

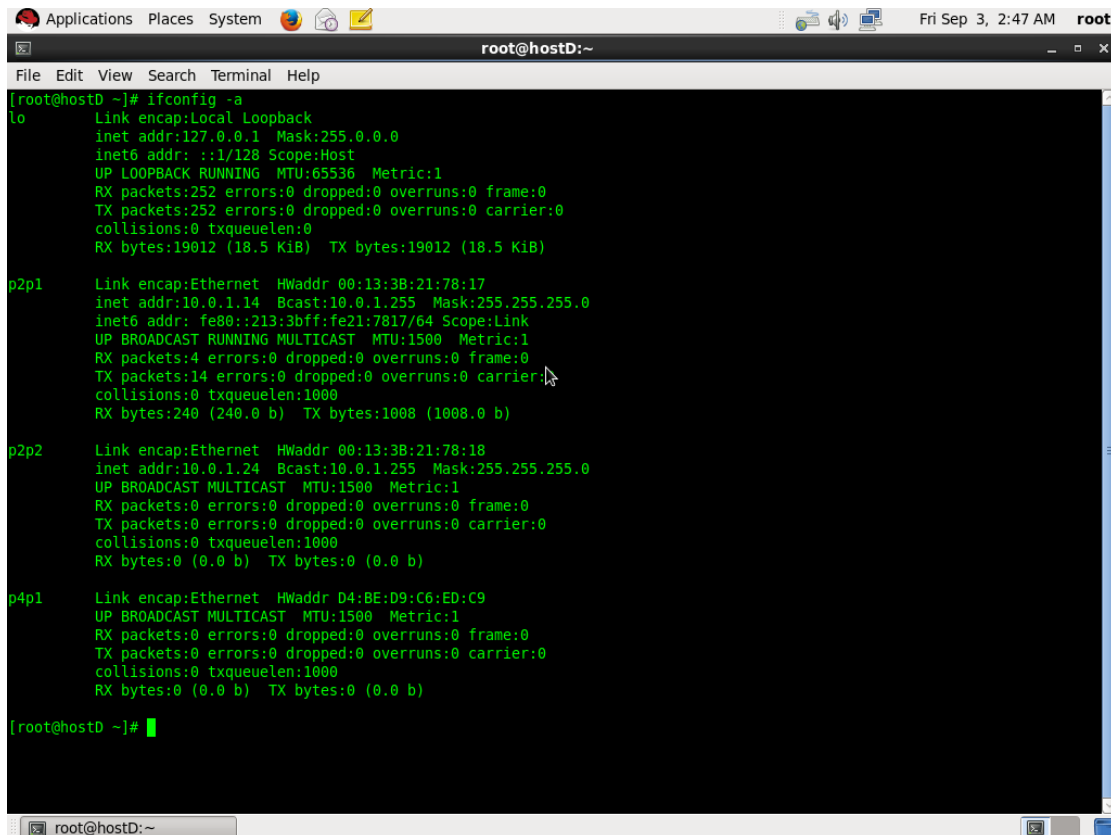
## COMPUTER NETWORKS (CN 434) LAB 01

**EXERCISE 01:** Changing the IP address of an interface. Use the `ifconfig` command to modify the IP address of the `p2p1` interface of computer D.

Initially the system is connected to computer A, we need to use the switch available to which computers A, B, C and D are connected for switching. For this exercise we need to use computer D, so we will shift from computer A to computer D by just pressing button D on the switch. On computer D, run `ifconfig -a` and save the output.

1. On computer D, run `ifconfig -a` and save the output.

Once switched to computer D from computer A, open terminal and run the command “`ifconfig -a`”. It displays the configuration parameters of all network interfaces, including the inactive interfaces. The output can be seen in Fig 1.1.



```
[root@hostD ~]# ifconfig -a
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:252 errors:0 dropped:0 overruns:0 frame:0
          TX packets:252 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:19012 (18.5 KiB)  TX bytes:19012 (18.5 KiB)

p2p1      Link encap:Ethernet  HWaddr 00:13:3B:21:78:17
          inet addr:10.0.1.14  Bcast:10.0.1.255  Mask:255.255.255.0
          inet6 addr: fe80::213:3bff:fe21:7817/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:240 (240.0 b)  TX bytes:1008 (1008.0 b)

p2p2      Link encap:Ethernet  HWaddr 00:13:3B:21:78:18
          inet addr:10.0.1.24  Bcast:10.0.1.255  Mask:255.255.255.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

p4p1      Link encap:Ethernet  HWaddr D4:BE:D9:C6:ED:C9
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

[root@hostD ~]#
```

Fig 1.1 Displaying configuration parameters of network interfaces

We can save the output data from terminal to text document by creating an empty document with desired name and run the command “ifconfig > text\_filename”. I created my file name as vyaganti\_e1.txt. I runned the command and saved the output. The output text file can be seen below.

```
lo      Link encap:Local Loopback
inet addr:127.0.0.1  Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
UP LOOPBACK RUNNING  MTU:65536  Metric:1
RX packets:276 errors:0 dropped:0 overruns:0 frame:0
TX packets:276 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:20844 (20.3 KiB)  TX bytes:20844 (20.3 KiB)
```

```
p2p1    Link encap:Ethernet  HWaddr 00:13:3B:21:78:17
inet addr:10.0.1.14  Bcast:10.0.1.255  Mask:255.255.255.0
inet6 addr: fe80::213:3bff:fe21:7817/64 Scope:Link
UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
RX packets:4 errors:0 dropped:0 overruns:0 frame:0
TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:240 (240.0 b)  TX bytes:1008 (1008.0 b)
```

```
p2p2    Link encap:Ethernet  HWaddr 00:13:3B:21:78:18
inet addr:10.0.1.24  Bcast:10.0.1.255  Mask:255.255.255.0
UP BROADCAST MULTICAST  MTU:1500  Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)
```

```
p4p1    Link encap:Ethernet  HWaddr D4:BE:D9:C6:ED:C9
UP BROADCAST MULTICAST  MTU:1500  Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)
```

2. Change the IP address of interface p2p1 of computer D to 10.0.1.16/24.

In terminal run the command “ifconfig p2p1 10.0.1.16/24 netmask 255.255.255.0 broadcast 10.0.1.255”. This assigns interface p2p1 the IP address 10.0.1.16/24 and a broadcast address of 10.0.1.255. The output can be seen in Fig 1.2.

```

root@hostD:~
File Edit View Search Terminal Help
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 b) TX bytes:0 (0.0 b)

[root@hostD ~]# ifconfig > vyaganti e1.txt
[root@hostD ~]# ifconfig p2p1 10.0.1.16/24 netmask 255.255.255.0 broadcast 10.0.1.255
Usage:
ifconfig [-a] [-v] [-s] <interface> [[<AF>] <address>]
[add <address>[/<prefixlen>]]
[del <address>[/<prefixlen>]]
[[-]broadcast <address>] [[-]pointopoint <address>]
[netmask <address>] [dstaddr <address>] [tunnel <address>]
[outfill <NN>] [keepalive <NN>]
[hw <HW> <address>] [metric <NN>] [mtu <NN>]
[[-]trailers] [[-]arp] [[-]allmulti]
[multicast] [[-]promisc]
[mem_start <NN>] [io_addr <NN>] [irq <NN>] [media <type>]
[txqueuelen <NN>]
[[-]dynamic]
[up|down] ...

<HW>=Hardware Type.
List of possible hardware types:
loop (Local Loopback) slip (Serial Line IP) cslip (VJ Serial Line IP)
slip6 (6-bit Serial Line IP) cslip6 (VJ 6-bit Serial Line IP) adaptive (Adaptive Serial Line IP)
strip (Metricom Starmode IP) ash (Ash) ether (Ethernet)
tr (16/4 Mbps Token Ring) tr (16/4 Mbps Token Ring (New)) ax25 (AMPR AX.25)
netrom (AMPR NET/ROM) rose (AMPR ROSE) tunnel (IP/IP Tunnel)
ppp (Point-to-Point Protocol) hdlc ((Cisco)-HDLC) lapb (LAPB)
arcnet (ARCnet) dlc1 (Frame Relay DLCI) frad (Frame Relay Access Device)
sit (IPv6-in-IPv4) fddi (Fiber Distributed Data Interface) hippi (HIPPI)
irda (IrLAP) ec (Econet) x25 (generic X.25)
infiniband (InfiniBand)

<AF>=Address family. Default: inet
List of possible address families:
unix (UNIX Domain) inet (DARPA Internet) inet6 (IPv6)
ax25 (AMPR AX.25) netrom (AMPR NET/ROM) rose (AMPR ROSE)
ipx (Novell IPX) ddp (Appletalk DDP) ec (Econet)
ash (Ash) x25 (CCITT X.25)

[root@hostD ~]#

```

Fig 1.2 Changing IP address of interface p2p1.

```

lo      Link encap:Local Loopback
        inet addr:127.0.0.1  Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING MTU:65536 Metric:1
        RX packets:300 errors:0 dropped:0 overruns:0 frame:0
        TX packets:300 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:22676 (22.1 KiB)  TX bytes:22676 (22.1 KiB)

p2p1    Link encap:Ethernet HWaddr 00:13:3B:21:78:17
        inet addr:10.0.1.16  Bcast:10.0.1.255  Mask:255.255.255.0
        inet6 addr: fe80::213:3bff:fe21:7817/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:4 errors:0 dropped:0 overruns:0 frame:0
        TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
        Collisions:0 txqueuelen:1000

```

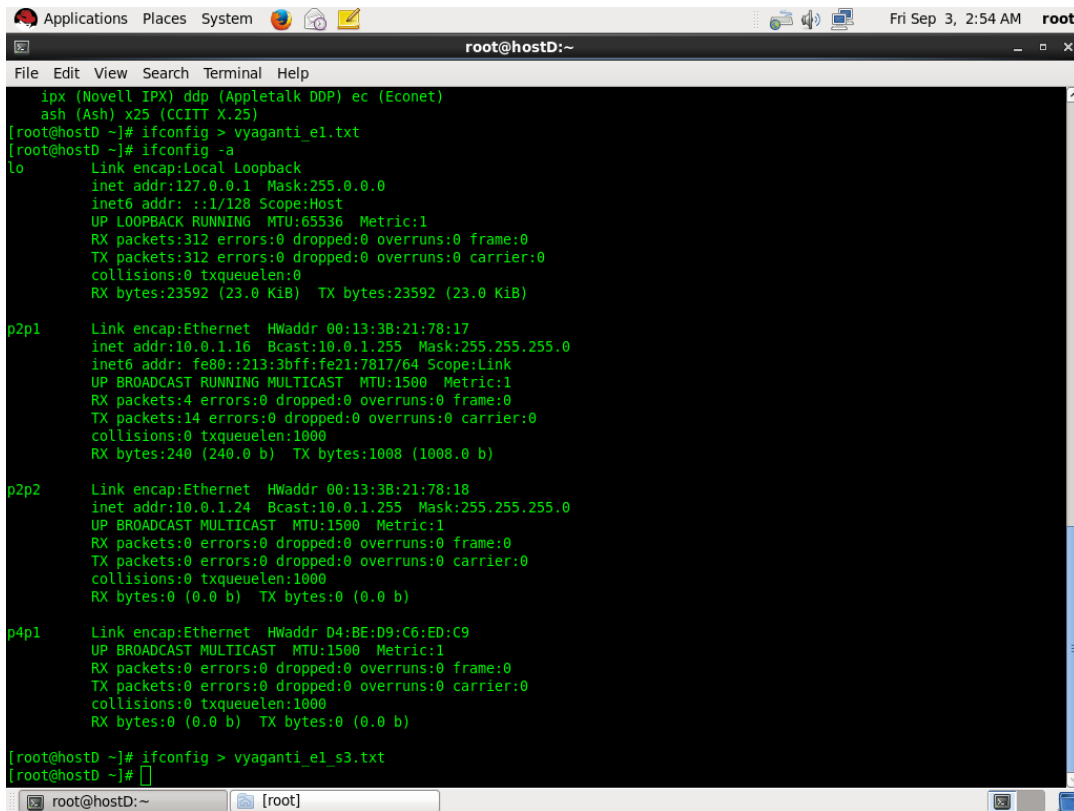
RX bytes:240 (240.0 b) TX bytes:1008 (1008.0 b)

