 DHCP Request - Transaction ID 0xde950de
5745 388.598263 10.0.0.1 10.0.0.131 DHCP 399 DHCP ACK - Transaction ID 0xde950de
5809 400.497664 10.0.0.131 10.0.0.1 DHCP 342 DHCP Release - Transaction ID 0xcba916c4
6753 544.742630 0.0.0.0 255.255.255.255 DHCP 344 DHCP Discover - Transaction ID 0x901b79f
Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255
User Datagram Protocol, Src Port: 68, Dst Port: 67
Dynamic Host Configuration Protocol (Discover)
Message type: Boot Request (1)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0xd99f7bb9
Seconds elapsed: 0
Bootp flags: 0x0000 (Unicast)
Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0
Client MAC address: IntelCor_bf:3a:bf (34:e6:ad:bf:3a:bf)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
0000 ff ff ff ff ff ff 34 e6 ad bf 3a bf 08 00 45 00
0010 01 4a 31 17 00 00 80 11 08 8d 00 00 00 00 ff ff
0020 ff ff 00 44 00 43 01 36 af 28 01 01 06 00 d9 9f
0030 7b b9 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0040 00 00 00 00 00 00 34 e6 ad bf 3a bf 00 00 00 00
Source Hardware Address (eth.src), 6 bytes
Packets: 7536 · Displayed: 15 (0.2%) · Dropped: 0 (0.0%)
Profile: Default

