

ECE 636  
COMPUTER NETWORKING LABORATORY

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Lab 2  
IP addressing and subnet masking

- I. In Experiment 2.2.1, what are the host name, IP address, broadcast address of your workstation? Which type of IP address does your IP address belong to? What are the interfaces and netmask of your workstation? Is this network sub-netted? Why?

**Host Name**            t3net10

**Broadcast Address**    10.10.225.255 for interface p1p1 and  
                                 10.10.102.11 for interface em1

**Interface Names**    em1 and p1p1

**Netmask of the interface** 255.255.255.0

Yes, the network is subnetted. Because the IP addresses of the interfaces on the network have a network mask (255.255.255.0) which indicates that it is a part of the sub-network.

- II. In Experiment 2.2.3, what is the function of netmask and/or subnet mask? What had happened to the status and routing table of the interface of your workstation when each change was made? Explain the phenomenon you observed. In Part c), i.e., mask=255.255.255.240, how many subnets can be configured? Why do we need to do subnetting for a network?

The genmask entry in the routing table changes when each change is made. The genmask is the network mask for the destination network.  
When the mask = 255.255.255.240, subnet bits = 12 and host bits = 12.

Number of subnets that can be configured using the mask 255.255.255.240 is  $2^{12-2} = 4096 - 2 = 4094$ .

Subnetting divides broadcast domains to facilitate effective traffic routing, enhancing network performance and speed. Traffic is decreased through subnetting, which makes sure that communication headed for a device inside a subnet stays inside that subnet.

### III. In Experiment 2.2.4, answer the following questions.

1. What are the host names and IP addresses of the experiment workstations? Describe the process of changing IP address (for all the cases)? What is the corresponding output? After changing each IP address, examine your ARP cache, interface configuration, and routing table. Clearly explain the outputs.

```
em1 10.10.102.11
p1p1 10.10.225.11
em1:0 10.10.102.33
p1p1:0 10.10.225.24
t3net09-50 ~ >: ifconfig p1p1:0 10.10.225.39
```

While observing the interface configuration, the IP address is changed on the host of that specific interface.

```
t3net09-49 ~ >: tcpdump -en host 10.10.225.10 -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
20:25:48.214752 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.209.187.afs3-fileserver: rx version (29)
20:25:48.214780 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.209.190.afs3-fileserver: rx version (29)
20:25:48.214791 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.208.238.afs3-fileserver: rx version (29)
20:25:48.214802 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.209.185.afs3-fileserver: rx version (29)
20:25:48.214813 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.209.188.afs3-fileserver: rx version (29)
20:25:48.214824 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.208.137.afs3-fileserver: rx version (29)
20:25:48.214835 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.208.211.afs3-fileserver: rx version (29)
20:25:52.222868 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.208.242.afs3-fileserver: rx version (29)
20:25:54.727865 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.208.241.afs3-fileserver: rx version (29)
20:26:01.240925 b4:96:91:51:d4:0f > 78:8a:20:be:0b:ae, ethertype IPv4 (0x0800), length 71: 10.10.225.10.afs3-callback > 128.235.209.189.afs3-fileserver: rx version (29)
```

The ARP cache consists of host and destination MAC addresses, length of the messages, protocol used (Ethernet IPv4 in hexadecimal notation) and version used.

There is no change observed in the routing table.

2. When you ping the IP-changed host from another host (i.e., from host C), explain what has happened and what the tcpdump outputs at hosts A and B are. What is the difference when you ping the host name and the duplicated IP address? Which machine responds to the icmp echo request generated by the ping command? Explain what you observed.

When one pings the IP-changed host, the ping is successful and ICMP packets are received.

The workstation's interface with the changed-IP responds to the ping command.

3. What is the IP address you used to change the IP of your workstation for the various conditions? Did the workstation work correctly after each change? Explain what you observed and the tcpdump outputs.

I used an unused IP Address 10.10.225.39 for various conditions. After I deleted the virtual interfaces the workstation was working correctly.

4. After changing IP addresses, could you ping from another host to your host successfully? What is the output of the corresponding tcpdump? Try to explain your observation.

After changing the IP address I could ping from another host to the computer. The corresponding tcpdump consisted of the MAC address of the host and the destination, length of the ARP and the protocol information in hexadecimal notation.

