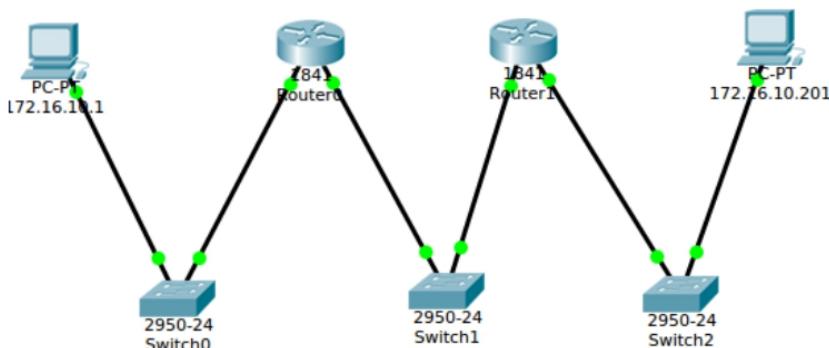


CN Lab Report – Week 7

IPv4 Addressing and Static Routing

NAME	SRN	SECTION
ANKITH J RAI	PES1UG19CS069	B
ARASADA LAKSHMI	PES1UG19CS082	B
PRANEETH		
AYUSH M KAPASI	PES1UG19CS099	B
AYUSH GIRISH GODEBOLE	PES1UG19CS098	B

Topology



Task 1 : Setting up manual IP addresses:

Ha's IP address is manually set to 172.16.10.1/24

```
student@CSELAB: ~
student@CSELAB:~$ ifconfig
enp2s0    Link encap:Ethernet HWaddr b8:ae:ed:a5:a5:99
          inet addr:172.16.10.1 Bcast:172.16.10.255 Mask:255.255.255.0
          inet6 addr: fe80::f59d:f4f6:2a12:567e/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:133 errors:0 dropped:0 overruns:0 frame:0
          TX packets:131 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:17658 (17.6 KB) TX bytes:15214 (15.2 KB)

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:282 errors:0 dropped:0 overruns:0 frame:0
        TX packets:282 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1
        RX bytes:20381 (20.3 KB) TX bytes:20381 (20.3 KB)
```

R1's IP address is manually set to 172.16.10.201/24(internal) and 172.16.11.1/24(external)

```
student@pesu-OptiPlex-3070:~
```

```
          RX bytes:26393499 (26.3 MB)  TX bytes:3343856 (3.3 MB)
enxd03745b0d977 Link encap:Ethernet HWaddr d0:37:45:b8:d9:77
      inet6 addr: fe80::896e:fad8:16b0:41dd/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:52 errors:0 dropped:0 overruns:0 frame:0
        TX packets:98 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:8583 (8.5 KB)  TX bytes:17458 (17.4 KB)

lo      Link encap:Local Loopback
      inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING MTU:65536 Metric:1
        RX packets:4334 errors:0 dropped:0 overruns:0 frame:0
        TX packets:4334 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:388749 (388.7 KB)  TX bytes:388749 (388.7 KB)

student@pesu-OptiPlex-3070:~$ ifconfig
enp1s0   Link encap:Ethernet HWaddr 00:4e:01:a4:20:fe
      inet6 addr: fe80::97ab:f2ee:ec83:8769/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:37999 errors:0 dropped:0 overruns:0 frame:0
        TX packets:18794 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:26400475 (26.4 MB)  TX bytes:3370821 (3.3 MB)

enxd03745b0d977 Link encap:Ethernet HWaddr d0:37:45:b8:d9:77
      inet6 addr: 172.16.10.2 Bcast:172.16.10.255 Mask:255.255.255.0
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:128 errors:0 dropped:0 overruns:0 frame:0
        TX packets:172 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:19922 (19.9 KB)  TX bytes:28500 (28.5 KB)

lo      Link encap:Local Loopback
      inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING MTU:65536 Metric:1
        RX packets:8308 errors:0 dropped:0 overruns:0 frame:0
        TX packets:8308 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:659221 (659.2 KB)  TX bytes:659221 (659.2 KB)
```