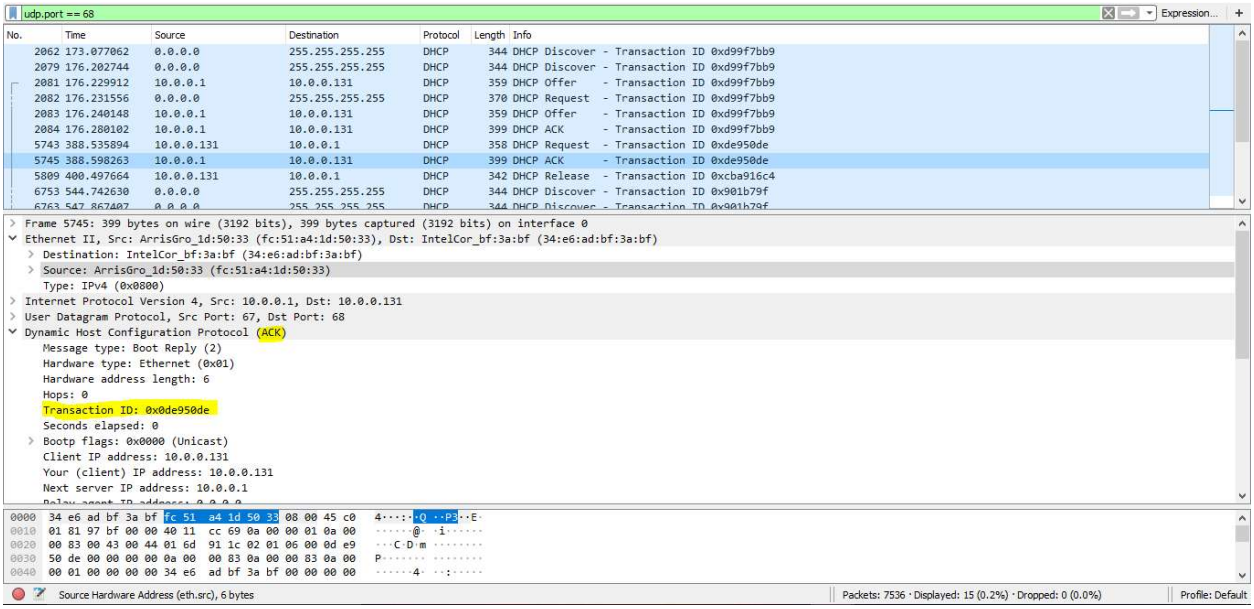

udp.port == 68
Expression...
No. Time Source Destination Protocol Length Info
2062 173.077062 0.0.0.0 255.255.255.255 DHCP 344 DHCP Discover - Transaction ID 0xd99f7bb9
2079 176.202744 0.0.0.0 255.255.255.255 DHCP 344 DHCP Discover - Transaction ID 0xd99f7bb9
2081 176.229912 10.0.0.1 10.0.0.131 DHCP 359 DHCP Offer - Transaction ID 0xd99f7bb9
2082 176.231556 0.0.0.0 255.255.255.255 DHCP 370 DHCP Request - Transaction ID 0xd99f7bb9
2083 176.240148 10.0.0.1 10.0.0.131 DHCP 359 DHCP Offer - Transaction ID 0xd99f7bb9
2084 176.280102 10.0.0.1 10.0.0.131 DHCP 399 DHCP ACK - Transaction ID 0xd99f7bb9
5743 388.535894 10.0.0.131 10.0.0.1 DHCP 358 DHCP Request - Transaction ID 0xde950de
5745 388.598263 10.0.0.1 10.0.0.131 DHCP 399 DHCP ACK - Transaction ID 0xde950de
5809 400.497664 10.0.0.131 10.0.0.1 DHCP 342 DHCP Release - Transaction ID 0xcba916c4
6753 544.742630 0.0.0.0 255.255.255.255 DHCP 344 DHCP Discover - Transaction ID 0x901b79f
Frame 2081: 359 bytes on wire (2872 bits), 359 bytes captured (2872 bits) on interface 0
Ethernet II, Src: ArrisGro_1d:50:33 (fc:51:a4:1d:50:33), Dst: IntelCor_bf:3a:bf (34:e6:ad:bf:3a:bf)
Internet Protocol Version 4, Src: 10.0.0.1, Dst: 10.0.0.131
User Datagram Protocol, Src Port: 67, Dst Port: 68
Dynamic Host Configuration Protocol (Offer)
Message type: Boot Reply (2)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0xd99f7bb9
Seconds elapsed: 0
Bootp flags: 0x0000 (Unicast)
Client IP address: 0.0.0.0
Your (client) IP address: 10.0.0.131
Next server IP address: 10.0.0.1
Relay agent IP address: 0.0.0.0
Client MAC address: IntelCor_bf:3a:bf (34:e6:ad:bf:3a:bf)
Client hardware address padding: 00000000000000000000
0000 34 e6 ad bf 3a bf fc 51 a4 1d 50 33 08 00 45 c0
0010 01 59 97 bc 00 00 40 11 cc 94 0a 00 00 01 0a 00
0020 00 83 00 43 00 44 01 45 ee fc 02 01 06 00 d9 9f
0030 7b b9 00 00 00 00 00 00 00 00 0a 00 00 83 0a 00
0040 00 01 00 00 00 00 34 e6 ad bf 3a bf 00 00 00 00
Source Hardware Address (eth.src), 6 bytes
Packets: 7536 · Displayed: 15 (0.2%) · Dropped: 0 (0.0%)
Profile: Default





The value of the Transaction-ID in the second set (Request/ACK) set of DHCP messages is **0x0de950de**.

