ECE 636
COMPUTER NETWORKING LABORATORY

Ayush Kale
31573799
ak2739@njit.edu

# 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.

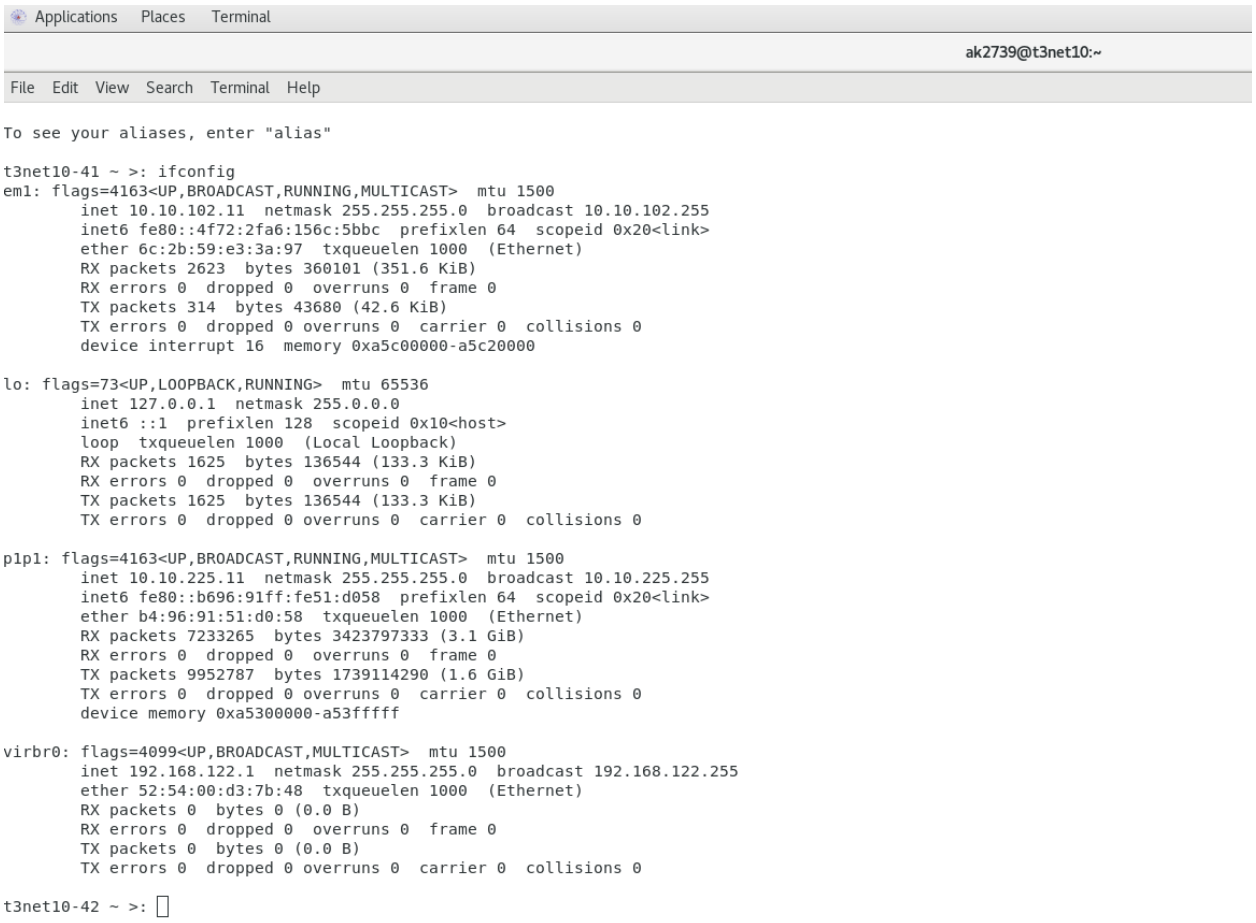
   I used an unused IP Address 10.10.225.39 for various conditions. After I deleted the virtual interfaces the workstation was working correctly.

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.

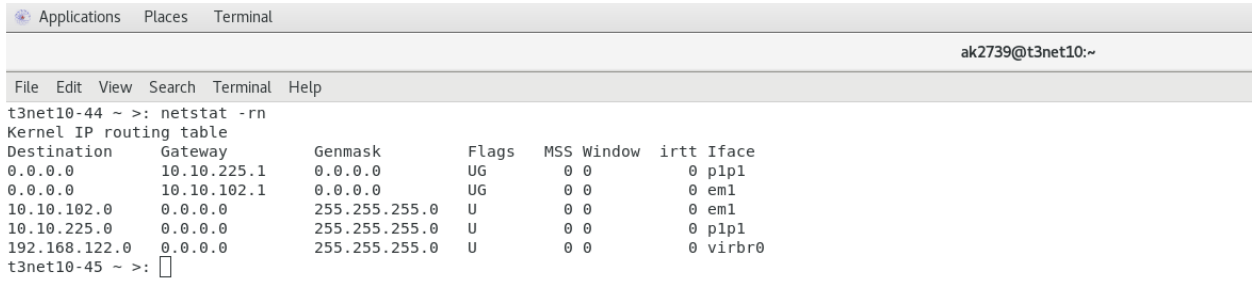
# Lab Descriptions

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



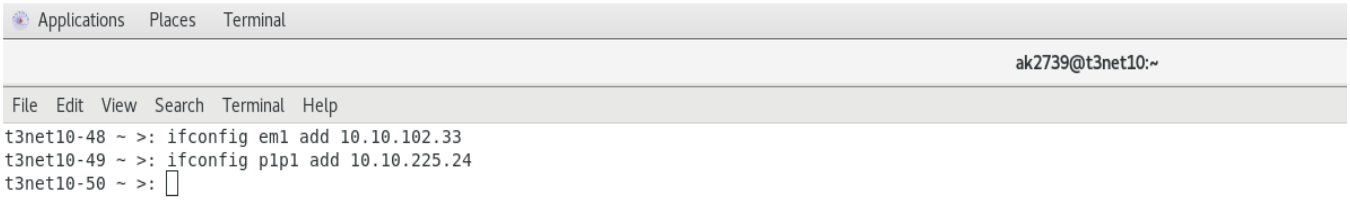

- Workstation has 2 interfaces em1 and p1p1. The IP address of em1 is 10.10.102.11 and IP address of p1p1 is 10.10.225.11.

