Notatki z ćw. 01/04/2023

```
C:\Users\local>nslookup www.wp.pl
DNS request timed out.
    timeout was 2 seconds.
Server:  UnKnown
Address:  213.184.8.5

DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
*** Request to UnKnown timed-out

C:\Users\local>
```

SIECI KOMPUTEROWE

06. WARSTWA ŁĄCZA DANYCH. ETHERNET. ARP

Dane odebrane z warstwy sieci trafiają do warstwy łącza danych. Co się dalej z nimi dzieje? Tego dowiemy się z niniejszego odcinka.

- Tutorial video, wersja MP3
- Zadania warstwy łącza danych
- Ramka warstwy łącza danych i komunikacja
- Protokół ARP
- Ethernet
- Test wiedzy - 20 pytań
- Pełna obudowa dydaktyczna


```
C:\Users\local>nslookup -?
Usage:
   nslookup [-opt ...]             # interactive mode using default server
   nslookup [-opt ...] - server    # interactive mode using 'server'
   nslookup [-opt ...] host        # just look up 'host' using default server
   nslookup [-opt ...] host server # just look up 'host' using 'server'

C:\Users\local>
```

NETSTAT

```
Displays protocol statistics and current TCP/IP network connections.

NETSTAT [-a] [-b] [-e] [-f] [-n] [-o] [-p proto] [-r] [-s] [-t] [-x] [-y] [interval]

  -a            Displays all connections and listening ports.
  -b            Displays the executable involved in creating each connection or
                listening port. In some cases well-known executables host
                multiple independent components, and in these cases the
                sequence of components involved in creating the connection
                or listening port is displayed. In this case the executable
                name is in [] at the bottom, on top is the component it called,
                and so forth until TCP/IP was reached. Note that this option
                can be time-consuming and will fail unless you have sufficient
                permissions.
  -e            Displays Ethernet statistics. This may be combined with the -s
                option.
  -f            Displays Fully Qualified Domain Names (FQDN) for foreign
                addresses.
  -n            Displays addresses and port numbers in numerical form.
  -o            Displays the owning process ID associated with each connection.
  -p proto      Shows connections for the protocol specified by proto; proto
                may be any of: TCP, UDP, TCPv6, or UDPv6.  If used with the -s
                option to display per-protocol statistics, proto may be any of:
                IP, IPv6, ICMP, ICMPv6, TCP, TCPv6, UDP, or UDPv6.
  -q            Displays all connections, listening ports, and bound
                nonlistening TCP ports. Bound nonlistening ports may or may not
                be associated with an active connection.
  -r            Displays the routing table.
  -s            Displays per-protocol statistics.  By default, statistics are
                shown for IP, IPv6, ICMP, ICMPv6, TCP, TCPv6, UDP, and UDPv6;
                the -p option may be used to specify a subset of the default.
  -t            Displays the current connection offload state.
  -x            Displays NetworkDirect connections, listeners, and shared
                endpoints.
  -y            Displays the TCP connection template for all connections.
                Cannot be combined with the other options.
  interval      Redisplays selected statistics, pausing interval seconds
                between each display.  Press CTRL+C to stop redisplaying
                statistics.  If omitted, netstat will print the current
                configuration information once.


C:\Users\local>
```

```
C:\Users\local>NETSTAT -a

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    0.0.0.0:135            DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:445            DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:902            DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:912            DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:5040           DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:11100          DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:49664          DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:49665          DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:49666          DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:49667          DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:49668          DESKTOP-718DGH2:0      LISTENING
  TCP    0.0.0.0:49675          DESKTOP-718DGH2:0      LISTENING
  TCP    127.0.0.1:11200        DESKTOP-718DGH2:0      LISTENING
  TCP    127.0.0.1:11300        DESKTOP-718DGH2:0      LISTENING
  TCP    127.0.0.1:11300        view-localhost:65202   ESTABLISHED
  TCP    127.0.0.1:50682        DESKTOP-718DGH2:0      LISTENING
  TCP    127.0.0.1:65202        view-localhost:11300   ESTABLISHED
  TCP    127.0.0.1:65238        view-localhost:65239   ESTABLISHED
  TCP    127.0.0.1:65239        view-localhost:65238   ESTABLISHED
  TCP    127.0.0.1:65241        view-localhost:65242   ESTABLISHED
  TCP    127.0.0.1:65242        view-localhost:65241   ESTABLISHED
  TCP    169.254.159.126:139    DESKTOP-718DGH2:0      LISTENING
  TCP    169.254.214.205:139    DESKTOP-718DGH2:0      LISTENING
  TCP    192.168.13.17:139      DESKTOP-718DGH2:0      LISTENING
```

wyświetla wszystkie połączenia i porty oczekujące

```
C:\Users\local>NETSTAT -e
Interface Statistics

                           Received            Sent

Bytes                    1008610914       158424230
Unicast packets             448866        31272366
Non-unicast packets          39948          114558
Discards                         0               0
Errors                           0               0
Unknown protocols                0

C:\Users\local>
```