# Lab Descriptions

## 1. Observe the IP address, netmask and routing table of your workstation.



To see your aliases, enter "alias"

```
t3net10-41 ~ >: ifconfig
em1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.11 netmask 255.255.255.0 broadcast 10.10.102.255
    inet6 fe80::4f72:2fa6:156c:5bbc prefixlen 64 scopeid 0x20<link>
    ether 6c:2b:59:e3:3a:97 txqueuelen 1000 (Ethernet)
    RX packets 2623 bytes 360101 (351.6 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 314 bytes 43680 (42.6 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 16 memory 0xa5c00000-a5c20000

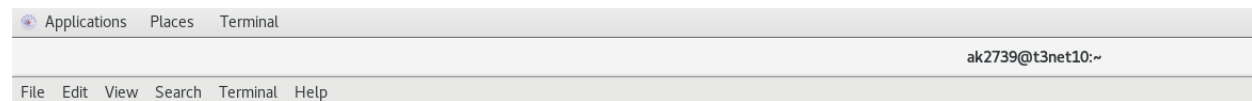
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 1625 bytes 136544 (133.3 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1625 bytes 136544 (133.3 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

p1p1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.225.11 netmask 255.255.255.0 broadcast 10.10.225.255
    inet6 fe80::b696:91ff:fe51:d058 prefixlen 64 scopeid 0x20<link>
    ether b4:96:91:51:d0:58 txqueuelen 1000 (Ethernet)
    RX packets 7233265 bytes 3423797333 (3.1 GiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 9952787 bytes 1739114290 (1.6 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:d3:7b:48 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
```

t3net10-42 ~ >: □

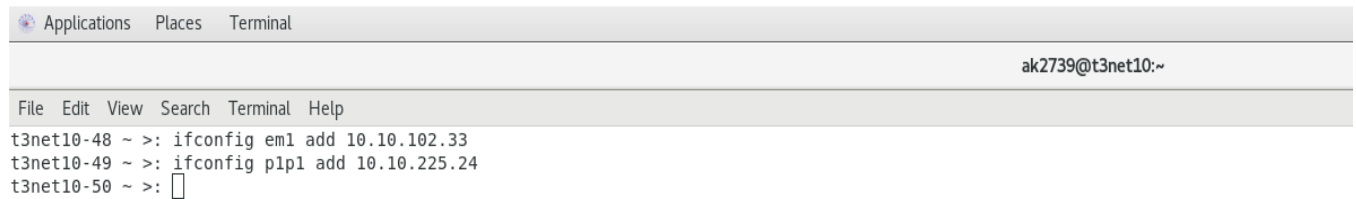
- Workstation has 2 interfaces em1 and p1p1. The IP address of em1 is 10.10.102.11 and IP address of p1p1 is 10.10.225.11.
- Netmask for the em1 interface is 255.255.255.0 and for p1p1 is 255.255.255.0.




```
t3net10-44 ~ >: netstat -rn
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
0.0.0.0 10.10.225.1 0.0.0.0 UG 0 0 0 p1p1
0.0.0.0 10.10.102.1 0.0.0.0 UG 0 0 0 em1
10.10.102.0 0.0.0.0 255.255.255.0 U 0 0 0 em1
10.10.225.0 0.0.0.0 255.255.255.0 U 0 0 0 p1p1
192.168.122.0 0.0.0.0 255.255.255.0 U 0 0 0 virbr0
t3net10-45 ~ >: □
```

- Routing Table of the workstation.

## 2. Create new virtual logical interface



The screenshot shows a terminal window with a menu bar at the top containing 'Applications', 'Places', and 'Terminal'. Below the menu bar is a status bar displaying 'ak2739@t3net10:~'. The main area of the terminal contains a menu bar with 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The terminal output shows three lines of commands and their prompts: 't3net10-48 ~ >: ifconfig em1 add 10.10.102.33', 't3net10-49 ~ >: ifconfig plp1 add 10.10.225.24', and 't3net10-50 ~ >:' followed by a cursor icon.

```
ak2739@t3net10:~  
File Edit View Search Terminal Help  
t3net10-48 ~ >: ifconfig em1 add 10.10.102.33  
t3net10-49 ~ >: ifconfig plp1 add 10.10.225.24  
t3net10-50 ~ >: 
```

- Creating virtual logical interfaces by using the above commands.

```
Applications Places Terminal
ak2739@t3net10:~
File Edit View Search Terminal Help
t3net10-48 ~ >: ifconfig em1 add 10.10.102.33
t3net10-49 ~ >: ifconfig plp1 add 10.10.225.24
t3net10-50 ~ >: ifconfig
em1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.11 netmask 255.255.255.0 broadcast 10.10.102.255
    inet6 fe80::4f72:2fa6:156c:5bbc prefixlen 64 scopeid 0x20<link>
    ether 6c:2b:59:e3:3a:97 txqueuelen 1000 (Ethernet)
    RX packets 2650 bytes 363791 (355.2 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 322 bytes 44784 (43.7 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 16 memory 0xa5c00000-a5c20000

em1:0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.33 netmask 255.255.255.0 broadcast 10.10.102.255
    ether 6c:2b:59:e3:3a:97 txqueuelen 1000 (Ethernet)
    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 1625 bytes 136544 (133.3 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1625 bytes 136544 (133.3 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

plp1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.225.11 netmask 255.255.255.0 broadcast 10.10.225.255
    inet6 fe80::b696:91ff:fe51:d058 prefixlen 64 scopeid 0x20<link>
    ether b4:96:91:51:d0:58 txqueuelen 1000 (Ethernet)
    RX packets 7235091 bytes 3424458984 (3.1 GiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 9955703 bytes 1741405553 (1.6 GiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device memory 0xa5300000-a53fffff

plp1:0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.225.24 netmask 255.255.255.0 broadcast 10.10.225.255
    ether b4:96:91:51:d0:58 txqueuelen 1000 (Ethernet)
    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:d3:7b:48 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

t3net10-51 ~ >: □
```

Results of the ifconfig with the new virtual interfaces marked by boxes.