- Netmask for the em1 interface is 255.255.255.0 and for p1p1 is 255.255.255.0.

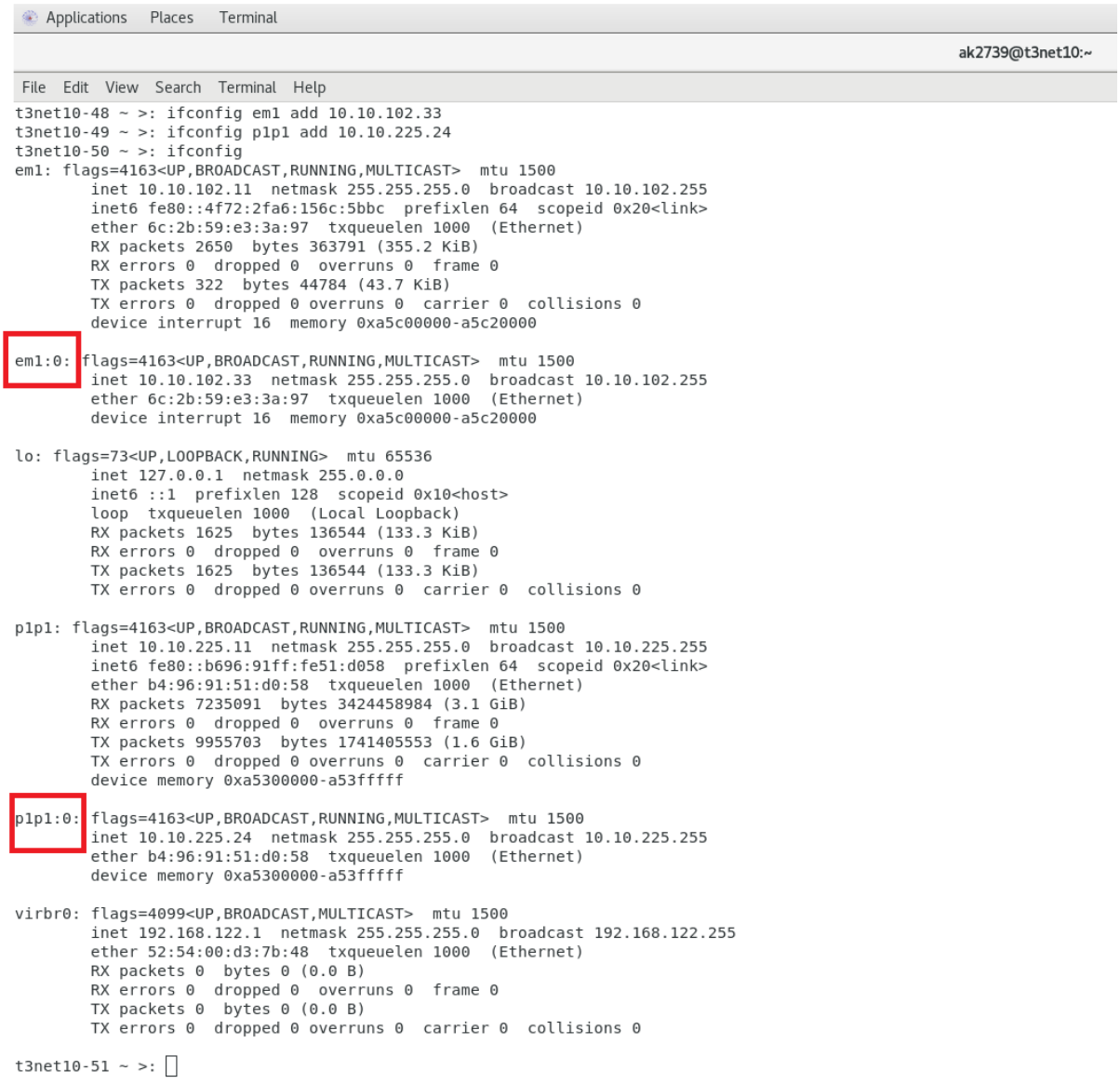


- Routing Table of the workstation.

## 2. Create new virtual logical interface

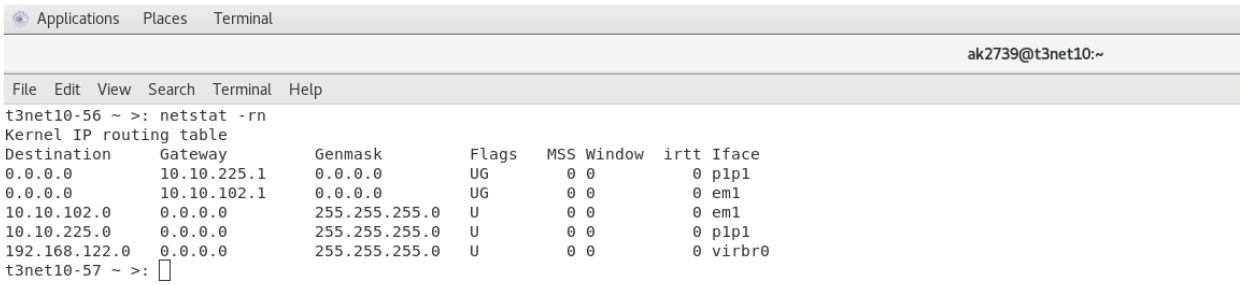



- Creating virtual logical interfaces by using the above commands.