R2's IP address is manually set to 172.16.11.201/24(external) and 172.16.12.1(internal)

```
student@pesu-OptiPlex-3070:~
```

```
          student@pesu-OptiPlex-3070:~$ ifconfig
enp1s0   Link encap:Ethernet HWaddr 00:4e:01:a4:23:c0
      inet6 addr: fe80::8961:ecff:fe01:23c0/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:24896 errors:0 dropped:0 overruns:0 frame:0
        TX packets:10766 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:24525060 (24.5 MB)  TX bytes:1185824 (1.1 MB)

enxd03745b0d971 Link encap:Ethernet HWaddr d0:37:45:b8:d9:51
      inet6 addr: fe80::97ab:f2ee:ec83:8769/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:134 errors:0 dropped:0 overruns:0 frame:0
        TX packets:152 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:20404 (20.4 KB)  TX bytes:25705 (25.7 KB)

lo      Link encap:Local Loopback
      inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING MTU:65536 Metric:1
        RX packets:6941 errors:0 dropped:0 overruns:0 frame:0
        TX packets:6941 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:535811 (535.8 KB)  TX bytes:535811 (535.8 KB)
```

Hd's IP address is manually set to 172.16.12.201/24

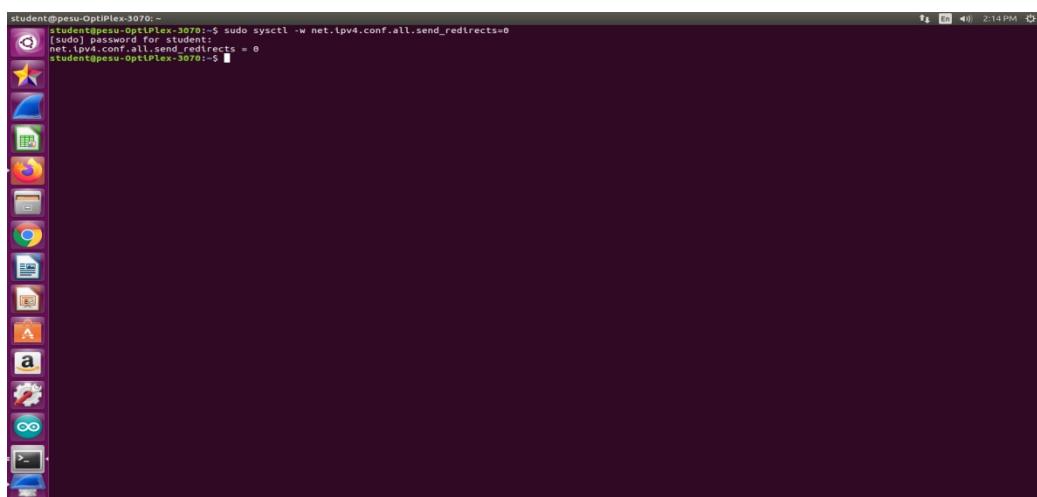
```
student@cselab:~$ ifconfig
enp2s0    Link encap:Ethernet HWaddr b8:ae:ed:a5:a6:0e
          inet addr:172.16.12.201 Bcast:172.16.12.255 Mask:255.255.255.0
          inet6 addr: fe80::c162:8de8:5422:b474/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:2259 errors:0 dropped:0 overruns:0 frame:0
          TX packets:287 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:288428 (288.4 KB) TX bytes:28969 (28.9 KB)

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:328 errors:0 dropped:0 overruns:0 frame:0
          TX packets:328 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:24849 (24.8 KB) TX bytes:24849 (24.8 KB)
```

For precautionary measure disable accepting the ICMP redirect packets at Host machines Ha and Hd.