- New Routing Table

```

Applications  Places  Terminal
ak2739@t3net10:~
File Edit View Search Terminal Help
t3net10-56 ~ >: netstat -rn
Kernel IP routing table
Destination      Gateway         Genmask         Flags   MSS Window  irtt Iface
0.0.0.0          10.10.225.1    0.0.0.0         UG        0 0        0 p1p1
0.0.0.0          10.10.102.1    0.0.0.0         UG        0 0        0 em1
10.10.102.0      0.0.0.0        255.255.255.0   U        0 0        0 em1
10.10.225.0      0.0.0.0        255.255.255.0   U        0 0        0 p1p1
192.168.122.0    0.0.0.0        255.255.255.0   U        0 0        0 virbr0
t3net10-57 ~ >: 

```

- Results of ping from different workstation ( t3net09) to the new IP addresses em1:0 and p1p1:0.

```

Applications  Places  Terminal
ak2739@t3net09:~
File Edit View Search Terminal Help
64 bytes from 10.10.225.24: icmp_seq=45 ttl=64 time=0.659 ms
64 bytes from 10.10.225.24: icmp_seq=46 ttl=64 time=0.804 ms
64 bytes from 10.10.225.24: icmp_seq=47 ttl=64 time=0.736 ms
64 bytes from 10.10.225.24: icmp_seq=48 ttl=64 time=0.608 ms
64 bytes from 10.10.225.24: icmp_seq=49 ttl=64 time=0.860 ms
64 bytes from 10.10.225.24: icmp_seq=50 ttl=64 time=0.871 ms
64 bytes from 10.10.225.24: icmp_seq=51 ttl=64 time=0.467 ms
64 bytes from 10.10.225.24: icmp_seq=52 ttl=64 time=0.468 ms
64 bytes from 10.10.225.24: icmp_seq=53 ttl=64 time=0.804 ms
64 bytes from 10.10.225.24: icmp_seq=54 ttl=64 time=0.836 ms
64 bytes from 10.10.225.24: icmp_seq=55 ttl=64 time=0.827 ms
64 bytes from 10.10.225.24: icmp_seq=56 ttl=64 time=0.531 ms
64 bytes from 10.10.225.24: icmp_seq=57 ttl=64 time=0.761 ms
64 bytes from 10.10.225.24: icmp_seq=58 ttl=64 time=0.852 ms
64 bytes from 10.10.225.24: icmp_seq=59 ttl=64 time=0.840 ms
64 bytes from 10.10.225.24: icmp_seq=60 ttl=64 time=0.853 ms
64 bytes from 10.10.225.24: icmp_seq=61 ttl=64 time=0.678 ms
64 bytes from 10.10.225.24: icmp_seq=62 ttl=64 time=0.648 ms
64 bytes from 10.10.225.24: icmp_seq=63 ttl=64 time=0.828 ms
64 bytes from 10.10.225.24: icmp_seq=64 ttl=64 time=0.828 ms
64 bytes from 10.10.225.24: icmp_seq=65 ttl=64 time=0.669 ms
64 bytes from 10.10.225.24: icmp_seq=66 ttl=64 time=0.842 ms
64 bytes from 10.10.225.24: icmp_seq=67 ttl=64 time=0.646 ms
64 bytes from 10.10.225.24: icmp_seq=68 ttl=64 time=0.849 ms
64 bytes from 10.10.225.24: icmp_seq=69 ttl=64 time=0.624 ms
64 bytes from 10.10.225.24: icmp_seq=70 ttl=64 time=0.839 ms
64 bytes from 10.10.225.24: icmp_seq=71 ttl=64 time=0.661 ms
64 bytes from 10.10.225.24: icmp_seq=72 ttl=64 time=0.722 ms
64 bytes from 10.10.225.24: icmp_seq=73 ttl=64 time=0.645 ms
64 bytes from 10.10.225.24: icmp_seq=74 ttl=64 time=0.741 ms
64 bytes from 10.10.225.24: icmp_seq=75 ttl=64 time=0.659 ms
64 bytes from 10.10.225.24: icmp_seq=76 ttl=64 time=0.647 ms
64 bytes from 10.10.225.24: icmp_seq=77 ttl=64 time=0.678 ms
64 bytes from 10.10.225.24: icmp_seq=78 ttl=64 time=0.660 ms

