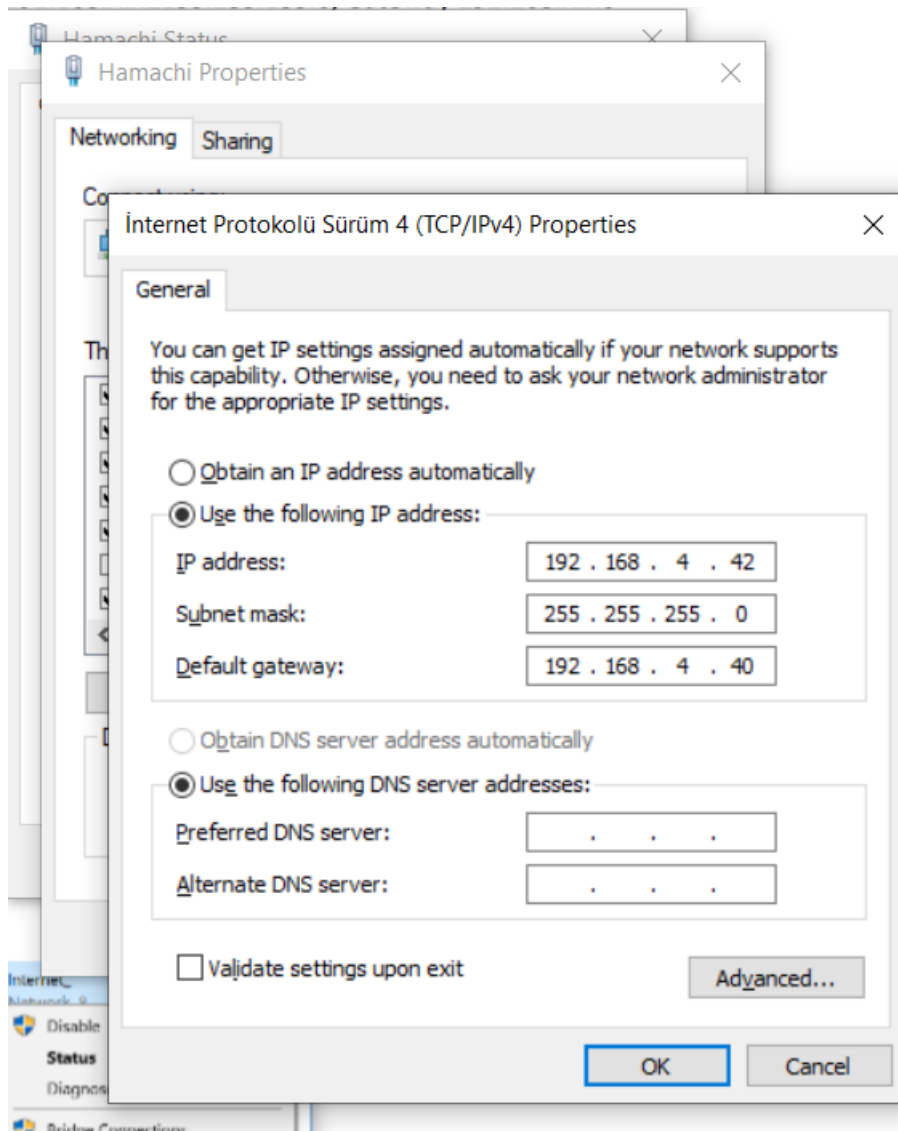


Laboratory tasks Data link layer - Ethernet

TASK 1

Configure the IP address to static.



After the configuration we should make IP address to dynamic for connection to teammate using Hamachi.