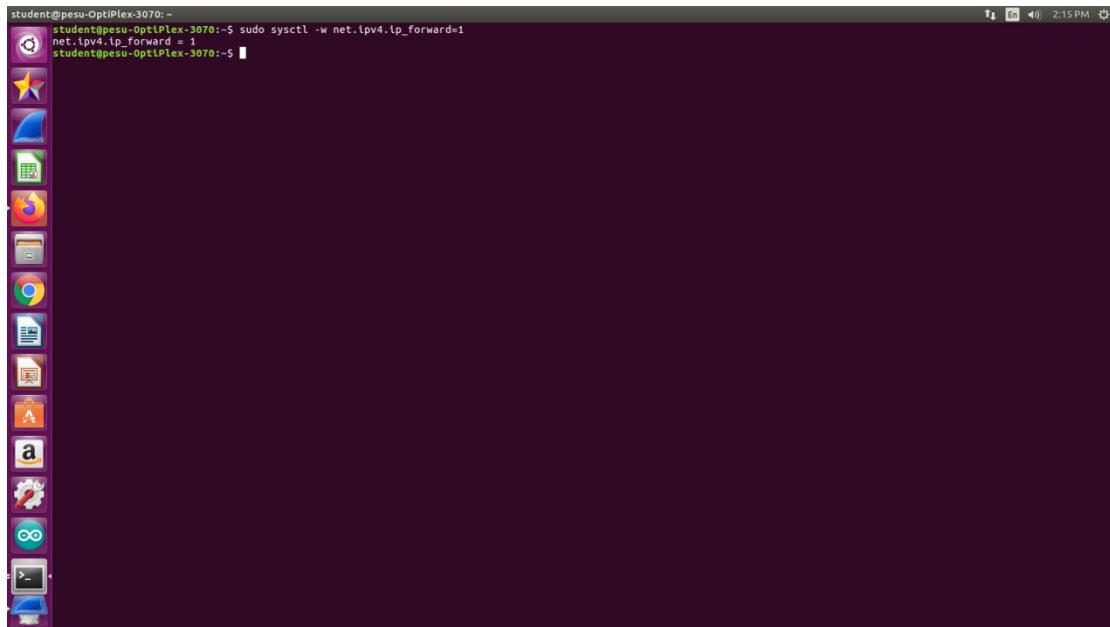
```
student@cselab:~$ sudo sysctl -w net.ipv4.conf.all.accept_redirects=0
[sudo] password for student:
net.ipv4.conf.all.accept_redirects = 0
```

At the routers, sending ICMP redirect packets are disabled



Task2:

Set the value of net.ipv4.ip_forward =1 in R1 & R2

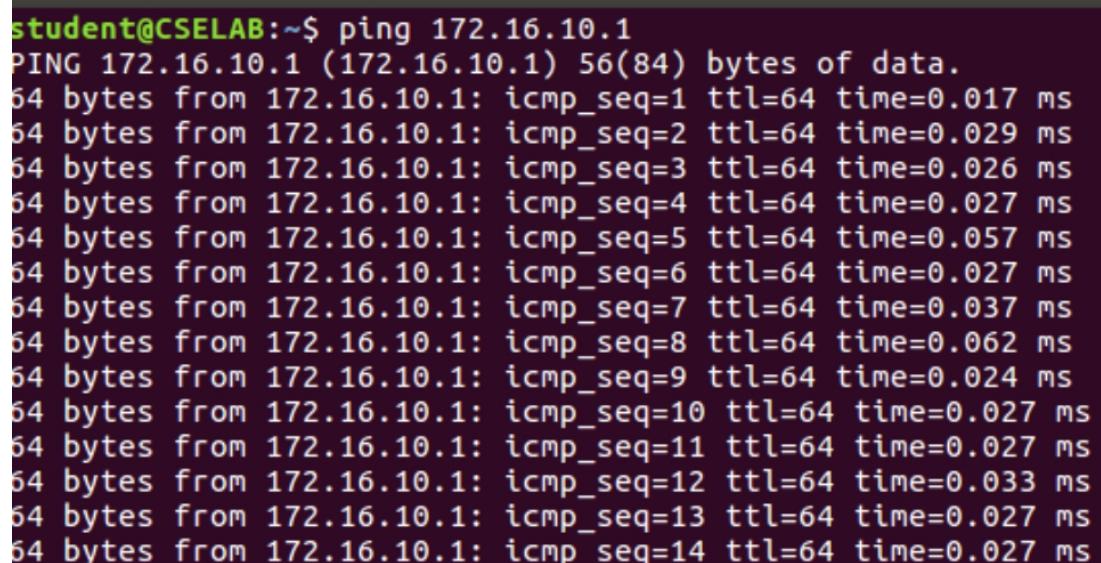


A screenshot of a Linux desktop environment. On the left is a vertical dock containing icons for various applications like a web browser, file manager, and terminal. The main window shows a terminal session with the following command and output:

```
student@pesu-OptiPlex-3070:~$ sudo sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
student@pesu-OptiPlex-3070:~$
```

Task 3:

At Ha, ping itself



A screenshot of a terminal window showing the output of the 'ping' command. The command was run at the prompt 'student@CSELAB:~\$' with the target address '172.16.10.1'. The output shows 15 successful echo requests sent to the local host, each with a 64-byte payload, an ICMP sequence number, a TTL of 64, and a time-to-live of 0.017 to 0.033 ms.

```
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=0.017 ms
64 bytes from 172.16.10.1: icmp_seq=2 ttl=64 time=0.029 ms
64 bytes from 172.16.10.1: icmp_seq=3 ttl=64 time=0.026 ms
64 bytes from 172.16.10.1: icmp_seq=4 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=5 ttl=64 time=0.057 ms
64 bytes from 172.16.10.1: icmp_seq=6 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=7 ttl=64 time=0.037 ms
64 bytes from 172.16.10.1: icmp_seq=8 ttl=64 time=0.062 ms
64 bytes from 172.16.10.1: icmp_seq=9 ttl=64 time=0.024 ms
64 bytes from 172.16.10.1: icmp_seq=10 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=11 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=12 ttl=64 time=0.033 ms
64 bytes from 172.16.10.1: icmp_seq=13 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=14 ttl=64 time=0.027 ms
```

At Hd, ping itself

```
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=0.532 ms
64 bytes from 172.16.12.201: icmp_seq=2 ttl=62 time=0.718 ms
64 bytes from 172.16.12.201: icmp_seq=3 ttl=62 time=0.675 ms
64 bytes from 172.16.12.201: icmp_seq=4 ttl=62 time=0.850 ms
64 bytes from 172.16.12.201: icmp_seq=5 ttl=62 time=0.733 ms
64 bytes from 172.16.12.201: icmp_seq=6 ttl=62 time=0.739 ms
64 bytes from 172.16.12.201: icmp_seq=7 ttl=62 time=0.734 ms
64 bytes from 172.16.12.201: icmp_seq=8 ttl=62 time=0.796 ms
64 bytes from 172.16.12.201: icmp_seq=9 ttl=62 time=0.742 ms
64 bytes from 172.16.12.201: icmp_seq=10 ttl=62 time=0.712 ms
64 bytes from 172.16.12.201: icmp_seq=11 ttl=62 time=0.760 ms
64 bytes from 172.16.12.201: icmp_seq=12 ttl=62 time=0.787 ms
64 bytes from 172.16.12.201: icmp_seq=13 ttl=62 time=0.626 ms
64 bytes from 172.16.12.201: icmp_seq=14 ttl=62 time=0.655 ms
64 bytes from 172.16.12.201: icmp_seq=15 ttl=62 time=0.603 ms
```

Enter the routing table entries:

At Ha:

```
sudo ip route add 172.16.12.0/24 via 172.16.10.201
sudo ip route add 172.16.11.0/24 via 172.16.10.201
```

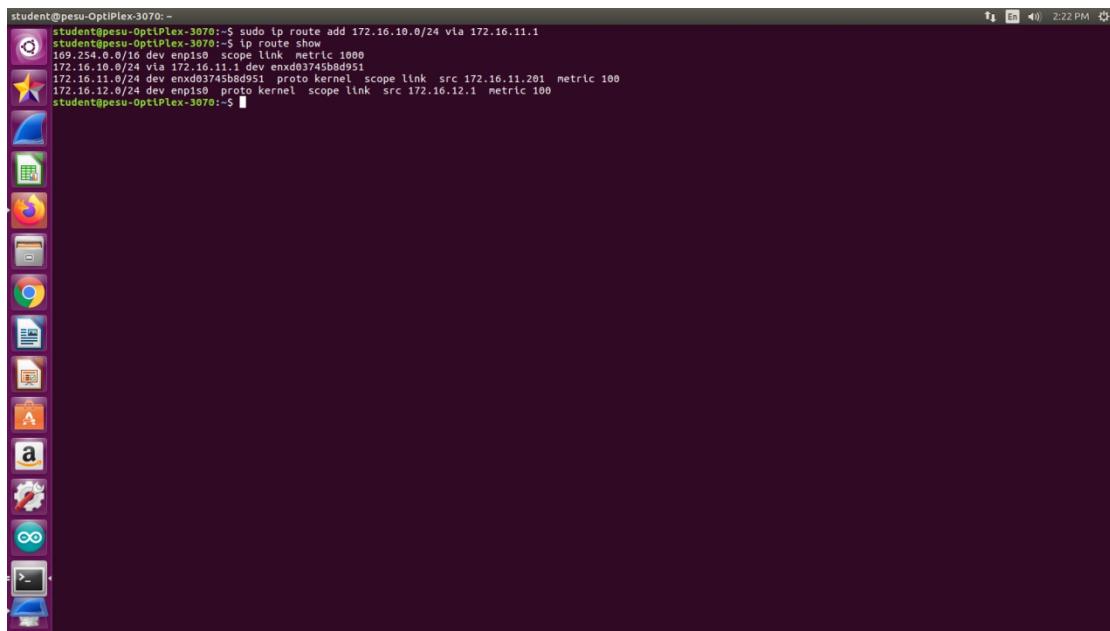
```
student@cselab:~$ ip route show
169.254.0.0/16 dev enp2s0  scope link  metric 1000
172.16.10.0/24 dev enp2s0  proto kernel  scope link  src 172.16.10.1  metric 100
172.16.11.0/24 via 172.16.10.201 dev enp2s0
172.16.12.0/24 via 172.16.10.201 dev enp2s0
```

