

LAB 3 REPORT

Part 1: DHCP

ipconfig /release:

```

管理员: Windows PowerShell
Windows PowerShell
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PS C:\WINDOWS\system32> ipconfig /release

Windows IP Configuration

Wireless LAN adapter WLAN:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . . : 2605:e000:4e13:bb00::5
    IPv6 Address. . . . . : 2605:e000:4e13:bb00:a479:cef0:7b4:7b42
    Temporary IPv6 Address. . . . . : 2605:e000:4e13:bb00:28c4:3501:cb14:a7b7
    Link-local IPv6 Address . . . . . : fe80::a479:cef0:7b4:7b42%18
    Default Gateway . . . . . : fe80::fe52:8dff:fed0:dc67%18
    
```

ipconfig /renew:

```

PS C:\WINDOWS\system32> ipconfig /renew

Windows IP Configuration

Wireless LAN adapter WLAN:

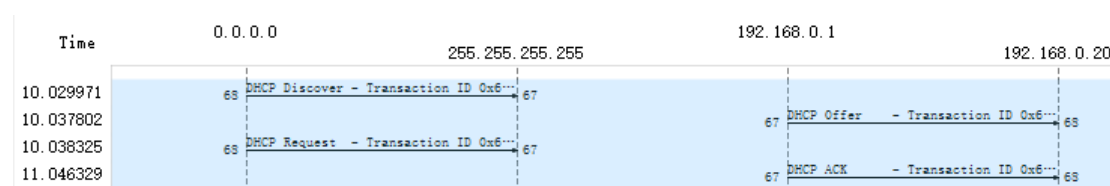
    Connection-specific DNS Suffix  . : socal.rr.com
    IPv6 Address. . . . . : 2605:e000:4e13:bb00::5
    IPv6 Address. . . . . : 2605:e000:4e13:bb00:a479:cef0:7b4:7b42
    Temporary IPv6 Address. . . . . : 2605:e000:4e13:bb00:28c4:3501:cb14:a7b7
    Link-local IPv6 Address . . . . . : fe80::a479:cef0:7b4:7b42%18
    IPv4 Address. . . . . : 192.168.0.20
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : fe80::fe52:8dff:fed0:dc67%18
                                192.168.0.1
    
```

1) All DHCP messages are sent over UDP.

58	10.029971	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x611539dc
Frame 58: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface 0						
Ethernet II, Src: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28), 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						
Bootstrap Protocol (Discover)						
59	10.037802	192.168.0.1	192.168.0.20	DHCP	359	DHCP Offer - Transaction ID 0x611539dc
Frame 59: 359 bytes on wire (2872 bits), 359 bytes captured (2872 bits) on interface 0						
Ethernet II, Src: Technico_d0:dc:67 (fc:52:8d:d0:dc:67), Dst: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)						
Internet Protocol Version 4, Src: 192.168.0.1, Dst: 192.168.0.20						
User Datagram Protocol, Src Port: 67, Dst Port: 68						
Bootstrap Protocol (Offer)						
60	10.038325	0.0.0.0	255.255.255.255	DHCP	366	DHCP Request - Transaction ID 0x611539dc
Frame 60: 366 bytes on wire (2928 bits), 366 bytes captured (2928 bits) on interface 0						
Ethernet II, Src: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28), 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						
Bootstrap Protocol (Request)						
63	11.046329	192.168.0.1	192.168.0.20	DHCP	359	DHCP ACK - Transaction ID 0x611539dc
Frame 63: 359 bytes on wire (2872 bits), 359 bytes captured (2872 bits) on interface 0						
Ethernet II, Src: Technico_d0:dc:67 (fc:52:8d:d0:dc:67), Dst: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)						
Internet Protocol Version 4, Src: 192.168.0.1, Dst: 192.168.0.20						
User Datagram Protocol, Src Port: 67, Dst Port: 68						
Bootstrap Protocol (ACK)						

2) DHCP uses client-server architecture.