wyświetla statystyki Ethernet-u. Ta opcja może być używana razem z opcją -s

```
C:\Users\local>NETSTAT -e -s
Interface Statistics

                           Received            Sent

Bytes                    1008905580       158489128
Unicast packets             448956        31273152
Non-unicast packets          43254          114620
Discards                         0               0
Errors                           0               0
Unknown protocols                0

IPv4 Statistics

  Packets Received                   = 10779050
  Received Header Errors             = 0
  Received Address Errors            = 5589900
  Datagrams Forwarded                = 0
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 125558
  Received Packets Delivered         = 5228794
  Output Requests                    = 2655376
  Routing Discards                   = 0
  Discarded Output Packets           = 10515
  Output Packet No Route             = 1160
  Reassembly Required                = 0
  Reassembly Successful              = 0
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 0
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 0

IPv6 Statistics

  Packets Received                   = 124963
  Received Header Errors             = 0
  Received Address Errors            = 17296
  Datagrams Forwarded                = 0
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 22810
  Received Packets Delivered         = 109495
  Output Requests                    = 14906
  Routing Discards                   = 0
  Discarded Output Packets           = 0
  Output Packet No Route             = 2
  Reassembly Required                = 0
  Reassembly Successful              = 0
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 0
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 0

ICMPv4 Statistics

                           Received    Sent
  Messages                 12262       3769
  Errors                   0           0
  Destination Unreachable  12230       3706
  Time Exceeded            0           0
  Parameter Problems       0           0
  Source Quenches          0           0
  Redirects                0           0
```

```
C:\Users\local>NETSTAT -n

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:11300        127.0.0.1:65202        ESTABLISHED
  TCP    127.0.0.1:65202        127.0.0.1:11300        ESTABLISHED
  TCP    127.0.0.1:65238        127.0.0.1:65239        ESTABLISHED
  TCP    127.0.0.1:65239        127.0.0.1:65238        ESTABLISHED
  TCP    127.0.0.1:65241        127.0.0.1:65242        ESTABLISHED
  TCP    127.0.0.1:65242        127.0.0.1:65241        ESTABLISHED
  TCP    192.168.13.17:49360    23.64.12.58:443        CLOSE_WAIT
  TCP    192.168.13.17:49363    13.107.237.254:443     CLOSE_WAIT
  TCP    192.168.13.17:49679    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49680    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49681    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49682    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:65193    185.94.157.11:80       CLOSE_WAIT
  TCP    192.168.13.17:65197    91.228.165.147:8883    ESTABLISHED
  TCP    192.168.13.17:65198    91.228.165.147:8883    ESTABLISHED
  TCP    192.168.13.17:65208    40.115.3.253:443       ESTABLISHED
  TCP    192.168.13.17:65209    213.184.0.58:2222      ESTABLISHED
  TCP    192.168.13.17:65260    54.186.162.207:443     ESTABLISHED
  TCP    192.168.13.17:65384    23.197.105.227:443     CLOSE_WAIT
  TCP    192.168.13.17:65385    23.197.105.227:443     CLOSE_WAIT
  TCP    192.168.13.17:65386    23.197.105.227:443     CLOSE_WAIT
  TCP    192.168.13.17:65390    23.45.137.104:80       ESTABLISHED
  TCP    192.168.13.17:65391    23.45.137.104:80       ESTABLISHED
  TCP    192.168.13.17:65392    23.45.137.104:80       ESTABLISHED
  TCP    192.168.13.17:65393    23.45.137.104:80       ESTABLISHED
  TCP    192.168.13.17:65394    23.45.137.104:80       ESTABLISHED
  TCP    192.168.13.17:65395    23.45.137.104:80       ESTABLISHED
  TCP    192.168.13.17:65397    23.197.105.166:80      ESTABLISHED
  TCP    192.168.13.17:65398    23.197.105.166:80      ESTABLISHED
  TCP    192.168.13.17:65399    23.197.105.227:443     CLOSE_WAIT
  TCP    192.168.13.17:65400    23.197.105.227:443     CLOSE_WAIT
  TCP    192.168.13.17:65401    23.197.105.227:443     CLOSE_WAIT
  TCP    192.168.13.17:65405    23.197.105.227:443     CLOSE_WAIT

C:\Users\local>
```

wyświetla adresy i porty w postaci liczbowej
adres 127.0.0.1 to nasz komputer

```
C:\Users\local>NETSTAT -s

IPv4 Statistics

  Packets Received                   = 10779558
  Received Header Errors             = 0
  Received Address Errors            = 5589900
  Datagrams Forwarded                = 0
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 125800
  Received Packets Delivered         = 5229404
  Output Requests                    = 2655645
  Routing Discards                   = 0
  Discarded Output Packets           = 10531
  Output Packet No Route             = 1160
  Reassembly Required                = 0
  Reassembly Successful              = 0
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 0
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 0

IPv6 Statistics

  Packets Received                   = 125203
  Received Header Errors             = 0
  Received Address Errors            = 17296
  Datagrams Forwarded                = 0
  Unknown Protocols Received         = 0
  Received Packets Discarded         = 22890
  Received Packets Delivered         = 109735
  Output Requests                    = 14920
  Routing Discards                   = 0
  Discarded Output Packets           = 0
  Output Packet No Route             = 2
  Reassembly Required                = 0
  Reassembly Successful              = 0
  Reassembly Failures                = 0
  Datagrams Successfully Fragmented  = 0
  Datagrams Failing Fragmentation    = 0
  Fragments Created                  = 0

ICMPv4 Statistics

                            Received    Sent
  Messages                  12267       3773
  Errors                    0           0
  Destination Unreachable   12235       3710
  Time Exceeded             0           0
  Parameter Problems        0           0
```

