

# Computer Networks Lab Week 7

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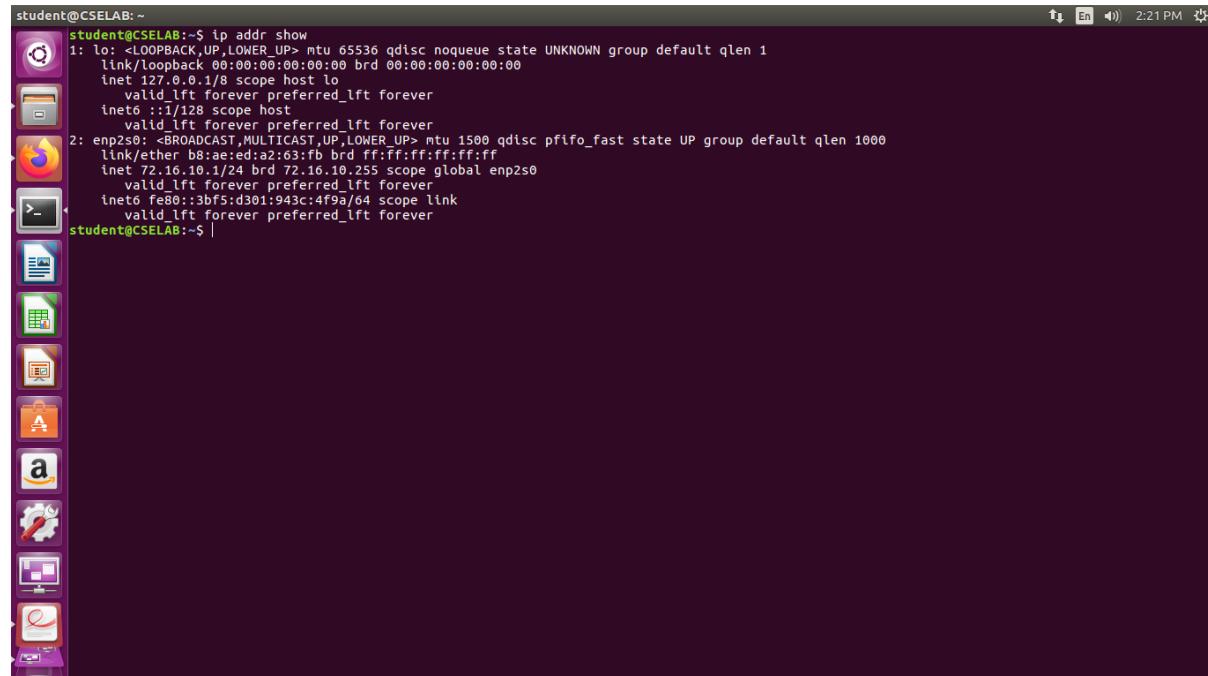
PES1UG19CS592

## Task 1: Assign IP addresses to all computers A, B, C, D (Source host HA, Router R1, Router R2 and Destination Host HD)

### Step1: Assign the IP addresses to Ha

Sudo ip addr add 172.16.10.1/24 dev eth1

Ip addr show



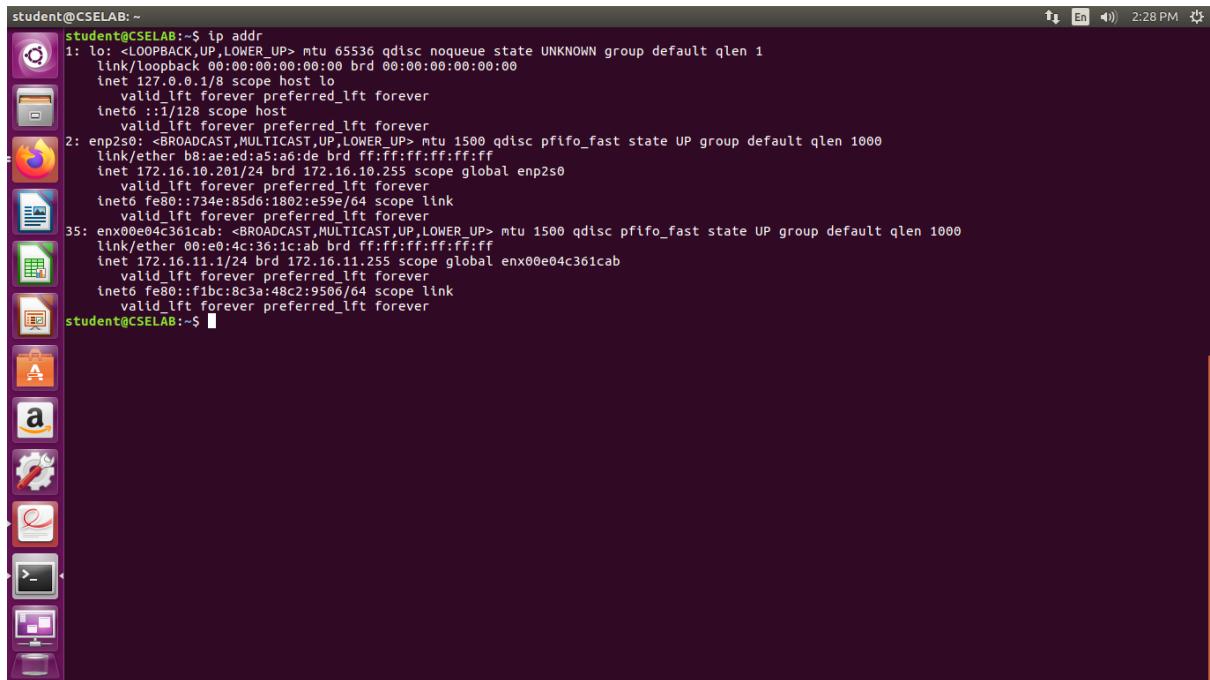
```
student@CSELAB:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether b8:ae:ed:a2:63:fb brd ff:ff:ff:ff:ff:ff
        inet 72.16.10.1/24 brd 72.16.10.255 scope global enp2s0
            valid_lft forever preferred_lft forever
        inet6 fe80::3bf5:d301:943c:4f9a/64 scope link
            valid_lft forever preferred_lft forever
student@CSELAB:~$ |
```