3) DHCP Timing Graph



4)

```

58 10.029971 0.0.0.0 255.255.255.255 DHCP 342 DHCP Discover - Transaction ID
0x611539dc
Frame 58: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface 0
Ethernet II, Src: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28), 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
Bootstrap Protocol (Discover)

```

5)

```

58 10.029971 0.0.0.0 255.255.255.255 DHCP 342 DHCP Discover - Transaction ID
0x611539dc
Frame 58: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface 0
Ethernet II, Src: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28), 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
Bootstrap Protocol (Discover)
  Message type: Boot Request (1)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x611539dc
  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_b9:d6:28 (9c:4e:36:b9:d6:28)
  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)

```

```

60 10.038325 0.0.0.0 255.255.255.255 DHCP 366 DHCP Request - Transaction ID
0x611539dc
Frame 60: 366 bytes on wire (2928 bits), 366 bytes captured (2928 bits) on interface 0
Ethernet II, Src: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28), 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
Bootstrap Protocol (Request)
  Message type: Boot Request (1)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x611539dc
  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_b9:d6:28 (9c:4e:36:b9:d6:28)
  Client hardware address padding: 00000000000000000000
  Server host name not given
  Boot file name not given
  Magic cookie: DHCP
  Option: (53) DHCP Message Type (Request)
    Length: 1
    DHCP: Request (3)

```

6) Transaction-ID for the first four DHCP messages:

No.	Time	Source	Destination	Protocol	Length	Info
58	10.029971	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x611539dc
59	10.037802	192.168.0.1	192.168.0.20	DHCP	359	DHCP Offer - Transaction ID 0x611539dc
60	10.038325	0.0.0.0	255.255.255.255	DHCP	366	DHCP Request - Transaction ID 0x611539dc
63	11.046329	192.168.0.1	192.168.0.20	DHCP	359	DHCP ACK - Transaction ID 0x611539dc
15062	1811.486757	192.168.0.20	192.168.0.1	DHCP	354	DHCP Request - Transaction ID 0xbdef2220
15070	1812.488109	192.168.0.1	192.168.0.20	DHCP	359	DHCP ACK - Transaction ID 0xbdef2220

Transaction-ID in the second set of DHCP messages:

No.	Time	Source	Destination	Protocol	Length	Info
58	10.029971	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x611539dc
59	10.037802	192.168.0.1	192.168.0.20	DHCP	359	DHCP Offer - Transaction ID 0x611539dc
60	10.038325	0.0.0.0	255.255.255.255	DHCP	366	DHCP Request - Transaction ID 0x611539dc
63	11.046329	192.168.0.1	192.168.0.20	DHCP	359	DHCP ACK - Transaction ID 0x611539dc
15062	1811.486757	192.168.0.20	192.168.0.1	DHCP	354	DHCP Request - Transaction ID 0xbdef2220
15070	1812.488109	192.168.0.1	192.168.0.20	DHCP	359	DHCP ACK - Transaction ID 0xbdef2220

Transaction-ID is used for the client to recognize which DHCP response to the associated request.

7) The host uses 0.0.0.0 as its source IP address. Both client and server use 255.255.255.255 as the destination address. The server uses its actual IP address as the source address.

No.	Time	Source	Destination	Protocol	Length	Info
58	10.029971	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x611539dc
59	10.037802	192.168.0.1	192.168.0.20	DHCP	359	DHCP Offer - Transaction ID 0x611539dc
60	10.038325	0.0.0.0	255.255.255.255	DHCP	366	DHCP Request - Transaction ID 0x611539dc
63	11.046329	192.168.0.1	192.168.0.20	DHCP	359	DHCP ACK - Transaction ID 0x611539dc

8) The IP address of my DHCP server is 192.168.0.1.