wyświetla statystykę wybranego protokołu. Domyślnie jest to statystyka protokołów TCP, UDP i IP

```
C:\Users\local>NETSTAT -p TCP

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:11300        view-localhost:65202   ESTABLISHED
  TCP    127.0.0.1:65202        view-localhost:11300   ESTABLISHED
  TCP    127.0.0.1:65238        view-localhost:65239   ESTABLISHED
  TCP    127.0.0.1:65239        view-localhost:65238   ESTABLISHED
  TCP    127.0.0.1:65241        view-localhost:65242   ESTABLISHED
  TCP    127.0.0.1:65242        view-localhost:65241   ESTABLISHED
  TCP    192.168.13.17:49360    a23-64-12-58:https     CLOSE_WAIT
  TCP    192.168.13.17:49363    13.107.237.254:https   CLOSE_WAIT
  TCP    192.168.13.17:49788    239:https              ESTABLISHED
  TCP    192.168.13.17:49792    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49793    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49794    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49795    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:65193    um15:http              CLOSE_WAIT
  TCP    192.168.13.17:65197    h1-epnsbroker04:8883   ESTABLISHED
  TCP    192.168.13.17:65198    h1-epnsbroker04:8883   ESTABLISHED
  TCP    192.168.13.17:65208    40.115.3.253:https     ESTABLISHED
  TCP    192.168.13.17:65209    testad:2222            ESTABLISHED
  TCP    192.168.13.17:65260    ec2-54-186-162-207:https  ESTABLISHED
  TCP    192.168.13.17:65384    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65385    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65386    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65390    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65391    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65392    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65393    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65394    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65395    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65397    a23-197-105-166:http   ESTABLISHED
  TCP    192.168.13.17:65398    a23-197-105-166:http   ESTABLISHED
  TCP    192.168.13.17:65399    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65400    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65401    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65405    a23-197-105-227:https  CLOSE_WAIT

C:\Users\local>
```

wyświetla połączenia dla określonego protokołu; może to być protokół TCP lub UDP

```
C:\Users\local>NETSTAT -s -p TCP

TCP Statistics for IPv4

  Active Opens                        = 20428
  Passive Opens                       = 1083
  Failed Connection Attempts          = 7623
  Reset Connections                   = 3531
  Current Connections                 = 29
  Segments Received                   = 3636345
  Segments Sent                       = 3100035
  Segments Retransmitted              = 18397

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:11300        view-localhost:65202   ESTABLISHED
  TCP    127.0.0.1:65202        view-localhost:11300   ESTABLISHED
  TCP    127.0.0.1:65238        view-localhost:65239   ESTABLISHED
  TCP    127.0.0.1:65239        view-localhost:65238   ESTABLISHED
  TCP    127.0.0.1:65241        view-localhost:65242   ESTABLISHED
  TCP    127.0.0.1:65242        view-localhost:65241   ESTABLISHED
  TCP    192.168.13.17:49360    a23-64-12-58:https     CLOSE_WAIT
  TCP    192.168.13.17:49363    13.107.237.254:https   CLOSE_WAIT
  TCP    192.168.13.17:49800    123:https              TIME_WAIT
  TCP    192.168.13.17:49811    waw07s06-in-f14:https  TIME_WAIT
  TCP    192.168.13.17:49814    muc03s08-in-f40:https  TIME_WAIT
  TCP    192.168.13.17:49874    um03:http              TIME_WAIT
  TCP    192.168.13.17:49881    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49882    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:65193    um15:http              CLOSE_WAIT
  TCP    192.168.13.17:65197    h1-epnsbroker04:8883   ESTABLISHED
  TCP    192.168.13.17:65198    h1-epnsbroker04:8883   ESTABLISHED
  TCP    192.168.13.17:65208    40.115.3.253:https     ESTABLISHED
  TCP    192.168.13.17:65209    testad:2222            ESTABLISHED
  TCP    192.168.13.17:65260    ec2-54-186-162-207:https  ESTABLISHED
  TCP    192.168.13.17:65384    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65385    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65386    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65390    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65391    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65392    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65393    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65394    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65395    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65397    a23-197-105-166:http   ESTABLISHED
  TCP    192.168.13.17:65398    a23-197-105-166:http   ESTABLISHED
  TCP    192.168.13.17:65399    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65400    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65401    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65405    a23-197-105-227:https  CLOSE_WAIT

C:\Users\local>
```