p2p2 Link encap:Ethernet HWaddr 00:13:3B:21:78:18  
inet addr:10.0.1.24 Bcast:10.0.1.255 Mask:255.255.255.0  
UP BROADCAST MULTICAST MTU:1500 Metric:1  
RX packets:0 errors:0 dropped:0 overruns:0 frame:0  
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0  
collisions:0 txqueuelen:1000  
RX bytes:0 (0.0 b) TX bytes:0 (0.0 b)

p4p1 Link encap:Ethernet HWaddr D4:BE:D9:C6:ED:C9  
UP BROADCAST MULTICAST MTU:1500 Metric:1  
RX packets:0 errors:0 dropped:0 overruns:0 frame:0  
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0  
collisions:0 txqueuelen:1000  
RX bytes:0 (0.0 b) TX bytes:0 (0.0 b)

3. Run `ifconfig -a` again and save the output.

Run the command “`ifconfig -a`” again after changing the interface of p2p1. The output can be seen in the Fig 1.3.



```

ipx (Novell IPX) ddp (Appletalk DDP) ec (Econet)
ash (Ash) x25 (CCITT X.25)
[root@hostD ~]# ifconfig > vyaganti_e1.txt
[root@hostD ~]# ifconfig -a
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:312 errors:0 dropped:0 overruns:0 frame:0
          TX packets:312 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:23592 (23.0 KiB)  TX bytes:23592 (23.0 KiB)

p2p1      Link encap:Ethernet  HWaddr 00:13:3B:21:78:17
          inet addr:10.0.1.16  Bcast:10.0.1.255  Mask:255.255.255.0
          inet6 addr: fe80::213:3bff:fe21:7817/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:240 (240.0 b)  TX bytes:1008 (1008.0 b)

p2p2      Link encap:Ethernet  HWaddr 00:13:3B:21:78:18
          inet addr:10.0.1.24  Bcast:10.0.1.255  Mask:255.255.255.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

p4p1      Link encap:Ethernet  HWaddr D4:BE:D9:C6:ED:C9
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

[root@hostD ~]# ifconfig > vyaganti_e1_s3.txt
[root@hostD ~]#

```

Fig 1.3 Displaying configuration parameters of network interfaces again.

The output text file can be seen below.

```

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:312 errors:0 dropped:0 overruns:0 frame:0
          TX packets:312 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:23592 (23.0 KiB)  TX bytes:23592 (23.0 KiB)

p2p1      Link encap:Ethernet  HWaddr 00:13:3B:21:78:17
          inet addr:10.0.1.16  Bcast:10.0.1.255  Mask:255.255.255.0
          inet6 addr: fe80::213:3bff:fe21:7817/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:240 (240.0 b)  TX bytes:1008 (1008.0 b)

```

p2p2    Link encap:Ethernet HWaddr 00:13:3B:21:78:18  
        inet addr:10.0.1.24 Bcast:10.0.1.255 Mask:255.255.255.0  
        UP BROADCAST MULTICAST MTU:1500 Metric:1  
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0  
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0  
        collisions:0 txqueuelen:1000  
        RX bytes:0 (0.0 b) TX bytes:0 (0.0 b)

p4p1    Link encap:Ethernet HWaddr D4:BE:D9:C6:ED:C9  
        UP BROADCAST MULTICAST MTU:1500 Metric:1  
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0  
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0  
        collisions:0 txqueuelen:1000  
        RX bytes:0 (0.0 b) TX bytes:0 (0.0 b)

#### EXPLANATION:

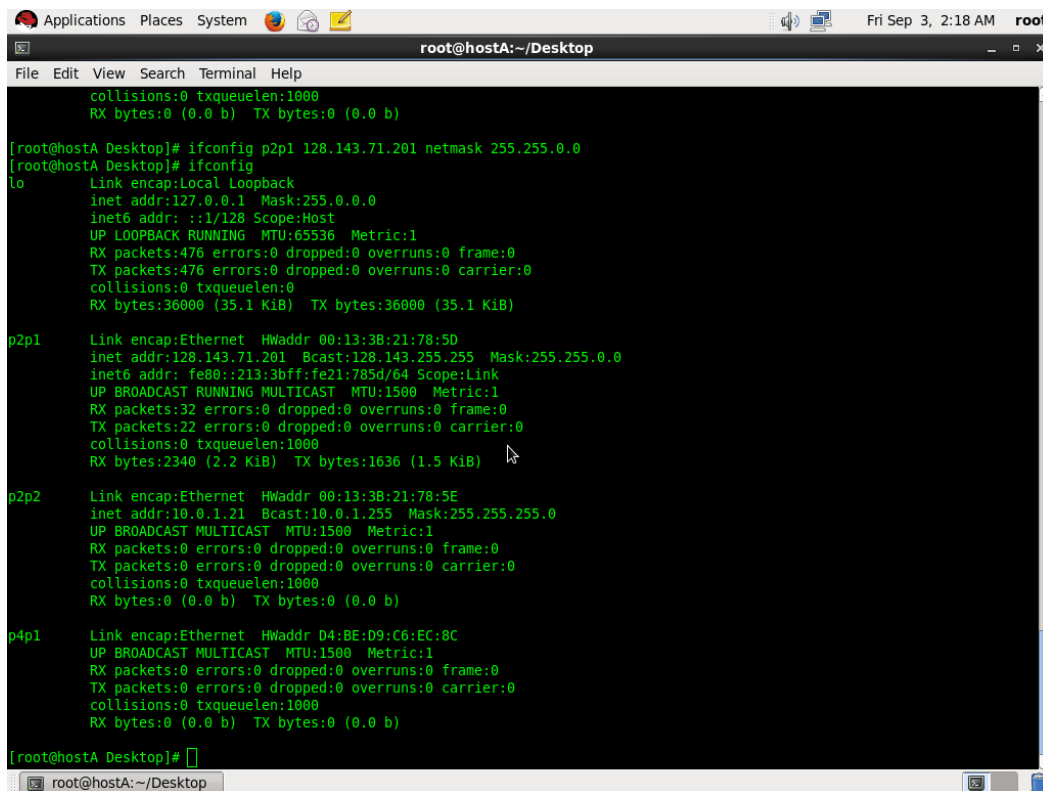
Where the 10.0.1.16/24 number pertains to the IP address of your machine. A private IP address. 255.255.255.0 denotes the network mask which decides the potential size of our network and the number 10.0.1.255 denotes the broadcast address. We've configured the interface IP from 10.0.1.14 to 10.0.1.16 with same broadcast address.

## EXERCISE 2: Changing netmasks.

Configure the interfaces of the hosts as shown in Table 2.

For this task we need to use the command “ifconfig p2p1 < IP Address of Ethernet Interface p2p1 > netmask <network mask>” for configuring the interfaces of each computer.

For computer A by using the table 2: IP addresses for exercise 2, get the IP Address of Ethernet Interface p2p1 and Network mask address. Run the command Ifconfig p2p1 128.143.71.201 netmask 255.255.0.0. The output can be seen in below Fig 2.1.1.



```
root@hostA: ~/Desktop
File Edit View Search Terminal Help
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 b) TX bytes:0 (0.0 b)

[root@hostA Desktop]# ifconfig p2p1 128.143.71.201 netmask 255.255.0.0
[root@hostA Desktop]# ifconfig
lo                Link encap:Local Loopback
                  inet addr:127.0.0.1  Mask:255.0.0.0
                  inet6 addr: ::1/128 Scope:Host
                  UP LOOPBACK RUNNING  MTU:65536  Metric:1
                  RX packets:476 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:476 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:0
                  RX bytes:36000 (35.1 KiB)  TX bytes:36000 (35.1 KiB)

p2p1              Link encap:Ethernet  HWaddr 00:13:3B:21:78:5D
                  inet addr:128.143.71.201  Bcast:128.143.255.255  Mask:255.255.0.0
                  inet6 addr: fe80::213:3bff:fe21:785d/64 Scope:Link
                  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
                  RX packets:32 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:22 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:2340 (2.2 KiB)  TX bytes:1636 (1.5 KiB)

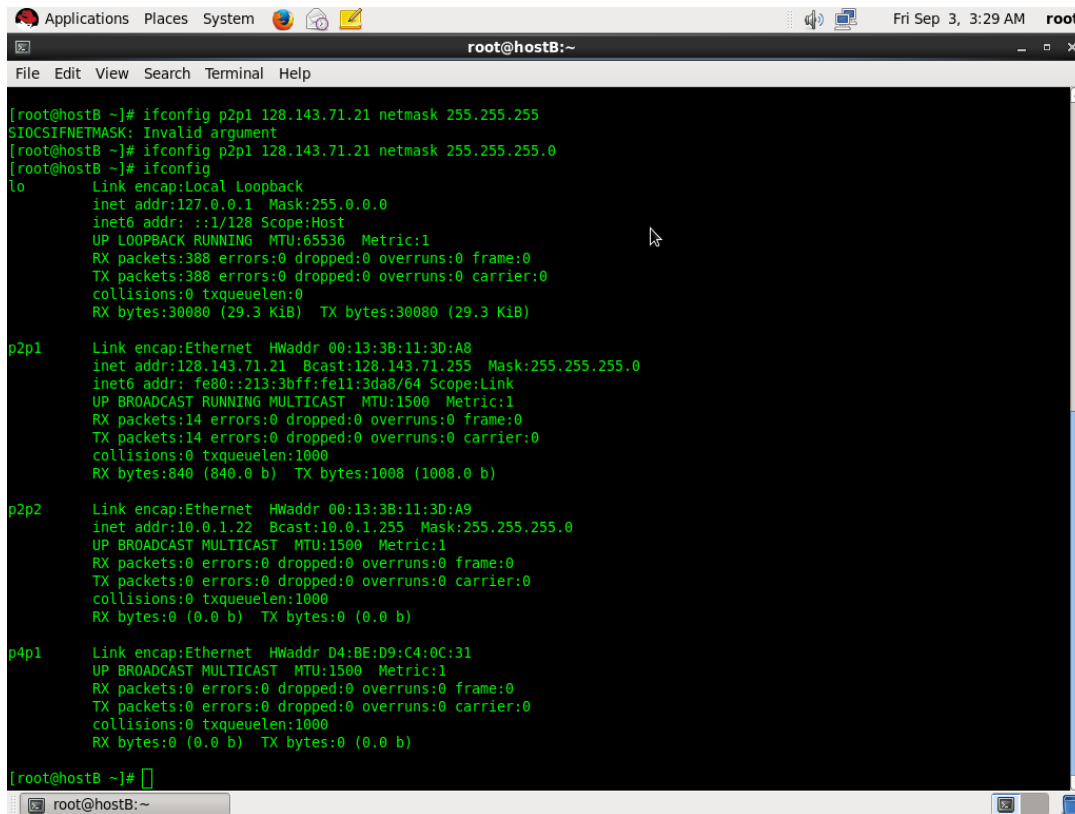
p2p2              Link encap:Ethernet  HWaddr 00:13:3B:21:78:5E
                  inet addr:10.0.1.21  Bcast:10.0.1.255  Mask:255.255.255.0
                  UP BROADCAST MULTICAST  MTU:1500  Metric:1
                  RX packets:0 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

p4p1              Link encap:Ethernet  HWaddr 04:BE:D9:C6:EC:8C
                  UP BROADCAST MULTICAST  MTU:1500  Metric:1
                  RX packets:0 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

[root@hostA Desktop]#
```

Fig 2.1.1 Interface configuration for computer A

For computer B by using the table 2: IP addresses for exercise 2, get the IP Address of Ethernet Interface p2p1 and Network mask address. Run the command Ifconfig p2p1 128.143.71.21 netmask 255.255.255.0. The output can be seen in below Fig 2.1.2.