### Step 2: Assign the IP address to R1

Sudo ip addr add 172.16.10.201/24 dev eth1

Sudo ip addr add 172.16.11.1/24 dev eth2

Ip addr show



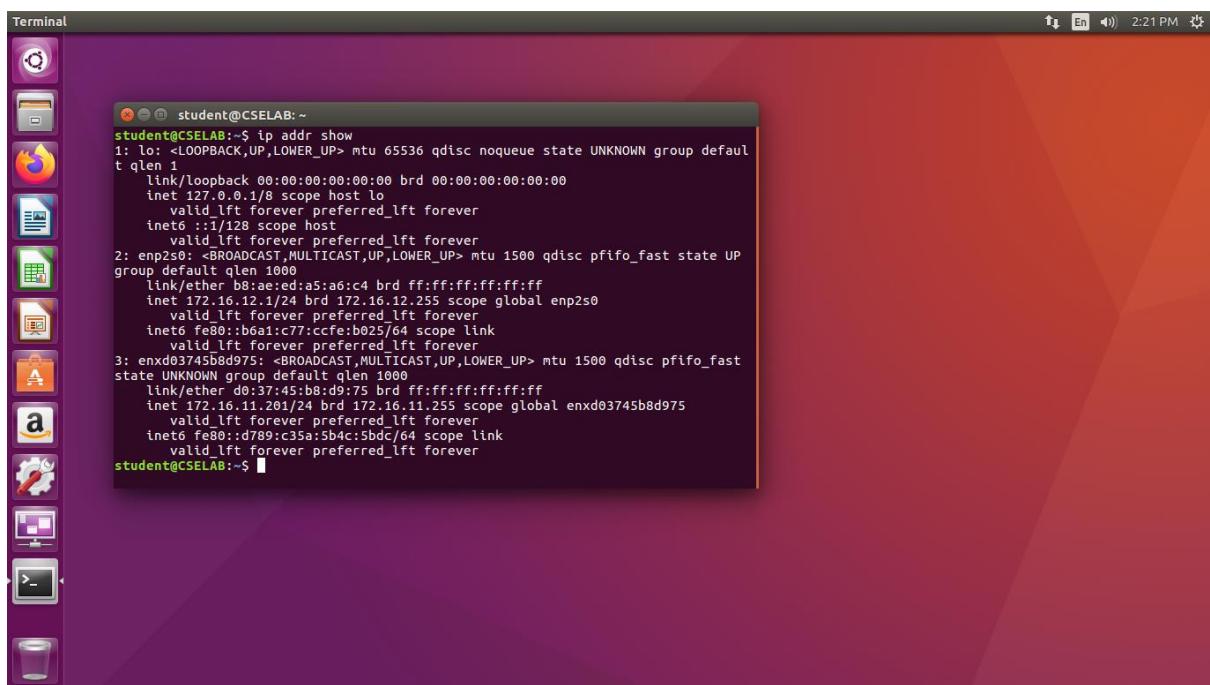
```
student@CSELAB:~$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
            inet6 ::1/128 scope host
                valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether b8:ae:ed:a5:a6:de brd ff:ff:ff:ff:ff:ff
        inet 172.16.10.201/24 brd 172.16.10.255 scope global enp2s0
            valid_lft forever preferred_lft forever
            inet6 fe80::734e:85de:1802:64 scope link
                valid_lft forever preferred_lft forever
35: enx00e04c361cab: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 00:e0:4c:36:1c:ab brd ff:ff:ff:ff:ff:ff
        inet 172.16.11.1/24 brd 172.16.11.255 scope global enx00e04c361cab
            valid_lft forever preferred_lft forever
            inet6 fe80::f1bc:8c3a:48c2:9506/64 scope link
                valid_lft forever preferred_lft forever
student@CSELAB:~$
```

### Step 3: Assign the IP address to R2

Sudo ip addr add 172.16.11.201/24 dev eth2

Sudo ip addr add 172.16.12.1/24 dev eth1

Ip addr show



```
Terminal
student@CSELAB:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
            inet6 ::1/128 scope host
                valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether b8:ae:ed:a5:a6:c4 brd ff:ff:ff:ff:ff:ff
        inet 172.16.12.1/24 brd 172.16.12.255 scope global enp2s0
            valid_lft forever preferred_lft forever
            inet6 fe80::b6a1:c77:ccfe:b025/64 scope link
                valid_lft forever preferred_lft forever
3: enxd03745b8d975: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UNKNOWN group default qlen 1000
    link/ether d0:37:45:b8:d9:75 brd ff:ff:ff:ff:ff:ff
        inet 172.16.11.201/24 brd 172.16.11.255 scope global enxd03745b8d975
            valid_lft forever preferred_lft forever
            inet6 fe80::d789:c35a:5b4c:5bd5/64 scope link
                valid_lft forever preferred_lft forever
student@CSELAB:~$
```

### Step 4: Assign the IP address to the Hd

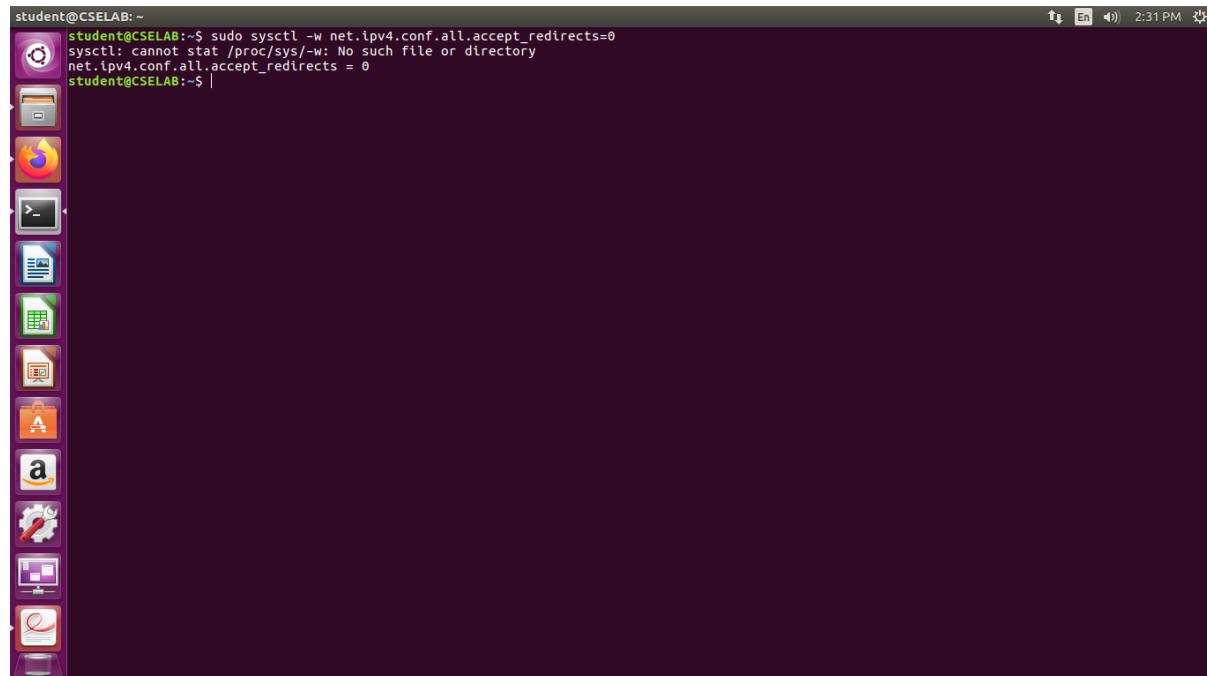
Sudo ip addr add 172.16.12.201/24 dev eth1