No.	Time	Source	Destination	Protocol	Length	Info
58	10.029971	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x611539dc
59	10.037802	192.168.0.1	192.168.0.20	DHCP	359	DHCP Offer - Transaction ID 0x611539dc
60	10.038325	0.0.0.0	255.255.255.255	DHCP	366	DHCP Request - Transaction ID 0x611539dc
63	11.046329	192.168.0.1	192.168.0.20	DHCP	359	DHCP ACK - Transaction ID 0x611539dc

9) The DHCP server offered 192.168.0.20 to my host in the DHCP Offer message, and the lease time is 1 hour. The DHCP message with “DHCP Message Type = DHCP Offer” contained the offered IP.

```

59 10.037802 192.168.0.1 192.168.0.20 DHCP 359 DHCP Offer - Transaction ID
0x611539dc
Frame 59: 359 bytes on wire (2872 bits), 359 bytes captured (2872 bits) on interface 0
Ethernet II, Src: Technico_d0:dc:67 (fc:52:8d:d0:dc:67), Dst: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)
Internet Protocol Version 4, Src: 192.168.0.1, Dst: 192.168.0.20
User Datagram Protocol, Src Port: 67, Dst Port: 68
Bootstrap Protocol (Offer)
  Message type: Boot Reply (2)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x611539dc
  Seconds elapsed: 0
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0
  Your (client) IP address: 192.168.0.20
  Next server IP address: 192.168.0.1
  Relay agent IP address: 0.0.0.0
  Client MAC address: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)
  Client hardware address padding: 00000000000000000000
  Server host name not given
  Boot file name not given
  Magic cookie: DHCP
  Option: (53) DHCP Message Type (Offer)
    Length: 1
    DHCP: Offer (2)
  Option: (1) Subnet Mask
    Length: 4
    Subnet Mask: 255.255.255.0

  Option: (2) Time Offset
    Length: 4
    Time Offset: (0s) 0 seconds
  Option: (3) Router
    Length: 4
    Router: 192.168.0.1
  Option: (23) Default IP Time-to-Live
    Length: 1
    Default IP Time-to-Live: 64
  Option: (51) IP Address Lease Time
    Length: 4
    IP Address Lease Time: (3600s) 1 hour
  Option: (54) DHCP Server Identifier
    Length: 4
    DHCP Server Identifier: 192.168.0.1
  Option: (58) Renewal Time Value
    Length: 4
    Renewal Time Value: (1800s) 30 minutes
  Option: (59) Rebinding Time Value
    Length: 4
    Rebinding Time Value: (3150s) 52 minutes, 30 seconds
  Option: (6) Domain Name Server
    Length: 12
    Domain Name Server: 209.18.47.62
    Domain Name Server: 209.18.47.61
    Domain Name Server: 209.18.47.63

```

10) DHCP server also provides network configuration information for the client.

11) In the given example, the IP address of relay agent is 0.0.0.0, which indicates that there is no relay agent. In my experiment, the IP address of relay agent is also 0.0.0.0, indicating that there is no relay agent in my experiment.

59	10.037802	192.168.0.1	192.168.0.20	DHCP	359	DHCP Offer	- Transaction ID
0x611539dc							
Frame 59: 359 bytes on wire (2872 bits), 359 bytes captured (2872 bits) on interface 0							
Ethernet II, Src: Technico_d0:dc:67 (fc:52:8d:d0:dc:67), Dst: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)							
Internet Protocol Version 4, Src: 192.168.0.1, Dst: 192.168.0.20							
User Datagram Protocol, Src Port: 67, Dst Port: 68							
Bootstrap Protocol (Offer)							
Message type: Boot Reply (2)							
Hardware type: Ethernet (0x01)							
Hardware address length: 6							
Hops: 0							
Transaction ID: 0x611539dc							
Seconds elapsed: 0							
Bootp flags: 0x0000 (Unicast)							
Client IP address: 0.0.0.0							
Your (client) IP address: 192.168.0.20							
Next server IP address: 192.168.0.1							
Relay agent IP address: 0.0.0.0							
Client MAC address: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)							
Client hardware address padding: 00000000000000000000							
Server host name not given							
Boot file name not given							
Magic cookie: DHCP							

12) The router line indicates the default gateway for the client. The subnet mask line tells the client which subnet mask it should use.