The image shows a terminal window titled 'root@hostB:~' with a menu bar (File, Edit, View, Search, Terminal, Help) and a status bar (Fri Sep 3, 3:29 AM, root). The terminal displays the output of the 'ifconfig' command for interfaces p2p1, lo, p2p2, and p4p1. The output for p2p1 shows it is an Ethernet interface with IP 128.143.71.21 and mask 255.255.255.0. The output for lo shows it is a loopback interface with IP 127.0.0.1 and mask 255.0.0.0. The output for p2p2 shows it is an Ethernet interface with IP 10.0.1.22 and mask 255.255.255.0. The output for p4p1 shows it is an Ethernet interface with IP 10.0.1.23 and mask 255.255.255.0. The terminal prompt is '[root@hostB ~]# '.

```
[root@hostB ~]# ifconfig p2p1 128.143.71.21 netmask 255.255.255
SIOCSIFNETMASK: Invalid argument
[root@hostB ~]# ifconfig p2p1 128.143.71.21 netmask 255.255.255.0
[root@hostB ~]# ifconfig
lo                Link encap:Local Loopback
                  inet addr:127.0.0.1  Mask:255.0.0.0
                  inet6 addr: ::1/128 Scope:Host
                  UP LOOPBACK RUNNING  MTU:65536  Metric:1
                  RX packets:388  errors:0  dropped:0  overruns:0  frame:0
                  TX packets:388  errors:0  dropped:0  overruns:0  carrier:0
                  collisions:0  txqueuelen:0
                  RX bytes:30080 (29.3 KiB)  TX bytes:30080 (29.3 KiB)

p2p1              Link encap:Ethernet  HWaddr 00:13:3B:11:3D:A8
                  inet addr:128.143.71.21  Bcast:128.143.71.255  Mask:255.255.255.0
                  inet6 addr: fe80::213:3bff:fe11:3da8/64 Scope:Link
                  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
                  RX packets:14  errors:0  dropped:0  overruns:0  frame:0
                  TX packets:14  errors:0  dropped:0  overruns:0  carrier:0
                  collisions:0  txqueuelen:1000
                  RX bytes:840 (840.0 b)  TX bytes:1008 (1008.0 b)

p2p2              Link encap:Ethernet  HWaddr 00:13:3B:11:3D:A9
                  inet addr:10.0.1.22  Bcast:10.0.1.255  Mask:255.255.255.0
                  UP BROADCAST MULTICAST  MTU:1500  Metric:1
                  RX packets:0  errors:0  dropped:0  overruns:0  frame:0
                  TX packets:0  errors:0  dropped:0  overruns:0  carrier:0
                  collisions:0  txqueuelen:1000
                  RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

p4p1              Link encap:Ethernet  HWaddr D4:BE:D9:C4:0C:31
                  UP BROADCAST MULTICAST  MTU:1500  Metric:1
                  RX packets:0  errors:0  dropped:0  overruns:0  frame:0
                  TX packets:0  errors:0  dropped:0  overruns:0  carrier:0
                  collisions:0  txqueuelen:1000
                  RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

[root@hostB ~]#
```

Fig 2.1.2 Interface configuration for computer B

For computer C by using the table 2: IP addresses for exercise 2, get the IP Address of Ethernet Interface p2p1 and Network mask address. Run the command  
Ifconfig p2p1 128.143.137.144 netmask 255.255.255.192. The output can be seen in below Fig 2.1.3.



```

root@hostC:~
File Edit View Search Terminal Help
SIOCSIFBROADCAST: No such device
[root@hostC ~]# ifconfig 128.143.137.144/26
128.143.137.144: error fetching interface information: Device not found
[root@hostC ~]# ifconfig p2p1 128.143.137.144 netmask 255.255.255.192
[root@hostC ~]# ifconfig
lo                Link encap:Local Loopback
                  inet addr:127.0.0.1  Mask:255.0.0.0
                  inet6 addr: ::1/128 Scope:Host
                  UP LOOPBACK RUNNING  MTU:65536  Metric:1
                  RX packets:380 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:380 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:0
                  RX bytes:29424 (28.7 KiB)  TX bytes:29424 (28.7 KiB)

p2p1              Link encap:Ethernet  HWaddr 00:13:3B:21:78:45
                  inet addr:128.143.137.144  Bcast:128.143.137.191  Mask:255.255.255.192
                  inet6 addr: fe80::213:3bff:fe21:7845/64 Scope:Link
                  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
                  RX packets:8 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:480 (480.0 b)  TX bytes:1008 (1008.0 b)

p2p2              Link encap:Ethernet  HWaddr 00:13:3B:21:78:46
                  inet addr:10.0.1.23  Bcast:10.0.1.255  Mask:255.255.255.0
                  UP BROADCAST MULTICAST  MTU:1500  Metric:1
                  RX packets:0 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

p4p1              Link encap:Ethernet  HWaddr D4:BE:D9:DC:F6:2C
                  UP BROADCAST MULTICAST  MTU:1500  Metric:1
                  RX packets:0 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

[root@hostC ~]#

```

Fig 2.1.3 Interface configuration for computer C

For computer D by using the table 2: IP addresses for exercise 2, get the IP Address of Ethernet Interface p2p1 and Network mask address. Run the command  
 Ifconfig p2p1 128.143.137.32 netmask 255.255.255.192. The output can be seen in below Fig 2.1.4.

```

Applications  Places  System  root@hostD:~
Fri Sep 3, 3:06 AM  root

File Edit View Search Terminal Help

collisions:0 txqueuelen:1000
RX bytes:0 (0.0 b) TX bytes:0 (0.0 b)

[root@hostD ~]# ifconfig p2p1 128.143.137.32 netmask 255.255.255.192
[root@hostD ~]# ifconfig
lo                Link encap:Local Loopback
                  inet addr:127.0.0.1  Mask:255.0.0.0
                  inet6 addr: ::1/128 Scope:Host
                  UP LOOPBACK RUNNING  MTU:65536  Metric:1
                  RX packets:376 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:376 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:0
                  RX bytes:28652 (27.9 KiB)  TX bytes:28652 (27.9 KiB)

p2p1              Link encap:Ethernet  HWaddr 00:13:3B:21:78:17
                  inet addr:128.143.137.32  Bcast:128.143.137.63  Mask:255.255.255.192
                  inet6 addr: fe80::213:3bff:fe21:7817/64 Scope:Link
                  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
                  RX packets:4 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:240 (240.0 b)  TX bytes:1008 (1008.0 b)

p2p2              Link encap:Ethernet  HWaddr 00:13:3B:21:78:18
                  inet addr:10.0.1.24  Bcast:10.0.1.255  Mask:255.255.255.0
                  UP BROADCAST MULTICAST  MTU:1500  Metric:1
                  RX packets:0 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

p4p1              Link encap:Ethernet  HWaddr D4:BE:D9:C6:ED:C9
                  UP BROADCAST MULTICAST  MTU:1500  Metric:1
                  RX packets:0 errors:0 dropped:0 overruns:0 frame:0
                  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
                  collisions:0 txqueuelen:1000
                  RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

[root@hostD ~]#

```

Fig 2.1.4 Interface configuration for computer D

Run Wireshark on computer A and capture the packets for the following ping commands (running each on the “from” computer). Save the Wireshark output to a text file (clearing the Packet details option), and save the output of the ping commands, including any error messages.

- i. From A to C: ping -c 3 128.143.137.144

```

PING 128.143.137.144 (128.143.137.14) 56(84) bytes of data.
64 bytes from 128.143.137.14: icmp_seq=1 ttl=64 time=0.714 ms
64 bytes from 128.143.137.14: icmp_seq=1 ttl=64 time=0.237 ms
64 bytes from 128.143.137.14: icmp_seq=1 ttl=64 time=0.225 ms

```

--- 128.143.137.14 ping statistics ---

```

3 packets transmitted, 3 received, 0% packet loss, time 2000ms
rtt min/avg/max.mdev = 0.225/0.392/0.714/0.227 ms

```

And got lost.

ii. From A to B: ping -c 3 128.143.71.21

PING 128.143.137.144 (128.143.137.14) 56(84) bytes of data.  
64 bytes from 128.143.137.14: icmp\_seq=1 ttl=64 time=0.714 ms  
64 bytes from 128.143.137.14: icmp\_seq=1 ttl=64 time=0.237 ms  
64 bytes from 128.143.137.14: icmp\_seq=1 ttl=64 time=0.225 ms

--- 128.143.137.14 ping statistics ---  
3 packets transmitted, 3 received, 0% packet loss, time 2000ms  
rtt min/avg/max.mdev = 0.225/0.392/0.714/0.227 ms

iii. From A to D: ping -c 3 128.143.137.32

Time	Source	Destination	Protocol	Length	Info
1 0.000000000	00:13:3b:11:3d:9c	ff:ff:ff:ff:ff:ff	ARP	42	Who has
128.143.137.32?	Tell 128.143.71.201				
2 1.000020644	00:13:3b:11:3d:9c	ff:ff:ff:ff:ff:ff	ARP	42	Who has
128.143.137.32?	Tell 128.143.71.201				
3 2.000006769	00:13:3b:11:3d:9c	ff:ff:ff:ff:ff:ff	ARP	42	Who has
128.143.137.32?	Tell 128.143.71.201				

- iv. From D to A: ping -c 3 128.143.71.201 : Network Unreachable  
v. From B to D: ping -c 3 128.143.137.32 : Network Unreachable  
vi. From B to C: ping -c 3 128.143.137.144 : Network Unreachable

## WIRESHARK OUTPUT FOR FIRST THREE PINGS:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	00:13:3b:21:78:5d	ff:ff:ff:ff:ff:ff	ARP	42	Who has 128.143.137.144? Tell 128.143.71.201

Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0  
 Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)  
 Address Resolution Protocol (request)  
 Hardware type: Ethernet (1)  
 Protocol type: IP (0x0800)  
 Hardware size: 6  
 Protocol size: 4  
 Opcode: request (1)  
 Sender MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
 Sender IP address: 128.143.71.201 (128.143.71.201)  
 Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)  
 Target IP address: 128.143.137.144 (128.143.137.144)

No.	Time	Source	Destination	Protocol	Length	Info
2	1.000018220	00:13:3b:21:78:5d	ff:ff:ff:ff:ff:ff	ARP	42	Who has 128.143.137.144? Tell 128.143.71.201

Frame 2: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0  
 Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)  
 Address Resolution Protocol (request)  
 Hardware type: Ethernet (1)  
 Protocol type: IP (0x0800)  
 Hardware size: 6  
 Protocol size: 4  
 Opcode: request (1)  
 Sender MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
 Sender IP address: 128.143.71.201 (128.143.71.201)  
 Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)  
 Target IP address: 128.143.137.144 (128.143.137.144)

No.	Time	Source	Destination	Protocol	Length	Info
3	2.000017194	00:13:3b:21:78:5d	ff:ff:ff:ff:ff:ff	ARP	42	Who has 128.143.137.144? Tell 128.143.71.201

Frame 3: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0  
 Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)  
 Address Resolution Protocol (request)  
 Hardware type: Ethernet (1)  
 Protocol type: IP (0x0800)  
 Hardware size: 6

Protocol size: 4  
Opcode: request (1)  
Sender MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
Sender IP address: 128.143.71.201 (128.143.71.201)  
Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)  
Target IP address: 128.143.137.144 (128.143.137.144)

No.	Time	Source	Destination	Protocol	Length	Info
4	140.869002282	00:13:3b:21:78:5d	ff:ff:ff:ff:ff:ff	ARP	42	Who has 128.143.71.21? Tell 128.143.71.201

Frame 4: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0  
Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)  
Address Resolution Protocol (request)

Hardware type: Ethernet (1)  
Protocol type: IP (0x0800)  
Hardware size: 6  
Protocol size: 4  
Opcode: request (1)  
Sender MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
Sender IP address: 128.143.71.201 (128.143.71.201)  
Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)  
Target IP address: 128.143.71.21 (128.143.71.21)

No.	Time	Source	Destination	Protocol	Length	Info
5	140.869235185	00:13:3b:11:3d:a8	00:13:3b:21:78:5d	ARP	60	128.143.71.21 is at 00:13:3b:11:3d:a8

Frame 5: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0  
Ethernet II, Src: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8), Dst: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
Address Resolution Protocol (reply)

Hardware type: Ethernet (1)  
Protocol type: IP (0x0800)  
Hardware size: 6  
Protocol size: 4  
Opcode: reply (2)  
Sender MAC address: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8)  
Sender IP address: 128.143.71.21 (128.143.71.21)  
Target MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
Target IP address: 128.143.71.201 (128.143.71.201)

No.	Time	Source	Destination	Protocol	Length	Info
6	140.869245941	128.143.71.201	128.143.71.21	ICMP	98	Echo (ping) request id=0x7d10, seq=1/256, ttl=64

Frame 6: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0  
 Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: 00:13:3b:11:3d:a8  
 (00:13:3b:11:3d:a8)  
 Internet Protocol Version 4, Src: 128.143.71.201 (128.143.71.201), Dst: 128.143.71.21  
 (128.143.71.21)  
 Internet Control Message Protocol

No.	Time	Source	Destination	Protocol	Length	Info
7	140.869383700	128.143.71.21	128.143.71.201	ICMP	98	Echo (ping) reply id=0x7d10, seq=1/256, ttl=64

Frame 7: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0  
 Ethernet II, Src: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8), Dst: 00:13:3b:21:78:5d  
 (00:13:3b:21:78:5d)  
 Internet Protocol Version 4, Src: 128.143.71.21 (128.143.71.21), Dst: 128.143.71.201  
 (128.143.71.201)  
 Internet Control Message Protocol

No.	Time	Source	Destination	Protocol	Length	Info
8	141.869532178	128.143.71.201	128.143.71.21	ICMP	98	Echo (ping) request id=0x7d10, seq=2/512, ttl=64

Frame 8: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0  
 Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: 00:13:3b:11:3d:a8  
 (00:13:3b:11:3d:a8)  
 Internet Protocol Version 4, Src: 128.143.71.201 (128.143.71.201), Dst: 128.143.71.21  
 (128.143.71.21)  
 Internet Control Message Protocol

No.	Time	Source	Destination	Protocol	Length	Info
9	141.869746938	128.143.71.21	128.143.71.201	ICMP	98	Echo (ping) reply id=0x7d10, seq=2/512, ttl=64

Frame 9: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0  
 Ethernet II, Src: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8), Dst: 00:13:3b:21:78:5d  
 (00:13:3b:21:78:5d)  
 Internet Protocol Version 4, Src: 128.143.71.21 (128.143.71.21), Dst: 128.143.71.201  
 (128.143.71.201)  
 Internet Control Message Protocol

No.	Time	Source	Destination	Protocol	Length	Info
10	142.869043315	128.143.71.201	128.143.71.21	ICMP	98	Echo (ping) request id=0x7d10, seq=3/768, ttl=64

Frame 10: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0

Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8)

Internet Protocol Version 4, Src: 128.143.71.201 (128.143.71.201), Dst: 128.143.71.21 (128.143.71.21)

Internet Control Message Protocol

No.	Time	Source	Destination	Protocol	Length	Info
11	142.869259313	128.143.71.21	128.143.71.201	ICMP	98	Echo (ping) reply id=0x7d10, seq=3/768, ttl=64

Frame 11: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0

Ethernet II, Src: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8), Dst: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)

Internet Protocol Version 4, Src: 128.143.71.21 (128.143.71.21), Dst: 128.143.71.201 (128.143.71.201)

Internet Control Message Protocol

No.	Time	Source	Destination	Protocol	Length	Info
12	145.869046684	00:13:3b:11:3d:a8	00:13:3b:21:78:5d	ARP	60	Who has 128.143.71.201? Tell 128.143.71.21

Frame 12: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0

Ethernet II, Src: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8), Dst: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)

Address Resolution Protocol (request)

Hardware type: Ethernet (1)

Protocol type: IP (0x0800)

Hardware size: 6

Protocol size: 4

Opcode: request (1)

Sender MAC address: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8)

Sender IP address: 128.143.71.21 (128.143.71.21)

Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)

Target IP address: 128.143.71.201 (128.143.71.201)

No.	Time	Source	Destination	Protocol	Length	Info
13	145.869059214	00:13:3b:21:78:5d	00:13:3b:11:3d:a8	ARP	42	128.143.71.201 is at 00:13:3b:21:78:5d

Frame 13: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0

Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8)

Address Resolution Protocol (reply)

Hardware type: Ethernet (1)

Protocol type: IP (0x0800)

Hardware size: 6

Protocol size: 4  
Opcode: reply (2)  
Sender MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
Sender IP address: 128.143.71.201 (128.143.71.201)  
Target MAC address: 00:13:3b:11:3d:a8 (00:13:3b:11:3d:a8)  
Target IP address: 128.143.71.21 (128.143.71.21)

No.	Time	Source	Destination	Protocol	Length	Info
14	797.889032979	00:13:3b:21:78:5d	ff:ff:ff:ff:ff:ff	ARP	42	Who has 128.143.137.32? Tell 128.143.71.201

Frame 14: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0  
Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)  
Address Resolution Protocol (request)

Hardware type: Ethernet (1)  
Protocol type: IP (0x0800)  
Hardware size: 6  
Protocol size: 4  
Opcode: request (1)  
Sender MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
Sender IP address: 128.143.71.201 (128.143.71.201)  
Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)  
Target IP address: 128.143.137.32 (128.143.137.32)

No.	Time	Source	Destination	Protocol	Length	Info
15	798.889061181	00:13:3b:21:78:5d	ff:ff:ff:ff:ff:ff	ARP	42	Who has 128.143.137.32? Tell 128.143.71.201

Frame 15: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0  
Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)  
Address Resolution Protocol (request)

Hardware type: Ethernet (1)  
Protocol type: IP (0x0800)  
Hardware size: 6  
Protocol size: 4  
Opcode: request (1)  
Sender MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)  
Sender IP address: 128.143.71.201 (128.143.71.201)  
Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)  
Target IP address: 128.143.137.32 (128.143.137.32)

No.	Time	Source	Destination	Protocol	Length	Info
16	799.889058029	00:13:3b:21:78:5d	ff:ff:ff:ff:ff:ff	ARP	42	Who has 128.143.137.32? Tell 128.143.71.201

Frame 16: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0



Ethernet II, Src: 00:13:3b:21:78:5d (00:13:3b:21:78:5d), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)

Address Resolution Protocol (request)

Hardware type: Ethernet (1)

Protocol type: IP (0x0800)

Hardware size: 6

Protocol size: 4

Opcode: request (1)

Sender MAC address: 00:13:3b:21:78:5d (00:13:3b:21:78:5d)

Sender IP address: 128.143.71.201 (128.143.71.201)

Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)

Target IP address: 128.143.137.32 (128.143.137.32)

**EXERCISE 3: Testing ssh keys.** Be sure that all screen shots include the ASUrite id of a group member. This should be in the login prompt when you ssh into a VM.

- i. Take a screen shot of your topology once it is ready (it should resemble Figure 3-9) and include it in your report.

The screenshot displays the GENI Portal interface. At the top, the header includes the GENI logo, the text 'GENI Portal', and navigation links: Home, Tools, Partners, Help, and Venkatesh Yaganti. Below the header is a dark navigation bar with tabs: Resources, Aggregates, Map, Members, Info, and Logs. The main content area shows details for a slice named 'vyaganti1' with project 'ASU-CSE434-Fall2021'. It indicates the slice expires in 6 days and the project expires in 97 days. Action buttons include 'Add Resources', 'Renew', 'Update SSH Keys', and 'Tools'. A 'Manage Resources' section shows a message 'Resources on Kentucky InstaGENI are ready.' with a 'View Rspec' button. Below this is a form for adding resources, including fields for Name (server), SSH to (syrotiu@pc2.lan.sdn.uky.edu:25011, asarabi3@pc2.lan.sdn.uky.edu:25011), Node Type (Other...), and Hardware Type (any). A diagram shows a 'server' node connected to a 'client' node. At the bottom, there are buttons for Renew, Renew Date, Delete, SSH, Restart, Snapshot, Details, Add Resources, and Expand. The footer shows 'GENI Portal Version 3.26' and 'Copyright © 2017 Raytheon BBN Technologies'.

- ii. Give the interface names and IPv4 addresses of the client and server assigned to the data plane and the control plane and include them in your report. (The data plane interfaces have IPv4 addresses of the form 10.1.x.y.)