```

Ping to 10.10.225.24

```
Applications Places Terminal

ak2739@t3net09:~

File Edit View Search Terminal Help

64 bytes from 10.10.102.33: icmp_seq=7 ttl=64 time=0.824 ms
64 bytes from 10.10.102.33: icmp_seq=8 ttl=64 time=0.402 ms
64 bytes from 10.10.102.33: icmp_seq=9 ttl=64 time=0.295 ms
64 bytes from 10.10.102.33: icmp_seq=10 ttl=64 time=0.655 ms
64 bytes from 10.10.102.33: icmp_seq=11 ttl=64 time=0.638 ms
64 bytes from 10.10.102.33: icmp_seq=12 ttl=64 time=0.797 ms
64 bytes from 10.10.102.33: icmp_seq=13 ttl=64 time=0.602 ms
64 bytes from 10.10.102.33: icmp_seq=14 ttl=64 time=0.597 ms
64 bytes from 10.10.102.33: icmp_seq=15 ttl=64 time=0.808 ms
64 bytes from 10.10.102.33: icmp_seq=16 ttl=64 time=0.640 ms
64 bytes from 10.10.102.33: icmp_seq=17 ttl=64 time=0.628 ms
64 bytes from 10.10.102.33: icmp_seq=18 ttl=64 time=0.606 ms
64 bytes from 10.10.102.33: icmp_seq=19 ttl=64 time=0.799 ms
64 bytes from 10.10.102.33: icmp_seq=20 ttl=64 time=0.716 ms
64 bytes from 10.10.102.33: icmp_seq=21 ttl=64 time=0.809 ms
64 bytes from 10.10.102.33: icmp_seq=22 ttl=64 time=0.800 ms
64 bytes from 10.10.102.33: icmp_seq=23 ttl=64 time=0.636 ms
64 bytes from 10.10.102.33: icmp_seq=24 ttl=64 time=0.791 ms
64 bytes from 10.10.102.33: icmp_seq=25 ttl=64 time=0.666 ms
64 bytes from 10.10.102.33: icmp_seq=26 ttl=64 time=0.675 ms
64 bytes from 10.10.102.33: icmp_seq=27 ttl=64 time=0.800 ms
64 bytes from 10.10.102.33: icmp_seq=28 ttl=64 time=0.698 ms
64 bytes from 10.10.102.33: icmp_seq=29 ttl=64 time=0.805 ms
64 bytes from 10.10.102.33: icmp_seq=30 ttl=64 time=0.808 ms
64 bytes from 10.10.102.33: icmp_seq=31 ttl=64 time=0.802 ms
64 bytes from 10.10.102.33: icmp_seq=32 ttl=64 time=0.621 ms
64 bytes from 10.10.102.33: icmp_seq=33 ttl=64 time=0.531 ms
64 bytes from 10.10.102.33: icmp_seq=34 ttl=64 time=0.795 ms
64 bytes from 10.10.102.33: icmp_seq=35 ttl=64 time=0.685 ms
64 bytes from 10.10.102.33: icmp_seq=36 ttl=64 time=0.804 ms
64 bytes from 10.10.102.33: icmp_seq=37 ttl=64 time=0.618 ms
64 bytes from 10.10.102.33: icmp_seq=38 ttl=64 time=0.711 ms
64 bytes from 10.10.102.33: icmp_seq=39 ttl=64 time=0.801 ms
64 bytes from 10.10.102.33: icmp_seq=40 ttl=64 time=0.800 ms
64 bytes from 10.10.102.33: icmp_seq=41 ttl=64 time=0.794 ms
64 bytes from 10.10.102.33: icmp_seq=42 ttl=64 time=0.290 ms
64 bytes from 10.10.102.33: icmp_seq=43 ttl=64 time=0.601 ms
64 bytes from 10.10.102.33: icmp_seq=44 ttl=64 time=0.796 ms
```

Ping to 10.10.102.33

- Output of tcpdumps while t3net09 pings the new ip addresses

```
t3net10-44 ~ >: tcpdump arp and host 10.10.225.24 -i plp1:0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on plp1:0, link-type EN10MB (Ethernet), capture size 262144 bytes
18:55:43.014184 ARP, Request who-has t3net10 tell t3net09, length 46
18:55:43.014229 ARP, Reply t3net10 is-at b4:96:91:51:d0:58 (oui Unknown), length 28
18:56:24.050167 ARP, Request who-has t3net10 tell t3net09, length 46
18:56:24.050196 ARP, Reply t3net10 is-at b4:96:91:51:d0:58 (oui Unknown), length 28
18:57:05.073924 ARP, Request who-has t3net10 tell t3net09, length 46
18:57:05.073959 ARP, Reply t3net10 is-at b4:96:91:51:d0:58 (oui Unknown), length 28
18:57:46.097819 ARP, Request who-has t3net10 tell t3net09, length 46
18:57:46.097857 ARP, Reply t3net10 is-at b4:96:91:51:d0:58 (oui Unknown), length 28
```

□



```
Applications Places Terminal
ak2739@t3net10:~
File Edit View Search Terminal Help
t3net10-69 ~ >: tcpdump arp and host 10.10.102.33 -i em1:0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on em1:0, link-type EN10MB (Ethernet), capture size 262144 bytes
19:11:51.761857 ARP, Request who-has t3net10 tell 10.10.102.10, length 46
19:11:51.761890 ARP, Reply t3net10 is-at 6c:2b:59:e3:3a:97 (oui Unknown), length 28
19:12:32.785753 ARP, Request who-has t3net10 tell 10.10.102.10, length 46
19:12:32.785788 ARP, Reply t3net10 is-at 6c:2b:59:e3:3a:97 (oui Unknown), length 28
19:13:13.825580 ARP, Request who-has t3net10 tell 10.10.102.10, length 46
19:13:13.825604 ARP, Reply t3net10 is-at 6c:2b:59:e3:3a:97 (oui Unknown), length 28
```

The tcpdump signifies the request and reply packets, with length of the ARP messages and the protocols used.

