ECE 636
COMPUTER NETWORKING LABORATORY

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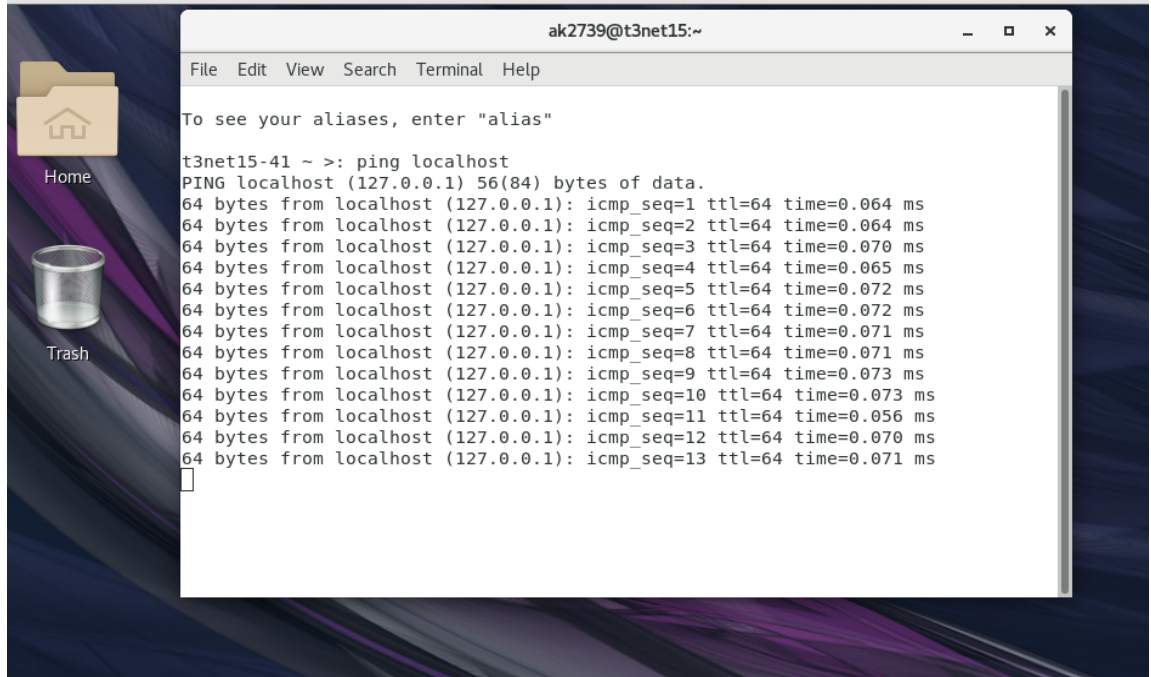
Experiment with ARP (Lab 1)

I.

1. Host Name   t3net15-21
   em1
2. IP Address 10.10.200.12
3. Type of IP Address *Class A*
4. Physical Address 6c:2b:59:e3:0e:8b
5. Broadcast Address 10.10.200.255
   P1p1
2. IP Address 10.10.226.12
3. Type of IP Address Class A
4. Physical Address b4:96:91:51:d0:46
5. Broadcast Address 10.10.226.255

6. Number of interfaces :The Host has 4 interfaces
7. Interface Names: (em, p1p1, lo, virbr0)
8. Loopback Interface: The loopback interface is **lo** with IP address 127.0.0.1.
9. If you ping the loopback interface by typing "ping localhost" at the terminal prompt, could any ICMP packet be observed on the output of your tcpdump? Why? (Please explain according to the layers of networks).