Hamachi ethernet adapter configurations.

```
Administrator: Command Prompt
239.255.255.250      01-00-5e-7f-ff-fa      static
255.255.255.255      ff-ff-ff-ff-ff-ff      static

C:\Windows\system32>ipconfig

Windows IP Configuration

Ethernet adapter Hamachi:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . . : 2620:9b::1931:b328
    Link-local IPv6 Address . . . . . : fe80::d04:cc7f:62ec:59be%13
    IPv4 Address. . . . . : 25.49.179.40
    Subnet Mask . . . . . : 255.0.0.0
    Default Gateway . . . . . : 2620:9b::1900:1

Ethernet adapter VirtualBox Host-Only Network:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::2889:a624:577e:bb1f%18
    IPv4 Address. . . . . : 192.168.56.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Wireless LAN adapter Wi-Fi:

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

Wireless LAN adapter Yerel Ağ Bağlantısı* 1:

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

Wireless LAN adapter Yerel Ağ Bağlantısı* 10:

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

Ethernet adapter Ethernet:

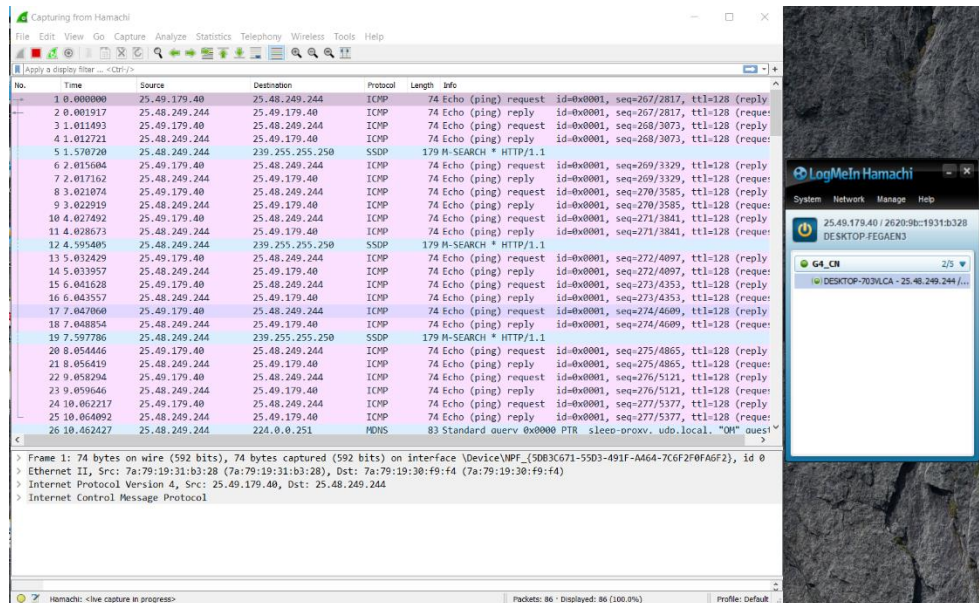
    Connection-specific DNS Suffix  . : 7-8.t17.ds.pwr.wroc.pl
    Link-local IPv6 Address . . . . . : fe80::a001:d094:1536:bbb1%3
    IPv4 Address. . . . . : 156.17.235.184
    Subnet Mask . . . . . : 255.255.255.128
    Default Gateway . . . . . : 156.17.235.254
```

Pinging to teammate.