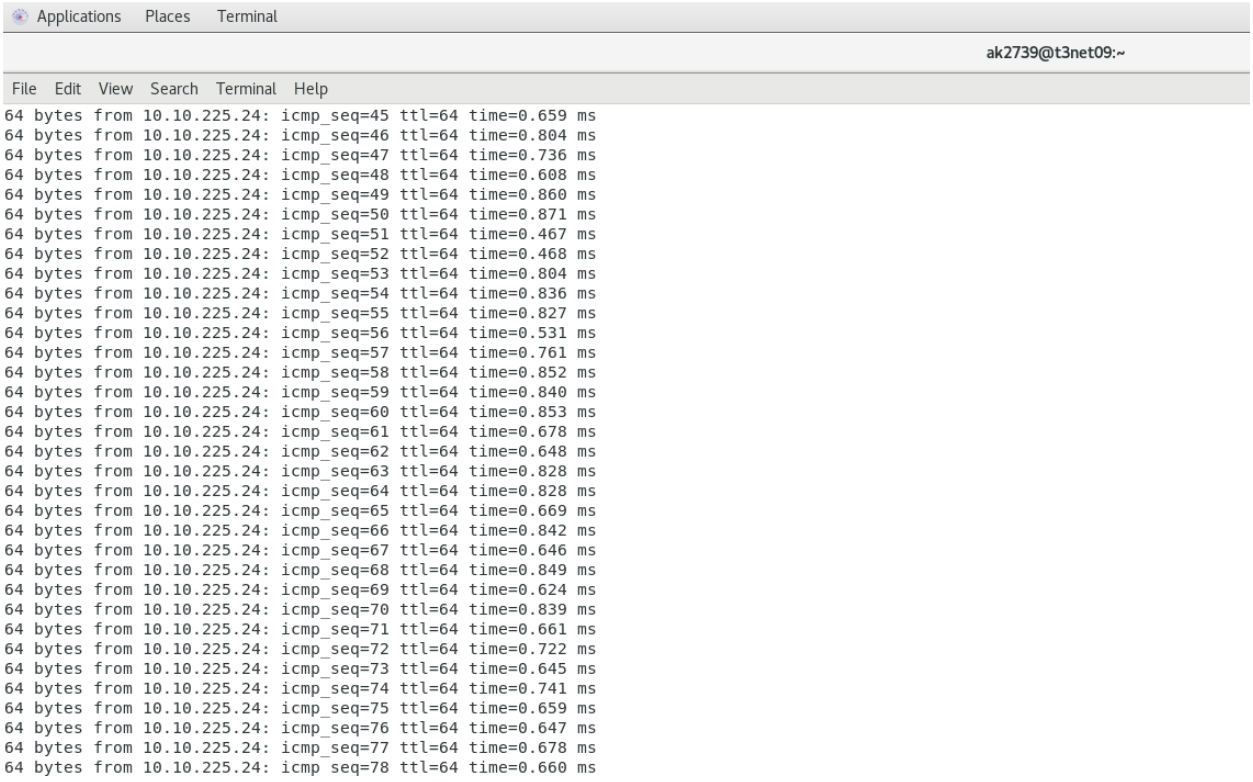



Results of the ifconfig with the new virtual interfaces marked by boxes.