For Server:

The control interface: 172.17.1.4

The data interface: 10.10.1.1

```
vyaganti@server: ~  
* Authenticating with public key "imported-openssh-key" from agent  
Welcome to Ubuntu 18.04.1 LTS (GNU/Linux 4.15.0-147-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/advantage  
  
* Super-optimized for small spaces - read how we shrank the memory  
  footprint of MicroK8s to make it the smallest full K8s around.  
  https://ubuntu.com/blog/microk8s-memory-optimisation  
  
* Canonical Livepatch is available for installation.  
  - Reduce system reboots and improve kernel security. Activate at:  
    https://ubuntu.com/livepatch  
  
The programs included with the Ubuntu system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by  
applicable law.  
  
vyaganti@server:~$ sudo ifconfig  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 172.17.1.4 netmask 255.240.0.0 broadcast 172.31.255.255  
    inet6 fe80::f5:1fff:fe97:389 prefixlen 64 scopeid 0x20<link>  
    ether 02:f5:1f:97:03:89 txqueuelen 1000 (Ethernet)  
    RX packets 1540 bytes 161015 (161.0 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 1485 bytes 150899 (150.8 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 10.10.1.1 netmask 255.255.255.0 broadcast 10.10.1.255  
    inet6 fe80::c3:28ff:fa5a:564c prefixlen 64 scopeid 0x20<link>  
    ether 02:c5:28:fa:56:4c txqueuelen 1000 (Ethernet)  
    RX packets 47 bytes 3301 (3.3 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 14 bytes 1708 (1.7 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
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 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  
  
vyaganti@server:~$
```

For Client:

The control interface: 172.17.1.3

The data interface: 10.10.1.2

```
vyaganti@client:~$  
* Authenticating with public key "imported-openssh-key" from agent  
Welcome to Ubuntu 18.04.1 LTS (GNU/Linux 4.15.0-147-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/advantage  
  
* Super-optimized for small spaces - read how we shrank the memory  
  footprint of MicroK8s to make it the smallest full K8s around.  
  https://ubuntu.com/blog/microk8s-memory-optimisation  
  
* Canonical Livepatch is available for installation.  
  - Reduce system reboots and improve kernel security. Activate at:  
    https://ubuntu.com/livepatch  
  
The programs included with the Ubuntu system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by  
applicable law.  
  
vyaganti@client:~$ sudo ifconfig  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500  
    inet 172.17.1.3 netmask 255.240.0.0 broadcast 172.31.255.255  
    inet6 fe80::42:8bff:fe3d:156 prefixlen 64 scopeid 0x20<link>  
    ether 02:43:8b:59:d1:96 txqueuelen 1000 (Ethernet)  
    RX packets 1506 bytes 152771 (152.7 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 1648 bytes 141300 (141.3 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500  
    inet 10.10.1.2 netmask 255.255.255.0 broadcast 10.10.1.255  
    inet6 fe80::ee:4aff:fe6d:4b64 prefixlen 64 scopeid 0x20<link>  
    ether 02:ee:4a:6d:4b:64 txqueuelen 1000 (Ethernet)  
    RX packets 31 bytes 1928 (1.9 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 13 bytes 1387 (1.3 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
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 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  
  
vyaganti@client:~$
```

iii. Take a screen shot of ping output on the client in 5.1(c) of the instructions.

```
vyaganti@server:~$ ping 10.10.1.1 -c 5  
PING 10.10.1.1 (10.10.1.1) 56(84) bytes of data:  
64 bytes from 10.10.1.1: icmp_seq=1 ttl=64 time=0.035 ms  
64 bytes from 10.10.1.1: icmp_seq=2 ttl=64 time=0.051 ms  
64 bytes from 10.10.1.1: icmp_seq=3 ttl=64 time=0.051 ms  
64 bytes from 10.10.1.1: icmp_seq=4 ttl=64 time=0.049 ms  
64 bytes from 10.10.1.1: icmp_seq=5 ttl=64 time=0.050 ms  
  
--- 10.10.1.1 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4084ms  
rtt min/avg/max/mdev = 0.035/0.047/0.051/0.007 ms  
vyaganti@server:~$
```

```
vyaganti@server:~$ ping 10.10.1.1 -c 5  
PING 10.10.1.1 (10.10.1.1) 56(84) bytes of data:  
64 bytes from 10.10.1.1: icmp_seq=1 ttl=64 time=0.035 ms  
64 bytes from 10.10.1.1: icmp_seq=2 ttl=64 time=0.051 ms  
64 bytes from 10.10.1.1: icmp_seq=3 ttl=64 time=0.051 ms  
64 bytes from 10.10.1.1: icmp_seq=4 ttl=64 time=0.049 ms  
64 bytes from 10.10.1.1: icmp_seq=5 ttl=64 time=0.050 ms  
  
--- 10.10.1.1 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4084ms  
rtt min/avg/max/mdev = 0.035/0.047/0.051/0.007 ms  
vyaganti@server:~$ ping 172.17.1.4 -c 5  
PING 172.17.1.4 (172.17.1.4) 56(84) bytes of data:  
64 bytes from 172.17.1.4: icmp_seq=1 ttl=64 time=0.037 ms  
64 bytes from 172.17.1.4: icmp_seq=2 ttl=64 time=0.050 ms  
64 bytes from 172.17.1.4: icmp_seq=3 ttl=64 time=0.051 ms  
64 bytes from 172.17.1.4: icmp_seq=4 ttl=64 time=0.049 ms  
64 bytes from 172.17.1.4: icmp_seq=5 ttl=64 time=0.051 ms  
  
--- 172.17.1.4 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4093ms  
rtt min/avg/max/mdev = 0.037/0.045/0.051/0.009 ms  
vyaganti@server:~$
```

- iv. Delete the resources from this slice when you are finished. This results in an empty slice that can be reused, i.e., other resources can be added to into it.

Deleted the resources using the “Delete” button under the slice in GENI portal.

**EXERCISE 4: Design Subnets.** Solve the subnet design problem posed in the section Challenge: Design Subnets that meets the requirements.

For LAN-A:

1. The subnet mask: 255.255.255.192
2. The network address: 10.10.172.128
3. The smallest IPv4 address that may be assigned to a host in the subnet: 10.10.172.129
4. The broadcast address for the subnet: 10.10.172.191
5. The highest IPv4 address that may be assigned to a host in the subnet: 10.10.172.190

For LAN-B:

1. The subnet mask: 255.255.255.128
2. The network address: 10.10.172.0
3. The smallest IPv4 address that may be assigned to a host in the subnet: 10.10.172.1
4. The broadcast address for the subnet: 10.10.172.127
5. The highest IPv4 address that may be assigned to a host in the subnet: 10.10.172.126

For LAN-C:

1. The subnet mask: 255.255.255.224
2. The network address: 10.10.172.192
3. The smallest IPv4 address that may be assigned to a host in the subnet: 10.10.172.193
4. The broadcast address for the subnet: 10.10.172.223
5. The highest IPv4 address that may be assigned to a host in the subnet: 10.10.172.222

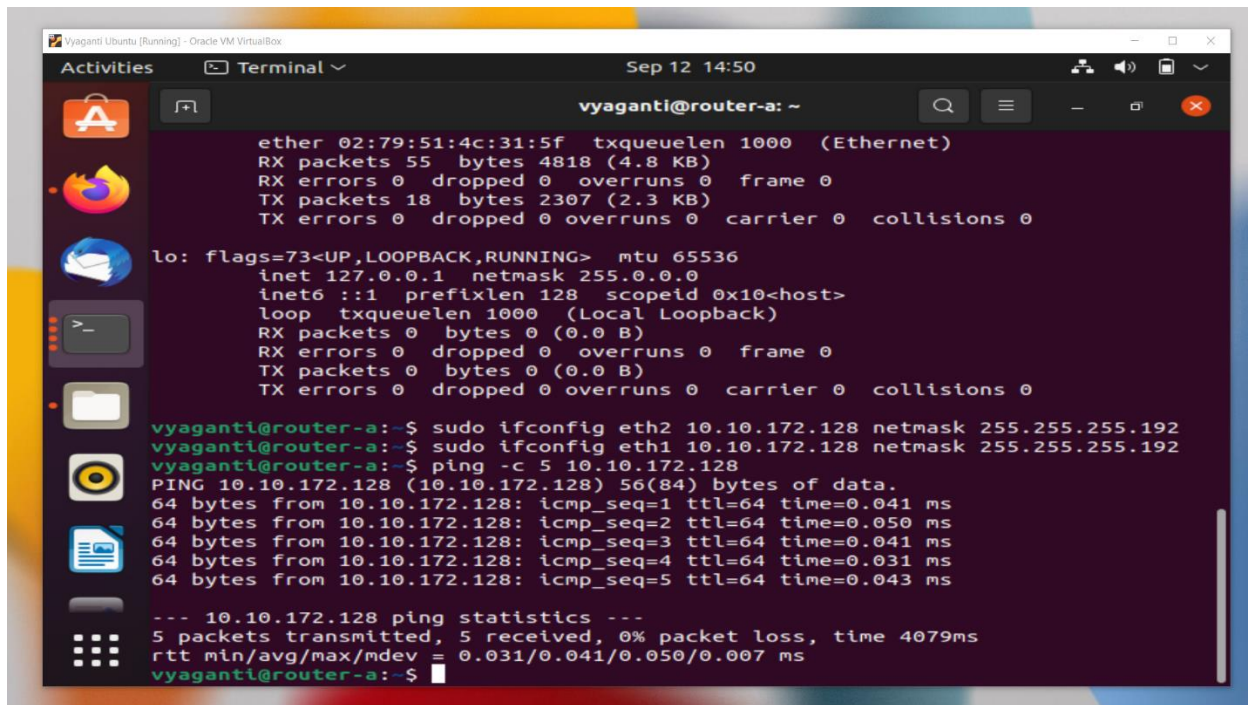
EXERCISE 5: Implement your Design. Configure the IPv4 address and subnet mask of each host in each LAN using your solution to Exercise 4.