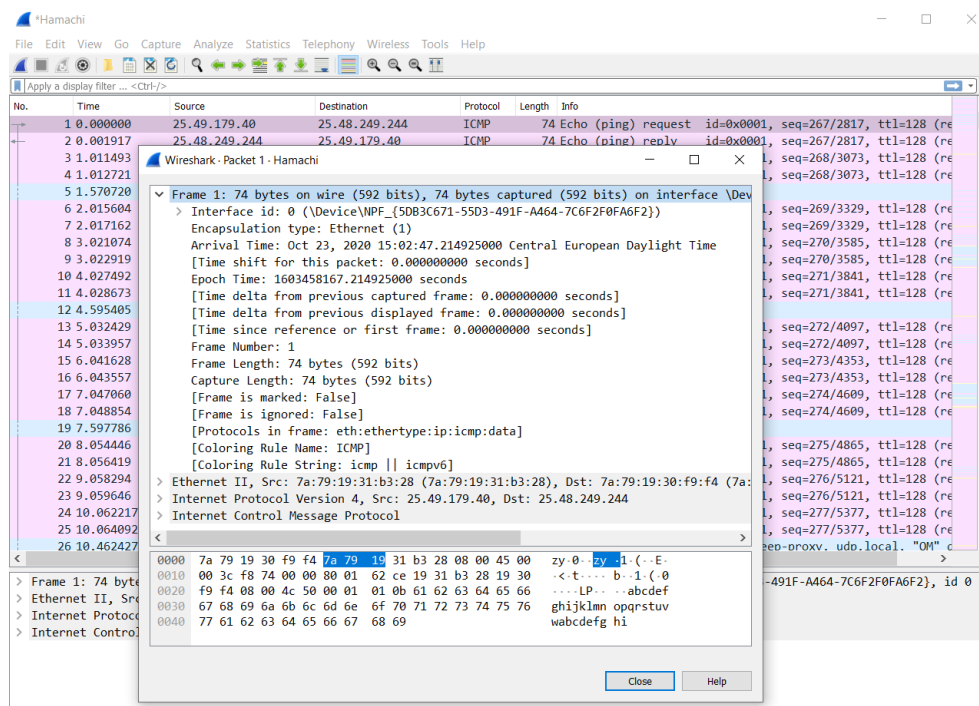
```
Pinging 25.48.249.244 with 32 bytes of data:
Reply from 25.48.249.244: bytes=32 time=2ms TTL=128
Reply from 25.48.249.244: bytes=32 time=1ms TTL=128
Reply from 25.48.249.244: bytes=32 time=2ms TTL=128
Reply from 25.48.249.244: bytes=32 time=1ms TTL=128
Reply from 25.48.249.244: bytes=32 time=1ms TTL=128
Reply from 25.48.249.244: bytes=32 time=2ms TTL=128
Reply from 25.48.249.244: bytes=32 time=1ms TTL=128
Reply from 25.48.249.244: bytes=32 time=1ms TTL=128
Reply from 25.48.249.244: bytes=32 time=1ms TTL=128
```

Task 2

Tracking ICMP protocols (sending ping to teammate) in Wireshark program



Analyze the Ethernet frame



Frame ID 1

Analyze the Ethernet frame. Find and write the following data:

Frame 1: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface \Device\NPF_{5DB3C671-55D3-491F-A464-7C6F2F0FA6F2}, id 0

Ethernet II, Src: 7a:79:19:31:b3:28 (7a:79:19:31:b3:28), Dst: 7a:79:19:30:f9:f4 (7a:79:19:30:f9:f4)

0000 7a 79 19 30 f9 f4 7a 79 19 31 b3 28 08 00

Recipient MAC Address : 7a:79:19:30:f9:f4

Sender MAC Address : 7a:79:19:31:b3:28

Internet Protocol Version 4, Src: 25.49.179.40, Dst: 25.48.249.244

Internet Control Message Protocol

Destination MAC Address -> 7a:79:19:30:f9:f4 -> 7a79.1930.f9f4

Source MAC Address -> 7a:79:19:31:b3:28 -> 7a79.1931.b328

When we compare these, destination physical address (MAC addresses) is lower than source physical address. Because in the second part of addresses, 1 is bigger than 0. That means destination is lower and source is higher.

TASK 3

Check the IP addresses on the PC interfaces connected to the external network

```
Administrator: Command Prompt

156.17.235.255      ff-ff-ff-ff-ff-ff      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: 25.49.179.40 --- 0xd
Internet Address    Physical Address      Type
25.0.0.1            7a-79-19-00-00-01     dynamic
25.255.255.255      ff-ff-ff-ff-ff-ff     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: 192.168.56.1 --- 0x12
Internet Address    Physical Address      Type
192.168.56.255      ff-ff-ff-ff-ff-ff     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

C:\Windows\system32>
```

Analysis of the ARP protocol.