Ip addr show

```
student@cselab:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether b8:ae:ed:a5:a6:16 brd ff:ff:ff:ff:ff:ff
        inet 172.16.12.201/24 brd 172.16.12.255 scope global enp2s0
            valid_lft forever preferred_lft forever
        inet6 fe80::a880:400c:2c65:79c0/64 scope link
            valid_lft forever preferred_lft forever
```

### Note 1: Disable accepting the ICMP redirect packets.

Sudo sysctl -w net.ipv4.conf.all.accept\_redirects=0



```
student@cselab:~$ sudo sysctl -w net.ipv4.conf.all.accept_redirects=0
[sudo] password for student:
net.ipv4.conf.all.accept_redirects = 0
```

### Note 2: Disable sending of the ICMP redirect message.

Sudo sysctl -w net.ipv4.conf.all.send\_redirects=0

```

student@CSELAB: ~
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether b8:ae:ed:a5:a6:c4 brd ff:ff:ff:ff:ff:ff
        inet 172.16.12.1/24 brd 172.16.12.255 scope global enp2s0
            valid_lft forever preferred_lft forever
        inet6 fe80::b8ae:edff:fea5:a6c4/64 scope link
            valid_lft forever preferred_lft forever
3: enx00e04c361cab: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 00:e0:4c:36:1c:ab brd ff:ff:ff:ff:ff:ff
        inet 172.16.11.1/24 brd 172.16.11.255 scope global enx00e04c361cab
            valid_lft forever preferred_lft forever
        inet6 fe80::fbc8:48c2:9506/64 scope link
            valid_lft forever preferred_lft forever
student@CSELAB:~$ ping 172.16.11.1
PING 172.16.11.1 (172.16.11.1) 56(84) bytes of data.
64 bytes from 172.16.11.1: icmp_seq=1 ttl=64 time=0.037 ms
64 bytes from 172.16.11.1: icmp_seq=2 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=3 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=4 ttl=64 time=0.048 ms
64 bytes from 172.16.11.1: icmp_seq=5 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=6 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=7 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=8 ttl=64 time=0.048 ms
64 bytes from 172.16.11.1: icmp_seq=9 ttl=64 time=0.051 ms
64 bytes from 172.16.11.1: icmp_seq=10 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=11 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=12 ttl=64 time=0.043 ms
64 bytes from 172.16.11.1: icmp_seq=13 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=14 ttl=64 time=0.048 ms
^C
--- 172.16.11.1 ping statistics ---
14 packets transmitted, 14 received, 0% packet loss, time 12999ms
rtt min/avg/max/mdev = 0.037/0.047/0.051/0.009 ms
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
[sudo] password for student:
sysctl: cannot stat /proc/sys/-w: No such file or directory
net.ipv4.conf.all.send_redirects = 0
student@CSELAB:~$ 

```

student@CSELAB: ~

```

student@CSELAB: ~
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether b8:ae:ed:a5:a6:c4 brd ff:ff:ff:ff:ff:ff
        inet 172.16.12.1/24 brd 172.16.12.255 scope global enp2s0
            valid_lft forever preferred_lft forever
        inet6 fe80::b8ae:edff:fea5:a6c4/64 scope link
            valid_lft forever preferred_lft forever
3: enx00e04c361cab: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 00:e0:4c:36:1c:ab brd ff:ff:ff:ff:ff:ff
        inet 172.16.11.1/24 brd 172.16.11.255 scope global enx00e04c361cab
            valid_lft forever preferred_lft forever
        inet6 fe80::fbc8:48c2:9506/64 scope link
            valid_lft forever preferred_lft forever
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
[sudo] password for student:
net.ipv4.conf.all.send_redirects = 0
student@CSELAB:~$ 

2: Since machines are on same physical interface, the router is going to send ICMP message disturbing the routing decision by hosts. Thus, disable sending of the ICMP redirect packets by these routers with aliasd interfaces. To have precautionary measures issue command in router machines R1 and R2.

$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
net@student-H8IN3:~$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
net@student-H8IN3:~$ 

Task 2: Convert the machines B and C into routers.

Note 1: Check if IP forwarding is enabled or not. We need to query the sysctl kernel value net.ipv4.ip_forward to see if forwarding is enabled or not using sysctl.

$ sysctl net.ipv4.ip_forward
net.ipv4.ip_forward=0

Other alternative to check out if IP forwarding is enabled or not through the value in the /proc/sys:
$ cat /proc/sys/net/ipv4/ip_forward
0

Command to set the value of net.ipv4.ip_forward in R1 & R2 is given below:
```

## Task 2: Convert the machines B and C into routers

- Checking if IP forwarding is enables or not.

```

student@CSELAB: ~
inet 127.0.0.1/8 scope host lo
    valid_lft forever preferred_lft forever
inet6 ::/128 scope host
    valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether b8:ae:ed:a5:a6:de brd ff:ff:ff:ff:ff:ff
inet 172.16.10.201/24 brd 172.16.10.255 scope global enp2s0
    valid_lft forever preferred_lft forever
inet6 fe80::734e:85d6:1802:e59e/64 scope link
    valid_lft forever preferred_lft forever
35: enx00e04c361cab: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether 00:e0:4c:36:1c:ab brd ff:ff:ff:ff:ff:ff
inet 172.16.11.1/24 brd 172.16.11.255 scope global enx00e04c361cab
    valid_lft forever preferred_lft forever
inet6 fe80::f1bc:8c3a:48c2:9506/64 scope link
    valid_lft forever preferred_lft forever
student@CSELAB:~$ ping 172.16.11.1
PING 172.16.11.1 (172.16.11.1) 56(84) bytes of data.
64 bytes from 172.16.11.1: icmp_seq=1 ttl=64 time=0.037 ms
64 bytes from 172.16.11.1: icmp_seq=2 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=3 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=4 ttl=64 time=0.048 ms
64 bytes from 172.16.11.1: icmp_seq=5 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=6 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=7 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=8 ttl=64 time=0.048 ms
64 bytes from 172.16.11.1: icmp_seq=9 ttl=64 time=0.051 ms
64 bytes from 172.16.11.1: icmp_seq=10 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=11 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=12 ttl=64 time=0.043 ms
64 bytes from 172.16.11.1: icmp_seq=13 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=14 ttl=64 time=0.048 ms
^C
--- 172.16.11.1 ping statistics ---
14 packets transmitted, 14 received, 0% packet loss, time 12999ms
rtt min/avg/max/mdev = 0.037/0.047/0.051/0.009 ms
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
[sudo] password for student:
sysctl: cannot stat /proc/sys/-w: No such file or directory
student@CSELAB:~$ sysctl net.ipv4.ip_forward
net.ipv4.ip_forward = 0
student@CSELAB:~$ 