### 3. Change netmask and observe the change of routing table on your host.

- Changing the netmask of the workstation

```
Applications Places Terminal
ak2739@t3net09:~
File Edit View Search Terminal Help
To see your aliases, enter "alias"
t3net09-41 ~ >: ifconfig em1:0 netmask 255.255.0.0
t3net09-42 ~ >: ifconfig em1:0 netmask 255.0.0.0
t3net09-43 ~ >: ifconfig em1:0 netmask 255.255.255.240
t3net09-44 ~ >: ifconfig p1p1:0 netmask 255.255.0.0
t3net09-45 ~ >: ifconfig p1p1:0 netmask 255.0.0.0
t3net09-46 ~ >: ifconfig p1p1:0 netmask 255.255.255.240
t3net09-47 ~ >: 
```

Changing the netmask of the workstation using the above commands.

Results of the routing table where the changed network masks have been highlighted.

```

Applications  Places  Terminal
ak2739@t3net09:~

File Edit View Search Terminal Help

t3net09-43 ~ >: netstat -rt
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
default gateway 0.0.0.0 UG 0 0 0 plp1
default gateway 0.0.0.0 UG 0 0 0 em1
10.10.0.0 0.0.0.0 255.255.0.0 U 0 0 0 plp1
10.10.102.0 0.0.0.0 255.255.255.0 U 0 0 0 em1
10.10.102.16 0.0.0.0 255.255.255.240 U 0 0 0 em1
10.10.225.0 0.0.0.0 255.255.255.0 U 0 0 0 plp1
192.168.122.0 0.0.0.0 255.255.255.0 U 0 0 0 virbr0

t3net09-44 ~ >: netstat -rt
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
default gateway 0.0.0.0 UG 0 0 0 plp1
default gateway 0.0.0.0 UG 0 0 0 em1
10.0.0.0 0.0.0.0 255.0.0.0 U 0 0 0 plp1
10.10.102.0 0.0.0.0 255.255.255.0 U 0 0 0 em1
10.10.102.16 0.0.0.0 255.255.255.240 U 0 0 0 em1
10.10.225.0 0.0.0.0 255.255.255.0 U 0 0 0 plp1
192.168.122.0 0.0.0.0 255.255.255.0 U 0 0 0 virbr0

t3net09-44 ~ >: netstat -rt
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
default gateway 0.0.0.0 UG 0 0 0 plp1
default gateway 0.0.0.0 UG 0 0 0 em1
10.10.102.0 0.0.0.0 255.255.255.0 U 0 0 0 em1
10.10.102.16 0.0.0.0 255.255.255.240 U 0 0 0 em1
10.10.225.0 0.0.0.0 255.255.255.0 U 0 0 0 plp1
10.10.225.16 0.0.0.0 255.255.255.240 U 0 0 0 plp1
192.168.122.0 0.0.0.0 255.255.255.0 U 0 0 0 virbr0
t3net09-44 ~ >: 

```

- Observed tcpdump output

```

t3net10-44 ~ >: tcpdump arp and host 10.10.225.24 -i plp1:0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on plp1:0, link-type EN10MB (Ethernet), capture size 262144 bytes
18:55:43.014184 ARP, Request who-has t3net10 tell t3net09, length 46
18:55:43.014229 ARP, Reply t3net10 is-at b4:96:91:51:d0:58 (oui Unknown), length 28
18:56:24.050167 ARP, Request who-has t3net10 tell t3net09, length 46
18:56:24.050196 ARP, Reply t3net10 is-at b4:96:91:51:d0:58 (oui Unknown), length 28
18:57:05.073924 ARP, Request who-has t3net10 tell t3net09, length 46
18:57:05.073959 ARP, Reply t3net10 is-at b4:96:91:51:d0:58 (oui Unknown), length 28
18:57:46.097819 ARP, Request who-has t3net10 tell t3net09, length 46
18:57:46.097857 ARP, Reply t3net10 is-at b4:96:91:51:d0:58 (oui Unknown), length 28