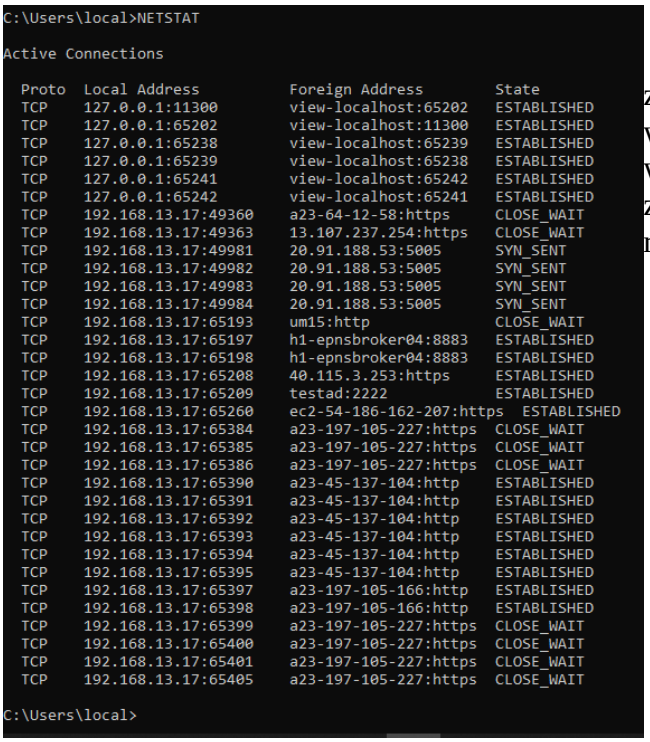
```
C:\Users\local>NETSTAT -s -p UDP

UDP Statistics for IPv4

  Datagrams Received    = 2588998
  No Ports              = 12083
  Receive Errors        = 109473
  Datagrams Sent        = 642500

Active Connections

  Proto  Local Address          Foreign Address        State

C:\Users\local>NETSTAT -s -p IP

IPv4 Statistics

  Packets Received                    = 10783675
  Received Header Errors              = 0
  Received Address Errors             = 5589915
  Datagrams Forwarded                 = 0
  Unknown Protocols Received          = 0
  Received Packets Discarded          = 126776
  Received Packets Delivered          = 5233880
  Output Requests                     = 2657913
  Routing Discards                    = 0
  Discarded Output Packets            = 10586
  Output Packet No Route              = 1160
  Reassembly Required                 = 0
  Reassembly Successful               = 0
  Reassembly Failures                 = 0
  Datagrams Successfully Fragmented   = 0
  Datagrams Failing Fragmentation     = 0
  Fragments Created                   = 0

C:\Users\local>
```

kiedy -p jest używane łącznie z opcją -s, to można wyświetlić wybrany protokół spośród możliwych: TCP, UDP i IP

```
C:\Users\local>NETSTAT -r
===========================================================================
Interface List
 19...0a 00 27 00 00 13 ......VirtualBox Host-Only Ethernet Adapter
 13...bc ae c5 cd 89 dd ......Realtek PCIe GbE Family Controller
 15...00 50 56 c0 00 01 ......VMware Virtual Ethernet Adapter for VMnet1
  9...00 50 56 c0 00 08 ......VMware Virtual Ethernet Adapter for VMnet8
  2...00 30 84 0b 2a e3 ......Realtek RTL8139/810x Family Fast Ethernet NIC
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0     192.168.13.1    192.168.13.17     25
        127.0.0.0        255.0.0.0         On-link         127.0.0.1    331
        127.0.0.1  255.255.255.255         On-link         127.0.0.1    331
  127.255.255.255  255.255.255.255         On-link         127.0.0.1    331
      169.254.0.0      255.255.0.0         On-link   169.254.159.126    291
      169.254.0.0      255.255.0.0         On-link   169.254.214.205    291
  169.254.159.126  255.255.255.255         On-link   169.254.159.126    291
  169.254.214.205  255.255.255.255         On-link   169.254.214.205    291
  169.254.255.255  255.255.255.255         On-link   169.254.159.126    291
  169.254.255.255  255.255.255.255         On-link   169.254.214.205    291
     192.168.13.0    255.255.255.0         On-link    192.168.13.17    281
    192.168.13.17  255.255.255.255         On-link    192.168.13.17    281
   192.168.13.255  255.255.255.255         On-link    192.168.13.17    281
     192.168.56.0    255.255.255.0         On-link     192.168.56.1    281
     192.168.56.1  255.255.255.255         On-link     192.168.56.1    281
   192.168.56.255  255.255.255.255         On-link     192.168.56.1    281
        224.0.0.0        240.0.0.0         On-link        127.0.0.1    331
        224.0.0.0        240.0.0.0         On-link     192.168.56.1    281
        224.0.0.0        240.0.0.0         On-link    192.168.13.17    281
        224.0.0.0        240.0.0.0         On-link   169.254.214.205    291
        224.0.0.0        240.0.0.0         On-link   169.254.159.126    291
  255.255.255.255  255.255.255.255         On-link        127.0.0.1    331
  255.255.255.255  255.255.255.255         On-link     192.168.56.1    281
  255.255.255.255  255.255.255.255         On-link    192.168.13.17    281
  255.255.255.255  255.255.255.255         On-link   169.254.214.205    291
  255.255.255.255  255.255.255.255         On-link   169.254.159.126    291
===========================================================================
Persistent Routes:
  None
```

```
IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  1    331 ::1/128                  On-link
 19    281 fe80::/64                On-link
 13    281 fe80::/64                On-link
  9    291 fe80::/64                On-link
 15    291 fe80::/64                On-link
 13    281 fe80::48f1:4658:f26a:4ef3/128
                                    On-link
  9    291 fe80::7e4d:7386:5dc4:ac0/128
                                    On-link
 19    281 fe80::8885:c812:f884:6259/128
                                    On-link
 15    291 fe80::d1c7:c291:8bc0:1a43/128
                                    On-link
  1    331 ff00::/8                 On-link
 19    281 ff00::/8                 On-link
 13    281 ff00::/8                 On-link
  9    291 ff00::/8                 On-link
 15    291 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None

C:\Users\local>
```