```

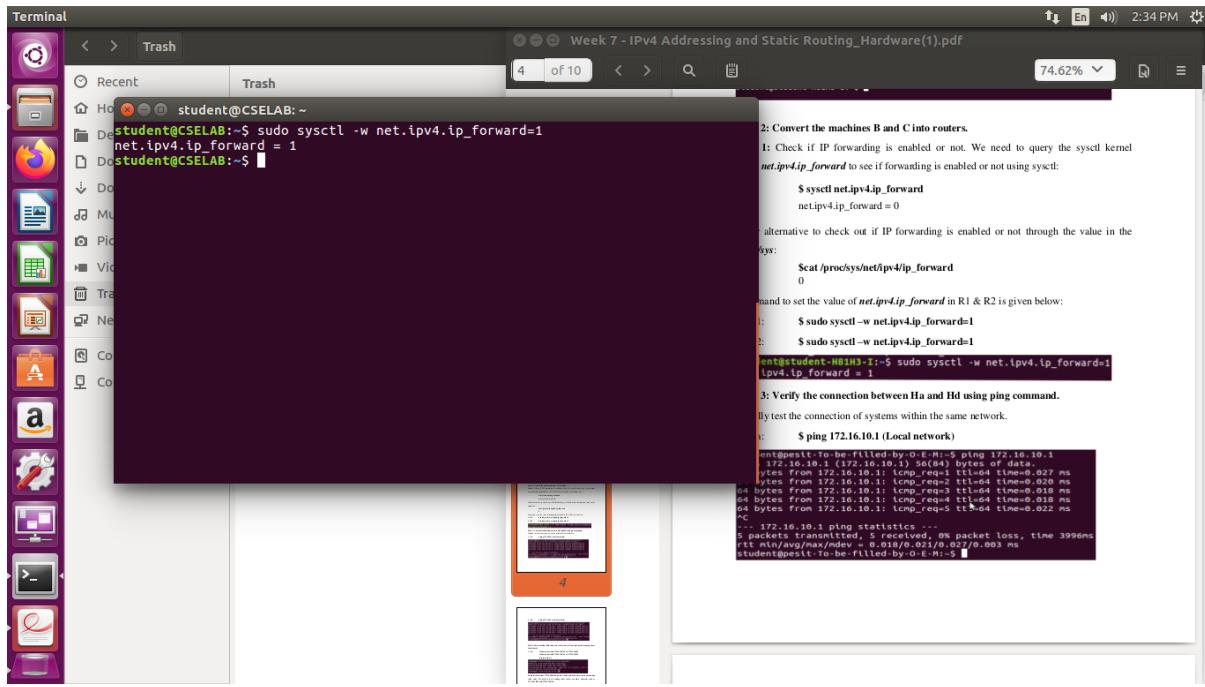
At R1: sudo sysctl -w net.ipv4.ip\_forward=1

```

student@CSELAB: ~
inet 127.0.0.1/8 scope host lo
    valid_lft forever preferred_lft forever
inet6 ::/128 scope host
    valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether b8:ae:ed:a5:a6:de brd ff:ff:ff:ff:ff:ff
inet 172.16.10.201/24 brd 172.16.10.255 scope global enp2s0
    valid_lft forever preferred_lft forever
inet6 fe80::734e:85d6:1802:e59e/64 scope link
    valid_lft forever preferred_lft forever
35: enx00e04c361cab: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether 00:e0:4c:36:1c:ab brd ff:ff:ff:ff:ff:ff
inet 172.16.11.1/24 brd 172.16.11.255 scope global enx00e04c361cab
    valid_lft forever preferred_lft forever
inet6 fe80::f1bc:8c3a:48c2:9506/64 scope link
    valid_lft forever preferred_lft forever
student@CSELAB:~$ ping 172.16.11.1
PING 172.16.11.1 (172.16.11.1) 56(84) bytes of data.
64 bytes from 172.16.11.1: icmp_seq=1 ttl=64 time=0.037 ms
64 bytes from 172.16.11.1: icmp_seq=2 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=3 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=4 ttl=64 time=0.048 ms
64 bytes from 172.16.11.1: icmp_seq=5 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=6 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=7 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=8 ttl=64 time=0.048 ms
64 bytes from 172.16.11.1: icmp_seq=9 ttl=64 time=0.051 ms
64 bytes from 172.16.11.1: icmp_seq=10 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=11 ttl=64 time=0.049 ms
64 bytes from 172.16.11.1: icmp_seq=12 ttl=64 time=0.043 ms
64 bytes from 172.16.11.1: icmp_seq=13 ttl=64 time=0.050 ms
64 bytes from 172.16.11.1: icmp_seq=14 ttl=64 time=0.048 ms
^C
--- 172.16.11.1 ping statistics ---
14 packets transmitted, 14 received, 0% packet loss, time 12999ms
rtt min/avg/max/mdev = 0.037/0.047/0.051/0.009 ms
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
[sudo] password for student:
sysctl: cannot stat /proc/sys/-w: No such file or directory
student@CSELAB:~$ sysctl net.ipv4.ip_forward
net.ipv4.ip_forward = 0
student@CSELAB:~$ sudo sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/-w: No such file or directory
net.ipv4.ip_forward = 1
student@CSELAB:~$ 