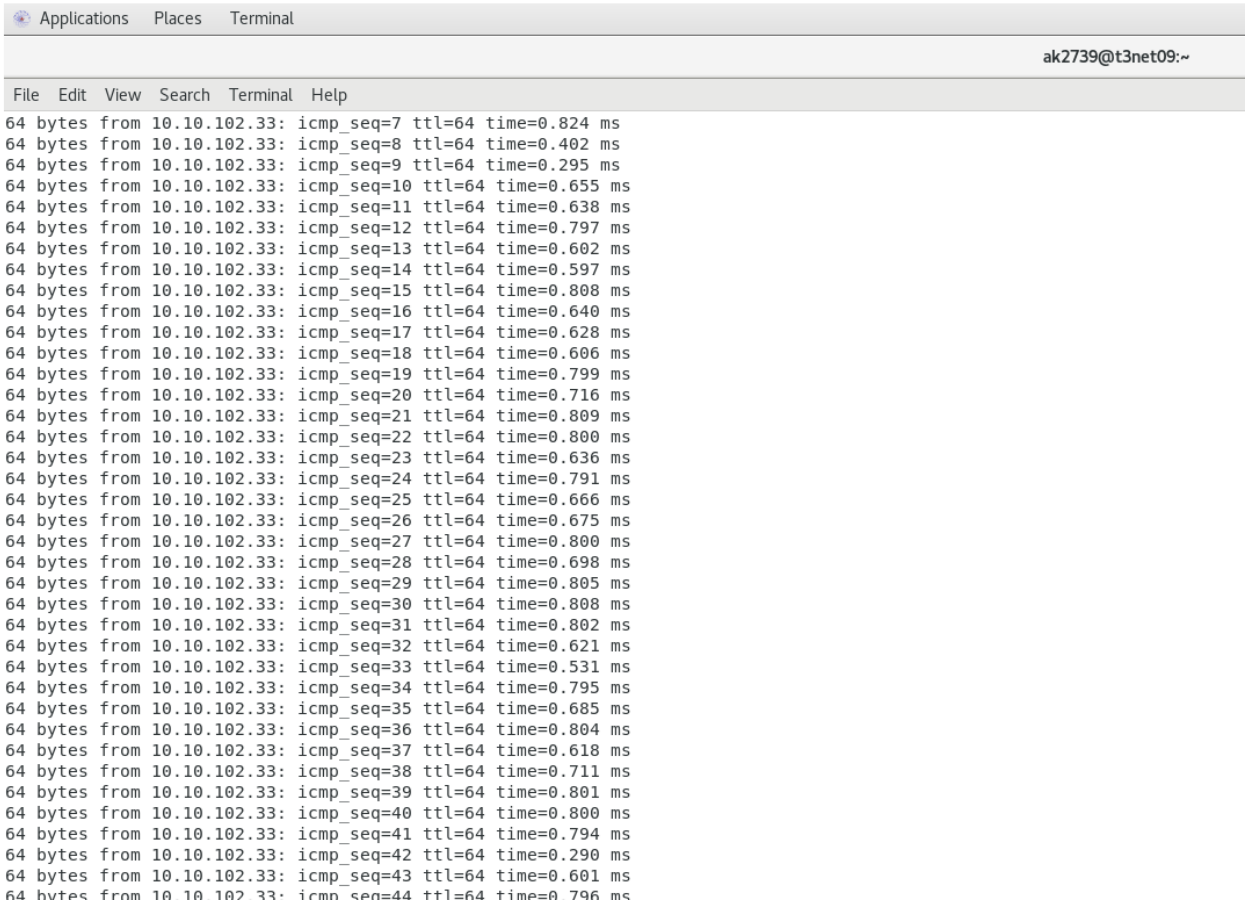
- New Routing Table




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



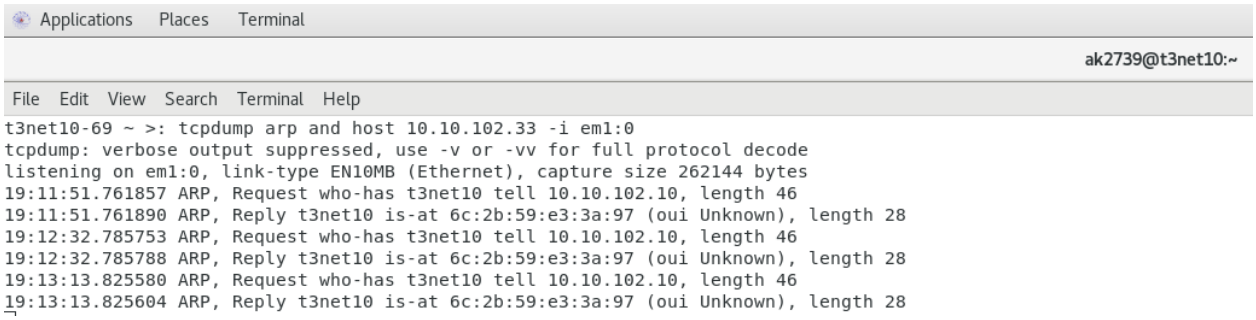

Ping to 10.10.225.24




Ping to 10.10.102.33

- Output of tcpdumps while t3net09 pings the new ip addresses

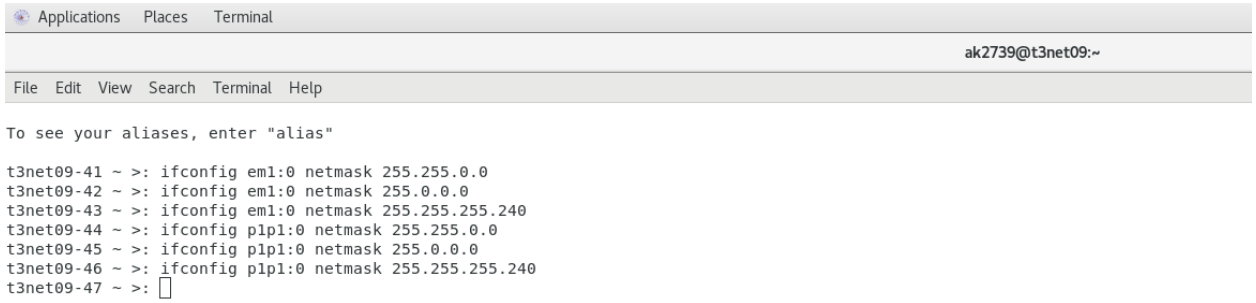
```
t3net10-44 ~ >: tcpdump arp and host 10.10.225.24 -i p1p1:0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on p1p1:0, link-type EN10MB (Ethernet), capture size 262144 bytes
18:55:43.014184 ARP, Request who-has t3net10 tell t3net09, length 46
18:55:43.014229 ARP, 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
```




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

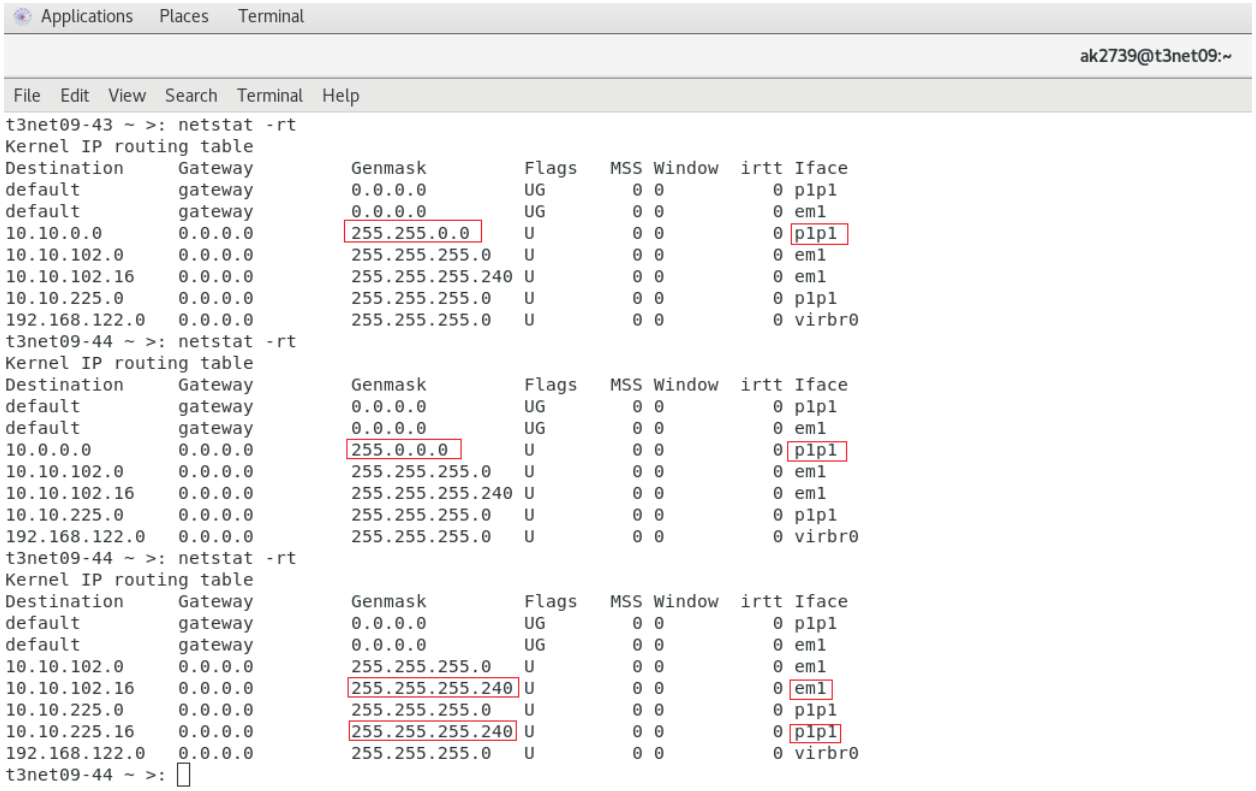
3. Change netmask and observe the change of routing table on your host.