3. Checking physical addresses of external PC network interfaces

```
Administrator: Command Prompt

Windows IP Configuration

Ethernet adapter Hamachi:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . . : 2620:9b::1931:b328
    Link-local IPv6 Address . . . . . : fe80::d04:cc7f:62ec:59be%13
    IPv4 Address. . . . . : 25.49.179.40
    Subnet Mask . . . . . : 255.0.0.0
    Default Gateway . . . . . : 2620:9b::1900:1

Ethernet adapter VirtualBox Host-Only Network:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::2889:a624:577e:bb1f%18
    IPv4 Address. . . . . : 192.168.56.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Wireless LAN adapter Wi-Fi:

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

Wireless LAN adapter Yere1 Ağ Bağlantısı* 1:

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

Wireless LAN adapter Yere1 Ağ Bağlantısı* 10:

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

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : 7-8.t17.ds.pwr.wroc.pl
    Link-local IPv6 Address . . . . . : fe80::a001:d094:1536:bbb1%3
    IPv4 Address. . . . . : 156.17.235.184
    Subnet Mask . . . . . : 255.255.255.128
    Default Gateway . . . . . : 156.17.235.254
```

4. Analyze the contents of the ARP table of PCs in Windows.

```
Administrator: Command Prompt

C:\Windows\system32>arp -d

C:\Windows\system32>arp -a

Interface: 156.17.235.184 --- 0x3
    Internet Address      Physical Address      Type
    156.17.235.254        78-fe-3d-32-57-81    dynamic
    224.0.0.22            01-00-5e-00-00-16    static

Interface: 25.49.179.40 --- 0xd
    Internet Address      Physical Address      Type
    224.0.0.22            01-00-5e-00-00-16    static
    255.255.255.255       ff-ff-ff-ff-ff-ff    static

Interface: 192.168.56.1 --- 0x12
    Internet Address      Physical Address      Type
    224.0.0.22            01-00-5e-00-00-16    static

C:\Windows\system32>ping 25.48.249.244

Pinging 25.48.249.244 with 32 bytes of data:
Reply from 25.48.249.244: bytes=32 time=1ms TTL=128
Reply from 25.48.249.244: bytes=32 time=2ms TTL=128
Reply from 25.48.249.244: bytes=32 time=2ms TTL=128
Reply from 25.48.249.244: bytes=32 time=2ms TTL=128

Ping statistics for 25.48.249.244:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\Windows\system32>arp -a

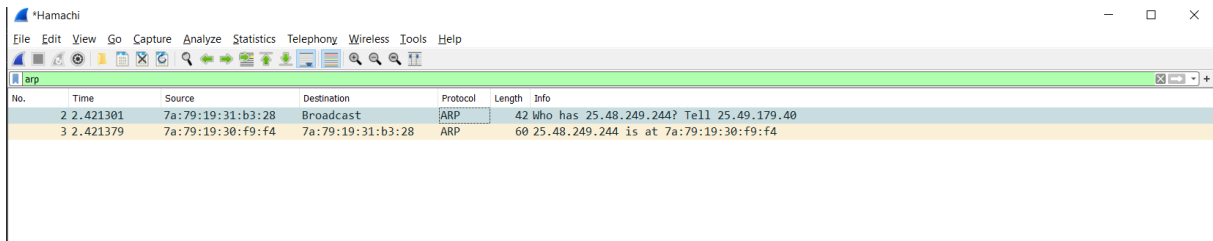
Interface: 156.17.235.184 --- 0x3
    Internet Address      Physical Address      Type
    156.17.235.141        b0-25-aa-38-21-a6    dynamic
    156.17.235.155        50-d4-f7-9e-80-77    dynamic
    156.17.235.254        78-fe-3d-32-57-81    dynamic
    156.17.235.255        ff-ff-ff-ff-ff-ff    static
    224.0.0.22            01-00-5e-00-00-16    static
    239.255.255.250       01-00-5e-7f-ff-fa    static

Interface: 25.49.179.40 --- 0xd
    Internet Address      Physical Address      Type
    25.255.255.255        7a-79-19-30-f9-f4    dynamic
    25.255.255.255        ff-ff-ff-ff-ff-ff    static
    224.0.0.22            01-00-5e-00-00-16    static
    239.255.255.250       01-00-5e-7f-ff-fa    static
    255.255.255.255       ff-ff-ff-ff-ff-ff    static

Interface: 192.168.56.1 --- 0x12
    Internet Address      Physical Address      Type
    192.168.56.255        ff-ff-ff-ff-ff-ff    static
    224.0.0.22            01-00-5e-00-00-16    static
    239.255.255.250       01-00-5e-7f-ff-fa    static

C:\Windows\system32>
```