```

Results of the routing table where the changed network masks have been highlighted.

```
Applications Places Terminal
ak2739@t3net09:~

File Edit View Search Terminal Help

To see your aliases, enter "alias"

t3net09-41 ~ >: netstat -rt
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
default gateway 0.0.0.0 UG 0 0 0 plp1
default gateway 0.0.0.0 UG 0 0 0 em1
10.10.102.0 0.0.0.0 255.255.255.0 U 0 0 0 em1
10.10.225.0 0.0.0.0 255.255.255.0 U 0 0 0 plp1
192.168.122.0 0.0.0.0 255.255.255.0 U 0 0 0 virbr0

t3net09-42 ~ >: netstat -rt
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
default gateway 0.0.0.0 UG 0 0 0 plp1
default gateway 0.0.0.0 UG 0 0 0 em1
10.10.0.0 0.0.0.0 255.255.0.0 U 0 0 0 em1
10.10.102.0 0.0.0.0 255.255.255.0 U 0 0 0 em1
10.10.225.0 0.0.0.0 255.255.255.0 U 0 0 0 plp1
192.168.122.0 0.0.0.0 255.255.255.0 U 0 0 0 virbr0

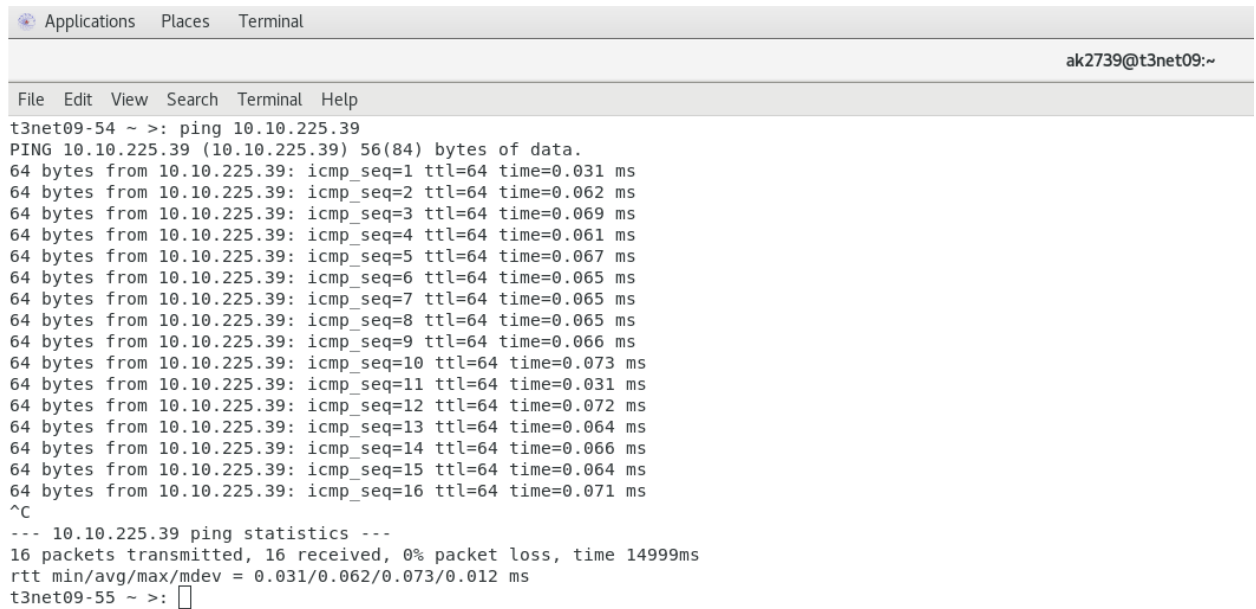
t3net09-42 ~ >: netstat -rt
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
default gateway 0.0.0.0 UG 0 0 0 plp1
default gateway 0.0.0.0 UG 0 0 0 em1
10.0.0.0 0.0.0.0 255.0.0.0 U 0 0 0 em1
10.10.102.0 0.0.0.0 255.255.255.0 U 0 0 0 em1
10.10.225.0 0.0.0.0 255.255.255.0 U 0 0 0 plp1
192.168.122.0 0.0.0.0 255.255.255.0 U 0 0 0 virbr0

t3net09-42 ~ >: netstat -rt
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
default gateway 0.0.0.0 UG 0 0 0 plp1
default gateway 0.0.0.0 UG 0 0 0 em1
10.10.102.0 0.0.0.0 255.255.255.0 U 0 0 0 em1
10.10.102.16 0.0.0.0 255.255.255.240 U 0 0 0 em1
10.10.225.0 0.0.0.0 255.255.255.0 U 0 0 0 plp1
192.168.122.0 0.0.0.0 255.255.255.0 U 0 0 0 virbr0

t3net09-42 ~ >: 
```