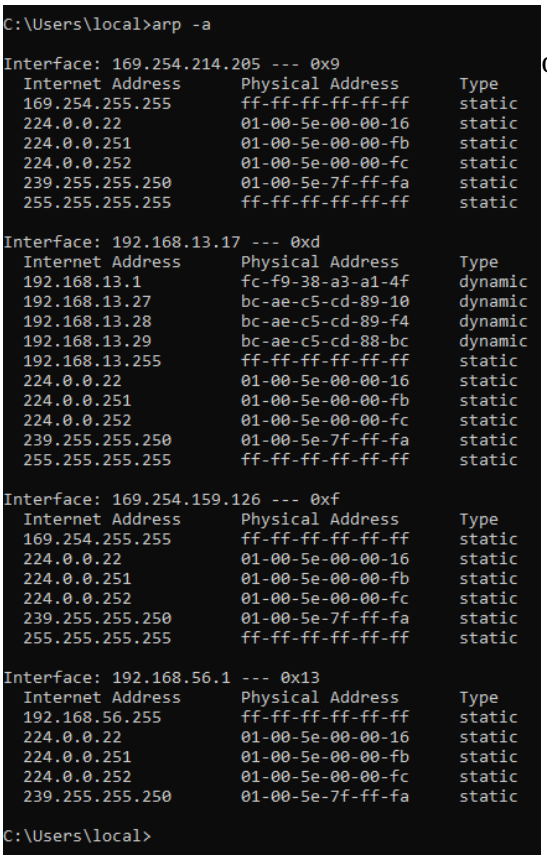
wyświetla tabele routingu



```
C:\Users\local>NETSTAT

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:11300        view-localhost:65202   ESTABLISHED
  TCP    127.0.0.1:65202        view-localhost:11300   ESTABLISHED
  TCP    127.0.0.1:65238        view-localhost:65239   ESTABLISHED
  TCP    127.0.0.1:65239        view-localhost:65238   ESTABLISHED
  TCP    127.0.0.1:65241        view-localhost:65242   ESTABLISHED
  TCP    127.0.0.1:65242        view-localhost:65241   ESTABLISHED
  TCP    192.168.13.17:49360    a23-64-12-58:https     CLOSE_WAIT
  TCP    192.168.13.17:49363    13.107.237.254:https   CLOSE_WAIT
  TCP    192.168.13.17:49981    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49982    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49983    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:49984    20.91.188.53:5005      SYN_SENT
  TCP    192.168.13.17:65193    um15:http              CLOSE_WAIT
  TCP    192.168.13.17:65197    h1-epnsbroker04:8883   ESTABLISHED
  TCP    192.168.13.17:65198    h1-epnsbroker04:8883   ESTABLISHED
  TCP    192.168.13.17:65208    40.115.3.253:https     ESTABLISHED
  TCP    192.168.13.17:65209    testad:2222            ESTABLISHED
  TCP    192.168.13.17:65260    ec2-54-186-162-207:https  ESTABLISHED
  TCP    192.168.13.17:65384    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65385    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65386    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65390    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65391    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65392    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65393    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65394    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65395    a23-45-137-104:http    ESTABLISHED
  TCP    192.168.13.17:65397    a23-197-105-166:http   ESTABLISHED
  TCP    192.168.13.17:65398    a23-197-105-166:http   ESTABLISHED
  TCP    192.168.13.17:65399    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65400    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65401    a23-197-105-227:https  CLOSE_WAIT
  TCP    192.168.13.17:65405    a23-197-105-227:https  CLOSE_WAIT

C:\Users\local>
```

wyświetla wybraną statystykę, odczekując zadaną ilość sekund pomiędzy każdym wyświetleniem. Naciśnięcie CTRL+C przerywa wyświetlanie statystyk. Jeżeli ta zmienna nie zostanie określona, program netstat wydrukuje raz informacje o konfiguracji.