    - Changing the netmask of the workstation




Changing the netmask of the workstation using the above commands.

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

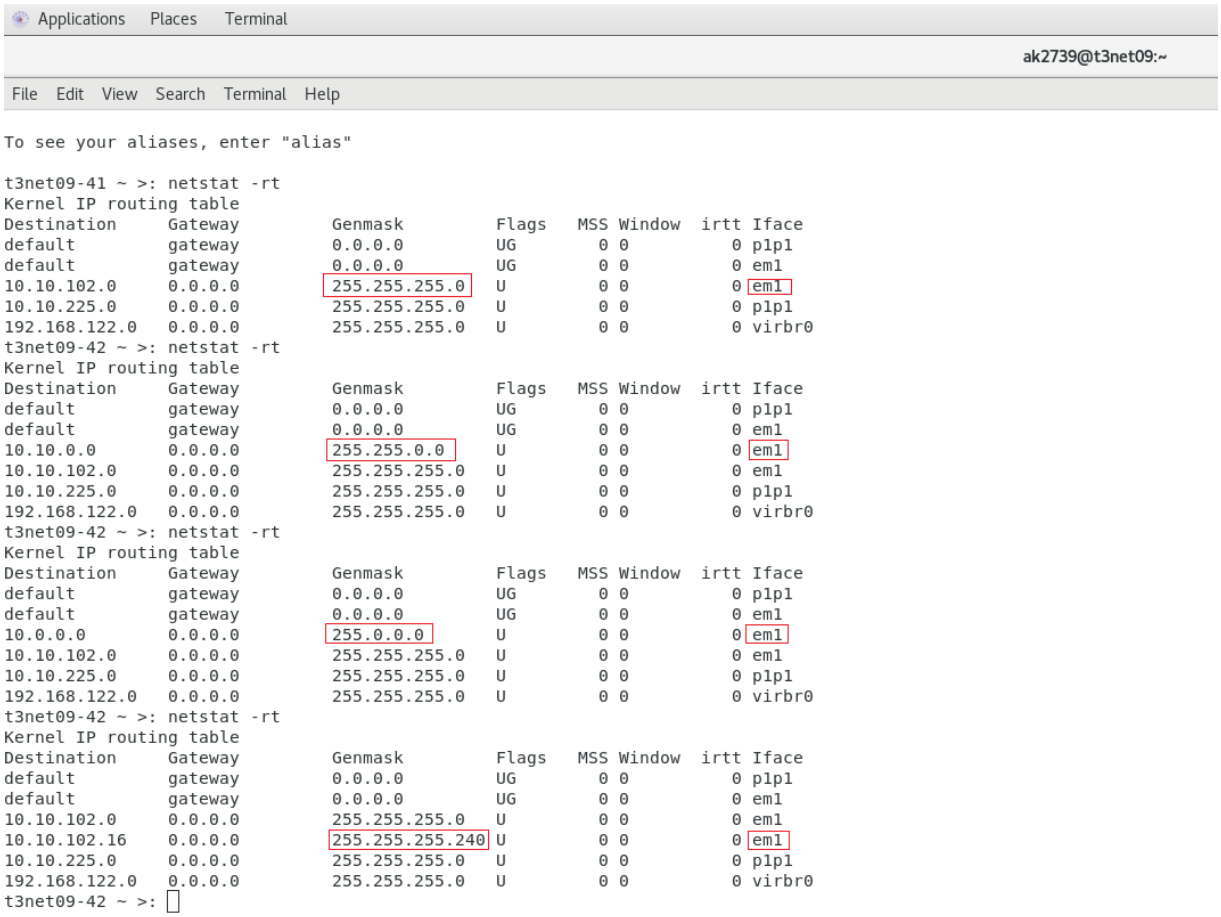


```
Applications  Places  Terminal                                   ak2739@t3net09:~
File  Edit  View  Search  Terminal  Help
t3net09-43 ~ >: netstat -rt
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
default         gateway         0.0.0.0         UG        0 0          0 p1p1
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 p1p1
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 p1p1
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 p1p1
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 p1p1
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 p1p1
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 p1p1
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 p1p1
10.10.225.16    0.0.0.0         255.255.255.240 U         0 0          0 p1p1
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 p1p1:0
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on p1p1:0, 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.



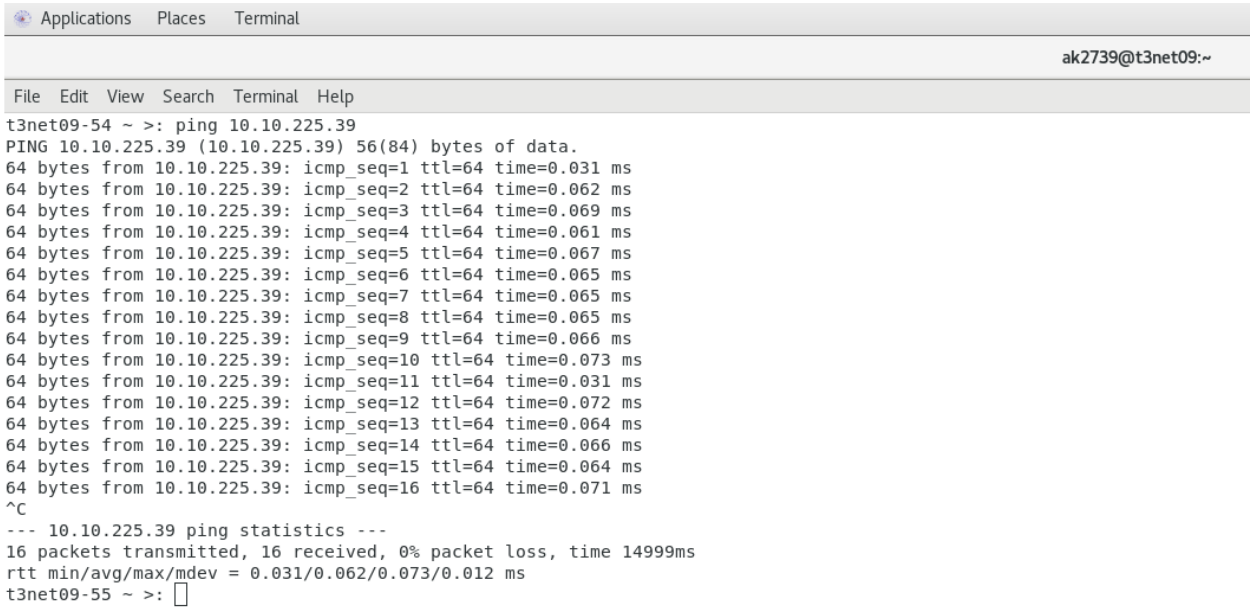
```
Applications  Places  Terminal                                  ak2739@t3net09:~
File  Edit  View  Search  Terminal  Help

