

LINUX NETWORKING MODULE 5 ASSESSMENT SOLUTION

-BY SAKTHI KUMAR S

4) Use Wireshark to capture DHCP Discover, Offer, Request, and Acknowledge messages and explain the process.

```
sakthi-kumar-s@sakthi-kumar-s-VirtualBox: ~  
(base) sakthi-kumar-s@sakthi-kumar-s-VirtualBox:~$ sudo dhclient -r  
[sudo] password for sakthi-kumar-s:  
(base) sakthi-kumar-s@sakthi-kumar-s-VirtualBox:~$ sudo dhclient  
Setting LLNMR support level "yes" for "2", but the global support level is "no".  
(base) sakthi-kumar-s@sakthi-kumar-s-VirtualBox:~$ sudo dhclient  
Error: ipv4: Address already assigned.  
(base) sakthi-kumar-s@sakthi-kumar-s-VirtualBox:~$
```

The image shows a Wireshark packet capture on interface enp0s3. The packet list pane displays several DHCP messages. The packet details pane shows the structure of a DHCP Discover message (Frame 7).

No.	Time	Source	Destination	Protocol	Length	Info
3	3.040023537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x0ee34a55
7	8.979956926	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x7c445c7d
8	8.981806592	10.0.2.2	255.255.255.255	DHCP	590	DHCP Offer - Transaction ID 0x7c445c7d
9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
10	8.983879290	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0x7c445c7d
52	27.739926955	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0xb6f3c876
53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

Frame 7: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface enp0s3.

- Ethernet II, Src: PCSSystemtec_ab:97:bd (08:00:27:ab:97:bd), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
- 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: 0x7c445c7d
 - Seconds elapsed: 0
 - Bootp flags: 0x0000 (Unicast)
 - 0... .. = Broadcast flag: Unicast
 - .000 0000 0000 0000 = Reserved flags: 0x0000
 - 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: PCSSystemtec_ab:97:bd (08:00:27:ab:97:bd)
 - Client hardware address padding: 00000000000000000000
 - Server host name not given

*enp0s3

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dhcpc

No.	Time	Source	Destination	Protocol	Length	Info
3	3.840623537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x6ee34a55
7	8.979956926	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x7c445c7d
8	8.981806592	10.0.2.2	255.255.255.255	DHCP	590	DHCP Offer - Transaction ID 0x7c445c7d
9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
10	8.983879290	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0x7c445c7d
52	27.739926955	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0xb6f3c876
53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

Client MAC address: PCSSystemtec_ab:97:bd (08:00:27:ab:97:bd)
 Client hardware address padding: 00000000000000000000
 Server host name not given
 Boot file name not given
 Magic cookie: DHCP

- Option: (53) DHCP Message Type (Discover)
 Length: 1
 DHCP: Discover (1)
- Option: (50) Requested IP Address (10.0.2.15)
 Length: 4
 Requested IP Address: 10.0.2.15
- Option: (12) Host Name
 Length: 25
 Host Name: sakthi-kumar-s-VirtualBox
- Option: (55) Parameter Request List
 Length: 13
 Parameter Request List Item: (1) Subnet Mask
 Parameter Request List Item: (28) Broadcast Address
 Parameter Request List Item: (2) Time Offset
 Parameter Request List Item: (3) Router
 Parameter Request List Item: (15) Domain Name