6.Polecenie arp
Protokół ARP (Address Resolution Protocol) – powiązanie adresu IP z adresem MAC



```
C:\Users\local>arp -a

Interface: 169.254.214.205 --- 0x9
  Internet Address      Physical Address      Type
  169.254.255.255       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: 192.168.13.17 --- 0xd
  Internet Address      Physical Address      Type
  192.168.13.1          fc-f9-38-a3-a1-4f     dynamic
  192.168.13.27         bc-ae-c5-cd-89-10     dynamic
  192.168.13.28         bc-ae-c5-cd-89-f4     dynamic
  192.168.13.29         bc-ae-c5-cd-88-bc     dynamic
  192.168.13.255        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: 169.254.159.126 --- 0xf
  Internet Address      Physical Address      Type
  169.254.255.255       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 --- 0x13
  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:\Users\local>
```

wyświetla bieżące wpisy protokołu ARP przez odpytywanie bieżących danych protokołu

```
C:\Users\local>arp -g

Interface: 169.254.214.205 --- 0x9
  Internet Address      Physical Address      Type
  169.254.255.255       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: 192.168.13.17 --- 0xd
  Internet Address      Physical Address      Type
  192.168.13.1          fc-f9-38-a3-a1-4f     dynamic
  192.168.13.27         bc-ae-c5-cd-89-10     dynamic
  192.168.13.28         bc-ae-c5-cd-89-f4     dynamic
  192.168.13.29         bc-ae-c5-cd-88-bc     dynamic
  192.168.13.255        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: 169.254.159.126 --- 0xf
  Internet Address      Physical Address      Type
  169.254.255.255       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 --- 0x13
  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:\Users\local>
```

```
C:\Users\local>arp -a  169.254.255.255 -v

Interface: 169.254.214.205 --- 0x9
  Internet Address      Physical Address      Type
  169.254.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 192.168.13.17 --- 0xd
  Internet Address      Physical Address      Type
  169.254.255.255       00-00-00-00-00-00     invalid

Interface: 169.254.159.126 --- 0xf
  Internet Address      Physical Address      Type
  169.254.255.255       ff-ff-ff-ff-ff-ff     static

C:\Users\local>
```

wyświetla bieżące wpisy protokołu ARP w trybie pełnym. Zostaną pokazane wszystkie nieprawidłowe wpisy oraz wpisy interfejsu pętli zwrotnej

6.1

a) Do czego służy protokół arp?

Protokół ARP (Address Resolution Protocol) służy do powiązania adresu IP z adresem MAC. ARP to mechanizm pozwalający na odwzorowanie adresu logicznego, czyli IP na adres fizyczny, czyli MAC.

b) Jakie informacje można uzyskać za pomocą polecenia arp?

Jak wpiszemy polecenie arp w wierszu konsoli to wyświetli nam się pomoc do tego polecenia, zawierająca wszystkie opcje.

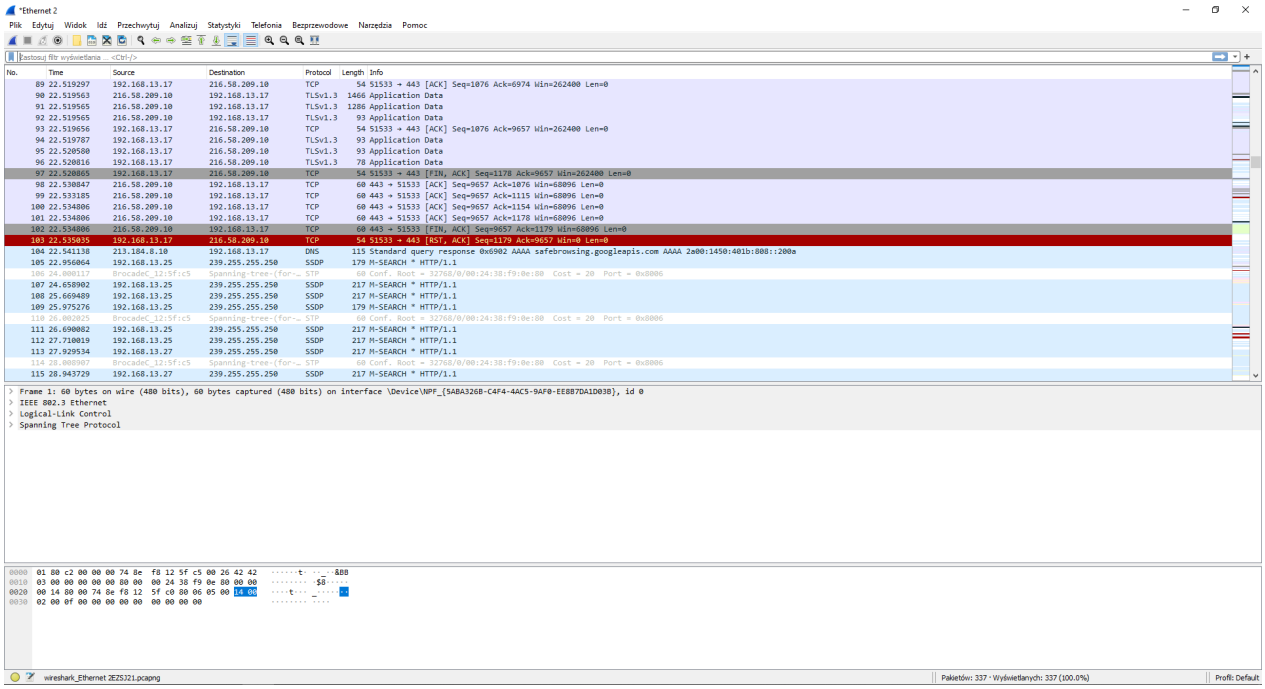
```
C:\Users\local>arp

Displays and modifies the IP-to-Physical address translation tables used by
address resolution protocol (ARP).

ARP -s inet_addr eth_addr [if_addr]
ARP -d inet_addr [if_addr]
ARP -a [inet_addr] [-N if_addr] [-v]

  -a            Displays current ARP entries by interrogating the current
                protocol data.  If inet_addr is specified, the IP and Physical
                addresses for only the specified computer are displayed.  If
                more than one network interface uses ARP, entries for each ARP
                table are displayed.
  -g            Same as -a.
  -v            Displays current ARP entries in verbose mode.  All invalid
                entries and entries on the loop-back interface will be shown.
  inet_addr     Specifies an internet address.
  -N if_addr    Displays the ARP entries for the network interface specified
                by if_addr.
  -d            Deletes the host specified by inet_addr. inet_addr may be
                wildcarded with * to delete all hosts.
  -s            Adds the host and associates the Internet address inet_addr
                with the Physical address eth_addr.  The Physical address is
                given as 6 hexadecimal bytes separated by hyphens. The entry
                is permanent.
  eth_addr      Specifies a physical address.
  if_addr       If present, this specifies the Internet address of the
                interface whose address translation table should be modified.
                If not present, the first applicable interface will be used.
Example:
  > arp -s 157.55.85.212   00-aa-00-62-c6-09  .... Adds a static entry.
  > arp -a                                    .... Displays the arp table.

C:\Users\local>
```