   When we use "ping localhost" to ping the loopback address we observe the ICMP Packets because we are pinging our own device.
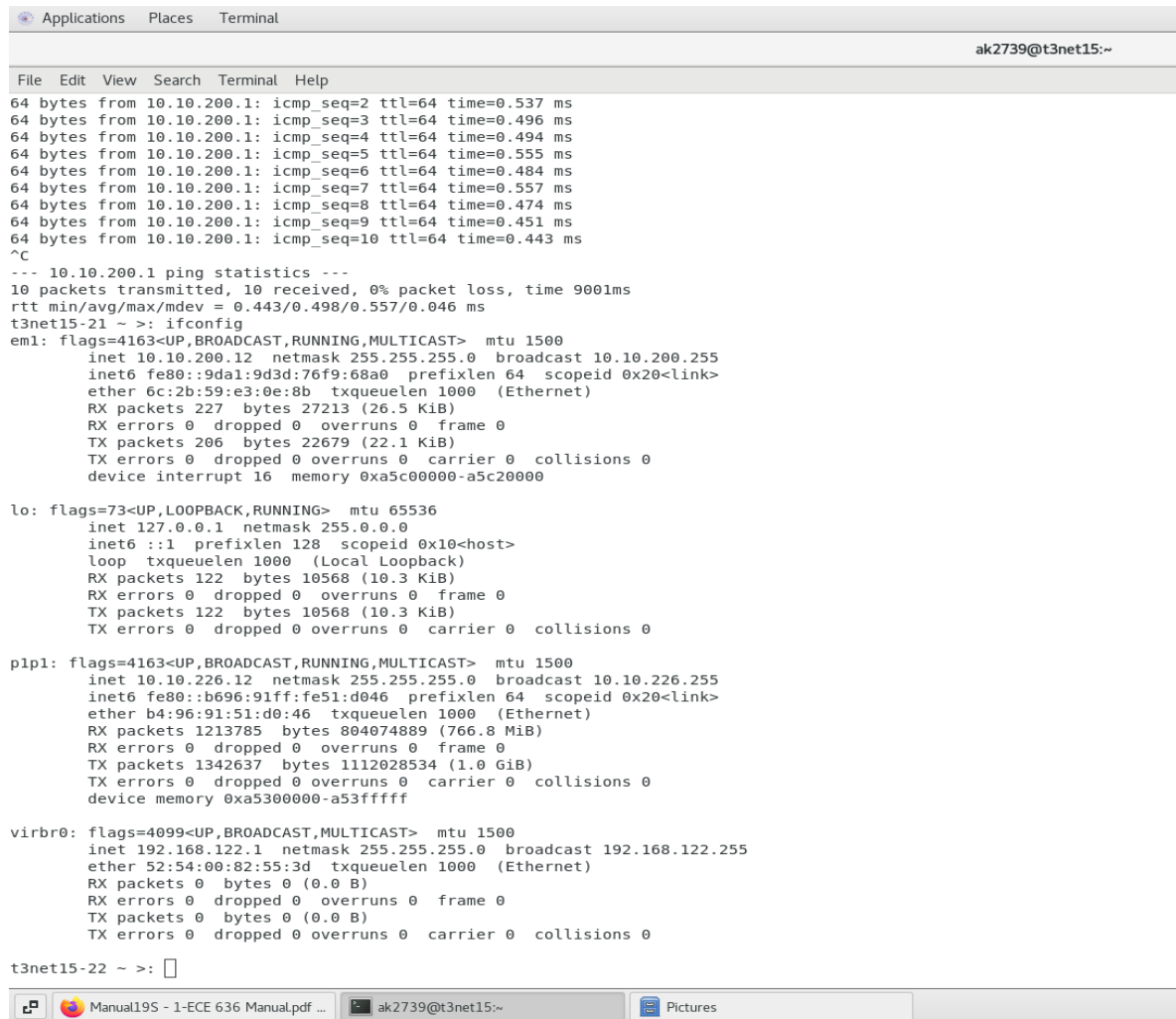
To see your aliases, enter "alias"

t3net15-41 ~ >: ping localhost
PING localhost (127.0.0.1) 56(84) bytes of data.
64 bytes from localhost (127.0.0.1): icmp_seq=1 ttl=64 time=0.064 ms
64 bytes from localhost (127.0.0.1): icmp_seq=2 ttl=64 time=0.064 ms
64 bytes from localhost (127.0.0.1): icmp_seq=3 ttl=64 time=0.070 ms
64 bytes from localhost (127.0.0.1): icmp_seq=4 ttl=64 time=0.065 ms
64 bytes from localhost (127.0.0.1): icmp_seq=5 ttl=64 time=0.072 ms
64 bytes from localhost (127.0.0.1): icmp_seq=6 ttl=64 time=0.072 ms
64 bytes from localhost (127.0.0.1): icmp_seq=7 ttl=64 time=0.071 ms
64 bytes from localhost (127.0.0.1): icmp_seq=8 ttl=64 time=0.071 ms
64 bytes from localhost (127.0.0.1): icmp_seq=9 ttl=64 time=0.073 ms
64 bytes from localhost (127.0.0.1): icmp_seq=10 ttl=64 time=0.073 ms
64 bytes from localhost (127.0.0.1): icmp_seq=11 ttl=64 time=0.056 ms
64 bytes from localhost (127.0.0.1): icmp_seq=12 ttl=64 time=0.070 ms
64 bytes from localhost (127.0.0.1): icmp_seq=13 ttl=64 time=0.071 ms