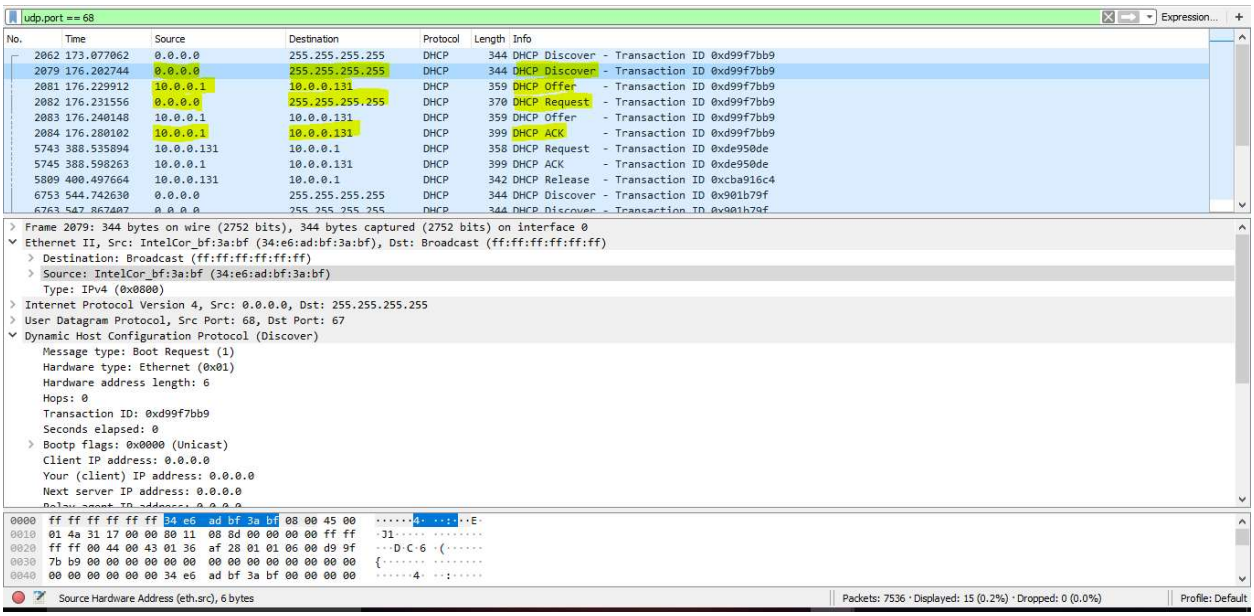




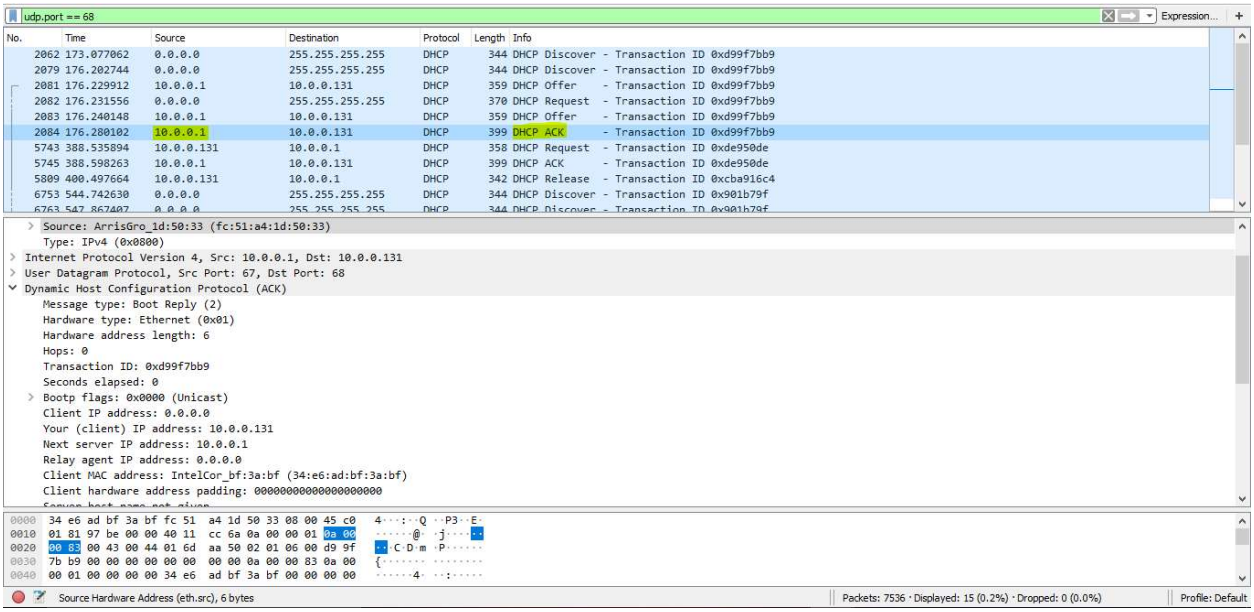
The Transaction-ID is primarily used by the DHCP server to **distinguish between the client requests** during the DHCP Request message process.

6.