c) Jakie opcje są dostępne dla tego polecenia?(proszę podać 3-4)
-a wyświetla
-d usuwa hosta
-s dodaje hosta

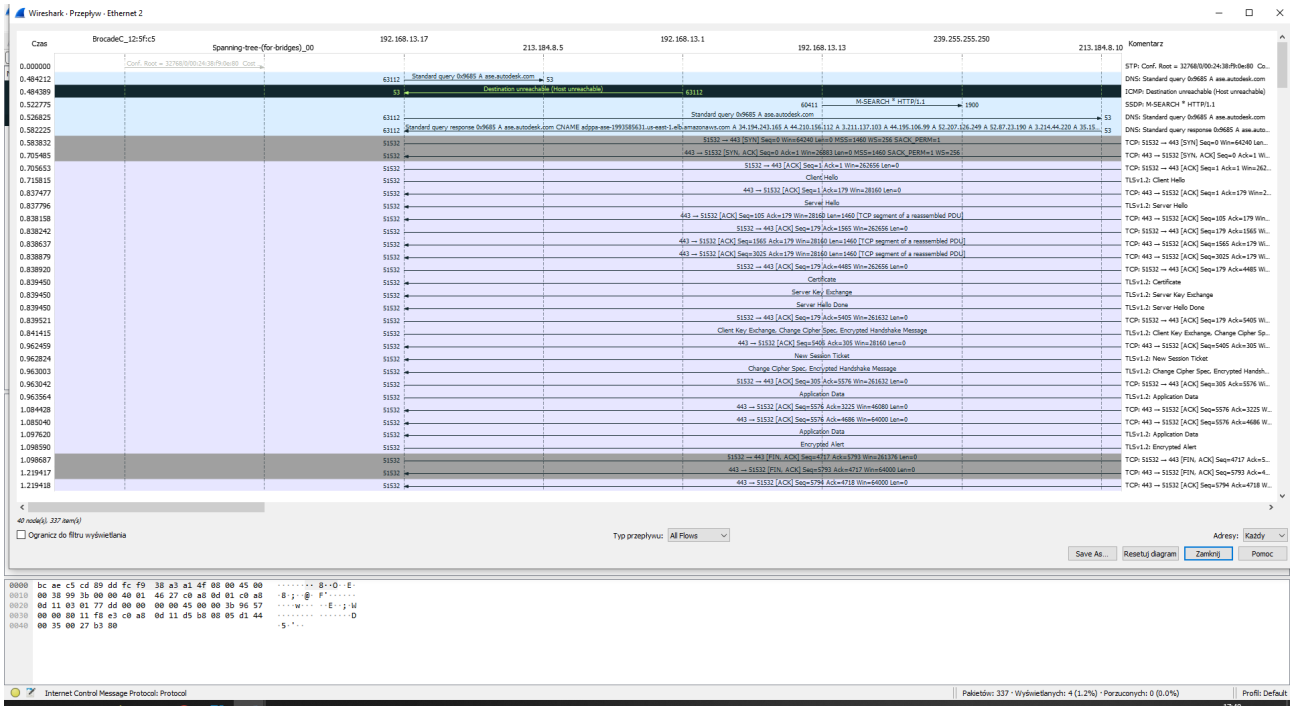
d) Czy informacje uzyskane za pomocą protokołu ARP są zapamiętywane w systemie operacyjnym?

Nie są zapamiętywane. Domyślnie, w systemach Windows wpis taki utrzymuje się maksymalnie do 10 minut, po tym czasie zostaje usunięty.