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 p1p1
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 p1p1
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 p1p1
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 p1p1
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 p1p1
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 p1p1
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 p1p1
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 p1p1
192.168.122.0   0.0.0.0         255.255.255.0   U         0 0          0 virbr0
t3net09-42 ~ >:
```

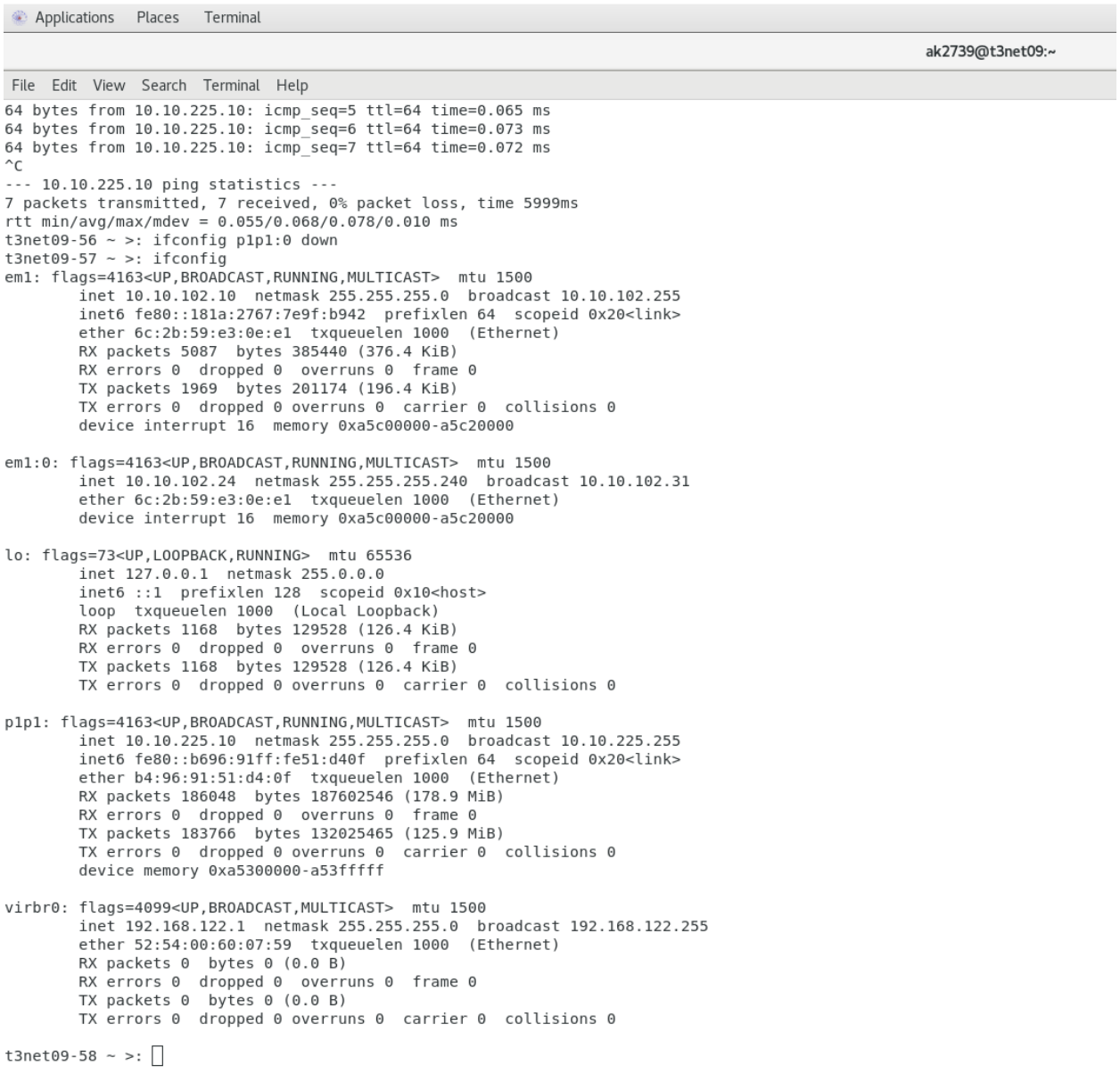
Experiment 2.2.4

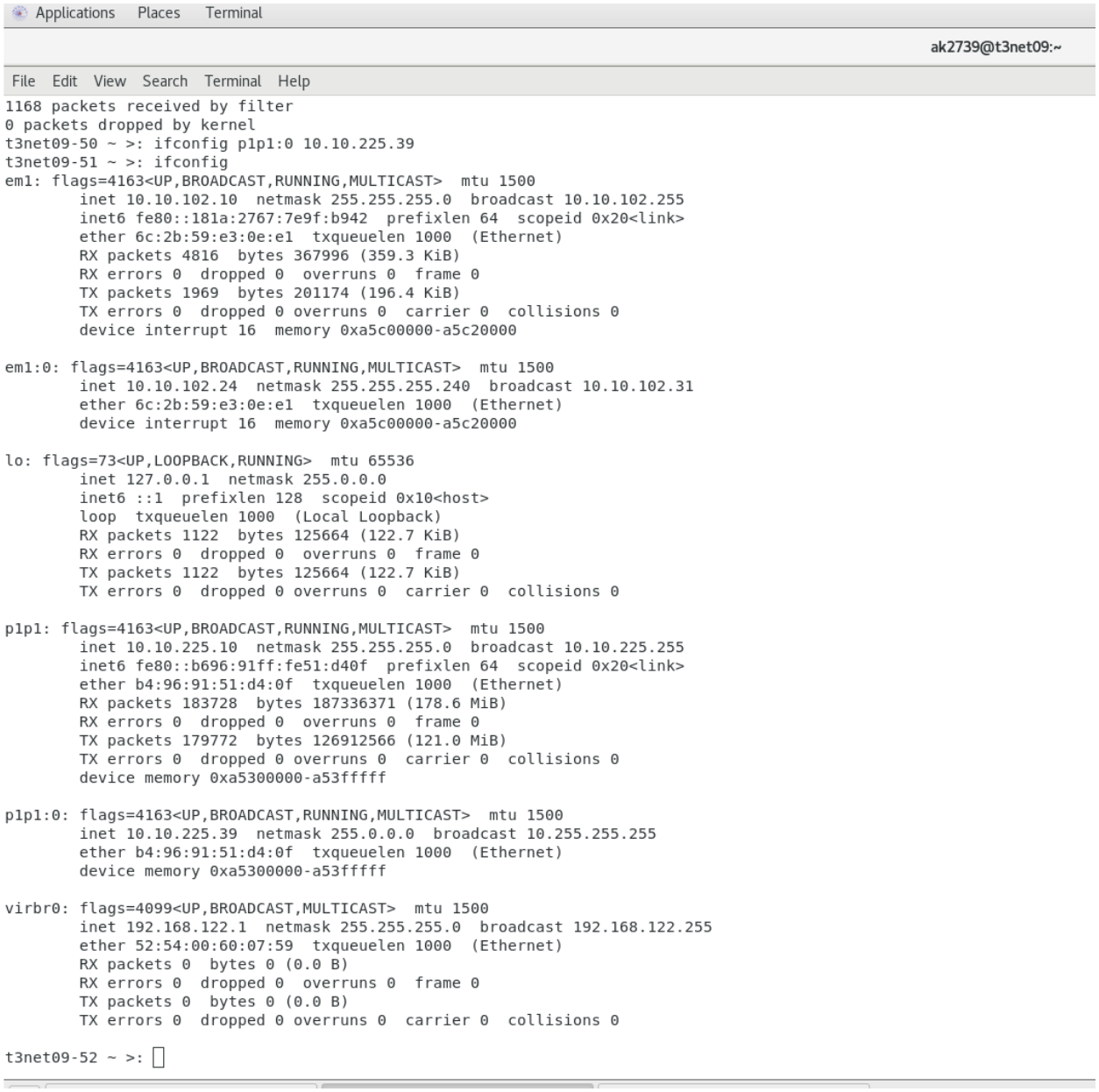
Change IP address



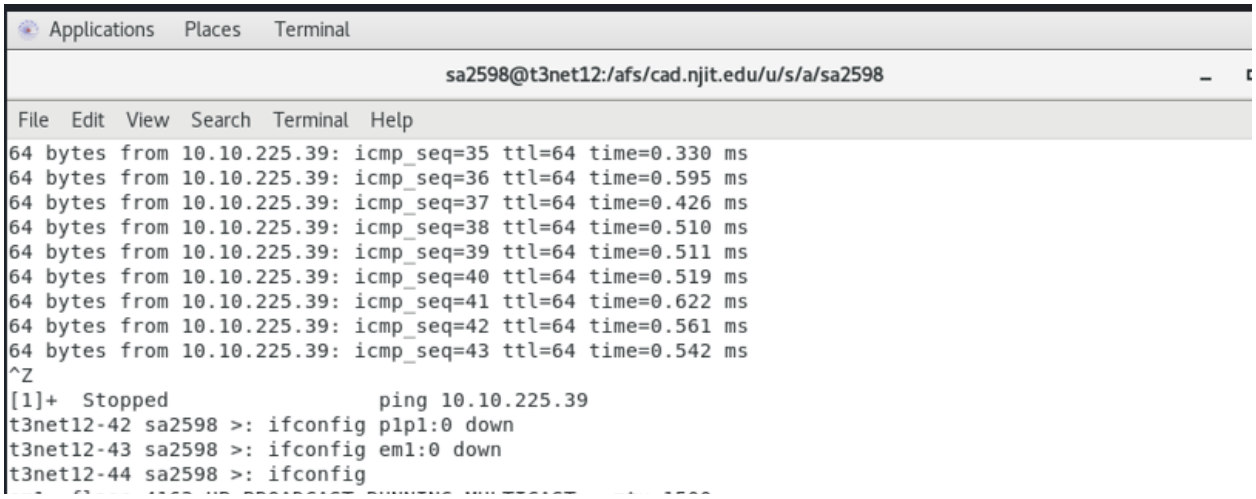

Result of ping to the changed IP address, 10.10.225.39