59	10.037802	192.168.0.1	192.168.0.20	DHCP	359	DHCP Offer	- Transaction ID
0x611539dc							
Frame 59: 359 bytes on wire (2872 bits), 359 bytes captured (2872 bits) on interface 0							
Ethernet II, Src: Technico_d0:dc:67 (fc:52:8d:d0:dc:67), Dst: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)							
Internet Protocol Version 4, Src: 192.168.0.1, Dst: 192.168.0.20							
User Datagram Protocol, Src Port: 67, Dst Port: 68							
Bootstrap Protocol (Offer)							
Message type: Boot Reply (2)							
Hardware type: Ethernet (0x01)							
Hardware address length: 6							
Hops: 0							
Transaction ID: 0x611539dc							
Seconds elapsed: 0							
Bootp flags: 0x0000 (Unicast)							
Client IP address: 0.0.0.0							
Your (client) IP address: 192.168.0.20							
Next server IP address: 192.168.0.1							
Relay agent IP address: 0.0.0.0							
Client MAC address: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)							
Client hardware address padding: 00000000000000000000							
Server host name not given							
Boot file name not given							
Magic cookie: DHCP							
Option: (53) DHCP Message Type (Offer)							
Length: 1							
DHCP: Offer (2)							
Option: (1) Subnet Mask							
Length: 4							
Subnet Mask: 255.255.255.0							
Option: (2) Time Offset							
Length: 4							
Time Offset: (0s) 0 seconds							
Option: (3) Router							
Length: 4							
Router: 192.168.0.1							

13) The client accepted the IP address.

```

60 10.038325 0.0.0.0 255.255.255.255 DHCP 366 DHCP Request - Transaction ID
0x611539dc
Frame 60: 366 bytes on wire (2928 bits), 366 bytes captured (2928 bits) on interface 0
Ethernet II, Src: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28), 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
Bootstrap Protocol (Request)
  Message type: Boot Request (1)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x611539dc
  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_b9:d6:28 (9c:4e:36:b9:d6:28)
  Client hardware address padding: 00000000000000000000
  Server host name not given
  Boot file name not given
  Magic cookie: DHCP
  Option: (53) DHCP Message Type (Request)
    Length: 1
    DHCP: Request (3)
  Option: (61) Client identifier
    Length: 7
    Hardware type: Ethernet (0x01)
    Client MAC address: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)
  Option: (50) Requested IP Address
    Length: 4
    Requested IP Address: 192.168.0.20

```

14) The client sends a DHCP Release message to cancel its current lease of the IP address given by the DHCP server. The server does not send a message back to the client to acknowledge the DHCP Release message. If the DHCP Release message is lost, the server would wait until the lease period is over for that IP address until it could reuse it for another client.

15) There was one ARP packet during the DHCP packet-exchange period. The ARP packet was used to map the MAC address with new IP address.

No.	Time	Source	Destination	Protocol	Length	Info
58	10.029971	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x611539dc
59	10.037802	192.168.0.1	192.168.0.20	DHCP	359	DHCP Offer - Transaction ID 0x611539dc
60	10.038325	0.0.0.0	255.255.255.255	DHCP	366	DHCP Request - Transaction ID 0x611539dc
61	10.147119	Technico_d...	Broadcast	ARP	60	Who has 192.168.0.20? Tell 192.168.0.1
62	10.150116	fe80::e06c...	ff02::c	UDP	718	49570 → 3702 Len=656
63	11.046329	192.168.0.1	192.168.0.20	DHCP	359	DHCP ACK - Transaction ID 0x611539dc

Part 2: ARP

16) The columns “Internet Address” and “Physical Address” indicate the corresponding IPv4 addresses and MAC addresses. The column “Type” indicates whether the IPv4 address is dynamic or static.

```

PS C:\WINDOWS\system32> arp -a

Interface: 192.168.0.20 --- 0x12
Internet Address      Physical Address      Type
192.168.0.1           fc-52-8d-d0-dc-67    dynamic
192.168.0.255         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

```

17) The hexadecimal value for the source address is 9c:4e:36:b9:d6:28. The hexadecimal value for the destination address is ff:ff:ff:ff:ff:ff, which is the broadcast address.