At R1:

```
sudo ip route add 172.16.12.0/24 via 172.16.11.201
```

At R2:

```
sudo ip route add 172.16.10.0/24 via 172.16.11.1
```



```
student@pesu-OptiPlex-3070:~$ sudo ip route add 172.16.10.0/24 via 172.16.11.1
student@pesu-OptiPlex-3070:~$ sudo ip route add 172.16.11.0/24 via 172.16.12.1
student@pesu-OptiPlex-3070:~$ sudo ip route add 172.16.12.0/24 via 172.16.11.1
student@pesu-OptiPlex-3070:~$
```

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
```

```
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 1
00
```

Task 5:

Ping Hd from Ha

```
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=0.532 ms
64 bytes from 172.16.12.201: icmp_seq=2 ttl=62 time=0.718 ms
64 bytes from 172.16.12.201: icmp_seq=3 ttl=62 time=0.675 ms
64 bytes from 172.16.12.201: icmp_seq=4 ttl=62 time=0.850 ms
64 bytes from 172.16.12.201: icmp_seq=5 ttl=62 time=0.733 ms
64 bytes from 172.16.12.201: icmp_seq=6 ttl=62 time=0.739 ms
64 bytes from 172.16.12.201: icmp_seq=7 ttl=62 time=0.734 ms
64 bytes from 172.16.12.201: icmp_seq=8 ttl=62 time=0.796 ms
64 bytes from 172.16.12.201: icmp_seq=9 ttl=62 time=0.742 ms
64 bytes from 172.16.12.201: icmp_seq=10 ttl=62 time=0.712 ms
64 bytes from 172.16.12.201: icmp_seq=11 ttl=62 time=0.760 ms
64 bytes from 172.16.12.201: icmp_seq=12 ttl=62 time=0.787 ms
64 bytes from 172.16.12.201: icmp_seq=13 ttl=62 time=0.626 ms
64 bytes from 172.16.12.201: icmp_seq=14 ttl=62 time=0.655 ms
64 bytes from 172.16.12.201: icmp_seq=15 ttl=62 time=0.603 ms
```

Ping Ha from Hd