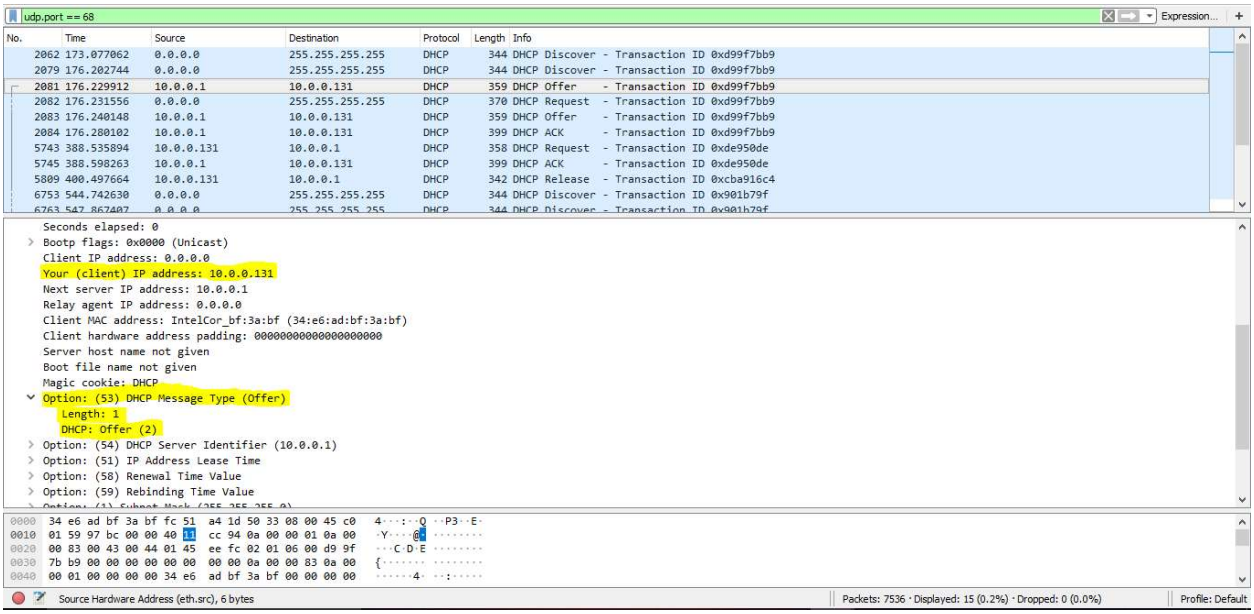
DHCP messages	**IP address**	
	Source	**Destination**
Discover	0.0.0.0	255.255.255.255
Offer	10.0.0.1	10.0.0.131
Request	0.0.0.0	255.255.255.255
ACK	10.0.0.1	10.0.0.131



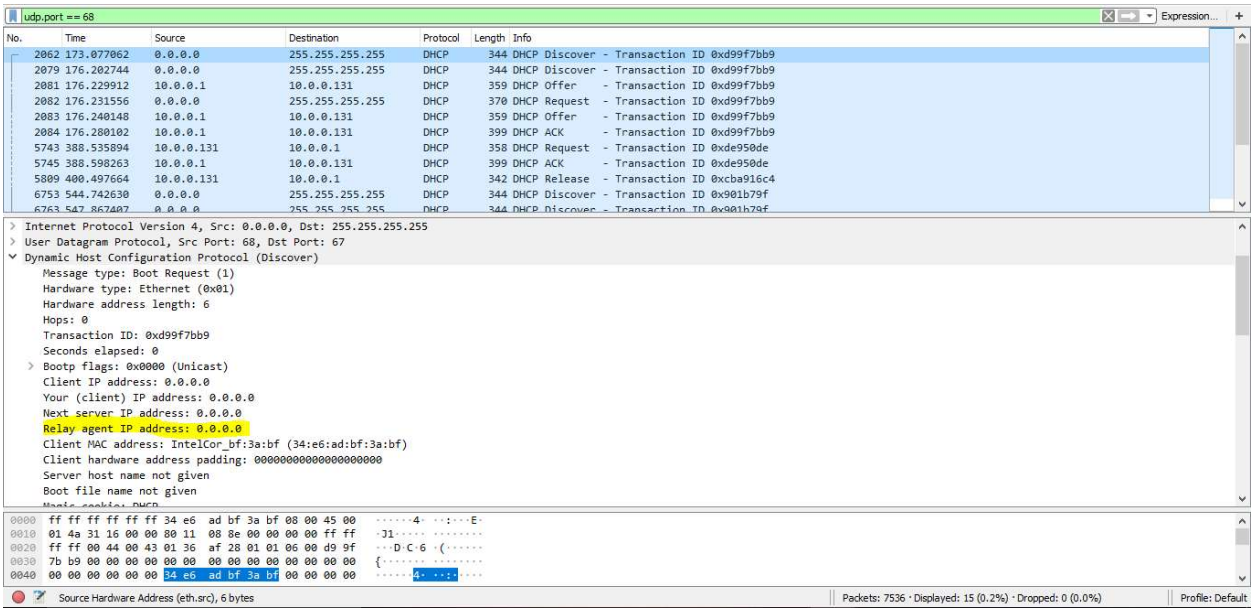
7. The IP address of my DHCP server is **10.0.0.1**. It sends **DHCP ACK messages**.