1.1 Objectives

1) Ifconfig

```
Applications    Places    Terminal                                                        ak2739@t3net15:~

File  Edit  View  Search  Terminal  Help
64 bytes from 10.10.200.1: icmp_seq=2 ttl=64 time=0.537 ms
64 bytes from 10.10.200.1: icmp_seq=3 ttl=64 time=0.496 ms
64 bytes from 10.10.200.1: icmp_seq=4 ttl=64 time=0.494 ms
64 bytes from 10.10.200.1: icmp_seq=5 ttl=64 time=0.555 ms
64 bytes from 10.10.200.1: icmp_seq=6 ttl=64 time=0.484 ms
64 bytes from 10.10.200.1: icmp_seq=7 ttl=64 time=0.557 ms
64 bytes from 10.10.200.1: icmp_seq=8 ttl=64 time=0.474 ms
64 bytes from 10.10.200.1: icmp_seq=9 ttl=64 time=0.451 ms
64 bytes from 10.10.200.1: icmp_seq=10 ttl=64 time=0.443 ms
^C
--- 10.10.200.1 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9001ms
rtt min/avg/max/mdev = 0.443/0.498/0.557/0.046 ms
t3net15-21 ~ >: ifconfig
em1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.10.200.12  netmask 255.255.255.0  broadcast 10.10.200.255
        inet6 fe80::9da1:9d3d:76f9:68a0  prefixlen 64  scopeid 0x20<link>
        ether 6c:2b:59:e3:0e:8b  txqueuelen 1000  (Ethernet)
        RX packets 227  bytes 27213 (26.5 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 206  bytes 22679 (22.1 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 16  memory 0xa5c00000-a5c20000

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 122  bytes 10568 (10.3 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 122  bytes 10568 (10.3 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

p1p1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.10.226.12  netmask 255.255.255.0  broadcast 10.10.226.255
        inet6 fe80::b696:91ff:fe51:d046  prefixlen 64  scopeid 0x20<link>
        ether b4:96:91:51:d0:46  txqueuelen 1000  (Ethernet)
        RX packets 1213785  bytes 804074889 (766.8 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1342637  bytes 1112028534 (1.0 GiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device memory 0xa5300000-a53fffff

virbr0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 192.168.122.1  netmask 255.255.255.0  broadcast 192.168.122.255
        ether 52:54:00:82:55:3d  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

t3net15-22 ~ >:

    Manual19S - 1-ECE 636 Manual.pdf ...    ak2739@t3net15:~         Pictures
```

1.2 Lab Descriptions

1.2.1 Observe the IP address and physical address of your workstation.
   em1
   IP Address 10.10.200.12
   Type of IP Address *Class A*
   Physical Address 6c:2b:59:e3:0e:8b

Broadcast Address 10.10.200.255

P1p1
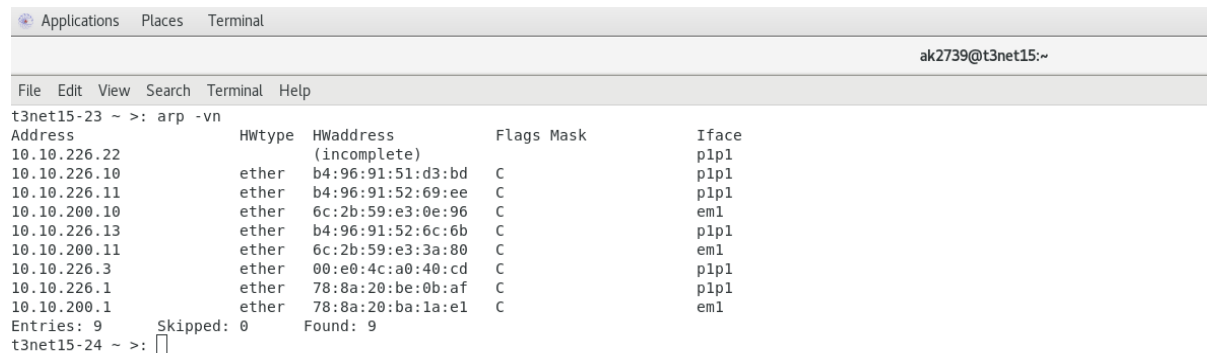
IP Address 10.10.226.12

Type of IP Address Class A

Physical Address b4:96:91:51:d0:46

Broadcast Address 10.10.226.255

1.2.2 ARP experiment

a) Use arp -vn to examine the ARP cache.

ARP Cache is a collection of ARP entries that are created when IP address is resolved to the MAC address.


```
Applications    Places    Terminal                                                          ak2739@t3net15:~

File  Edit  View  Search  Terminal  Help
t3net15-23 ~ >: arp -vn
Address               HWtype  HWaddress           Flags Mask       Iface
10.10.226.22                  (incomplete)                         p1p1
10.10.226.10          ether   b4:96:91:51:d3:bd   C                p1p1
10.10.226.11          ether   b4:96:91:52:69:ee   C                p1p1
10.10.200.10          ether   6c:2b:59:e3:0e:96   C                em1
10.10.226.13          ether   b4:96:91:52:6c:6b   C                p1p1
10.10.200.11          ether   6c:2b:59:e3:3a:80   C                em1
10.10.226.3           ether   00:e0:4c:a0:40:cd   C                p1p1
10.10.226.1           ether   78:8a:20:be:0b:af   C                p1p1
10.10.200.1           ether   78:8a:20:ba:1a:e1   C                em1
Entries: 9     Skipped: 0     Found: 9
t3net15-24 ~ >: 
```

b) Observe the operation of ARP when executing the SSH command to connect to one existing workstation.