WIRESHARK

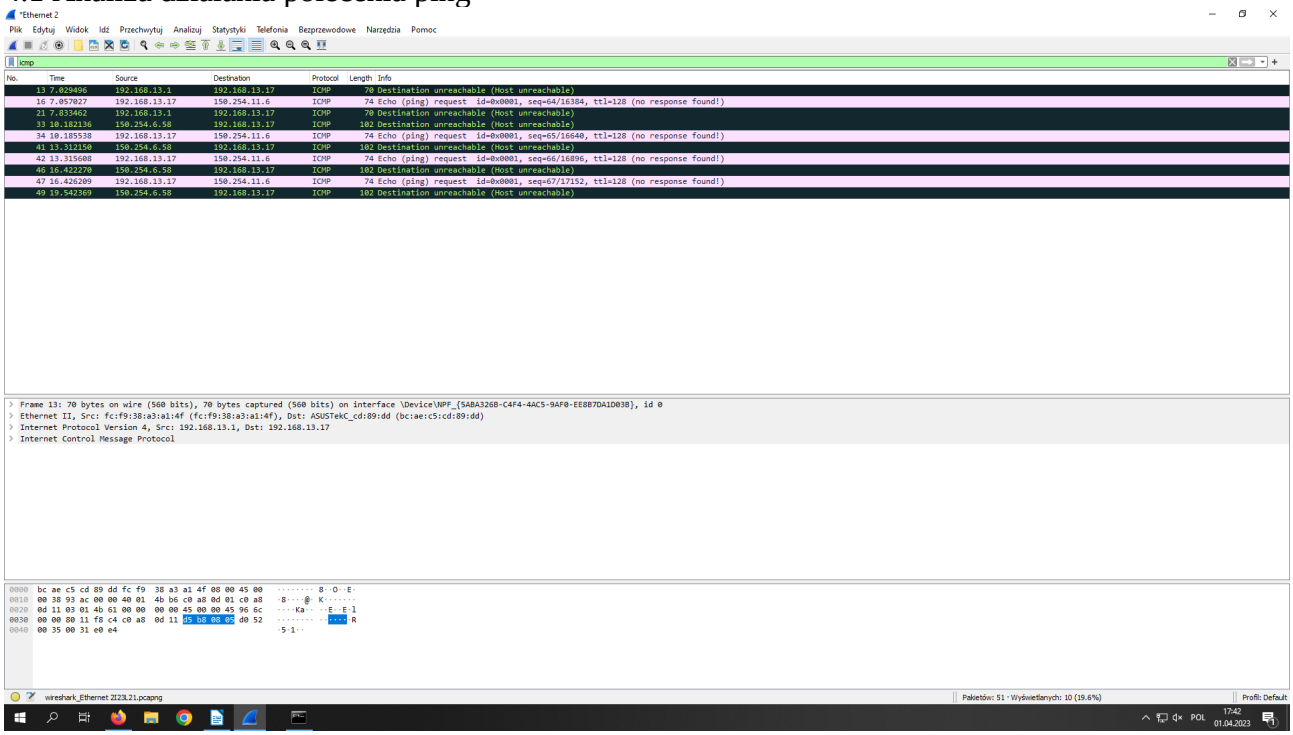


okno aplikacji



graf przepływu

4.1 Analiza działania polecenia ping



a) komputer wysłał 4 wiadomości, typu:
„Echo (ping) request …”
b) komputer otrzymał 6 wiadomości, typu:
„Destination unreachable (Host unreachable)”
c) 1) Ethernet II, Src: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f), Dst: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd); Internet Protocol Version 4, Src: 192.168.13.1, Dst: 192.168.13.17

2) Ethernet II, Src: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd), Dst: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f); Internet Protocol Version 4, Src: 192.168.13.17, Dst: 150.254.11.6

3) Ethernet II, Src: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f), Dst: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd); Internet Protocol Version 4, Src: 192.168.13.1, Dst: 192.168.13.17

4) Ethernet II, Src: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f), Dst: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd); Internet Protocol Version 4, Src: 150.254.6.58, Dst: 192.168.13.17

5) Ethernet II, Src: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd), Dst: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f); Internet Protocol Version 4, Src: 192.168.13.17, Dst: 150.254.11.6

6) Internet Protocol Version 4, Src: 192.168.13.17, Dst: 150.254.11.6; Internet Protocol Version 4, Src: 150.254.6.58, Dst: 192.168.13.17

7) Ethernet II, Src: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd), Dst: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f); Internet Protocol Version 4, Src: 192.168.13.17, Dst: 150.254.11.6

8)Ethernet II, Src: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f), Dst: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd); Internet Protocol Version 4, Src: 150.254.6.58, Dst: 192.168.13.17

9)Ethernet II, Src: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd), Dst: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f); Internet Protocol Version 4, Src: 192.168.13.17, Dst: 150.254.11.6

10)Ethernet II, Src: fc:f9:38:a3:a1:4f (fc:f9:38:a3:a1:4f), Dst: ASUSTekC_cd:89:dd (bc:ae:c5:cd:89:dd); Internet Protocol Version 4, Src: 150.254.6.58, Dst: 192.168.13.17