## Experiment 2.2.4

### Change IP address



```
t3net09-54 ~ >: ping 10.10.225.39
PING 10.10.225.39 (10.10.225.39) 56(84) bytes of data.
64 bytes from 10.10.225.39: icmp_seq=1 ttl=64 time=0.031 ms
64 bytes from 10.10.225.39: icmp_seq=2 ttl=64 time=0.062 ms
64 bytes from 10.10.225.39: icmp_seq=3 ttl=64 time=0.069 ms
64 bytes from 10.10.225.39: icmp_seq=4 ttl=64 time=0.061 ms
64 bytes from 10.10.225.39: icmp_seq=5 ttl=64 time=0.067 ms
64 bytes from 10.10.225.39: icmp_seq=6 ttl=64 time=0.065 ms
64 bytes from 10.10.225.39: icmp_seq=7 ttl=64 time=0.065 ms
64 bytes from 10.10.225.39: icmp_seq=8 ttl=64 time=0.065 ms
64 bytes from 10.10.225.39: icmp_seq=9 ttl=64 time=0.066 ms
64 bytes from 10.10.225.39: icmp_seq=10 ttl=64 time=0.073 ms
64 bytes from 10.10.225.39: icmp_seq=11 ttl=64 time=0.031 ms
64 bytes from 10.10.225.39: icmp_seq=12 ttl=64 time=0.072 ms
64 bytes from 10.10.225.39: icmp_seq=13 ttl=64 time=0.064 ms
64 bytes from 10.10.225.39: icmp_seq=14 ttl=64 time=0.066 ms
64 bytes from 10.10.225.39: icmp_seq=15 ttl=64 time=0.064 ms
64 bytes from 10.10.225.39: icmp_seq=16 ttl=64 time=0.071 ms
^C
--- 10.10.225.39 ping statistics ---
16 packets transmitted, 16 received, 0% packet loss, time 14999ms
rtt min/avg/max/mdev = 0.031/0.062/0.073/0.012 ms
t3net09-55 ~ >: □
```

Result of ping to the changed IP address, 10.10.225.39

## Deleting the plp1:0 interface

```
Applications Places Terminal

ak2739@t3net09:~

File Edit View Search Terminal Help

64 bytes from 10.10.225.10: icmp_seq=5 ttl=64 time=0.065 ms
64 bytes from 10.10.225.10: icmp_seq=6 ttl=64 time=0.073 ms
64 bytes from 10.10.225.10: icmp_seq=7 ttl=64 time=0.072 ms
^C
--- 10.10.225.10 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 5999ms
rtt min/avg/max/mdev = 0.055/0.068/0.078/0.010 ms
t3net09-56 ~ >: ifconfig plp1:0 down
t3net09-57 ~ >: ifconfig
em1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.10 netmask 255.255.255.0 broadcast 10.10.102.255
    inet6 fe80::181a:2767:7e9f:b942 prefixlen 64 scopeid 0x20<link>
    ether 6c:2b:59:e3:0e:e1 txqueuelen 1000 (Ethernet)
    RX packets 5087 bytes 385440 (376.4 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1969 bytes 201174 (196.4 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 16 memory 0xa5c00000-a5c20000

em1:0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.24 netmask 255.255.255.240 broadcast 10.10.102.31
    ether 6c:2b:59:e3:0e:e1 txqueuelen 1000 (Ethernet)
    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 1168 bytes 129528 (126.4 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1168 bytes 129528 (126.4 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

plp1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.225.10 netmask 255.255.255.0 broadcast 10.10.225.255
    inet6 fe80::b696:91ff:fe51:d40f prefixlen 64 scopeid 0x20<link>
    ether b4:96:91:51:d4:0f txqueuelen 1000 (Ethernet)
    RX packets 186048 bytes 187602546 (178.9 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 183766 bytes 132025465 (125.9 MiB)
    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 52:54:00:60:07:59 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

t3net09-58 ~ >: □
```

```
Applications Places Terminal

ak2739@t3net09:~

File Edit View Search Terminal Help

1168 packets received by filter
0 packets dropped by kernel
t3net09-50 ~ >: ifconfig p1p1:0 10.10.225.39
t3net09-51 ~ >: ifconfig
em1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.10 netmask 255.255.255.0 broadcast 10.10.102.255
    inet6 fe80::181a:2767:7e9f:b942 prefixlen 64 scopeid 0x20<link>
    ether 6c:2b:59:e3:0e:e1 txqueuelen 1000 (Ethernet)
    RX packets 4816 bytes 367996 (359.3 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1969 bytes 201174 (196.4 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 16 memory 0xa5c00000-a5c20000

em1:0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.24 netmask 255.255.255.240 broadcast 10.10.102.31
    ether 6c:2b:59:e3:0e:e1 txqueuelen 1000 (Ethernet)
    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 1122 bytes 125664 (122.7 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1122 bytes 125664 (122.7 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

p1p1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.225.10 netmask 255.255.255.0 broadcast 10.10.225.255
    inet6 fe80::b696:91ff:fe51:d40f prefixlen 64 scopeid 0x20<link>
    ether b4:96:91:51:d4:0f txqueuelen 1000 (Ethernet)
    RX packets 183728 bytes 187336371 (178.6 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 179772 bytes 126912566 (121.0 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device memory 0xa5300000-a53fffff

p1p1:0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.225.39 netmask 255.0.0.0 broadcast 10.255.255.255
    ether b4:96:91:51:d4:0f txqueuelen 1000 (Ethernet)
    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 52:54:00:60:07:59 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

t3net09-52 ~ >: □
```