```

At R2: sudo sysctl -w net.ipv4.ip\_forward=1



### Task 3: Verify the connection between Ha and Hd using ping command

At Ha: ping 172.16.10.1(local network)

```
student@CSELAB:~$ ping 172.16.10.1
PING 172.16.10.1 (172.16.10.1) 56(84) bytes of data.
64 bytes from 172.16.10.1: icmp_seq=1 ttl=64 time=0.063 ms
64 bytes from 172.16.10.1: icmp_seq=2 ttl=64 time=0.037 ms
64 bytes from 172.16.10.1: icmp_seq=3 ttl=64 time=0.036 ms
64 bytes from 172.16.10.1: icmp_seq=4 ttl=64 time=0.042 ms
64 bytes from 172.16.10.1: icmp_seq=5 ttl=64 time=0.024 ms
64 bytes from 172.16.10.1: icmp_seq=6 ttl=64 time=0.043 ms
64 bytes from 172.16.10.1: icmp_seq=7 ttl=64 time=0.030 ms
64 bytes from 172.16.10.1: icmp_seq=8 ttl=64 time=0.045 ms
64 bytes from 172.16.10.1: icmp_seq=9 ttl=64 time=0.028 ms
64 bytes from 172.16.10.1: icmp_seq=10 ttl=64 time=0.059 ms
64 bytes from 172.16.10.1: icmp_seq=11 ttl=64 time=0.043 ms
64 bytes from 172.16.10.1: icmp_seq=12 ttl=64 time=0.021 ms
64 bytes from 172.16.10.1: icmp_seq=13 ttl=64 time=0.042 ms
64 bytes from 172.16.10.1: icmp_seq=14 ttl=64 time=0.020 ms
64 bytes from 172.16.10.1: icmp_seq=15 ttl=64 time=0.041 ms
64 bytes from 172.16.10.1: icmp_seq=16 ttl=64 time=0.036 ms
64 bytes from 172.16.10.1: icmp_seq=17 ttl=64 time=0.023 ms
64 bytes from 172.16.10.1: icmp_seq=18 ttl=64 time=0.018 ms
64 bytes from 172.16.10.1: icmp_seq=19 ttl=64 time=0.077 ms
^C
--- 172.16.10.1 ping statistics ---
19 packets transmitted, 19 received, 0% packet loss, time 17996ms
rtt min/avg/max/mdev = 0.018/0.038/0.077/0.015 ms
student@CSELAB:~$
```

At Hd: ping 172.16.12.1(local network)

```

student@CSELAB:~$ ping 172.16.12.1
PING 172.16.12.1 (172.16.12.1) 56(84) bytes of data.
64 bytes from 172.16.12.1: icmp_seq=1 ttl=64 time=0.384 ms
64 bytes from 172.16.12.1: icmp_seq=2 ttl=64 time=0.240 ms
64 bytes from 172.16.12.1: icmp_seq=3 ttl=64 time=0.244 ms
64 bytes from 172.16.12.1: icmp_seq=4 ttl=64 time=0.248 ms
64 bytes from 172.16.12.1: icmp_seq=5 ttl=64 time=0.237 ms
64 bytes from 172.16.12.1: icmp_seq=6 ttl=64 time=0.201 ms
64 bytes from 172.16.12.1: icmp_seq=7 ttl=64 time=0.236 ms
64 bytes from 172.16.12.1: icmp_seq=8 ttl=64 time=0.237 ms
64 bytes from 172.16.12.1: icmp_seq=9 ttl=64 time=0.254 ms
64 bytes from 172.16.12.1: icmp_seq=10 ttl=64 time=0.269 ms
64 bytes from 172.16.12.1: icmp_seq=11 ttl=64 time=0.249 ms
^C
--- 172.16.12.1 ping statistics ---
11 packets transmitted, 11 received, 0% packet loss, time 9997ms
rtt min/avg/max/mdev = 0.201/0.254/0.384/0.046 ms

```

**Task 4: insert routing table entries on each system to direct ipv4 packets to ping across the networks.**

**At Ha:**

sudo ip route add 172.16.12.0/24 via 172.16.10.201

Sudo ip route add 172.12.11.0/24 via 172.16.10.201

Ip route show

```

student@CSELAB:~$ sudo ip route add 172.16.12.0/24 via 172.16.10.201
student@CSELAB:~$ sudo ip route add 172.16.11.0/24 via 172.16.10.201
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0  scope link  metric 1000
172.16.10.0/24 dev enp2s0  proto kernel  scope link  src 172.16.10.1  metric 100
172.16.11.0/24 via 172.16.10.201 dev enp2s0
172.16.12.0/24 via 172.16.10.201 dev enp2s0
student@CSELAB:~$ 

```

**At R1:**

Sudo ip route add 172.16.12.0/24 via 172.16.11.201

Ip route show

```

student@CSELAB:~$ sudo ip route add 172.16.12.0/24 via 172.16.11.201
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0  scope link  metric 1000
172.16.10.0/24 dev enp2s0  proto kernel  scope link  src 172.16.10.201  metric 100
172.16.11.0/24 dev enx00e04c361cab  proto kernel  scope link  src 172.16.11.1  metric 100
172.16.12.0/24 via 172.16.11.201 dev enx00e04c361cab

```

**At R2:**

Sudo ip route add 172.16.10.0/24 via 172.16.11.1

Ip route show

```
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enxd03745b8d975 scope link metric 1000
172.16.10.0/24 via 172.16.11.1 dev enxd03745b8d975
172.16.11.0/24 dev enxd03745b8d975 proto kernel scope link src 172.16.11.201
metric 100
172.16.12.0/24 dev enp2s0 proto kernel scope link src 172.16.12.1 metric 100
student@CSELAB:~$ 

72.16.11.201 metric 1
72.16.12.1 metric 1

6.12.1
6.12.1

student@pesit-To-be-filled-by-O-E-M:~$ ip route show
default via 172.16.12.1 dev eth1 proto static
169.254.0.0/16 dev eth1 scope link metric 1000
172.16.10.0/24 via 172.16.12.1 dev eth1
172.16.11.0/24 dev eth1 proto kernel scope link src 172.16.12.201 metric 1
student@pesit-To-be-filled-by-O-E-M:~$ 
```

**Task 5:** After adding routing table entries again verify the connection from Ha and Hd using ping command.

#### At Hd:

Sudo ip route add 172.16.10.0/24 via 172.16.12.1

Sudo ip route add 172.16.11.0/24 via 172.16.12.1

Ip route show

```
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0 scope link metric 1000
172.16.10.0/24 via 172.16.12.1 dev enp2s0
172.16.11.0/24 via 172.16.12.1 dev enp2s0
172.16.12.0/24 dev enp2s0 proto kernel scope link src 172.16.12.201 metric 100
```