0000 ff ff ff ff ff 08 00 27 ab
 0010 01 48 00 00 00 00 11 39 96
 0020 ff ff 00 44 00 43 01 34 f3 1c
 0030 5c 7d 00 00 00 00 00 00 00
 0040 00 00 00 00 00 00 00 00 00
 0050 00 00 00 00 00 00 00 00 00
 0060 00 00 00 00 00 00 00 00 00
 0070 00 00 00 00 00 00 00 00 00
 0080 00 00 00 00 00 00 00 00 00
 0090 00 00 00 00 00 00 00 00 00
 00a0 00 00 00 00 00 00 00 00 00
 00b0 00 00 00 00 00 00 00 00 00
 00c0 00 00 00 00 00 00 00 00 00
 00d0 00 00 00 00 00 00 00 00 00
 00e0 00 00 00 00 00 00 00 00 00
 00f0 00 00 00 00 00 00 00 00 00
 0100 00 00 00 00 00 00 00 00 00
 0110 00 00 00 00 00 00 63 82 53 63
 0120 00 02 0f 0c 19 73 61 6b 74 68
 0130 72 2d 73 2d 56 69 72 74 75 61
 0140 01 1c 02 03 0f 06 77 0c 2c 2f

*enp0s3

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dhcpc

No.	Time	Source	Destination	Protocol	Length	Info
3	3.840623537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x6ee34a55
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9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
10	8.983879290	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0x7c445c7d
52	27.739926955	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0xb6f3c876
53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

Length: 25
 Host Name: sakthi-kumar-s-VirtualBox

- Option: (55) Parameter Request List
 Length: 13
 Parameter Request List Item: (1) Subnet Mask
 Parameter Request List Item: (28) Broadcast Address
 Parameter Request List Item: (2) Time Offset
 Parameter Request List Item: (3) Router
 Parameter Request List Item: (15) Domain Name
 Parameter Request List Item: (6) Domain Name Server
 Parameter Request List Item: (119) Domain Search
 Parameter Request List Item: (12) Host Name
 Parameter Request List Item: (44) NetBIOS over TCP/IP Name Server
 Parameter Request List Item: (47) NetBIOS over TCP/IP Scope
 Parameter Request List Item: (26) Interface MTU
 Parameter Request List Item: (121) Classless Static Route
 Parameter Request List Item: (42) Network Time Protocol Servers
- Option: (255) End
 Option End: 255
 Padding: 0000000000000000

0000 ff ff ff ff ff 08 00 27 ab
 0010 01 48 00 00 00 00 11 39 96
 0020 ff ff 00 44 00 43 01 34 f3 1c
 0030 5c 7d 00 00 00 00 00 00 00
 0040 00 00 00 00 00 00 00 00 00
 0050 00 00 00 00 00 00 00 00 00
 0060 00 00 00 00 00 00 00 00 00
 0070 00 00 00 00 00 00 00 00 00
 0080 00 00 00 00 00 00 00 00 00
 0090 00 00 00 00 00 00 00 00 00
 00a0 00 00 00 00 00 00 00 00 00
 00b0 00 00 00 00 00 00 00 00 00
 00c0 00 00 00 00 00 00 00 00 00
 00d0 00 00 00 00 00 00 00 00 00
 00e0 00 00 00 00 00 00 00 00 00
 00f0 00 00 00 00 00 00 00 00 00
 0100 00 00 00 00 00 00 00 00 00
 0110 00 00 00 00 00 00 63 82 53 63
 0120 00 02 0f 0c 19 73 61 6b 74 68
 0130 72 2d 73 2d 56 69 72 74 75 61
 0140 01 1c 02 03 0f 06 77 0c 2c 2f

*enp0s3

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dhcpc

No.	Time	Source	Destination	Protocol	Length	Info
3	3.040023537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x6ee34a55
7	8.979956926	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x7c445c7d
8	8.981806592	10.0.2.2	255.255.255.255	DHCP	590	DHCP Offer - Transaction ID 0x7c445c7d
9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
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53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

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: 0x7c445c7d
 Seconds elapsed: 0
 Bootp flags: 0x0000 (Unicast)
 0... .. = Broadcast flag: Unicast
 0000 0000 0000 0000 = Reserved flags: 0x0000
 Client IP address: 0.0.0.0
 Your (client) IP address: 10.0.2.15
 Next server IP address: 10.0.2.2
 Relay agent IP address: 0.0.0.0
 Client MAC address: PCSSystemtec_ab:97:bd (08:00:27:ab:97:bd)
 Client hardware address padding: 00000000000000000000
 Server host name not given
 Boot file name: ubuntu 24.04.01 LTS.pxz
 Magic cookie: DHCP
 Option: (53) DHCP Message Type (Offer)