# Deleting the p1p1:0 interface

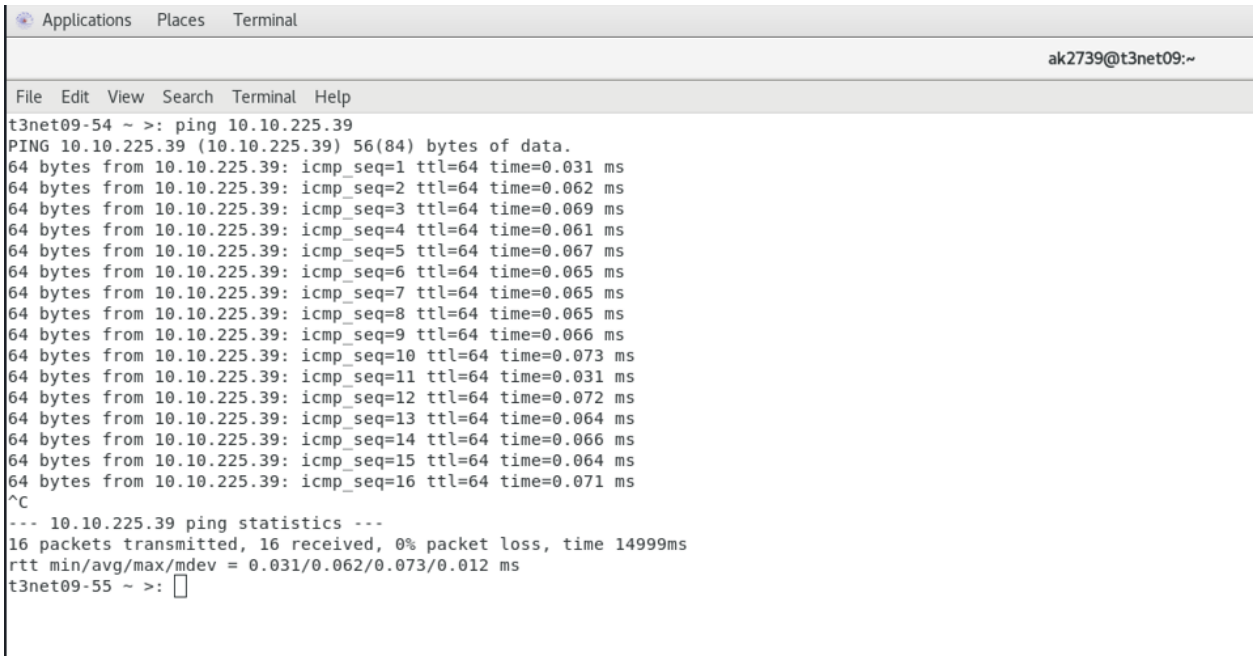




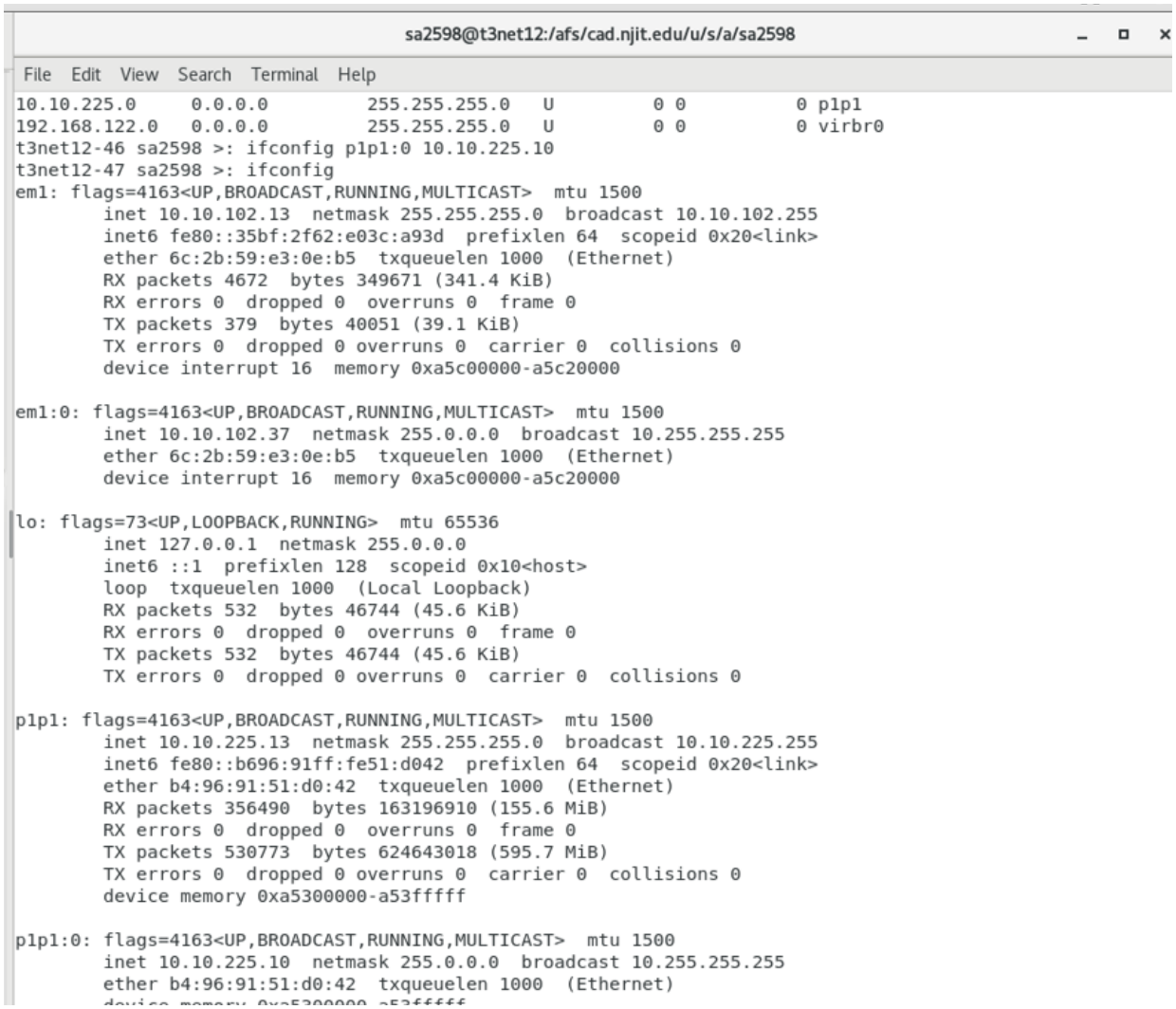

Interface description after p1p1:0 was created.




Ping results from a different workstation to the IP address 10.10.225.39




Ping results from the same workstation to the IP address 10.10.225.39




Re-changing the changed IP address done by the other host of the interface p1p1:0.