**Task 5:** After adding routing table entries again verify the connection from Ha and Hd using ping command

#### Step 1 : testing path from Ha and Hd

Ping 172.16.12.1 and ping 172.16.12.201

```

student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0  scope link  metric 1000
172.16.10.0/24 dev enp2s0  proto kernel  scope link  src 172.16.10.1  metric 100
172.16.12.0/24 via 172.16.10.201 dev enp2s0
student@CSELAB:~$ ping 172.16.12.1
PING 172.16.12.1 (172.16.12.1) 56(84) bytes of data.
64 bytes from 172.16.12.1: icmp_seq=1 ttl=63 time=0.989 ms
64 bytes from 172.16.12.1: icmp_seq=2 ttl=63 time=1.13 ms
64 bytes from 172.16.12.1: icmp_seq=3 ttl=63 time=1.13 ms
64 bytes from 172.16.12.1: icmp_seq=4 ttl=63 time=1.05 ms
64 bytes from 172.16.12.1: icmp_seq=5 ttl=63 time=1.18 ms
64 bytes from 172.16.12.1: icmp_seq=6 ttl=63 time=0.665 ms
^C
--- 172.16.12.1 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5006ms
rtt min/avg/max/mdev = 0.665/1.025/1.183/0.178 ms
student@CSELAB:~$ ping 172.16.12.201
PING 172.16.12.201 (172.16.12.201) 56(84) bytes of data.
64 bytes from 172.16.12.201: icmp_seq=1 ttl=62 time=1.31 ms
64 bytes from 172.16.12.201: icmp_seq=2 ttl=62 time=1.32 ms
64 bytes from 172.16.12.201: icmp_seq=3 ttl=62 time=1.38 ms
64 bytes from 172.16.12.201: icmp_seq=4 ttl=62 time=1.37 ms
64 bytes from 172.16.12.201: icmp_seq=5 ttl=62 time=1.31 ms
64 bytes from 172.16.12.201: icmp_seq=6 ttl=62 time=1.32 ms
^C
--- 172.16.12.201 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5007ms
rtt min/avg/max/mdev = 1.311/1.338/1.383/0.035 ms
student@CSELAB:~$ |

```

## Step 2: Testing path from Hd and Ha

Ping 172.16.10.1 and ping 172.16.10.201

```

student@CSELAB:~$ ping 172.16.10.1
PING 172.16.10.1 (172.16.10.1) 56(84) bytes of data.
64 bytes from 172.16.10.1: icmp_seq=1 ttl=62 time=1.38 ms
64 bytes from 172.16.10.1: icmp_seq=2 ttl=62 time=1.40 ms
64 bytes from 172.16.10.1: icmp_seq=3 ttl=62 time=1.38 ms
64 bytes from 172.16.10.1: icmp_seq=4 ttl=62 time=1.31 ms
64 bytes from 172.16.10.1: icmp_seq=5 ttl=62 time=1.38 ms
64 bytes from 172.16.10.1: icmp_seq=6 ttl=62 time=1.40 ms
64 bytes from 172.16.10.1: icmp_seq=7 ttl=62 time=1.41 ms
^C
--- 172.16.10.1 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6009ms
rtt min/avg/max/mdev = 1.314/1.386/1.413/0.036 ms
student@CSELAB:~$ ping 172.16.10.201
PING 172.16.10.201 (172.16.10.201) 56(84) bytes of data.
64 bytes from 172.16.10.201: icmp_seq=1 ttl=63 time=1.15 ms
64 bytes from 172.16.10.201: icmp_seq=2 ttl=63 time=1.20 ms
64 bytes from 172.16.10.201: icmp_seq=3 ttl=63 time=1.18 ms
64 bytes from 172.16.10.201: icmp_seq=4 ttl=63 time=1.19 ms
64 bytes from 172.16.10.201: icmp_seq=5 ttl=63 time=1.10 ms
64 bytes from 172.16.10.201: icmp_seq=6 ttl=63 time=1.18 ms
64 bytes from 172.16.10.201: icmp_seq=7 ttl=63 time=1.12 ms
64 bytes from 172.16.10.201: icmp_seq=8 ttl=63 time=1.18 ms
^C
--- 172.16.10.201 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7009ms
rtt min/avg/max/mdev = 1.104/1.167/1.203/0.044 ms

```

## Task 6: check each system neighbour to verify the connection

At Ha: ip neigh show

```
student@CSELAB:~$ ip neigh show
172.16.10.201 dev enp2s0 lladdr b8:ae:ed:a5:a6:de STALE
student@CSELAB:~$ ping 172.16.12.201
PING 172.16.12.201 (172.16.12.201) 56(84) bytes of data.
64 bytes from 172.16.12.201: icmp_seq=1 ttl=62 time=1.34 ms
64 bytes from 172.16.12.201: icmp_seq=2 ttl=62 time=1.41 ms
64 bytes from 172.16.12.201: icmp_seq=3 ttl=62 time=1.39 ms
^C
--- 172.16.12.201 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 1.340/1.382/1.411/0.030 ms
student@CSELAB:~$ ping 172.16.10.201
PING 172.16.10.201 (172.16.10.201) 56(84) bytes of data.
64 bytes from 172.16.10.201: icmp_seq=1 ttl=64 time=0.262 ms
64 bytes from 172.16.10.201: icmp_seq=2 ttl=64 time=0.207 ms
64 bytes from 172.16.10.201: icmp_seq=3 ttl=64 time=0.201 ms
^C
--- 172.16.10.201 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 1999ms
rtt min/avg/max/mdev = 0.201/0.223/0.262/0.030 ms
student@CSELAB:~$ ip neigh show
172.16.10.201 dev enp2s0 lladdr b8:ae:ed:a5:a6:de REACHABLE
student@CSELAB:~$
```

At R1: ip neigh show

```
student@CSELAB:~$ ip neigh show
172.16.10.1 dev enp2s0 lladdr b8:ae:ed:a2:63:fb STALE
172.16.11.201 dev enx00e04c361cab lladdr d0:37:45:b8:d9:75 STALE
student@CSELAB:~$
```

At R2: ip neigh show

```
Terminal student@CSELAB:~$ ip neigh show
172.16.12.201 dev enp2s0 lladdr b8:ae:ed:a5:a6:16 REACHABLE
172.16.11.1 dev enxd03745b8d975 lladdr 00:e0:4c:36:1c:ab STALE
student@CSELAB:~$
```

At Hd: ip neigh show

```
System Settings ~$ ip neigh show
172.16.12.1 dev enp2s0 lladdr b8:ae:ed:a5:a6:c4 REACHABLE
```