0000 ff ff ff ff ff ff 52 55 0a 00
 0010 02 40 00 19 00 00 40 11 6c 83
 0020 ff ff 00 43 00 44 02 2c 0a eb
 0030 5c 7d 00 00 00 00 00 00 00
 0040 02 02 00 00 00 00 00 00 27 ab
 0050 00 00 00 00 00 00 00 00 00
 0060 00 00 00 00 00 00 00 00 00
 0070 00 00 00 00 00 00 00 00 00
 0080 00 00 00 00 00 00 00 00 00
 0090 00 00 00 00 00 00 75 62 75 6e
 00a0 30 34 2e 30 31 20 4c 54 53 2e
 00b0 00 00 00 00 00 00 00 00 00
 00c0 00 00 00 00 00 00 00 00 00
 00d0 00 00 00 00 00 00 00 00 00
 00e0 00 00 00 00 00 00 00 00 00
 00f0 00 00 00 00 00 00 00 00 00
 0100 00 00 00 00 00 00 00 00 00
 0110 00 00 00 00 00 00 63 82 53 63
 0120 00 02 02 01 04 ff ff ff 00 03
 0130 04 0a 00 02 03 33 04 00 01 51
 0140 78 ff 00 00 00 00 00 00 00 00

*enp0s3

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dhcpc

No.	Time	Source	Destination	Protocol	Length	Info
3	3.040023537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x6ee34a55
7	8.979956926	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x7c445c7d
8	8.981806592	10.0.2.2	255.255.255.255	DHCP	590	DHCP Offer - Transaction ID 0x7c445c7d
9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
10	8.983879290	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0x7c445c7d
52	27.739926955	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0xb6f3c876
53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

Length: 1
 DHCP: Offer (2)
 Option: (54) DHCP Server Identifier (10.0.2.2)
 Length: 4
 DHCP Server Identifier: 10.0.2.2
 Option: (1) Subnet Mask (255.255.255.0)
 Length: 4
 Subnet Mask: 255.255.255.0
 Option: (3) Router
 Length: 4
 Router: 10.0.2.2
 Option: (6) Domain Name Server
 Length: 4
 Domain Name Server: 10.0.2.3
 Option: (51) IP Address Lease Time
 Length: 4
 IP Address Lease Time: 1 day (86400)
 Option: (12) Host Name
 Length: 4
 Host Name: vbox
 Option: (255) End

0000 ff ff ff ff ff ff 52 55 0a 00
 0010 02 40 00 19 00 00 40 11 6c 83
 0020 ff ff 00 43 00 44 02 2c 0a eb
 0030 5c 7d 00 00 00 00 00 00 00
 0040 02 02 00 00 00 00 00 00 27 ab
 0050 00 00 00 00 00 00 00 00 00
 0060 00 00 00 00 00 00 00 00 00
 0070 00 00 00 00 00 00 00 00 00
 0080 00 00 00 00 00 00 00 00 00
 0090 00 00 00 00 00 00 75 62 75 6e
 00a0 30 34 2e 30 31 20 4c 54 53 2e
 00b0 00 00 00 00 00 00 00 00 00
 00c0 00 00 00 00 00 00 00 00 00
 00d0 00 00 00 00 00 00 00 00 00
 00e0 00 00 00 00 00 00 00 00 00
 00f0 00 00 00 00 00 00 00 00 00
 0100 00 00 00 00 00 00 00 00 00
 0110 00 00 00 00 00 00 63 82 53 63
 0120 00 02 02 01 04 ff ff ff 00 03
 0130 04 0a 00 02 03 33 04 00 01 51
 0140 78 ff 00 00 00 00 00 00 00 00