No.	Time	Source	Destination	Protocol	Length	Info
463	4.334072	IntelCor_b9:d6:28	Broadcast	ARP	42	Who has 192.168.0.1? Tell 192.168.0.20
469	4.378415	Technico_d0:dc:67	IntelCor_b9:d6:28	ARP	42	192.168.0.1 is at fc:52:8d:d0:dc:67

```
> Frame 463: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
> Ethernet II, Src: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
> Address Resolution Protocol (request)
```

18) The hex value for the Ethernet Frame type field is 0x0806, for ARP.

```
410 3.535833 LcfcHefe_b7:e5:0f Broadcast ARP 60 Who has 192.168.0.0? Tell
192.168.0.13
Frame 410: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
Ethernet II, Src: LcfcHefe_b7:e5:0f (50:7b:9d:b7:e5:0f), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Destination: Broadcast (ff:ff:ff:ff:ff:ff)
Source: LcfcHefe_b7:e5:0f (50:7b:9d:b7:e5:0f)
Type: ARP (0x0806)
Padding: 0000000000000000000000000000000000000000000000000000000000000000
Address Resolution Protocol (request)
```

19) a) 20 bytes.

b) 1, which is for request.

c) Yes.

d) In the “Target MAC address”, which is set to 00:00:00:00:00:00.

```
463 4.334072 IntelCor_b9:d6:28 Broadcast ARP 42 Who has 192.168.0.1? Tell
192.168.0.20
Frame 463: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
Ethernet II, Src: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Address Resolution Protocol (request)
Hardware type: Ethernet (1)
Protocol type: IPv4 (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: request (1)
Sender MAC address: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)
Sender IP address: 192.168.0.20
Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
Target IP address: 192.168.0.1
```

20) a) 20 bytes.

b) 2, which is for reply.

c) In the “Sender MAC address”.

```
469 4.378415 Technico_d0:dc:67 IntelCor_b9:d6:28 ARP 42 192.168.0.1 is at fc:
52:8d:d0:dc:67
Frame 469: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
Ethernet II, Src: Technico_d0:dc:67 (fc:52:8d:d0:dc:67), Dst: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)
Address Resolution Protocol (reply)
Hardware type: Ethernet (1)
Protocol type: IPv4 (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: reply (2)
Sender MAC address: Technico_d0:dc:67 (fc:52:8d:d0:dc:67)
Sender IP address: 192.168.0.1
Target MAC address: IntelCor_b9:d6:28 (9c:4e:36:b9:d6:28)
Target IP address: 192.168.0.20
```

21) The hexadecimal value for the source address is fc:52:8d:d0:dc:67. The hexadecimal value for the destination address is 9c:4e:36:b9:d6:28, which is the broadcast address.

No.	Time	Source	Destination	Protocol	Length	Info
463	4.334072	IntelCor_b9:d6:28	Broadcast	ARP	42	Who has 192.168.0.1? Tell 192.168.0.20
469	4.378415	Technico_d0:dc:67	IntelCor_b9:d6:28	ARP	42	192.168.0.1 is at fc:52:8d:d0:dc:67

> Frame 469: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0

> Ethernet II, Src: Technico d0:dc:67 (fc:52:8d:d0:dc:67), Dst: IntelCor b9:d6:28 (9c:4e:36:b9:d6:28)

> Address Resolution Protocol (reply)

22) Because my machine is not the machine that sent the request. The ARP request is sent to broadcast, but the ARP reply is sent directly to the client.