- i. Take a screen shot showing the output of the ping -c 5 IP command between the two hosts in the same LAN and include each one in your report.

```
vyaganti@router-c: ~  
ether 02:84:0b:4f:24:f1 txqueuelen 1000 (Ethernet)  
RX packets 35 bytes 2722 (2.7 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 9 bytes 1033 (1.0 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
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 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  
  
vyaganti@router-c:~$ sudo ifconfig eth2 10.10.172.192 netmask 255.255.255.224  
vyaganti@router-c:~$ sudo ifconfig eth1 10.10.172.192 netmask 255.255.255.224  
vyaganti@router-c:~$ ping -c 5 10.10.172.192  
PING 10.10.172.192 (10.10.172.192) 56(84) bytes of data:  
64 bytes from 10.10.172.192: icmp_seq=1 ttl=64 time=0.035 ms  
64 bytes from 10.10.172.192: icmp_seq=2 ttl=64 time=0.036 ms  
64 bytes from 10.10.172.192: icmp_seq=3 ttl=64 time=0.030 ms  
64 bytes from 10.10.172.192: icmp_seq=4 ttl=64 time=0.034 ms  
64 bytes from 10.10.172.192: icmp_seq=5 ttl=64 time=0.030 ms  
  
--- 10.10.172.192 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4097ms  
rtt min/avg/max/mdev = 0.030/0.033/0.036/0.002 ms  
vyaganti@router-c:~$
```

```
vyaganti@router-b: ~  
ether 02:4e:e9:72:20:65 txqueuelen 1000 (Ethernet)  
RX packets 33 bytes 2347 (2.3 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 23 bytes 3227 (3.2 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
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 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  
  
vyaganti@router-b:~$ sudo ifconfig eth2 10.10.172.0 netmask 255.255.255.128  
vyaganti@router-b:~$ sudo ifconfig eth1 10.10.172.0 netmask 255.255.255.128  
vyaganti@router-b:~$ ping -c 5 10.10.172.0  
PING 10.10.172.0 (10.10.172.0) 56(84) bytes of data:  
64 bytes from 10.10.172.0: icmp_seq=1 ttl=64 time=0.034 ms  
64 bytes from 10.10.172.0: icmp_seq=2 ttl=64 time=0.042 ms  
64 bytes from 10.10.172.0: icmp_seq=3 ttl=64 time=0.041 ms  
64 bytes from 10.10.172.0: icmp_seq=4 ttl=64 time=0.031 ms  
64 bytes from 10.10.172.0: icmp_seq=5 ttl=64 time=0.041 ms  
  
--- 10.10.172.0 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4096ms  
rtt min/avg/max/mdev = 0.031/0.037/0.042/0.008 ms  
vyaganti@router-b:~$
```





```

vyaganti@router-a: ~
ether 02:79:51:4c:31:5f txqueuelen 1000 (Ethernet)
RX packets 55 bytes 4818 (4.8 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 18 bytes 2307 (2.3 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

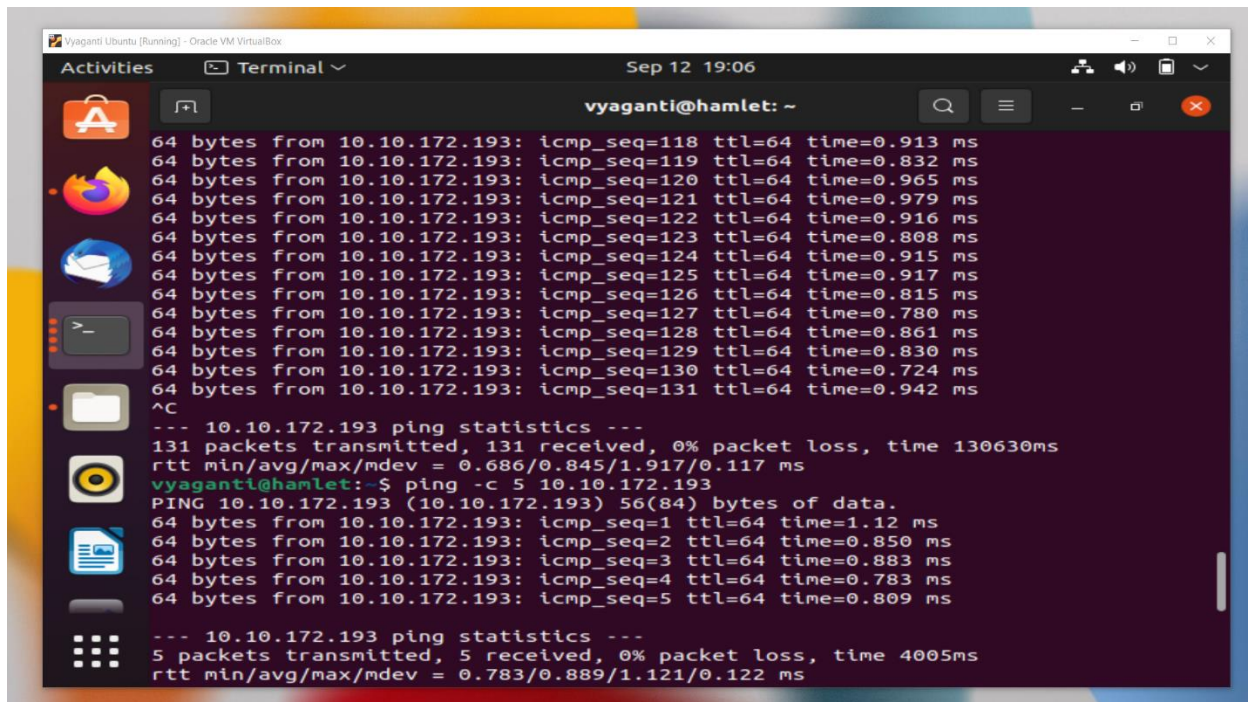
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
inet 127.0.0.1 netmask 255.0.0.0
inet6 ::1 prefixlen 128 scopeid 0x10<host>
loop txqueuelen 1000 (Local Loopback)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

vyaganti@router-a:~$ sudo ifconfig eth2 10.10.172.128 netmask 255.255.255.192
vyaganti@router-a:~$ sudo ifconfig eth1 10.10.172.128 netmask 255.255.255.192
vyaganti@router-a:~$ ping -c 5 10.10.172.128
PING 10.10.172.128 (10.10.172.128) 56(84) bytes of data.
64 bytes from 10.10.172.128: icmp_seq=1 ttl=64 time=0.041 ms
64 bytes from 10.10.172.128: icmp_seq=2 ttl=64 time=0.050 ms
64 bytes from 10.10.172.128: icmp_seq=3 ttl=64 time=0.041 ms
64 bytes from 10.10.172.128: icmp_seq=4 ttl=64 time=0.031 ms
64 bytes from 10.10.172.128: icmp_seq=5 ttl=64 time=0.043 ms

--- 10.10.172.128 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4079ms
rtt min/avg/max/mdev = 0.031/0.041/0.050/0.007 ms
vyaganti@router-a:~$

```

- ii. Take a screen shot showing the output of the ping -c 5 IP between a host in LAN A and a host in LAN B, between a host in LAN B and a host in LAN C, and between a host in LAN C and a host in LAN A, and include them in your report.



```

vyaganti@hamlet: ~
64 bytes from 10.10.172.193: icmp_seq=118 ttl=64 time=0.913 ms
64 bytes from 10.10.172.193: icmp_seq=119 ttl=64 time=0.832 ms
64 bytes from 10.10.172.193: icmp_seq=120 ttl=64 time=0.965 ms
64 bytes from 10.10.172.193: icmp_seq=121 ttl=64 time=0.979 ms
64 bytes from 10.10.172.193: icmp_seq=122 ttl=64 time=0.916 ms
64 bytes from 10.10.172.193: icmp_seq=123 ttl=64 time=0.808 ms
64 bytes from 10.10.172.193: icmp_seq=124 ttl=64 time=0.915 ms
64 bytes from 10.10.172.193: icmp_seq=125 ttl=64 time=0.917 ms
64 bytes from 10.10.172.193: icmp_seq=126 ttl=64 time=0.815 ms
64 bytes from 10.10.172.193: icmp_seq=127 ttl=64 time=0.780 ms
64 bytes from 10.10.172.193: icmp_seq=128 ttl=64 time=0.861 ms
64 bytes from 10.10.172.193: icmp_seq=129 ttl=64 time=0.830 ms
64 bytes from 10.10.172.193: icmp_seq=130 ttl=64 time=0.724 ms
64 bytes from 10.10.172.193: icmp_seq=131 ttl=64 time=0.942 ms
^C
--- 10.10.172.193 ping statistics ---
131 packets transmitted, 131 received, 0% packet loss, time 130630ms
rtt min/avg/max/mdev = 0.686/0.845/1.917/0.117 ms
vyaganti@hamlet:~$ ping -c 5 10.10.172.193
PING 10.10.172.193 (10.10.172.193) 56(84) bytes of data.
64 bytes from 10.10.172.193: icmp_seq=1 ttl=64 time=1.12 ms
64 bytes from 10.10.172.193: icmp_seq=2 ttl=64 time=0.850 ms
64 bytes from 10.10.172.193: icmp_seq=3 ttl=64 time=0.883 ms
64 bytes from 10.10.172.193: icmp_seq=4 ttl=64 time=0.783 ms
64 bytes from 10.10.172.193: icmp_seq=5 ttl=64 time=0.809 ms

--- 10.10.172.193 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 0.783/0.889/1.121/0.122 ms

```

```
vyaganti@othello: ~  
inet6 fe80::9d:b7ff:fe1c:8f9c prefixlen 64 scopeid 0x20<link>  
ether 02:9d:b7:1c:8f:9c txqueuelen 1000 (Ethernet)  
RX packets 55 bytes 4985 (4.9 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 19 bytes 2154 (2.1 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
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 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  
  
vyaganti@othello:~$ sudo ifconfig eth1 10.10.172.1 netmask 255.255.255.128  
vyaganti@othello:~$ ping -c 5 10.10.172.126  
PING 10.10.172.126 (10.10.172.126) 56(84) bytes of data.  
64 bytes from 10.10.172.126: icmp_seq=1 ttl=64 time=1.90 ms  
64 bytes from 10.10.172.126: icmp_seq=2 ttl=64 time=0.864 ms  
64 bytes from 10.10.172.126: icmp_seq=3 ttl=64 time=0.838 ms  
64 bytes from 10.10.172.126: icmp_seq=4 ttl=64 time=0.679 ms  
64 bytes from 10.10.172.126: icmp_seq=5 ttl=64 time=0.677 ms  
  
--- 10.10.172.126 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4005ms  
rtt min/avg/max/mdev = 0.677/0.993/1.908/0.464 ms  
vyaganti@othello:~$
```

```
vyaganti@romeo: ~  
inet6 fe80::e7:84ff:fee6:c02b prefixlen 64 scopeid 0x20<link>  
ether 02:e7:84:e6:c0:2b txqueuelen 1000 (Ethernet)  
RX packets 40 bytes 2965 (2.9 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 22 bytes 2683 (2.6 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
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 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  
  
vyaganti@romeo:~$ sudo ifconfig eth1 10.10.172.129 netmask 255.255.255.192  
vyaganti@romeo:~$ ping -c 5 10.10.172.190  
PING 10.10.172.190 (10.10.172.190) 56(84) bytes of data.  
64 bytes from 10.10.172.190: icmp_seq=1 ttl=64 time=1.38 ms  
64 bytes from 10.10.172.190: icmp_seq=2 ttl=64 time=0.480 ms  
64 bytes from 10.10.172.190: icmp_seq=3 ttl=64 time=0.525 ms  
64 bytes from 10.10.172.190: icmp_seq=4 ttl=64 time=0.554 ms  
64 bytes from 10.10.172.190: icmp_seq=5 ttl=64 time=0.480 ms  
  
--- 10.10.172.190 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4047ms  
rtt min/avg/max/mdev = 0.480/0.684/1.381/0.349 ms  
vyaganti@romeo:~$
```



EXERCISE 6: Add Routing Rules. Configure the route on each host in each LAN, and also on each router.