Interface description after p1p1:0 was created.

```
Applications Places Terminal
sa2598@t3net12:/afs/cad.njit.edu/u/s/a/sa2598
File Edit View Search Terminal Help
64 bytes from 10.10.225.39: icmp_seq=35 ttl=64 time=0.330 ms
64 bytes from 10.10.225.39: icmp_seq=36 ttl=64 time=0.595 ms
64 bytes from 10.10.225.39: icmp_seq=37 ttl=64 time=0.426 ms
64 bytes from 10.10.225.39: icmp_seq=38 ttl=64 time=0.510 ms
64 bytes from 10.10.225.39: icmp_seq=39 ttl=64 time=0.511 ms
64 bytes from 10.10.225.39: icmp_seq=40 ttl=64 time=0.519 ms
64 bytes from 10.10.225.39: icmp_seq=41 ttl=64 time=0.622 ms
64 bytes from 10.10.225.39: icmp_seq=42 ttl=64 time=0.561 ms
64 bytes from 10.10.225.39: icmp_seq=43 ttl=64 time=0.542 ms
^Z
[1]+  Stopped                  ping 10.10.225.39
t3net12-42 sa2598 >: ifconfig plp1:0 down
t3net12-43 sa2598 >: ifconfig em1:0 down
t3net12-44 sa2598 >: ifconfig
```

Ping results from a different workstation to the IP address 10.10.225.39

```
Applications Places Terminal
ak2739@t3net09:~
File Edit View Search Terminal Help
t3net09-54 ~ >: ping 10.10.225.39
PING 10.10.225.39 (10.10.225.39) 56(84) bytes of data.
64 bytes from 10.10.225.39: icmp_seq=1 ttl=64 time=0.031 ms
64 bytes from 10.10.225.39: icmp_seq=2 ttl=64 time=0.062 ms
64 bytes from 10.10.225.39: icmp_seq=3 ttl=64 time=0.069 ms
64 bytes from 10.10.225.39: icmp_seq=4 ttl=64 time=0.061 ms
64 bytes from 10.10.225.39: icmp_seq=5 ttl=64 time=0.067 ms
64 bytes from 10.10.225.39: icmp_seq=6 ttl=64 time=0.065 ms
64 bytes from 10.10.225.39: icmp_seq=7 ttl=64 time=0.065 ms
64 bytes from 10.10.225.39: icmp_seq=8 ttl=64 time=0.065 ms
64 bytes from 10.10.225.39: icmp_seq=9 ttl=64 time=0.066 ms
64 bytes from 10.10.225.39: icmp_seq=10 ttl=64 time=0.073 ms
64 bytes from 10.10.225.39: icmp_seq=11 ttl=64 time=0.031 ms
64 bytes from 10.10.225.39: icmp_seq=12 ttl=64 time=0.072 ms
64 bytes from 10.10.225.39: icmp_seq=13 ttl=64 time=0.064 ms
64 bytes from 10.10.225.39: icmp_seq=14 ttl=64 time=0.066 ms
64 bytes from 10.10.225.39: icmp_seq=15 ttl=64 time=0.064 ms
64 bytes from 10.10.225.39: icmp_seq=16 ttl=64 time=0.071 ms
^C
--- 10.10.225.39 ping statistics ---
16 packets transmitted, 16 received, 0% packet loss, time 14999ms
rtt min/avg/max/mdev = 0.031/0.062/0.073/0.012 ms
t3net09-55 ~ >: □
```

Ping results from the same workstation to the IP address 10.10.225.39

```
sa2598@t3net12:/afs/cad.njit.edu/u/s/a/sa2598
File Edit View Search Terminal Help
10.10.225.0    0.0.0.0      255.255.255.0  U      0 0      0 plp1
192.168.122.0 0.0.0.0      255.255.255.0  U      0 0      0 virbr0
t3net12-46 sa2598 >: ifconfig plp1:0 10.10.225.10
t3net12-47 sa2598 >: ifconfig
em1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.13 netmask 255.255.255.0 broadcast 10.10.102.255
    inet6 fe80::35bf:2f62:e03c:a93d prefixlen 64 scopeid 0x20<link>
    ether 6c:2b:59:e3:0e:b5 txqueuelen 1000 (Ethernet)
    RX packets 4672 bytes 349671 (341.4 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 379 bytes 40051 (39.1 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 16 memory 0xa5c00000-a5c20000

em1:0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.102.37 netmask 255.0.0.0 broadcast 10.255.255.255
    ether 6c:2b:59:e3:0e:b5 txqueuelen 1000 (Ethernet)
    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 532 bytes 46744 (45.6 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 532 bytes 46744 (45.6 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

plp1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.225.13 netmask 255.255.255.0 broadcast 10.10.225.255
    inet6 fe80::b696:91ff:fe51:d042 prefixlen 64 scopeid 0x20<link>
    ether b4:96:91:51:d0:42 txqueuelen 1000 (Ethernet)
    RX packets 356490 bytes 163196910 (155.6 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 530773 bytes 624643018 (595.7 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device memory 0xa5300000-a53fffff

plp1:0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.10.225.10 netmask 255.0.0.0 broadcast 10.255.255.255
    ether b4:96:91:51:d0:42 txqueuelen 1000 (Ethernet)
    device memory 0xa5300000-a53fffff
```

Re-changing the changed IP address done by the other host of the interface plp1:0.