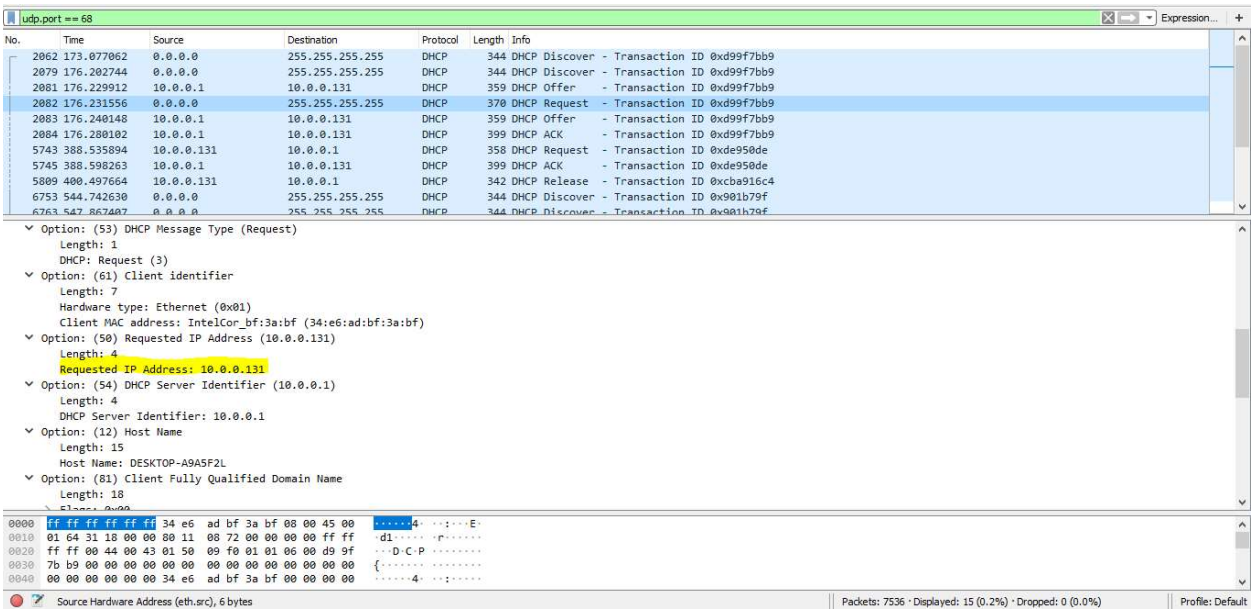
8. The IP address that the DHCP server is offering to my host in the DHCP Offer message is **10.0.0.131**. In **option 53**, the **DHCP Message Type (Offer)** is given along with **Length (1)** and **DHCP: Offer (2)**.