```
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=0.017 ms
64 bytes from 172.16.10.1: icmp_seq=2 ttl=64 time=0.029 ms
64 bytes from 172.16.10.1: icmp_seq=3 ttl=64 time=0.026 ms
64 bytes from 172.16.10.1: icmp_seq=4 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=5 ttl=64 time=0.057 ms
64 bytes from 172.16.10.1: icmp_seq=6 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=7 ttl=64 time=0.037 ms
64 bytes from 172.16.10.1: icmp_seq=8 ttl=64 time=0.062 ms
64 bytes from 172.16.10.1: icmp_seq=9 ttl=64 time=0.024 ms
64 bytes from 172.16.10.1: icmp_seq=10 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=11 ttl=64 time=0.027 ms
64 bytes from 172.16.10.1: icmp_seq=12 ttl=64 time=0.033 ms
64 bytes from 172.16.10.1: icmp_seq=13 ttl=64 time=0.027 ms
```

Task 6:

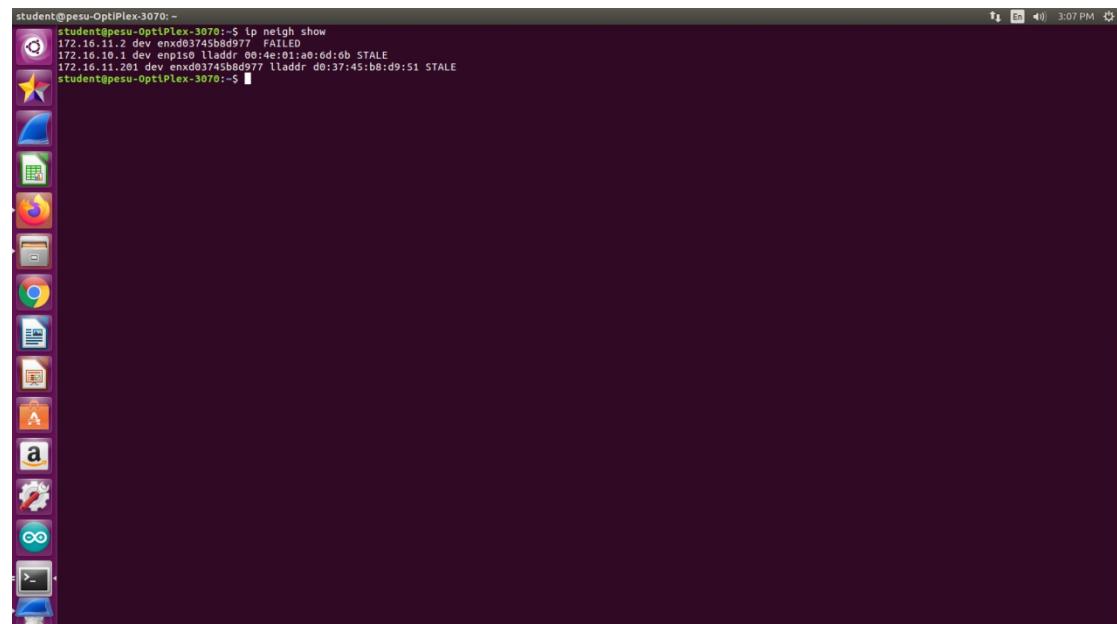
Verify the connections:

Ha:

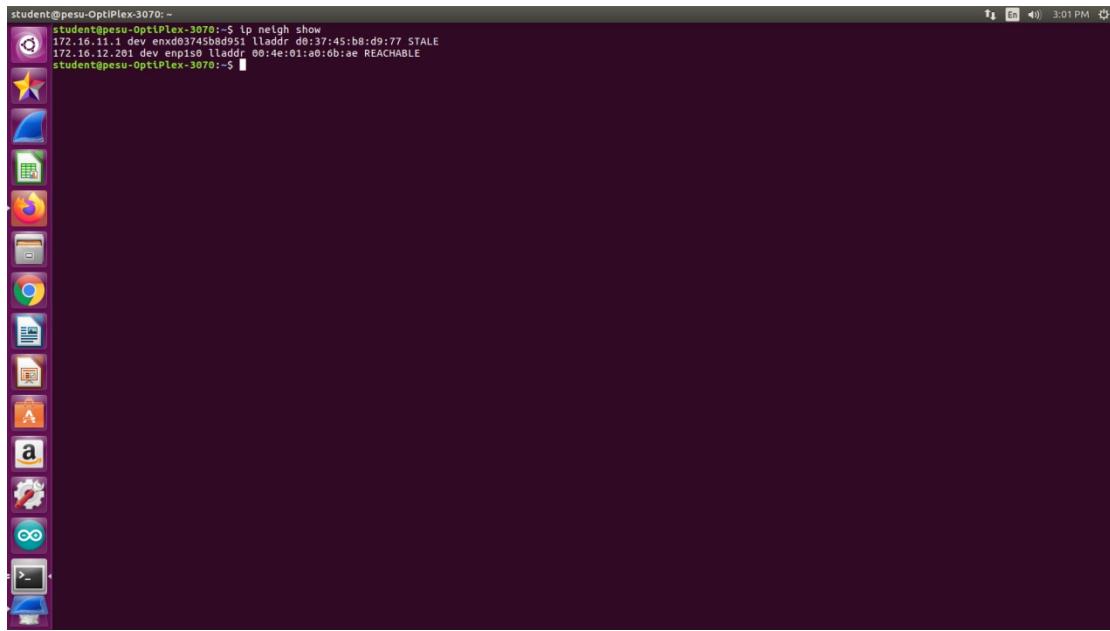
```
student@CSELAB: ~
student@CSELAB:~$ ip neigh show
172.16.10.201 dev enp2s0 lladdr b8:ae:ed:a5:a6:32 REACHABLE
```

R1:

```
student@pesu-OptiPlex-3070:~$ ip neigh show
172.16.11.2 dev enxd03745b8d977 FAILED
172.16.10.1 dev enpiso lladdr 00:4e:01:a8:0d:6b STALE
172.16.11.201 dev enxd03745b8d977 lladdr d0:37:45:b8:d9:51 STALE
student@pesu-OptiPlex-3070:~$
```



R2:



```
student@pesu-OptiPlex-3070:~$ ip neigh show
172.16.11.1 dev enxd03745b8d951 lladdr 00:37:45:b8:d9:77 STALE
172.16.12.201 dev ens1f0 lladdr 00:4e:01:a0:db:ae REACHABLE
student@pesu-OptiPlex-3070:~$
```

Hd:

```
student@cselab:~$ ip neigh show
172.16.12.1 dev enp2s0 lladdr b8:ae:ed:a5:a6:b5 REACHABLE
```

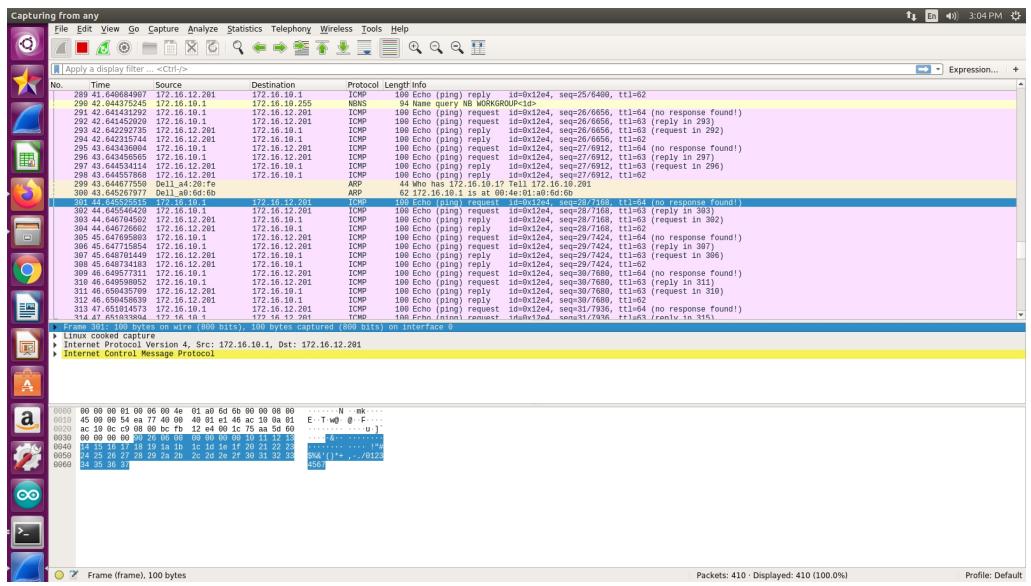
Wireshark screenshots of the host machines and the routers:

At Ha, ping Hd and the following ICMP packets are captured in wireshark...

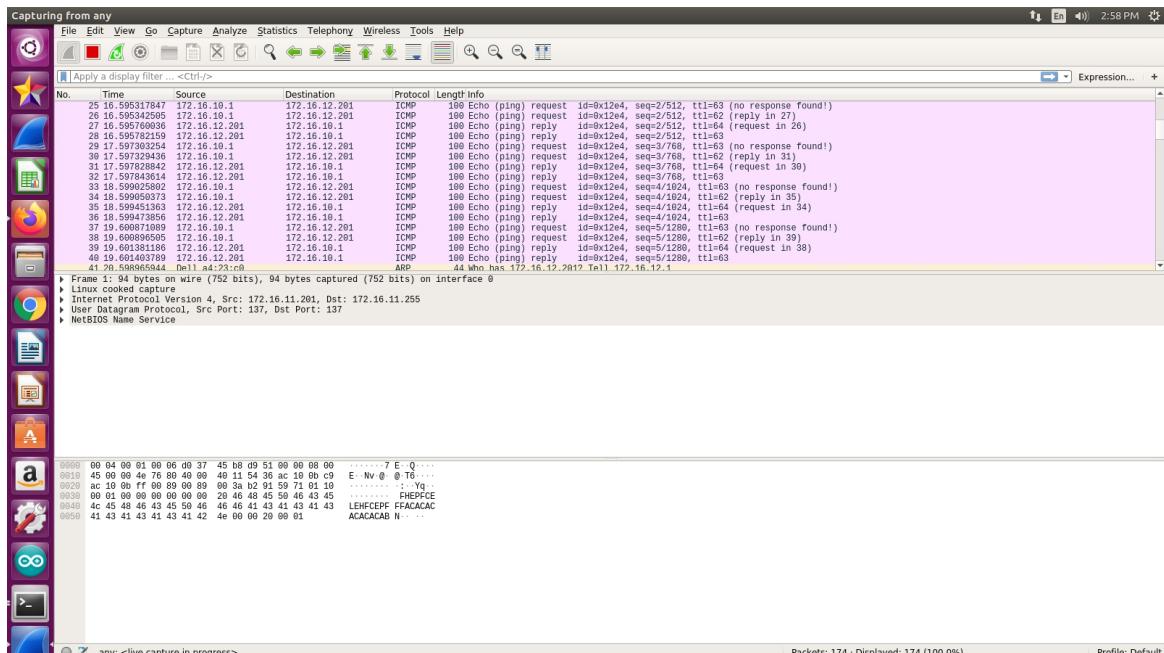
At Ha:

6.809237224	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request	id=0x0c5e, seq=2/512, ttl=64 (req)
6.809984767	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply	id=0x0c5e, seq=2/512, ttl=62 (rec)
7.808247802	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request	id=0x0c5e, seq=3/768, ttl=64 (req)
7.809021894	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply	id=0x0c5e, seq=3/768, ttl=62 (rec)
8.807963158	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request	id=0x0c5e, seq=4/1024, ttl=64 (req)
8.808653207	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply	id=0x0c5e, seq=4/1024, ttl=62 (rec)
9.807975804	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request	id=0x0c5e, seq=5/1280, ttl=64 (req)
9.808720367	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply	id=0x0c5e, seq=5/1280, ttl=62 (rec)
10.807910517	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request	id=0x0c5e, seq=6/1536, ttl=64 (req)