*enp0s3

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dhcp

No.	Time	Source	Destination	Protocol	Length	Info
3	3.040623537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x6ee34a55
7	8.979956926	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x7c445c7d
8	8.981806592	10.0.2.2	255.255.255.255	DHCP	590	DHCP Offer - Transaction ID 0x7c445c7d
9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
10	8.983879290	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0x7c445c7d
52	27.739926955	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0xb6f3c876
53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

User Datagram Protocol, Src Port: 68, Dst Port: 67

Dynamic Host Configuration Protocol (Request)

Message type: Boot Request (1)

Hardware type: Ethernet (0x01)

Hardware address length: 6

Hops: 0

Transaction ID: 0x7c445c7d

Seconds elapsed: 0

Bootp flags: 0x0000 (Unicast)

0... .. = Broadcast flag: Unicast

0000 0000 0000 0000 = Reserved flags: 0x0000

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: PCSSystemtec_ab:97:bd (08:00:27:ab:97:bd)

Client hardware address padding: 000000000000000000

Server host name not given

Boot file name not given

Magic cookie: DHCP

Option: (53) DHCP Message Type (Request)

0000 ff ff ff ff ff 08 00 27 ab
0010 01 48 00 00 00 00 00 11 39 96
0020 ff ff 00 44 00 43 01 34 ea da
0030 5c 7d 00 00 00 00 00 00 00 00
0040 00 00 00 00 00 00 00 00 00 00
0050 00 00 00 00 00 00 00 00 00 00
0060 00 00 00 00 00 00 00 00 00 00
0070 00 00 00 00 00 00 00 00 00 00
0080 00 00 00 00 00 00 00 00 00 00
0090 00 00 00 00 00 00 00 00 00 00
00a0 00 00 00 00 00 00 00 00 00 00
00b0 00 00 00 00 00 00 00 00 00 00
00c0 00 00 00 00 00 00 00 00 00 00
00d0 00 00 00 00 00 00 00 00 00 00
00e0 00 00 00 00 00 00 00 00 00 00
00f0 00 00 00 00 00 00 00 00 00 00
0100 00 00 00 00 00 00 00 00 00 00
0110 00 00 00 00 00 00 00 63 82 53 63
0120 00 02 02 32 04 0a 00 02 0f 0c
0130 69 2d 6b 75 6d 61 72 2d 73 2d
0140 6c 42 6f 78 37 0d 01 1c 02 03

*enp0s3

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dhcp

No.	Time	Source	Destination	Protocol	Length	Info
3	3.040623537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x6ee34a55
7	8.979956926	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x7c445c7d
8	8.981806592	10.0.2.2	255.255.255.255	DHCP	590	DHCP Offer - Transaction ID 0x7c445c7d
9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
10	8.983879290	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0x7c445c7d
52	27.739926955	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0xb6f3c876
53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

Length: 1

DHCP: Request (3)

Option: (54) DHCP Server Identifier (10.0.2.2)

Length: 4

DHCP Server Identifier: 10.0.2.2

Option: (50) Requested IP Address (10.0.2.15)