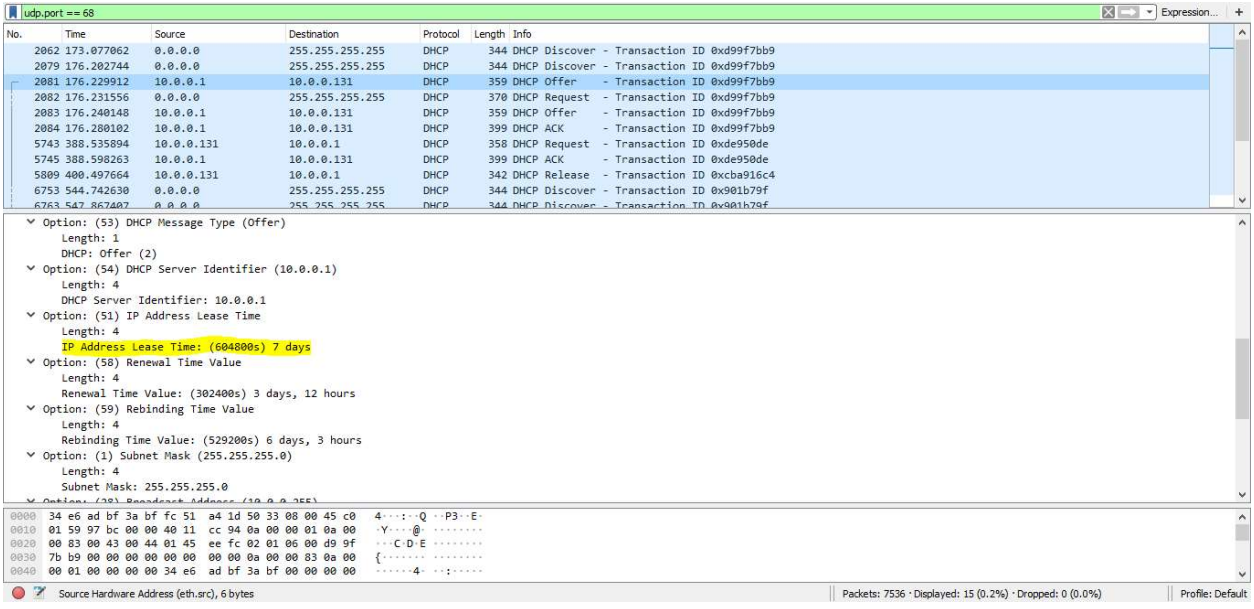
9. The value “0.0.0.0” for the Relay agent IP address in the trace indicate the absence of a relay agent. There is no relay agent in my experiment.



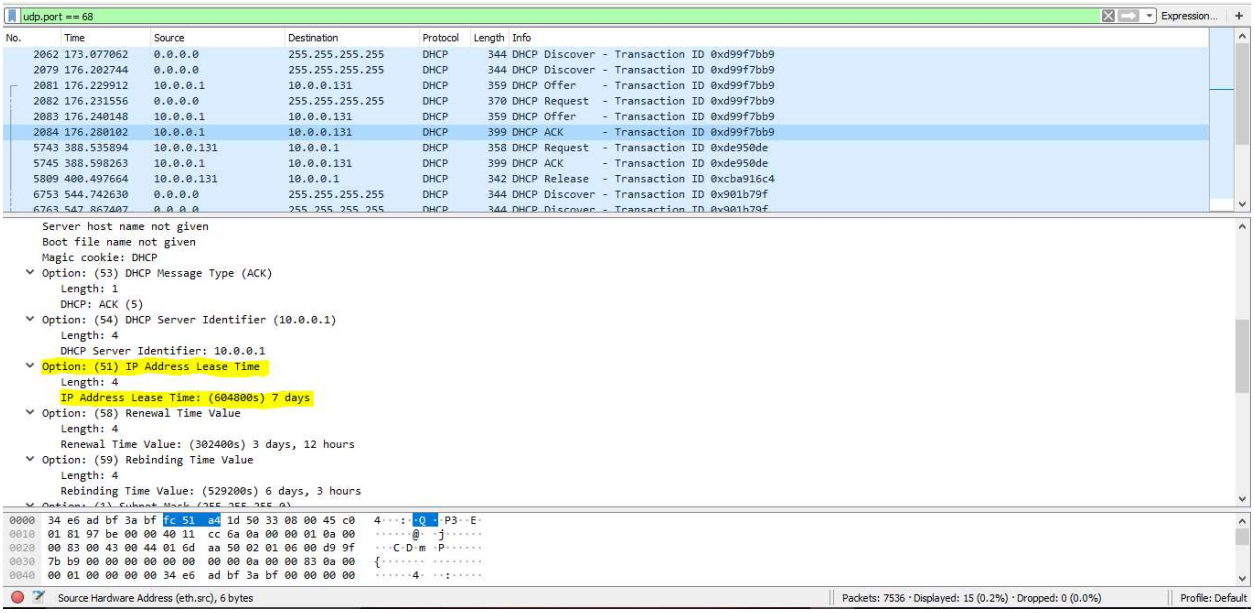
10. Yes, the client accepts the IP address offered by the DHCP server – **10.0.0.131**. In the client’s response to the first server OFFER message, the client sends back a DHCP Request message requesting the specific IP address. The client’s requested address is in option (50) in the trace.