Workstation IP Address- em1 10.10.200.12

Ping to all other hosts in the subnet 10.10.200.10 and 10.10.200.11

```
To see your aliases, enter "alias"

t3net15-37 ~ >: ping 10.10.200.10
PING 10.10.200.10 (10.10.200.10) 56(84) bytes of data.
64 bytes from 10.10.200.10: icmp_seq=1 ttl=64 time=0.582 ms
64 bytes from 10.10.200.10: icmp_seq=2 ttl=64 time=0.825 ms
64 bytes from 10.10.200.10: icmp_seq=3 ttl=64 time=0.516 ms
64 bytes from 10.10.200.10: icmp_seq=4 ttl=64 time=0.457 ms
64 bytes from 10.10.200.10: icmp_seq=5 ttl=64 time=0.602 ms
64 bytes from 10.10.200.10: icmp_seq=6 ttl=64 time=0.827 ms
64 bytes from 10.10.200.10: icmp_seq=7 ttl=64 time=0.623 ms
64 bytes from 10.10.200.10: icmp_seq=8 ttl=64 time=0.702 ms
64 bytes from 10.10.200.10: icmp_seq=9 ttl=64 time=0.795 ms
64 bytes from 10.10.200.10: icmp_seq=10 ttl=64 time=0.464 ms
^C
--- 10.10.200.10 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9005ms
rtt min/avg/max/mdev = 0.457/0.639/0.827/0.136 ms
t3net15-38 ~ >: ping 10.10.200.11
PING 10.10.200.11 (10.10.200.11) 56(84) bytes of data.
64 bytes from 10.10.200.11: icmp_seq=1 ttl=64 time=0.367 ms
64 bytes from 10.10.200.11: icmp_seq=2 ttl=64 time=0.317 ms
64 bytes from 10.10.200.11: icmp_seq=3 ttl=64 time=0.568 ms
64 bytes from 10.10.200.11: icmp_seq=4 ttl=64 time=0.604 ms
64 bytes from 10.10.200.11: icmp_seq=5 ttl=64 time=0.692 ms
64 bytes from 10.10.200.11: icmp_seq=6 ttl=64 time=0.695 ms
64 bytes from 10.10.200.11: icmp_seq=7 ttl=64 time=0.615 ms
64 bytes from 10.10.200.11: icmp_seq=8 ttl=64 time=0.615 ms
64 bytes from 10.10.200.11: icmp_seq=9 ttl=64 time=0.701 ms
64 bytes from 10.10.200.11: icmp_seq=10 ttl=64 time=0.726 ms
^C
--- 10.10.200.11 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9005ms
rtt min/avg/max/mdev = 0.317/0.590/0.726/0.133 ms
t3net15-39 ~ >: 
```

Tcpdump program while ping to all other hosts in the subnet

```
t3net15-39 ~ >: tcpdump arp and host 10.10.200.12 -i em1
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on em1, link-type EN10MB (Ethernet), capture size 262144 bytes
19:06:50.158305 ARP, Request who-has t3net15 tell 10.10.200.10, length 46
19:06:50.158352 ARP, Reply t3net15 is-at 6c:2b:59:e3:0e:8b (oui Unknown), length 28
19:06:56.164750 ARP, Request who-has 10.10.200.10 tell t3net15, length 28
19:06:56.165163 ARP, Reply 10.10.200.10 is-at 6c:2b:59:e3:0e:96 (oui Unknown), length 46
19:07:07.501556 ARP, Request who-has t3net15 tell 10.10.200.11, length 46
19:07:07.501603 ARP, Reply t3net15 is-at 6c:2b:59:e3:0e:8b (oui Unknown), length 28
19:07:13.508942 ARP, Request who-has 10.10.200.11 tell t3net15, length 28
19:07:13.509386 ARP, Reply 10.10.200.11 is-at 6c:2b:59:e3:3a:80 (oui Unknown), length 46
```

Workstation IP Address : p1p1 : 10.10.226.12
Ping to all other hosts in the subnet 10.10.226.11 and 10.10.226.10