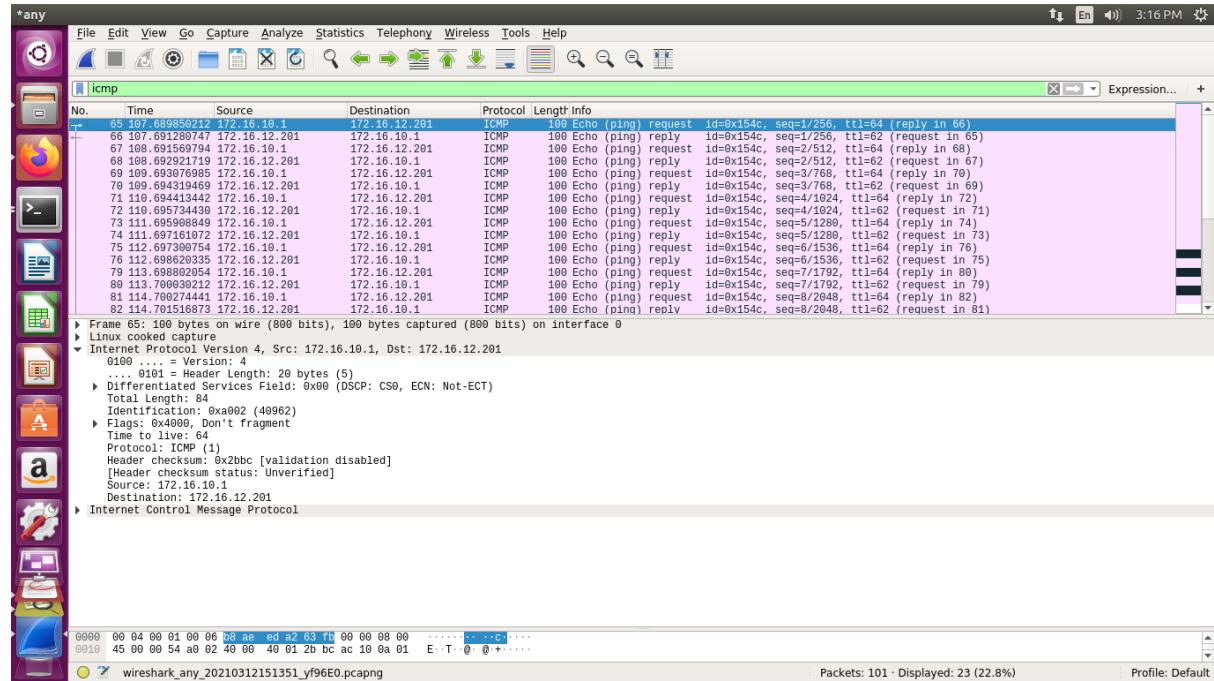
## Task 7: Capture the packets from Ha and Hd using wireshark tool

### Step1: capture packets from Ha and Hd

At Ha:

T1: sudo wireshark

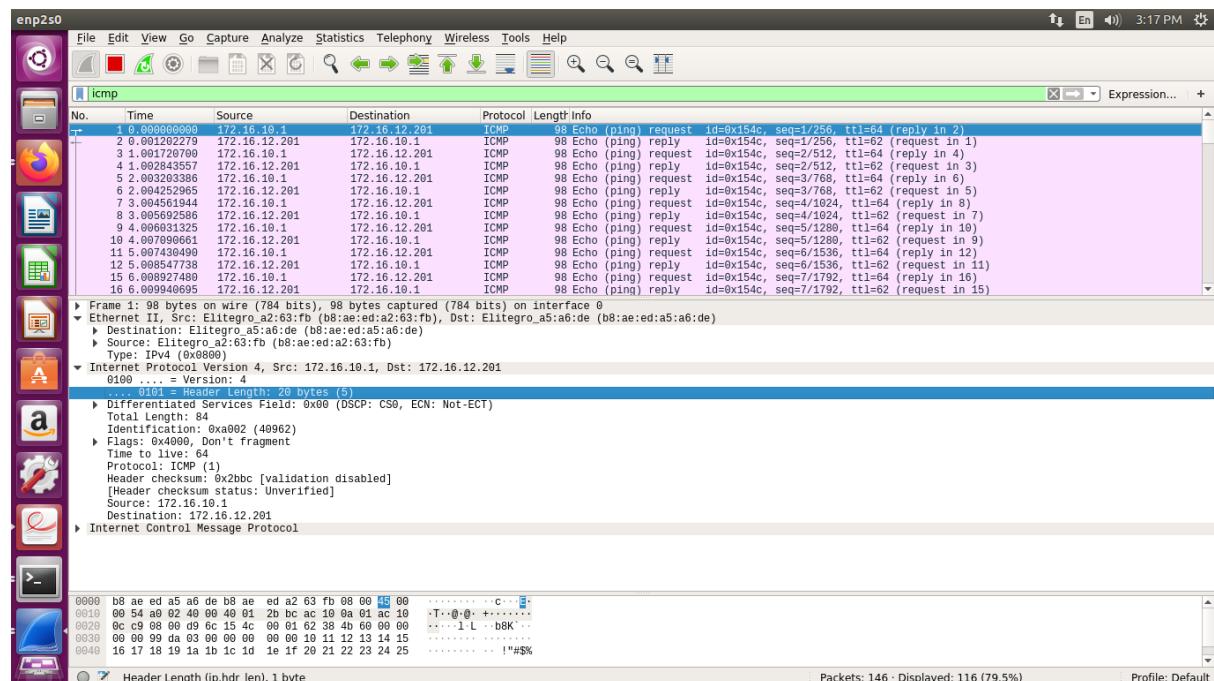
T2: ping 172.16.12.201



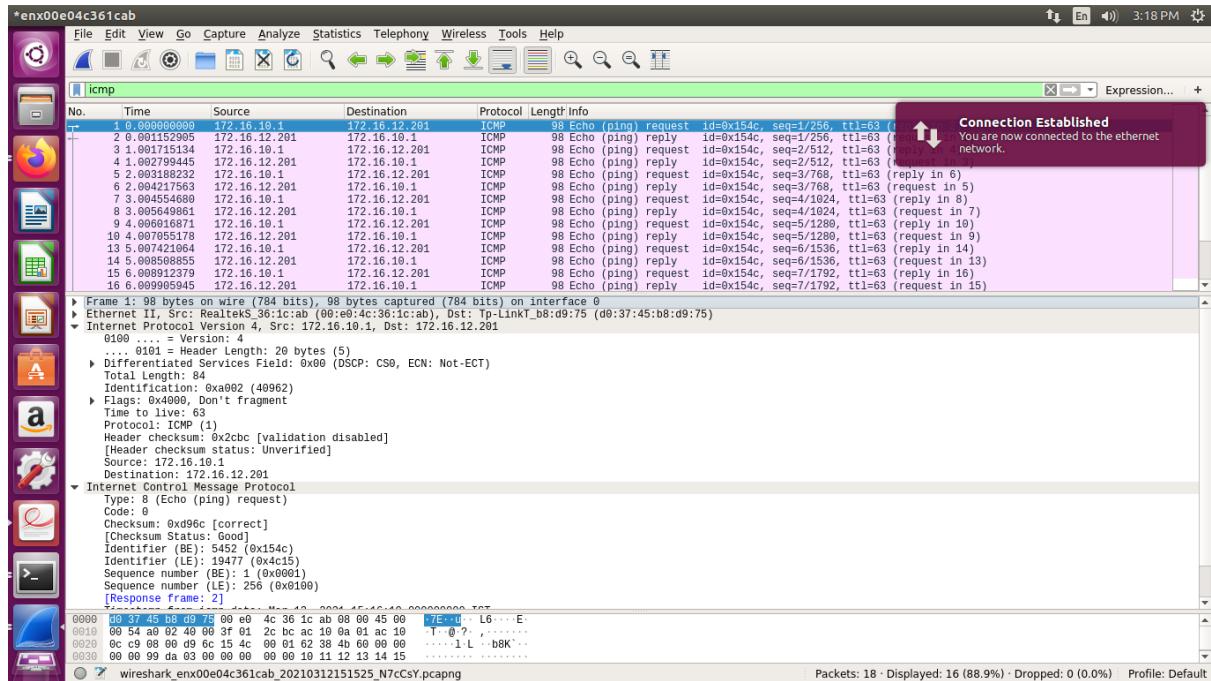
### Step 2: Capture packets from R1 using both eth1 and eth2 interfaces.