Length: 4

Requested IP Address: 10.0.2.15

Option: (12) Host Name

Length: 25

Host Name: sakthi-kumar-s-VirtualBox

Option: (55) Parameter Request List

Length: 13

Parameter Request List Item: (1) Subnet Mask

Parameter Request List Item: (28) Broadcast Address

Parameter Request List Item: (2) Time Offset

Parameter Request List Item: (3) Router

Parameter Request List Item: (15) Domain Name

Parameter Request List Item: (6) Domain Name Server

Parameter Request List Item: (119) Domain Search

Parameter Request List Item: (12) Host Name

0000 ff ff ff ff ff 08 00 27 ab
0010 01 48 00 00 00 00 00 11 39 96
0020 ff ff 00 44 00 43 01 34 ea da
0030 5c 7d 00 00 00 00 00 00 00 00
0040 00 00 00 00 00 00 00 00 00 00
0050 00 00 00 00 00 00 00 00 00 00
0060 00 00 00 00 00 00 00 00 00 00
0070 00 00 00 00 00 00 00 00 00 00
0080 00 00 00 00 00 00 00 00 00 00
0090 00 00 00 00 00 00 00 00 00 00
00a0 00 00 00 00 00 00 00 00 00 00
00b0 00 00 00 00 00 00 00 00 00 00
00c0 00 00 00 00 00 00 00 00 00 00
00d0 00 00 00 00 00 00 00 00 00 00
00e0 00 00 00 00 00 00 00 00 00 00
00f0 00 00 00 00 00 00 00 00 00 00
0100 00 00 00 00 00 00 00 00 00 00
0110 00 00 00 00 00 00 00 63 82 53 63
0120 00 02 02 32 04 0a 00 02 0f 0c
0130 69 2d 6b 75 6d 61 72 2d 73 2d
0140 6c 42 6f 78 37 0d 01 1c 02 03

*enp0s3

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dhcp

No.	Time	Source	Destination	Protocol	Length	Info
3	3.040623537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x6ee34a55
7	8.979956926	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x7c445c7d
8	8.981806592	10.0.2.2	255.255.255.255	DHCP	590	DHCP Offer - Transaction ID 0x7c445c7d
9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
10	8.983879299	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0x7c445c7d
52	27.739926955	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0xb6f3c876
53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

User Datagram Protocol, Src Port: 67, Dst Port: 68

Dynamic Host Configuration Protocol (ACK)

Message type: Boot Reply (2)

Hardware type: Ethernet (0x01)

Hardware address length: 6

Hops: 0

Transaction ID: 0x7c445c7d

Seconds elapsed: 0

Bootp flags: 0x0000 (Unicast)

0... .. = Broadcast flag: Unicast

0000 0000 0000 0000 = Reserved flags: 0x0000

Client IP address: 0.0.0.0

Your (client) IP address: 10.0.2.15

Next server IP address: 10.0.2.2

Relay agent IP address: 0.0.0.0

Client MAC address: PCSSystemtec_ab:97:bd (08:00:27:ab:97:bd)

Client hardware address padding: 00000000000000000000

Server host name not given

Boot file name: ubuntu 24.04.01 LTS.pxe

Magic cookie: DHCP

Option: (53) DHCP Message Type (ACK)

*enp0s3

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dhcp

No.	Time	Source	Destination	Protocol	Length	Info
3	3.040623537	10.0.2.15	10.0.2.2	DHCP	342	DHCP Release - Transaction ID 0x6ee34a55
7	8.979956926	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x7c445c7d
8	8.981806592	10.0.2.2	255.255.255.255	DHCP	590	DHCP Offer - Transaction ID 0x7c445c7d
9	8.982179734	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x7c445c7d
10	8.983879299	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0x7c445c7d
52	27.739926955	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0xb6f3c876
53	27.741152626	10.0.2.2	255.255.255.255	DHCP	590	DHCP ACK - Transaction ID 0xb6f3c876

Boot file name: ubuntu 24.04.01 LTS.pxe

Magic cookie: DHCP

Option: (53) DHCP Message Type (ACK)

Length: 1

DHCP: ACK (5)

Option: (54) DHCP Server Identifier (10.0.2.2)

Length: 4

DHCP Server Identifier: 10.0.2.2

Option: (1) Subnet Mask (255.255.255.0)

Length: 4

Subnet Mask: 255.255.255.0

Option: (3) Router

Length: 4

Router: 10.0.2.2

Option: (6) Domain Name Server

Length: 4

Domain Name Server: 10.0.2.3

Option: (51) IP Address Lease Time

Length: 4

IP Address Lease Time: 1 day (86400)

Option: (12) Host Name