- i. Take a screen shot of the output of the route -n command on each node and on each router and include it in your report

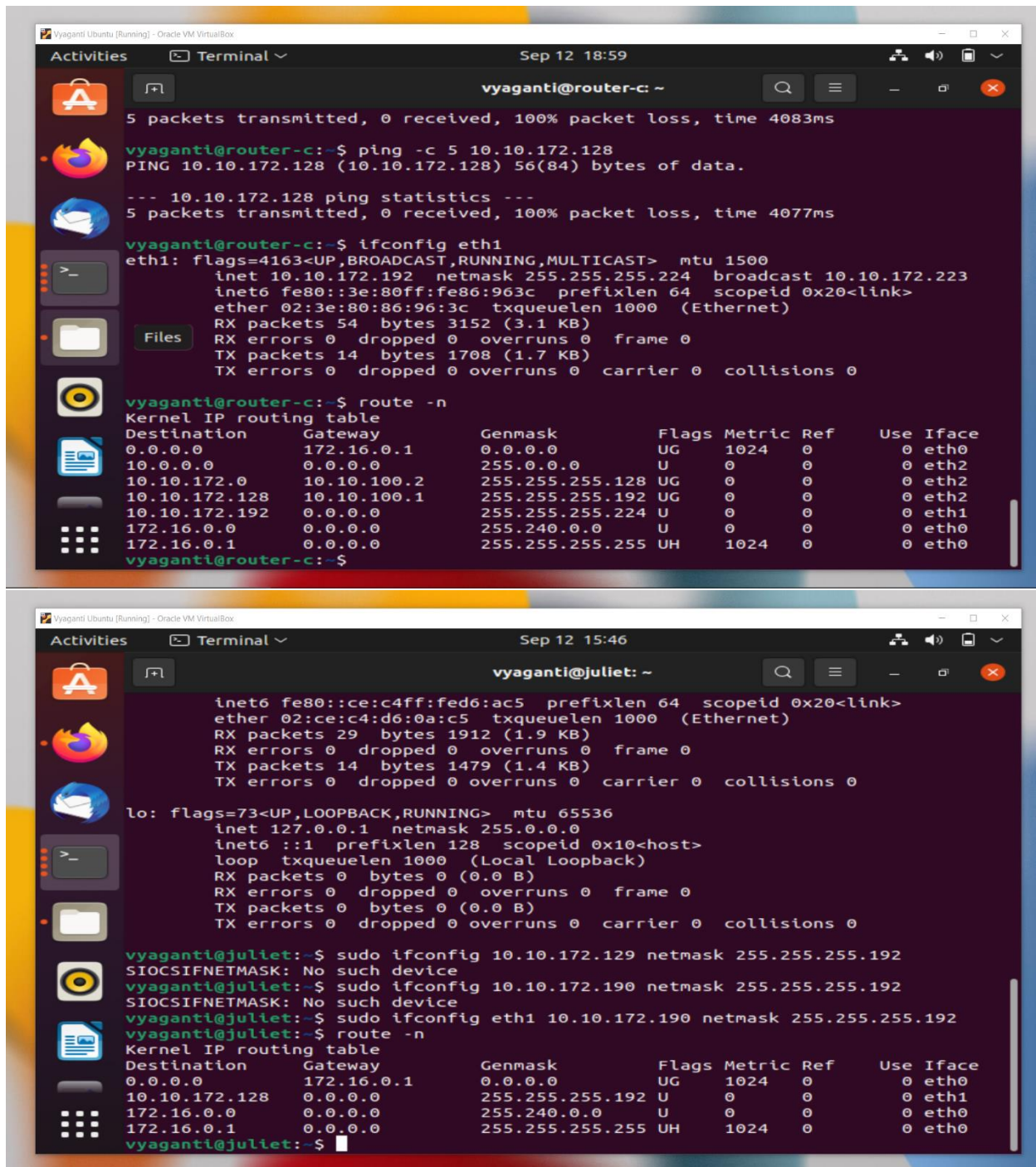
The top screenshot shows the terminal for router-a. It displays network statistics for eth0 and eth2, followed by a ping test to 10.10.172.192 which shows 100% packet loss. The user then attempts to configure eth1 with IP 10.10.128, which fails due to permissions. Finally, the user runs 'route -n' to display the kernel IP routing table.

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	172.16.0.1	0.0.0.0	UG	1024	0	0	eth0
10.0.0.0	0.0.0.0	255.0.0.0	U	0	0	0	eth2
10.10.172.0	10.10.100.2	255.255.255.128	UG	0	0	0	eth2
10.10.172.128	0.0.0.0	255.255.255.192	U	0	0	0	eth1
10.10.172.192	10.10.100.3	255.255.255.224	UG	0	0	0	eth2
172.16.0.0	0.0.0.0	255.240.0.0	U	0	0	0	eth0
172.16.0.1	0.0.0.0	255.255.255.255	UH	1024	0	0	eth0

The bottom screenshot shows the terminal for router-b. It displays network statistics for the loopback interface lo. The user then adds two static routes using 'sudo route add': one for the 10.10.172.128/24 network pointing to gateway 10.10.100.1, and another for the 10.10.172.192/24 network pointing to gateway 10.10.100.3. Finally, the user runs 'route -n' to display the updated kernel IP routing table.

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	172.16.0.1	0.0.0.0	UG	1024	0	0	eth0
10.0.0.0	0.0.0.0	255.0.0.0	U	0	0	0	eth2
10.10.172.0	0.0.0.0	255.255.255.128	U	0	0	0	eth1
10.10.172.128	10.10.100.1	255.255.255.192	UG	0	0	0	eth2
10.10.172.192	10.10.100.3	255.255.255.224	UG	0	0	0	eth2
172.16.0.0	0.0.0.0	255.240.0.0	U	0	0	0	eth0
172.16.0.1	0.0.0.0	255.255.255.255	UH	1024	0	0	eth0





The image displays two screenshots of a terminal window within a virtual machine environment, showing network configuration and status checks.

**Top Screenshot (Sep 12 18:59):**

The terminal is running on a host named `vyaganti@router-c`. The user performs the following commands:

- `ping -c 5 10.10.172.128`: Results in 5 packets transmitted, 0 received, 100% packet loss, time 4083ms.
- `ifconfig eth1`: Shows configuration for `eth1` with IP `10.10.172.192`, netmask `255.255.255.224`, and broadcast `10.10.172.223`. It also shows RX and TX statistics.
- `route -n`: Displays the Kernel IP routing table.

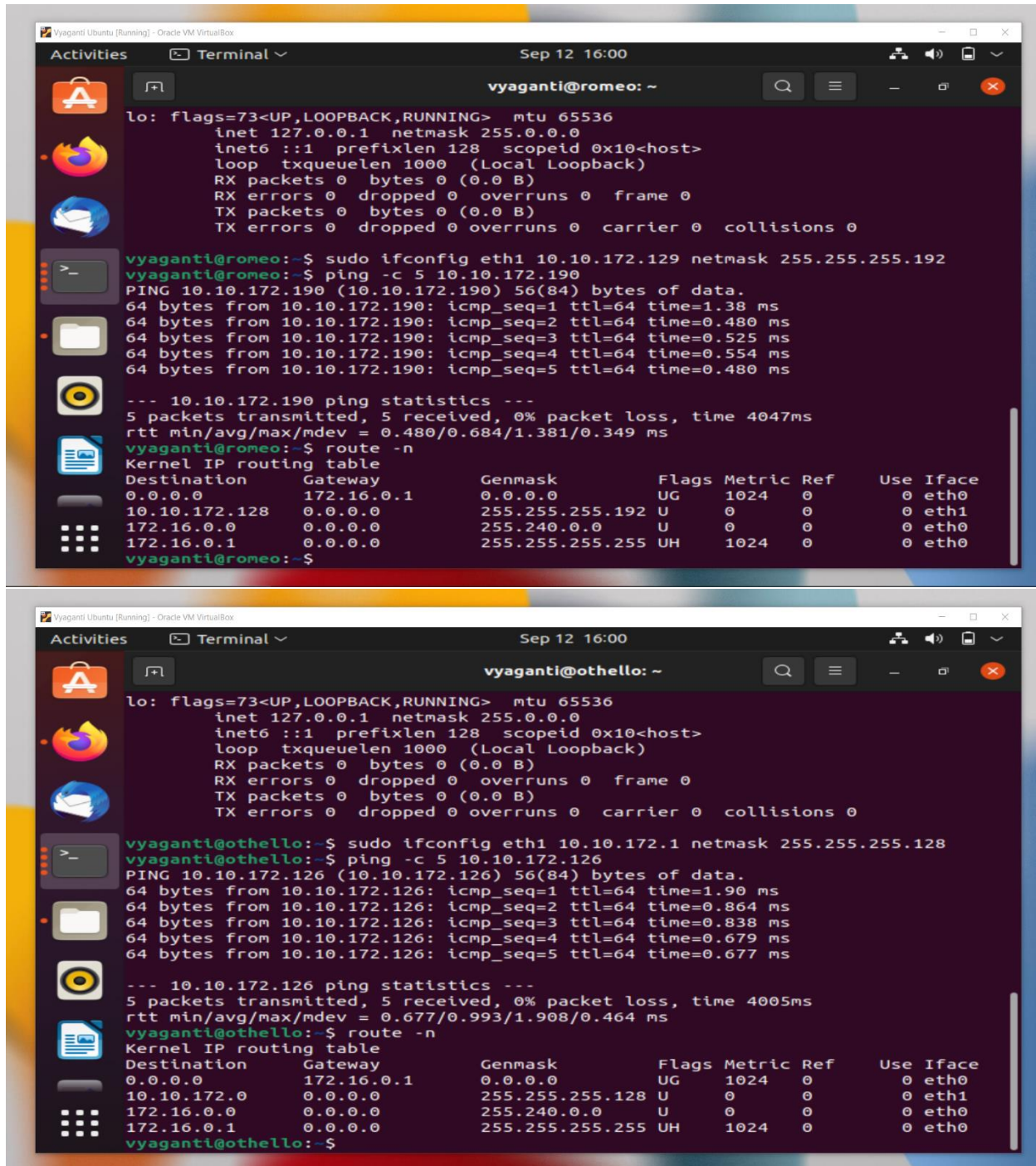
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	172.16.0.1	0.0.0.0	UG	1024	0	0	eth0
10.0.0.0	0.0.0.0	255.0.0.0	U	0	0	0	eth2
10.10.172.0	10.10.100.2	255.255.255.128	UG	0	0	0	eth2
10.10.172.128	10.10.100.1	255.255.255.192	UG	0	0	0	eth2
10.10.172.192	0.0.0.0	255.255.255.224	U	0	0	0	eth1
172.16.0.0	0.0.0.0	255.240.0.0	U	0	0	0	eth0
172.16.0.1	0.0.0.0	255.255.255.255	UH	1024	0	0	eth0

**Bottom Screenshot (Sep 12 15:46):**

The terminal is running on a host named `vyaganti@juliet`. The user performs the following commands:

- `ifconfig eth1`: Shows configuration for `eth1` with IP `10.10.172.190`, netmask `255.255.255.192`, and broadcast `10.10.172.223`. It also shows RX and TX statistics.
- `route -n`: Displays the Kernel IP routing table.