9. Arp Frames



The image shows a Wireshark packet capture window titled 'Hamachi'. The filter is set to 'arp'. Two ARP frames are visible in the packet list:

No.	Time	Source	Destination	Protocol	Length	Info
2	2.421301	7a:79:19:31:b3:28	Broadcast	ARP	42	Who has 25.48.249.244? Tell 25.49.179.40
3	2.421379	7a:79:19:30:f9:f4	7a:79:19:31:b3:28	ARP	60	25.48.249.244 is at 7a:79:19:30:f9:f4

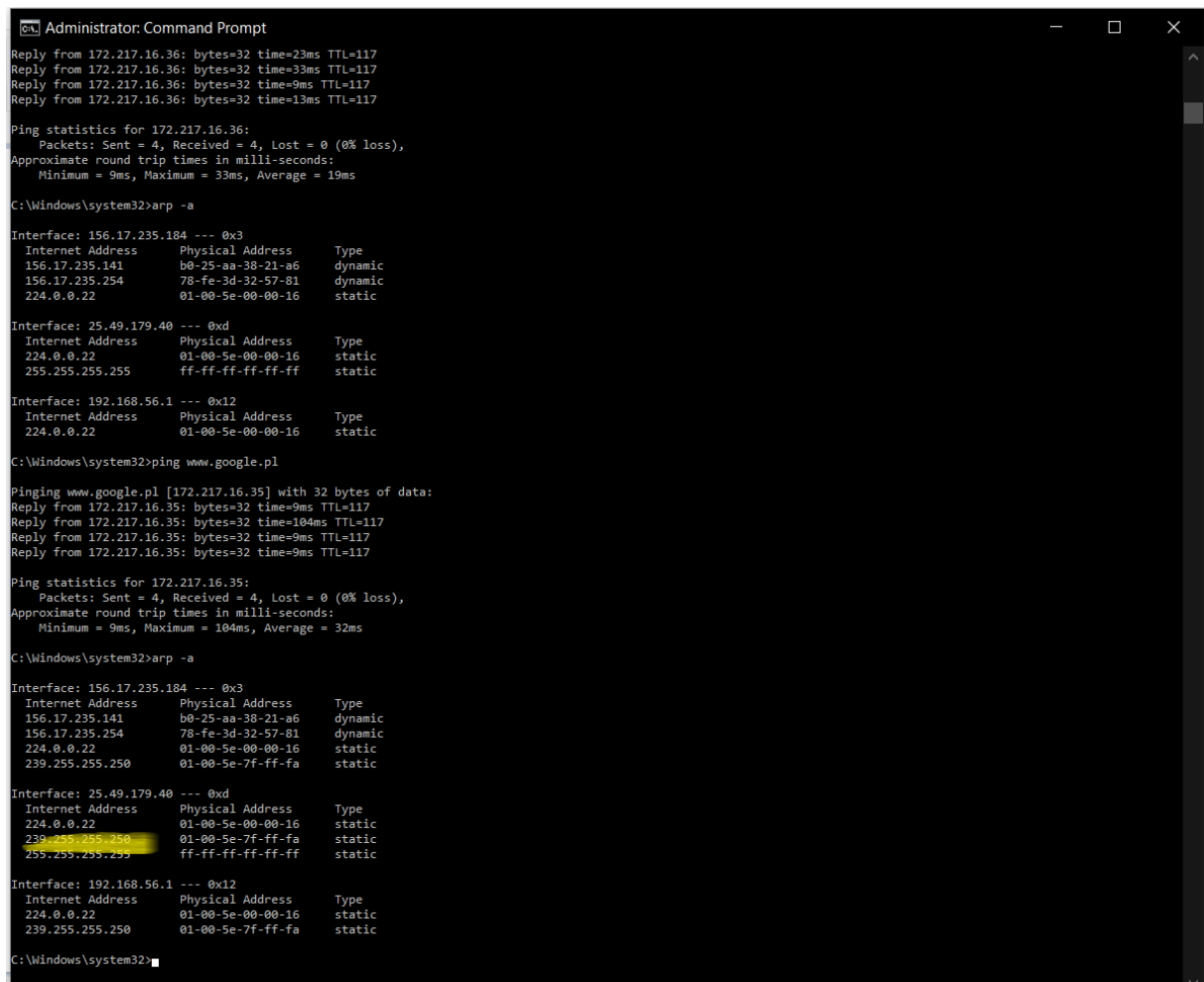
ID – Source and Destination MAC addresses – ARP content

```
> Frame 2: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{5DB3C671-55D3-491F-A464-7C6F2F0FA6F2}, id 0
> Ethernet II, Src: 7a:79:19:31:b3:28 (7a:79:19:31:b3:28), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
> Address Resolution Protocol (request)

> Frame 3: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface \Device\NPF_{5DB3C671-55D3-491F-A464-7C6F2F0FA6F2}, id 0
> Ethernet II, Src: 7a:79:19:30:f9:f4 (7a:79:19:30:f9:f4), Dst: 7a:79:19:31:b3:28 (7a:79:19:31:b3:28)
> Address Resolution Protocol (reply)
```

ARP protocol analysis for external hosts communication. Analysis of MAC addresses of external hosts

239.255.255.250 IP is added to ARP table. This address is used UPnP / SSDP discover devices on a VLAN. That's the answer of "why these addresses are not different from each other". So all data are sent via SSDP.