10.808618722	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply	id=0x0c5e, seq=6/1536, ttl=62 (rec)
10.814676990	Elitegro_a5:a6:32		ARP	62	Who has 172.16.10.1? Tell 172.16.10.201	
10.814706441	Elitegro_35:c2:46		ARP	44	172.16.10.1 is at b8:ae:ed:35:c2:46	

At R1:



At R2:



At Hd:

1.999884587	172.16.12.201	172.16.10.1	ICMP	98 Echo (ping) reply id=0xb3f, seq=3/768, ttl=64 (request in 3)
3.999837835	172.16.10.1	172.16.12.201	ICMP	98 Echo (ping) request id=0xb3f, seq=5/1280, ttl=62 (reply in 6)
3.999875938	172.16.12.201	172.16.10.1	ICMP	98 Echo (ping) reply id=0xb3f, seq=5/1280, ttl=64 (request in 5)
5.005744888	Elitegro_a5:a6:b5	Elitegro_a5:a6:0e	ARP	60 Who has 172.16.12.201? Tell 172.16.12.1
5.005771121	Elitegro_a5:a6:b5	Elitegro_a5:a6:b5	ARP	42 172.16.12.201 is at b8:ae:ed:a5:a6:0e
7.000036398	172.16.10.1	172.16.12.201	ICMP	98 Echo (ping) request id=0xb3f, seq=8/2048, ttl=62 (reply in 10)
7.000074491	172.16.12.201	172.16.10.1	ICMP	98 Echo (ping) reply id=0xb3f, seq=8/2048, ttl=64 (request in 9)
9.000075694	172.16.10.1	172.16.12.201	ICMP	98 Echo (ping) request id=0xb3f, seq=10/2560, ttl=62 (reply in 12)
9.000109953	172.16.12.201	172.16.10.1	ICMP	98 Echo (ping) reply id=0xb3f, seq=10/2560, ttl=64 (request in 11)
11.000040011	172.16.10.1	172.16.12.201	ICMP	98 Echo (ping) request id=0xb3f, seq=12/3072, ttl=62 (reply in 14)
11.000074265	172.16.12.201	172.16.10.1	ICMP	98 Echo (ping) reply id=0xb3f, seq=12/3072, ttl=64 (request in 13)
12.000067063	172.16.10.1	172.16.12.201	ICMP	98 Echo (ping) request id=0xb3f, seq=13/3328, ttl=62 (reply in 16)
42 000010110	172.16.12.201	172.16.10.1	TCP	00 Echo (ping) reply id=0xb3f, seq=13/3328, ttl=62 (request in 15)