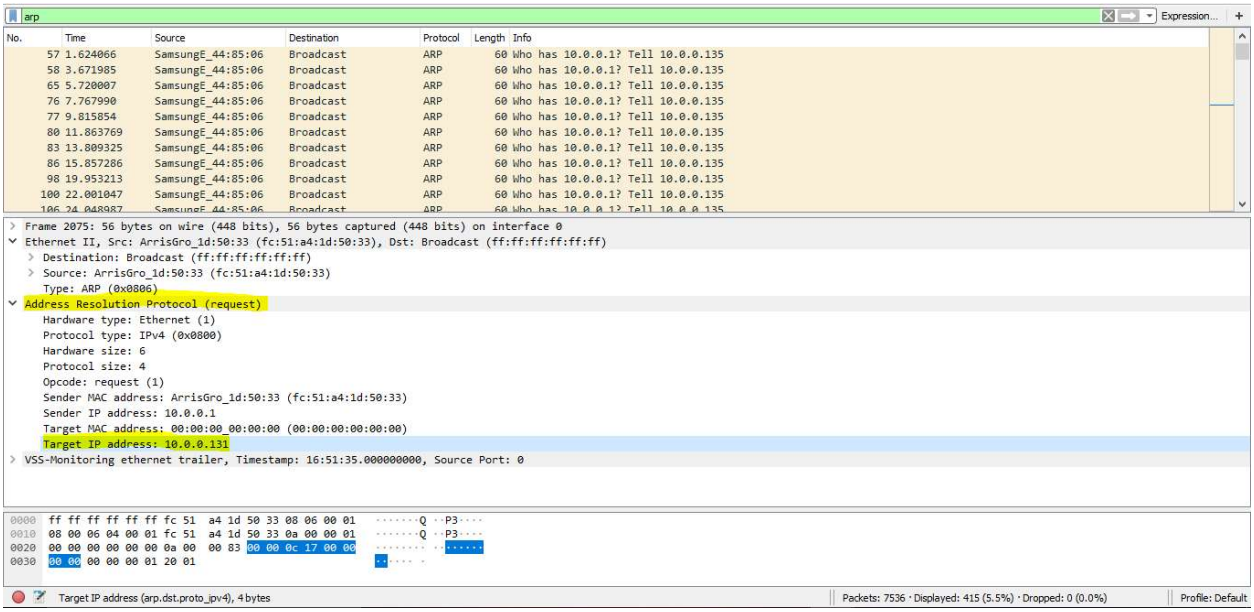
11. The offer message also includes the **IP Address Lease Time: (604800s) 7 days** although this is not the main information that the client requires apart from the client IP address to start communicating.



12. The lease time is mentioned in **option (51) IP Address Lease Time** in the trace. The lease time in my experiment is 604800s (7 days).



13. The purpose of the DHCP release message is to **cancel the lease given to an IP address** by the DHCP server. The DHCP release message is sent by the client. The DHCP server **does not** issue an acknowledgement of receipt of the client's DHCP request. If the client's DHCP release message is lost, the DHCP server must **wait** until the end of the IP address' lease period so it can be reused for another client.
14. ARP requests were made by the DHCP server during the DHCP packet-exchange period. The purpose of the ARP packets is to ensure that the IP address is not used by another client. This request process is done before an IP address is offered to a client.



References

Chapter_4_V7.01.ppt, Canvas

Computer Networking, Kurose, Ross