The image shows a Windows Command Prompt window titled 'Administrator: Command Prompt'. It displays the output of several commands:

```
Reply from 172.217.16.36: bytes=32 time=23ms TTL=117
Reply from 172.217.16.36: bytes=32 time=33ms TTL=117
Reply from 172.217.16.36: bytes=32 time=9ms TTL=117
Reply from 172.217.16.36: bytes=32 time=13ms TTL=117

Ping statistics for 172.217.16.36:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 9ms, Maximum = 33ms, Average = 19ms

C:\Windows\system32>arp -a

Interface: 156.17.235.184 --- 0x3
    Internet Address      Physical Address        Type
    156.17.235.141        b0-25-aa-38-21-a6      dynamic
    156.17.235.254        78-fe-3d-32-57-81      dynamic
    224.0.0.22            01-00-5e-00-00-16      static

Interface: 25.49.179.40 --- 0xd
    Internet Address      Physical Address        Type
    224.0.0.22            01-00-5e-00-00-16      static
    255.255.255.255       ff-ff-ff-ff-ff-ff      static

Interface: 192.168.56.1 --- 0x12
    Internet Address      Physical Address        Type
    224.0.0.22            01-00-5e-00-00-16      static

C:\Windows\system32>ping www.google.pl

Pinging www.google.pl [172.217.16.35] with 32 bytes of data:
Reply from 172.217.16.35: bytes=32 time=9ms TTL=117
Reply from 172.217.16.35: bytes=32 time=104ms TTL=117
Reply from 172.217.16.35: bytes=32 time=9ms TTL=117
Reply from 172.217.16.35: bytes=32 time=9ms TTL=117

Ping statistics for 172.217.16.35:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 9ms, Maximum = 104ms, Average = 32ms

C:\Windows\system32>arp -a

Interface: 156.17.235.184 --- 0x3
    Internet Address      Physical Address        Type
    156.17.235.141        b0-25-aa-38-21-a6      dynamic
    156.17.235.254        78-fe-3d-32-57-81      dynamic
    224.0.0.22            01-00-5e-00-00-16      static
    239.255.255.250       01-00-5e-7f-ff-fa      static
    255.255.255.255       ff-ff-ff-ff-ff-ff      static

Interface: 25.49.179.40 --- 0xd
    Internet Address      Physical Address        Type
    224.0.0.22            01-00-5e-00-00-16      static
    239.255.255.250       01-00-5e-7f-ff-fa      static
    255.255.255.255       ff-ff-ff-ff-ff-ff      static

Interface: 192.168.56.1 --- 0x12
    Internet Address      Physical Address        Type
    224.0.0.22            01-00-5e-00-00-16      static
    239.255.255.250       01-00-5e-7f-ff-fa      static

C:\Windows\system32>
```

Hamachi

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-F>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	25.48.249.244	25.255.255.255	UDP	86	57621 → 57621 Len=44
2	12.769675	25.48.249.244	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
3	13.781086	25.48.249.244	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
4	14.782270	25.48.249.244	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
5	15.785070	25.48.249.244	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
6	37.981840	25.48.249.244	25.255.255.255	UDP	86	57621 → 57621 Len=44
7	52.127651	25.48.249.244	239.255.255.250	SSDP	211	M-SEARCH * HTTP/1.1
8	53.135323	25.48.249.244	239.255.255.250	SSDP	211	M-SEARCH * HTTP/1.1
9	54.137321	25.48.249.244	239.255.255.250	SSDP	211	M-SEARCH * HTTP/1.1
10	55.138669	25.48.249.244	239.255.255.250	SSDP	211	M-SEARCH * HTTP/1.1
11	66.905738	25.49.179.40	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
12	67.906541	25.49.179.40	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
13	68.907246	25.49.179.40	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
14	69.908313	25.49.179.40	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
15	75.967601	25.48.249.244	25.255.255.255	UDP	86	57621 → 57621 Len=44
16	76.267563	25.48.249.244	224.0.0.251	MDNS	87	Standard query 0x0000 PTR _spotify-connect_tcp.local, "QM" question
17	79.222561	25.49.179.40	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
18	80.223164	25.49.179.40	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
19	81.224194	25.49.179.40	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
20	81.269260	25.48.249.244	239.255.255.250	SSDP	167	M-SEARCH * HTTP/1.1
21	82.225537	25.49.179.40	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
22	113.964774	25.48.249.244	25.255.255.255	UDP	86	57621 → 57621 Len=44
23	132.787171	25.48.249.244	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
24	133.797626	25.48.249.244	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
25	134.811778	25.48.249.244	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
26	135.813490	25.48.249.244	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1

> Frame 1: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface \Device\NPF_{5DB3C671-55D3-491F-A464-7C6F2F8FA6F2}, id 0

> Ethernet II, Src: 7a:79:19:30:f9:f4 (7a:79:19:30:f9:f4), Dst: Broadcast (ff:ff:ff:ff:ff:ff)

> Internet Protocol Version 4, Src: 25.48.249.244, Dst: 25.255.255.255

> User Datagram Protocol, Src Port: 57621, Dst Port: 57621

> Data (44 bytes)