File   Edit   View   Search   Terminal   Help

```
^C
--- 10.10.200.10 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9005ms
rtt min/avg/max/mdev = 0.457/0.639/0.827/0.136 ms
t3net15-38 ~ >: ping 10.10.200.11
PING 10.10.200.11 (10.10.200.11) 56(84) bytes of data.
64 bytes from 10.10.200.11: icmp_seq=1 ttl=64 time=0.367 ms
64 bytes from 10.10.200.11: icmp_seq=2 ttl=64 time=0.317 ms
64 bytes from 10.10.200.11: icmp_seq=3 ttl=64 time=0.568 ms
64 bytes from 10.10.200.11: icmp_seq=4 ttl=64 time=0.604 ms
64 bytes from 10.10.200.11: icmp_seq=5 ttl=64 time=0.692 ms
64 bytes from 10.10.200.11: icmp_seq=6 ttl=64 time=0.695 ms
64 bytes from 10.10.200.11: icmp_seq=7 ttl=64 time=0.615 ms
64 bytes from 10.10.200.11: icmp_seq=8 ttl=64 time=0.615 ms
64 bytes from 10.10.200.11: icmp_seq=9 ttl=64 time=0.701 ms
64 bytes from 10.10.200.11: icmp_seq=10 ttl=64 time=0.726 ms
^C
--- 10.10.200.11 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9005ms
rtt min/avg/max/mdev = 0.317/0.590/0.726/0.133 ms
t3net15-39 ~ >: ping 10.10.226.11
PING 10.10.226.11 (10.10.226.11) 56(84) bytes of data.
64 bytes from 10.10.226.11: icmp_seq=1 ttl=64 time=0.621 ms
64 bytes from 10.10.226.11: icmp_seq=2 ttl=64 time=0.623 ms
64 bytes from 10.10.226.11: icmp_seq=3 ttl=64 time=0.717 ms
64 bytes from 10.10.226.11: icmp_seq=4 ttl=64 time=0.641 ms
64 bytes from 10.10.226.11: icmp_seq=5 ttl=64 time=0.724 ms
64 bytes from 10.10.226.11: icmp_seq=6 ttl=64 time=0.707 ms
64 bytes from 10.10.226.11: icmp_seq=7 ttl=64 time=0.725 ms
64 bytes from 10.10.226.11: icmp_seq=8 ttl=64 time=0.724 ms
64 bytes from 10.10.226.11: icmp_seq=9 ttl=64 time=0.771 ms
^C
--- 10.10.226.11 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8005ms
rtt min/avg/max/mdev = 0.621/0.694/0.771/0.059 ms
t3net15-40 ~ >: ping 10.10.226.10
PING 10.10.226.10 (10.10.226.10) 56(84) bytes of data.
64 bytes from 10.10.226.10: icmp_seq=1 ttl=64 time=0.613 ms
64 bytes from 10.10.226.10: icmp_seq=2 ttl=64 time=0.397 ms
64 bytes from 10.10.226.10: icmp_seq=3 ttl=64 time=0.332 ms
64 bytes from 10.10.226.10: icmp_seq=4 ttl=64 time=0.635 ms
64 bytes from 10.10.226.10: icmp_seq=5 ttl=64 time=0.371 ms
64 bytes from 10.10.226.10: icmp_seq=6 ttl=64 time=0.321 ms
64 bytes from 10.10.226.10: icmp_seq=7 ttl=64 time=0.609 ms
64 bytes from 10.10.226.10: icmp_seq=8 ttl=64 time=0.356 ms
64 bytes from 10.10.226.10: icmp_seq=9 ttl=64 time=0.390 ms
^C
--- 10.10.226.10 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8000ms
rtt min/avg/max/mdev = 0.321/0.447/0.635/0.124 ms
t3net15-41 ~ >: clear

t3net15-42 ~ >: ping 10.10.226.11
```

Manual19S - 1-ECE 636 Manual.pdf ...   ak2739@t3net15:~   ak2739@t3net15:~

Tcpdump program while ping to all other hosts in the subnet

File Edit View Search Terminal Help

```
t3net15-39 ~ >: tcpdump arp and host 10.10.200.12 -i em1
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on em1, link-type EN10MB (Ethernet), capture size 262144 bytes
19:06:50.158305 ARP, Request who-has t3net15 tell 10.10.200.10, length 46
19:06:50.158352 ARP, Reply t3net15 is-at 6c:2b:59:e3:0e:8b (oui Unknown), length 28
19:06:56.164750 ARP, Request who-has 10.10.200.10 tell t3net15, length 28
19:06:56.165163 ARP, Reply 10.10.200.10 is-at 6c:2b:59:e3:0e:96 (oui Unknown), length 46
19:07:07.501556 ARP, Request who-has t3net15 tell 10.10.200.11, length 46
19:07:07.501603 ARP, Reply t3net15 is-at 6c:2b:59:e3:0e:8b (oui Unknown), length 28
19:07:13.508942 ARP, Request who-has 10.10.200.11 tell t3net15, length 28
19:07:13.509386 ARP, Reply 10.10.200.11 is-at 6c:2b:59:e3:3a:80 (oui Unknown), length 46
^C
8 packets captured
8 packets received by filter
0 packets dropped by kernel
t3net15-40 ~ >: tcpdump arp and host 10.10.226.12 -i p1p1
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on p1p1, link-type EN10MB (Ethernet), capture size 262144 bytes
19:12:49.268841 ARP, Request who-has gateway tell t3net15, length 28
19:12:49.269150 ARP, Reply gateway is-at 78:8a:20:be:0b:af (oui Unknown), length 46
19:12:54.282042 ARP, Request who-has t3net15 tell gateway, length 46
19:12:54.282068 ARP, Reply t3net15 is-at b4:96:91:51:d0:46 (oui Unknown), length 28
19:13:02.765568 ARP, Request who-has t3net15 tell t3net14, length 46
19:13:02.765614 ARP, Reply t3net15 is-at b4:96:91:51:d0:46 (oui Unknown), length 28
19:13:08.772714 ARP, Request who-has t3net14 tell t3net15, length 28
19:13:08.773175 ARP, Reply t3net14 is-at b4:96:91:52:69:ee (oui Unknown), length 46
19:13:09.188852 ARP, Request who-has t3net tell t3net15, length 28
19:13:09.189146 ARP, Reply t3net is-at 00:e0:4c:a0:40:cd (oui Unknown), length 46
19:13:14.574243 ARP, Request who-has t3net15 tell t3net13, length 46
19:13:14.574289 ARP, Reply t3net15 is-at b4:96:91:51:d0:46 (oui Unknown), length 28
19:13:16.164820 ARP, Request who-has gateway tell t3net15, length 28
19:13:16.165132 ARP, Reply gateway is-at 78:8a:20:be:0b:af (oui Unknown), length 46
19:13:20.580694 ARP, Request who-has t3net13 tell t3net15, length 28
19:13:20.581261 ARP, Reply t3net13 is-at b4:96:91:51:d3:bd (oui Unknown), length 46
19:13:25.274072 ARP, Request who-has t3net15 tell gateway, length 46
19:13:25.274100 ARP, Reply t3net15 is-at b4:96:91:51:d0:46 (oui Unknown), length 28
```