Sudo wireshark

At eth1:



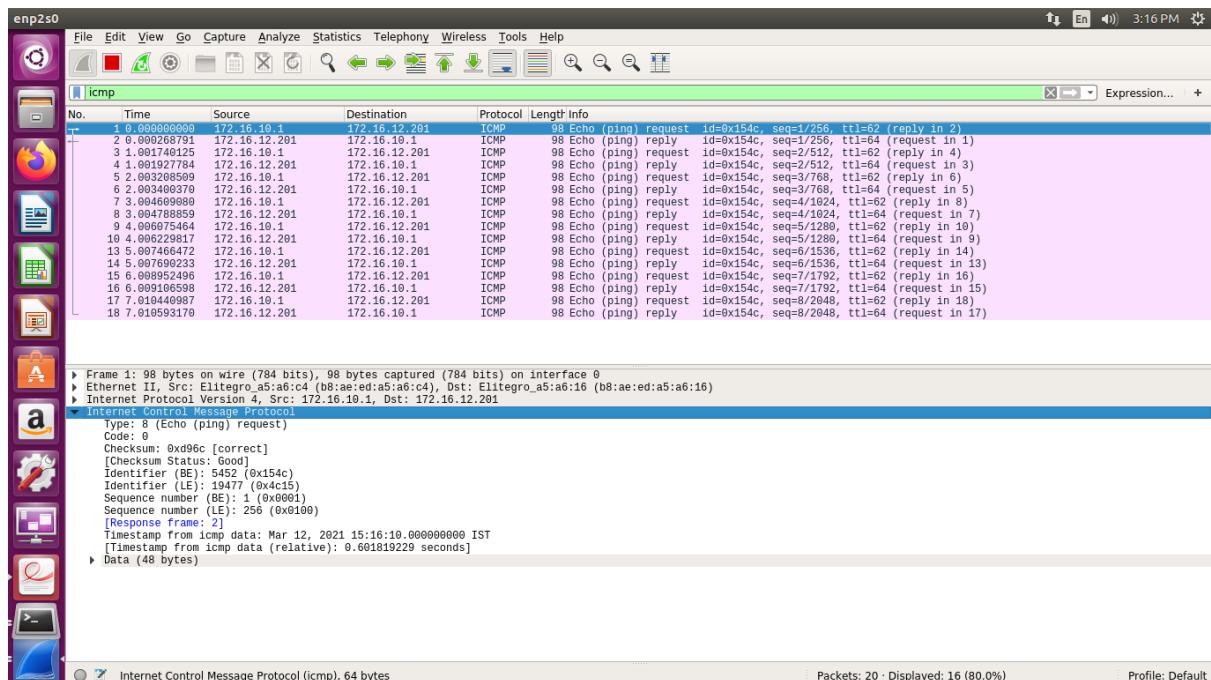
At eth2:



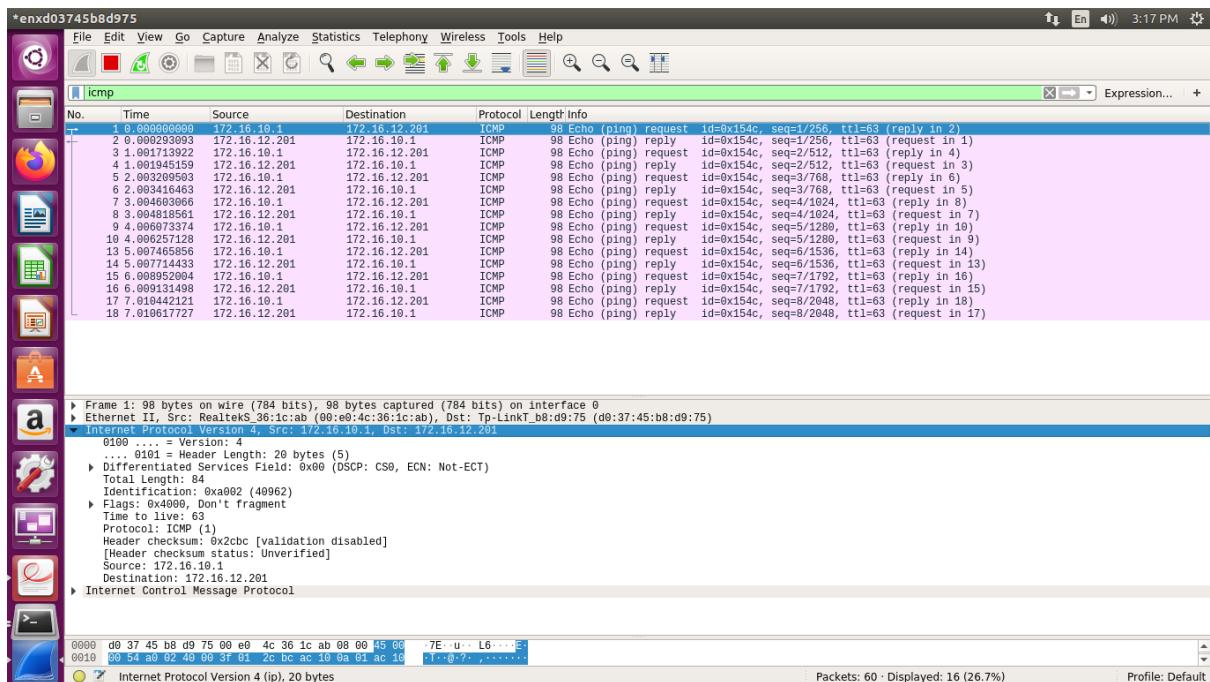
### Step 3: Capture packets from R2 using both eth1 and eth2 interfaces.

Sudo wireshark

At eth1:



At eth2:



## Step 4: Capture packets from Hd and Ha

At Hd:

T1: sudo wirehark