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	172.16.0.1	0.0.0.0	UG	1024	0	0	eth0
10.10.172.128	0.0.0.0	255.255.255.192	U	0	0	0	eth1
172.16.0.0	0.0.0.0	255.240.0.0	U	0	0	0	eth0
172.16.0.1	0.0.0.0	255.255.255.255	UH	1024	0	0	eth0



The image shows two screenshots of a terminal window in a virtual machine, likely Oracle VM VirtualBox, running Vyaganti Ubuntu. The terminal window has a title bar with 'Vyaganti Ubuntu [Running] - Oracle VM VirtualBox' and a date/time display of 'Sep 12 16:00'. The terminal shows the user 'vyaganti' at the prompt 'vyaganti@romeo: ~' in the first screenshot and 'vyaganti@othello: ~' in the second. The terminal output includes the status of the loopback interface 'lo', the configuration of the ethernet interface 'eth1' using 'sudo ifconfig', and the results of a 'ping -c 5' command to a specific IP address. The ping statistics show 5 packets transmitted, 5 received, and 0% packet loss. The routing table is also displayed using 'route -n', showing the kernel IP routing table with columns for Destination, Gateway, Genmask, Flags, Metric, Ref, Use, and Iface.

```

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 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

vyaganti@romeo:~$ sudo ifconfig eth1 10.10.172.129 netmask 255.255.255.192
vyaganti@romeo:~$ ping -c 5 10.10.172.190
PING 10.10.172.190 (10.10.172.190) 56(84) bytes of data:
64 bytes from 10.10.172.190: icmp_seq=1 ttl=64 time=1.38 ms
64 bytes from 10.10.172.190: icmp_seq=2 ttl=64 time=0.480 ms
64 bytes from 10.10.172.190: icmp_seq=3 ttl=64 time=0.525 ms
64 bytes from 10.10.172.190: icmp_seq=4 ttl=64 time=0.554 ms
64 bytes from 10.10.172.190: icmp_seq=5 ttl=64 time=0.480 ms

--- 10.10.172.190 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4047ms
rtt min/avg/max/mdev = 0.480/0.684/1.381/0.349 ms
vyaganti@romeo:~$ route -n
Kernel IP routing table
Destination        Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0            172.16.0.1     0.0.0.0         UG    1024  0      0 eth0
10.10.172.128      0.0.0.0        255.255.255.192 U    0    0      0 eth1
172.16.0.0         0.0.0.0        255.240.0.0     U    0    0      0 eth0
172.16.0.1         0.0.0.0        255.255.255.255 UH   1024  0      0 eth0
vyaganti@romeo:~$

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 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

vyaganti@othello:~$ sudo ifconfig eth1 10.10.172.1 netmask 255.255.255.128
vyaganti@othello:~$ ping -c 5 10.10.172.126
PING 10.10.172.126 (10.10.172.126) 56(84) bytes of data:
64 bytes from 10.10.172.126: icmp_seq=1 ttl=64 time=1.90 ms
64 bytes from 10.10.172.126: icmp_seq=2 ttl=64 time=0.864 ms
64 bytes from 10.10.172.126: icmp_seq=3 ttl=64 time=0.838 ms
64 bytes from 10.10.172.126: icmp_seq=4 ttl=64 time=0.679 ms
64 bytes from 10.10.172.126: icmp_seq=5 ttl=64 time=0.677 ms

--- 10.10.172.126 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 0.677/0.993/1.908/0.464 ms
vyaganti@othello:~$ route -n
Kernel IP routing table
Destination        Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0            172.16.0.1     0.0.0.0         UG    1024  0      0 eth0
10.10.172.0        0.0.0.0        255.255.255.128 U    0    0      0 eth1
172.16.0.0         0.0.0.0        255.240.0.0     U    0    0      0 eth0
172.16.0.1         0.0.0.0        255.255.255.255 UH   1024  0      0 eth0
vyaganti@othello:~$

```



The top screenshot shows a terminal window titled 'Vyaganti Ubuntu [Running] - Oracle VM VirtualBox' with the date 'Sep 12 16:00'. The user is 'vyaganti@desdemona: ~'. The terminal output shows network statistics for 'eth1' and 'lo', followed by the command 'sudo ifconfig eth1 10.10.172.126 netmask 255.255.255.128' and the command 'route -n'. The output of 'route -n' is a table showing the kernel IP routing table.

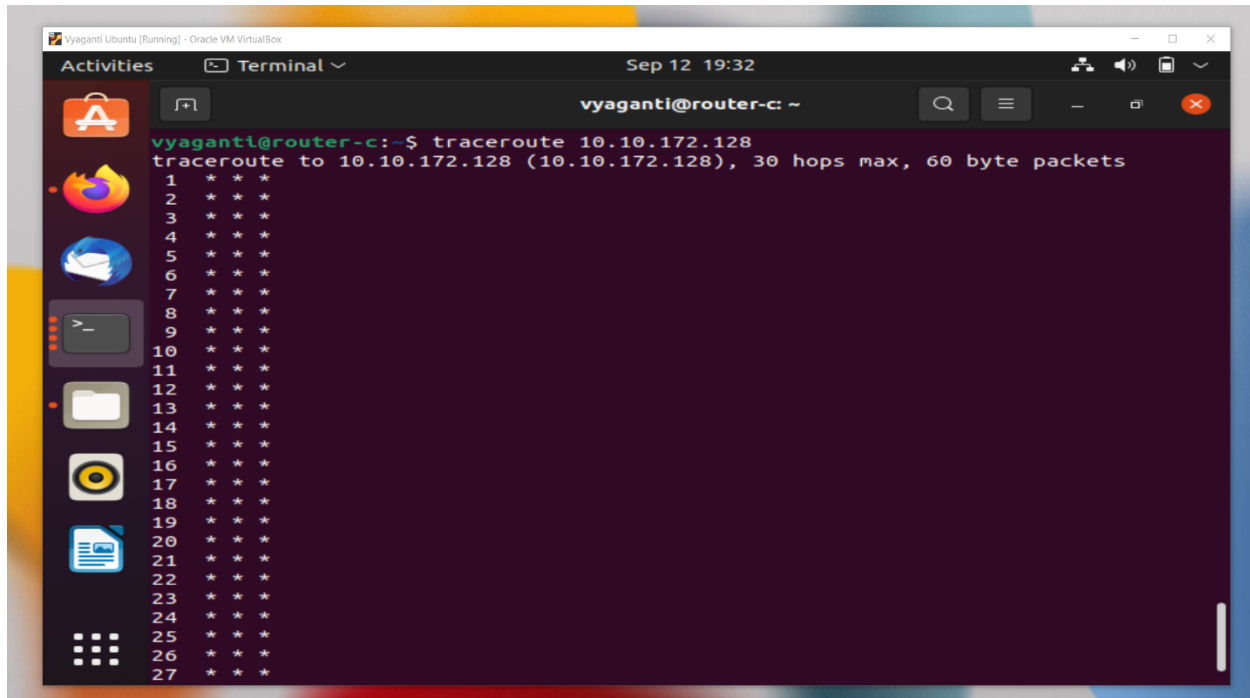
Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	172.16.0.1	0.0.0.0	UG	1024	0	0	eth0
10.10.172.0	0.0.0.0	255.255.255.128	U	0	0	0	eth1
172.16.0.0	0.0.0.0	255.240.0.0	U	0	0	0	eth0
172.16.0.1	0.0.0.0	255.255.255.255	UH	1024	0	0	eth0

The bottom screenshot shows a terminal window titled 'Vyaganti Ubuntu [Running] - Oracle VM VirtualBox' with the date 'Sep 12 16:01'. The user is 'vyaganti@hamlet: ~'. The terminal output shows the results of a 'ping -c 5 10.10.172.193' command, followed by 'ping statistics' and the command 'route -n'. The output of 'route -n' is a table showing the kernel IP routing table.

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
0.0.0.0	172.16.0.1	0.0.0.0	UG	1024	0	0	eth0
10.10.172.192	0.0.0.0	255.255.255.224	U	0	0	0	eth1
172.16.0.0	0.0.0.0	255.240.0.0	U	0	0	0	eth0
172.16.0.1	0.0.0.0	255.255.255.255	UH	1024	0	0	eth0

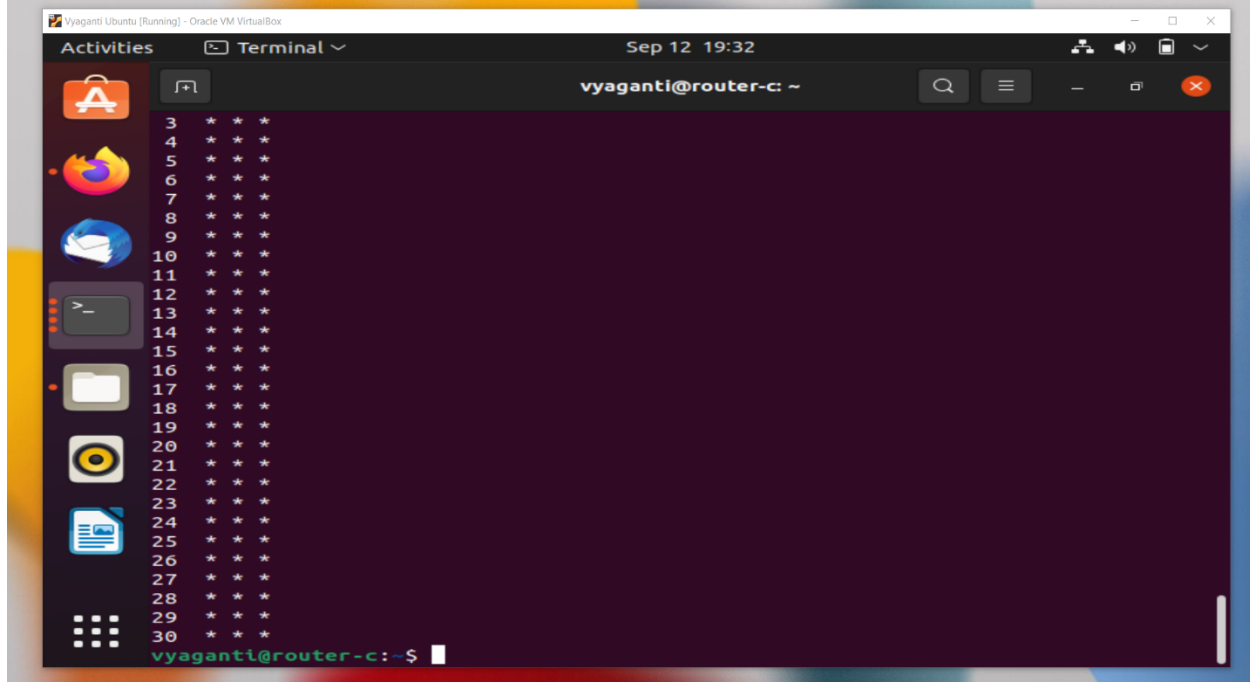
- ii. Take a screen shot of the output of the ping -c 5 IP command from node-11 to node-4, from node-5 to node-6, and from node-10 to node-7 and include them in your report.

- iii. Follow the instructions to configure the routing rules for the 10.10.100.0/24 network. Now, take a screen shot of the output of the traceroute IP command from node-11 to node-4 and include it in your report.



The screenshot shows a terminal window titled "Vyaganti Ubuntu [Running] - Oracle VM VirtualBox" with the date and time "Sep 12 19:32". The terminal prompt is "vyaganti@router-c: ~". The command "traceroute 10.10.172.128" has been executed, resulting in the following output:

```
vyaganti@router-c:~$ traceroute 10.10.172.128
traceroute to 10.10.172.128 (10.10.172.128), 30 hops max, 60 byte packets
 1  * * *
 2  * * *
 3  * * *
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
```



The screenshot shows a terminal window titled "Vyaganti Ubuntu [Running] - Oracle VM VirtualBox" with the date and time "Sep 12 19:32". The terminal prompt is "vyaganti@router-c: ~". The command "traceroute 10.10.172.128" has been executed, resulting in the following output:

```
vyaganti@router-c:~$ traceroute 10.10.172.128
traceroute to 10.10.172.128 (10.10.172.128), 30 hops max, 60 byte packets
 3  * * *
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```