ARP cache is deleted

File Edit View Search Terminal Help

```
t3net15-51 ~ >: arp -vn
Address              HWtype  HWaddress          Flags Mask      Iface
10.10.200.10         ether   6c:2b:59:e3:0e:96  C                em1
10.10.226.3          ether   00:e0:4c:a0:40:cd  C                p1p1
10.10.226.1          ether   78:8a:20:be:0b:af  C                p1p1
Entries: 3      Skipped: 0      Found: 3
t3net15-52 ~ >: arp -d 10.10.200.10
t3net15-53 ~ >: arp -d 10.10.226.3
t3net15-54 ~ >: arp -d 10.10.226.1
t3net15-55 ~ >: arp -vn
Address              HWtype  HWaddress          Flags Mask      Iface
10.10.226.3          ether   00:e0:4c:a0:40:cd  C                p1p1
10.10.226.1          ether   78:8a:20:be:0b:af  C                p1p1
Entries: 2      Skipped: 0      Found: 2
t3net15-56 ~ >: arp -d 10.10.226.3
t3net15-57 ~ >: arp -d 10.10.226.1
t3net15-58 ~ >: arp -vn
Entries: 0      Skipped: 0      Found: 0
t3net15-59 ~ >:
```

Use ssh to connect to any host, after the arp cache is deleted and verified using arp -vn.

```
                                                                          ak2739@t3net15:~

File  Edit  View  Search  Terminal  Help

t3net15-51 ~ >: arp -vn
Address                 HWtype  HWaddress          Flags Mask        Iface
10.10.200.10            ether   6c:2b:59:e3:0e:96  C                 em1
10.10.226.3             ether   00:e0:4c:a0:40:cd  C                 p1p1
10.10.226.1             ether   78:8a:20:be:0b:af  C                 p1p1
Entries: 3      Skipped: 0      Found: 3
t3net15-52 ~ >: arp -d 10.10.200.10
t3net15-53 ~ >: arp -d 10.10.226.3
t3net15-54 ~ >: arp -d 10.10.226.1
t3net15-55 ~ >: arp -vn
Address                 HWtype  HWaddress          Flags Mask        Iface
10.10.226.3             ether   00:e0:4c:a0:40:cd  C                 p1p1
10.10.226.1             ether   78:8a:20:be:0b:af  C                 p1p1
Entries: 2      Skipped: 0      Found: 2
t3net15-56 ~ >: arp -d 10.10.226.3
t3net15-57 ~ >: arp -d 10.10.226.1
t3net15-58 ~ >: arp -vn
Entries: 0      Skipped: 0      Found: 0
t3net15-59 ~ >: ssh 10.10.102.10
ssh: connect to host 10.10.102.10 port 22: Connection timed out
t3net15-60 ~ >: □
```

Observing tcp dump at the same time

```
                                                                          ak2739@t3net15:~

File  Edit  View  Search  Terminal  Help

To see your aliases, enter "alias"

t3net15-41 ~ >: tcpdump arp and host 10.10.200.12 -i em1
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on em1, link-type EN10MB (Ethernet), capture size 262144 bytes
^C
0 packets captured
0 packets received by filter
0 packets dropped by kernel
t3net15-42 ~ >: □
```

```
 ● Applications    Places    Terminal
                                                                          ak2739@t3net15:~

File  Edit  View  Search  Terminal  Help

To see your aliases, enter "alias"

t3net15-41 ~ >: tcpdump arp and host 10.10.200.12 -i em1
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on em1, link-type EN10MB (Ethernet), capture size 262144 bytes
^C
0 packets captured
0 packets received by filter
0 packets dropped by kernel
t3net15-42 ~ >: arp -vn
Address                 HWtype  HWaddress          Flags Mask        Iface
10.10.226.3             ether   00:e0:4c:a0:40:cd  C                 p1p1
10.10.226.1             ether   78:8a:20:be:0b:af  C                 p1p1
Entries: 2      Skipped: 0      Found: 2
t3net15-43 ~ >: □
```

Examining the ARP cache after the SSH connection.

c) ARP request to a nonexistent host

```
t3net15-86 ~ >: ssh 10.10.200.23
ssh: connect to host 10.10.200.23 port 22: No route to host
t3net15-87 ~ >: ssh 10.10.226.33
ssh: connect to host 10.10.226.33 port 22: No route to host
t3net15-88 ~ >: ▯
```

```
To see your aliases, enter "alias"

t3net15-41 ~ >: tcpdump arp and host 10.10.200.12 -i em1
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on em1, link-type EN10MB (Ethernet), capture size 262144 bytes
19:57:56.010544 ARP, Request who-has t3net15 tell 10.10.200.10, length 46
19:57:56.010581 ARP, Reply t3net15 is-at 6c:2b:59:e3:0e:8b (oui Unknown), length 28
19:58:50.317158 ARP, Request who-has 10.10.200.23 tell t3net15, length 28
19:58:51.320099 ARP, Request who-has 10.10.200.23 tell t3net15, length 28
19:58:52.322036 ARP, Request who-has 10.10.200.23 tell t3net15, length 28
19:58:53.324141 ARP, Request who-has 10.10.200.23 tell t3net15, length 28
19:58:54.326049 ARP, Request who-has 10.10.200.23 tell t3net15, length 28
19:58:55.328022 ARP, Request who-has 10.10.200.23 tell t3net15, length 28
^C
8 packets captured
8 packets received by filter
0 packets dropped by kernel
t3net15-42 ~ >: arp -vn
Address                 HWtype  HWaddress          Flags Mask        Iface
10.10.200.10            ether   6c:2b:59:e3:0e:96  C                 em1
10.10.226.3             ether   00:e0:4c:a0:40:cd  C                 p1p1
10.10.226.33                    (incomplete)                        p1p1
10.10.200.23                    (incomplete)                        em1
10.10.226.1             ether   78:8a:20:be:0b:af  C                 p1p1
Entries: 5      Skipped: 0       Found: 5
```

d) Decode/trace an ARP packet request/reply

```
0 packets received by filter
0 packets dropped by kernel
t3net15-43 ~ >:
t3net15-43 ~ >: clear
t3net15-44 ~ >: tcpdump -nx arp and host 10.10.200.12 -i em1
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on em1, link-type EN10MB (Ethernet), capture size 262144 bytes
20:06:10.297916 ARP, Request who-has 10.10.200.11 tell 10.10.200.12, length 28
        0x0000:  0001 0800 0604 0001 6c2b 59e3 0e8b 0a0a
        0x0010:  c80c 0000 0000 0000 0a0a c80b
20:06:10.298108 ARP, Reply 10.10.200.11 is-at 6c:2b:59:e3:3a:80, length 46
        0x0000:  0001 0800 0604 0002 6c2b 59e3 3a80 0a0a
        0x0010:  c80b 6c2b 59e3 0e8b 0a0a c80c 0000 0000
        0x0020:  0000 0000 0000 0000 0000 0000 0000
20:06:15.307775 ARP, Request who-has 10.10.200.12 tell 10.10.200.11, length 46
        0x0000:  0001 0800 0604 0001 6c2b 59e3 3a80 0a0a
        0x0010:  c80b 0000 0000 0000 0a0a c80c 0000 0000
        0x0020:  0000 0000 0000 0000 0000 0000 0000
20:06:15.307806 ARP, Reply 10.10.200.12 is-at 6c:2b:59:e3:0e:8b, length 28
        0x0000:  0001 0800 0604 0002 6c2b 59e3 0e8b 0a0a
        0x0010:  c80c 6c2b 59e3 3a80 0a0a c80b
20:06:32.856596 ARP, Request who-has 10.10.200.13 tell 10.10.200.12, length 28
        0x0000:  0001 0800 0604 0001 6c2b 59e3 0e8b 0a0a
        0x0010:  c80c 0000 0000 0000 0a0a c80d
20:06:32.857093 ARP, Reply 10.10.200.13 is-at e4:54:e8:5b:a8:9d, length 46
        0x0000:  0001 0800 0604 0002 e454 e85b a89d 0a0a
        0x0010:  c80d 6c2b 59e3 0e8b 0a0a c80c 0000 0000
        0x0020:  0000 0000 0000 0000 0000 0000 0000
20:06:37.871964 ARP, Request who-has 10.10.200.12 tell 10.10.200.13, length 46
        0x0000:  0001 0800 0604 0001 e454 e85b a89d 0a0a
        0x0010:  c80d 0000 0000 0000 0a0a c80c 0000 0000
        0x0020:  0000 0000 0000 0000 0000 0000 0000
20:06:37.871994 ARP, Reply 10.10.200.12 is-at 6c:2b:59:e3:0e:8b, length 28
        0x0000:  0001 0800 0604 0002 6c2b 59e3 0e8b 0a0a
        0x0010:  c80c e454 e85b a89d 0a0a c80d
20:06:41.888006 ARP, Request who-has 10.10.200.11 tell 10.10.200.12, length 28
        0x0000:  0001 0800 0604 0001 6c2b 59e3 0e8b 0a0a
        0x0010:  c80c 0000 0000 0000 0a0a c80b
20:06:41.888248 ARP, Reply 10.10.200.11 is-at 6c:2b:59:e3:3a:80, length 46
        0x0000:  0001 0800 0604 0002 6c2b 59e3 3a80 0a0a
        0x0010:  c80b 6c2b 59e3 0e8b 0a0a c80c 0000 0000
        0x0020:  0000 0000 0000 0000 0000 0000 0000
20:06:47.197028 ARP, Request who-has 10.10.200.12 tell 10.10.200.10, length 46
        0x0000:  0001 0800 0604 0001 6c2b 59e3 0e96 0a0a
        0x0010:  c80a 0000 0000 0000 0a0a c80c 0000 0000
        0x0020:  0000 0000 0000 0000 0000 0000 0000
20:06:47.197059 ARP, Reply 10.10.200.12 is-at 6c:2b:59:e3:0e:8b, length 28
        0x0000:  0001 0800 0604 0002 6c2b 59e3 0e8b 0a0a
        0x0010:  c80c 6c2b 59e3 0e96 0a0a c80a
20:08:44.944161 ARP, Request who-has 10.10.200.11 tell 10.10.200.12, length 28
        0x0000:  0001 0800 0604 0001 6c2b 59e3 0e8b 0a0a
        0x0010:  c80c 0000 0000 0000 0a0a c80b
```

```
To see your aliases, enter "alias"

t3net15-41 ~ >: ping 10.10.200.11
PING 10.10.200.11 (10.10.200.11) 56(84) bytes of data.
64 bytes from 10.10.200.11: icmp_seq=1 ttl=64 time=0.403 ms
64 bytes from 10.10.200.11: icmp_seq=2 ttl=64 time=0.360 ms
64 bytes from 10.10.200.11: icmp_seq=3 ttl=64 time=0.379 ms
64 bytes from 10.10.200.11: icmp_seq=4 ttl=64 time=0.604 ms
64 bytes from 10.10.200.11: icmp_seq=5 ttl=64 time=0.626 ms
64 bytes from 10.10.200.11: icmp_seq=6 ttl=64 time=0.465 ms
64 bytes from 10.10.200.11: icmp_seq=7 ttl=64 time=0.432 ms
64 bytes from 10.10.200.11: icmp_seq=8 ttl=64 time=0.701 ms
64 bytes from 10.10.200.11: icmp_seq=9 ttl=64 time=0.413 ms
64 bytes from 10.10.200.11: icmp_seq=10 ttl=64 time=0.238 ms
64 bytes from 10.10.200.11: icmp_seq=11 ttl=64 time=0.453 ms
64 bytes from 10.10.200.11: icmp_seq=12 ttl=64 time=0.448 ms
^C
--- 10.10.200.11 ping statistics ---
12 packets transmitted, 12 received, 0% packet loss, time 11002ms
rtt min/avg/max/mdev = 0.238/0.460/0.701/0.122 ms
t3net15-42 ~ >: ping 10.10.200.13
PING 10.10.200.13 (10.10.200.13) 56(84) bytes of data.
64 bytes from 10.10.200.13: icmp_seq=1 ttl=64 time=0.801 ms
64 bytes from 10.10.200.13: icmp_seq=2 ttl=64 time=0.812 ms
64 bytes from 10.10.200.13: icmp_seq=3 ttl=64 time=0.520 ms
64 bytes from 10.10.200.13: icmp_seq=4 ttl=64 time=0.609 ms
64 bytes from 10.10.200.13: icmp_seq=5 ttl=64 time=0.566 ms
64 bytes from 10.10.200.13: icmp_seq=6 ttl=64 time=0.566 ms
64 bytes from 10.10.200.13: icmp_seq=7 ttl=64 time=0.625 ms
64 bytes from 10.10.200.13: icmp_seq=8 ttl=64 time=0.692 ms
64 bytes from 10.10.200.13: icmp_seq=9 ttl=64 time=0.495 ms
64 bytes from 10.10.200.13: icmp_seq=10 ttl=64 time=0.580 ms
64 bytes from 10.10.200.13: icmp_seq=11 ttl=64 time=0.699 ms
64 bytes from 10.10.200.13: icmp_seq=12 ttl=64 time=0.496 ms
64 bytes from 10.10.200.13: icmp_seq=13 ttl=64 time=0.484 ms
64 bytes from 10.10.200.13: icmp_seq=14 ttl=64 time=0.682 ms
^C
--- 10.10.200.13 ping statistics ---
14 packets transmitted, 14 received, 0% packet loss, time 13007ms
rtt min/avg/max/mdev = 0.484/0.616/0.812/0.105 ms
t3net15-43 ~ >: 
```

Protocol used - Ethernet