COMPUTER NETWORKS LAB

WEEK-10

NAME	SRN
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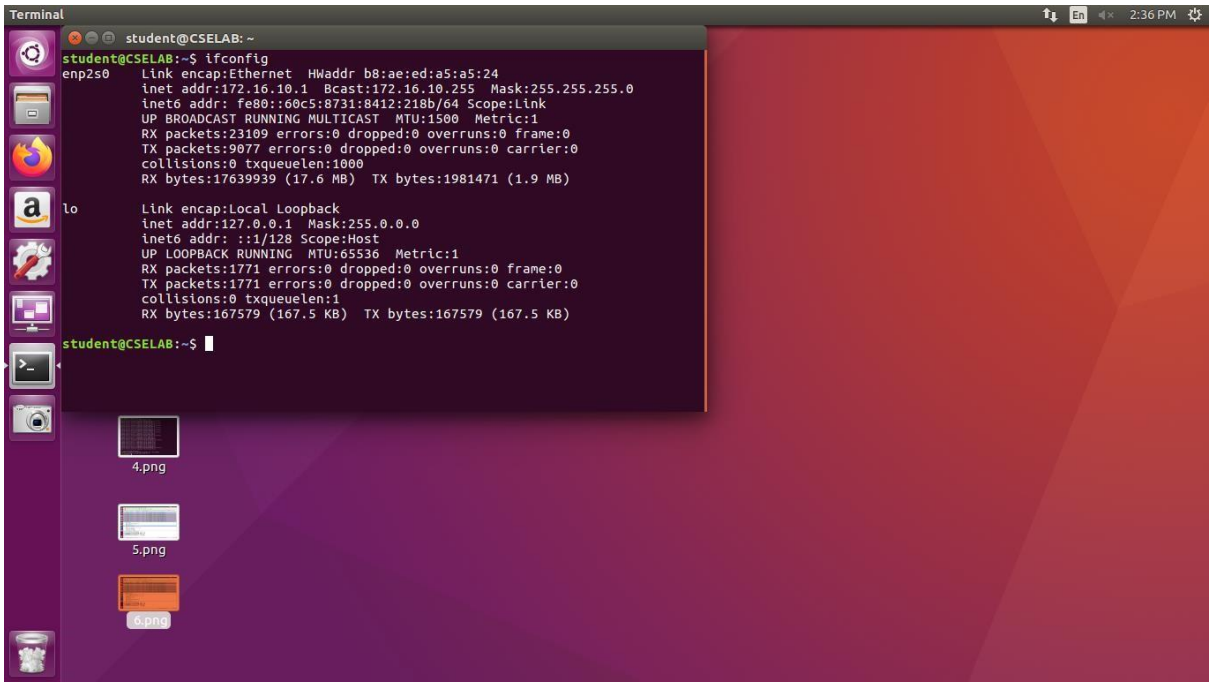
SECTION : H2

STEP 1: Assigning IP Addresses to each computer At

H_a:



At H_b:

```
student@CSELAB:~$ ifconfig
enp2s0    Link encap:Ethernet  HWaddr b8:ae:ed:a5:a5:d9
          inet addr:172.16.11.2  Bcast:172.16.11.255  Mask:255.255.255.0
          inet6 addr: fe80::ef3e:a634:755a:82e6/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:14664 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:11165326 (11.1 MB)  TX bytes:811374 (811.3 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:1320 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1320 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:141788 (141.7 KB)  TX bytes:141788 (141.7 KB)
```

At R_1:

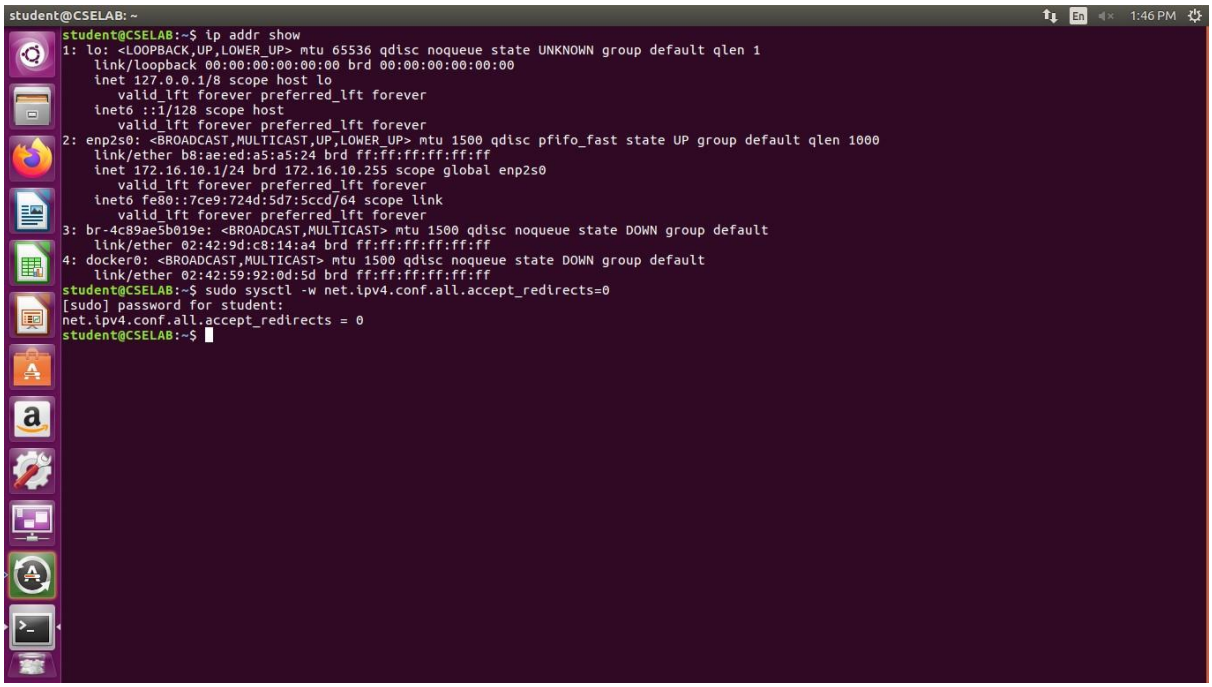
```
student@CSELAB:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       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:a5:ff brd ff:ff:ff:ff:ff:ff
    inet 172.16.10.2/24 brd 172.16.10.255 scope global enp2s0
       valid_lft forever preferred_lft forever
    inet6 fe80::35bb:8c3:281:5c15/64 scope link
       valid_lft forever preferred_lft forever
```

At R_2:

```
student@CSELAB:~$ ifconfig
enp2s0    Link encap:Ethernet  HWaddr b8:ae:ed:a5:a6:6a
          inet addr:172.16.10.3  Bcast:172.16.10.255  Mask:255.255.255.0
          inet6 addr: fe80::e884:d003:928b:2815/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:20806 errors:0 dropped:0 overruns:0 frame:0
          TX packets:7772 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:18323273 (18.3 MB)  TX bytes:1015130 (1.0 MB)

enx00594d6ea7c2 Link encap:Ethernet  HWaddr 00:59:4d:6e:a7:c2
          inet addr:172.16.11.1  Bcast:172.16.11.255  Mask:255.255.255.0
          inet6 addr: fe80::f0c8:1a5c:7cc1:9aa/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:9 errors:0 dropped:0 overruns:0 frame:0
          TX packets:42 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2388 (2.3 KB)  TX bytes:6024 (6.0 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:4824 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4824 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:369371 (369.3 KB)  TX bytes:369371 (369.3 KB)
```

Disabling accepting the ICMP redirect packets

At H_a:

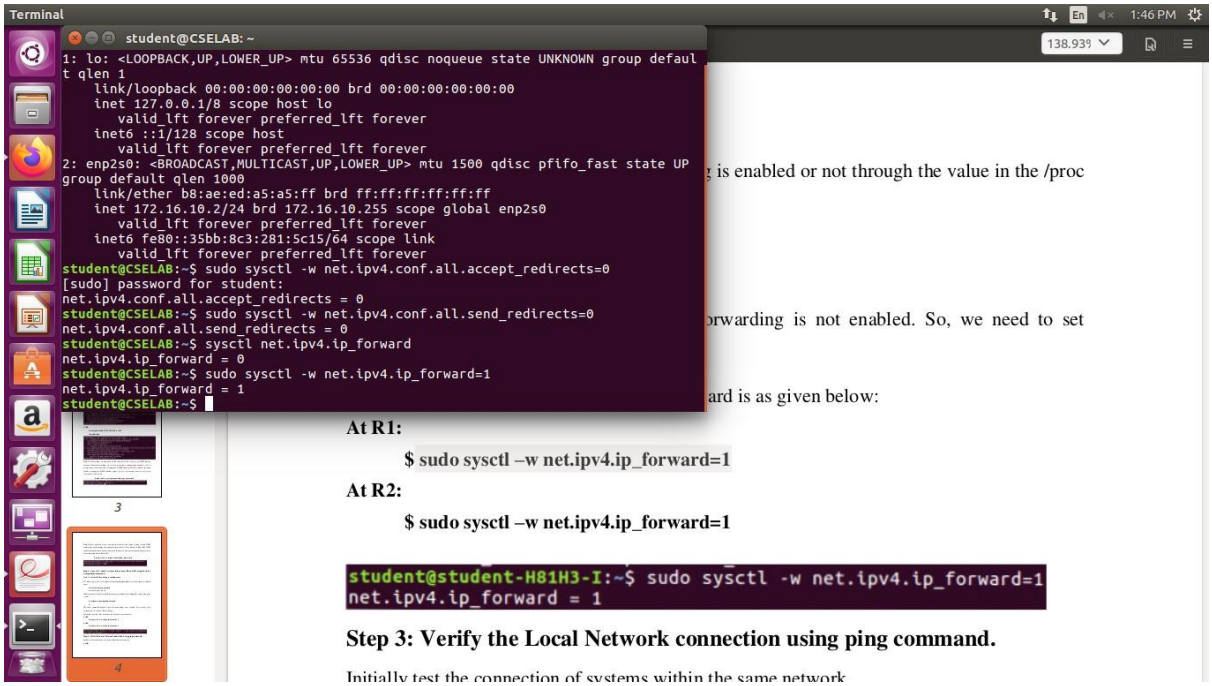


At H_b:

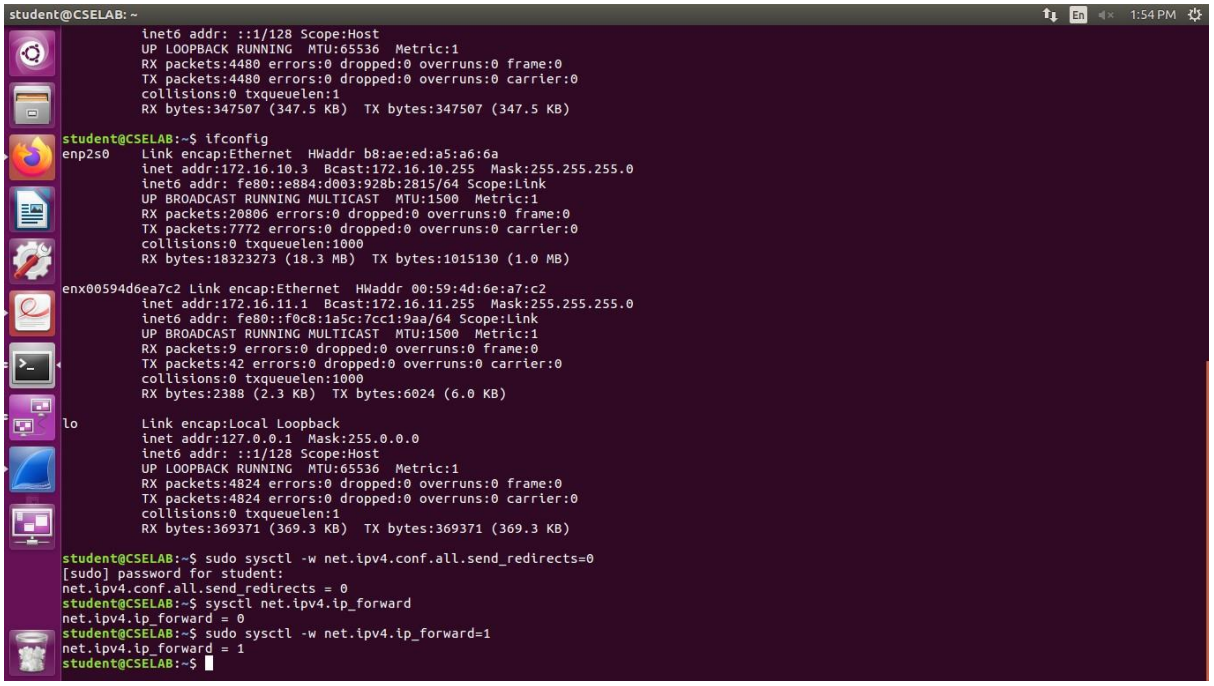
```
student@CSELAB:~$ ifconfig
enp2s0    Link encap:Ethernet  HWaddr b8:ae:ed:a5:a5:d9
          inet addr:172.16.11.2  Bcast:172.16.11.255  Mask:255.255.255.0
          inet6 addr: fe80::ef3e:a634:755a:82e6/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:14664 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:11165326 (11.1 MB)  TX bytes:811374 (811.3 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:1320 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1320 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:141788 (141.7 KB)  TX bytes:141788 (141.7 KB)

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

STEP 2: Converting two systems into routers R_1 and R_2 At

R_1:



At R_2:



STEP 3: Verifying the local network using ping command

At H_a:

```
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=0.077 ms
64 bytes from 172.16.10.1: icmp_seq=2 ttl=64 time=0.066 ms
64 bytes from 172.16.10.1: icmp_seq=3 ttl=64 time=0.073 ms
64 bytes from 172.16.10.1: icmp_seq=4 ttl=64 time=0.072 ms
64 bytes from 172.16.10.1: icmp_seq=5 ttl=64 time=0.065 ms
^C
--- 172.16.10.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 3998ms
rtt min/avg/max/mdev = 0.065/0.070/0.077/0.010 ms
student@CSELAB:~$
```

At H_b:

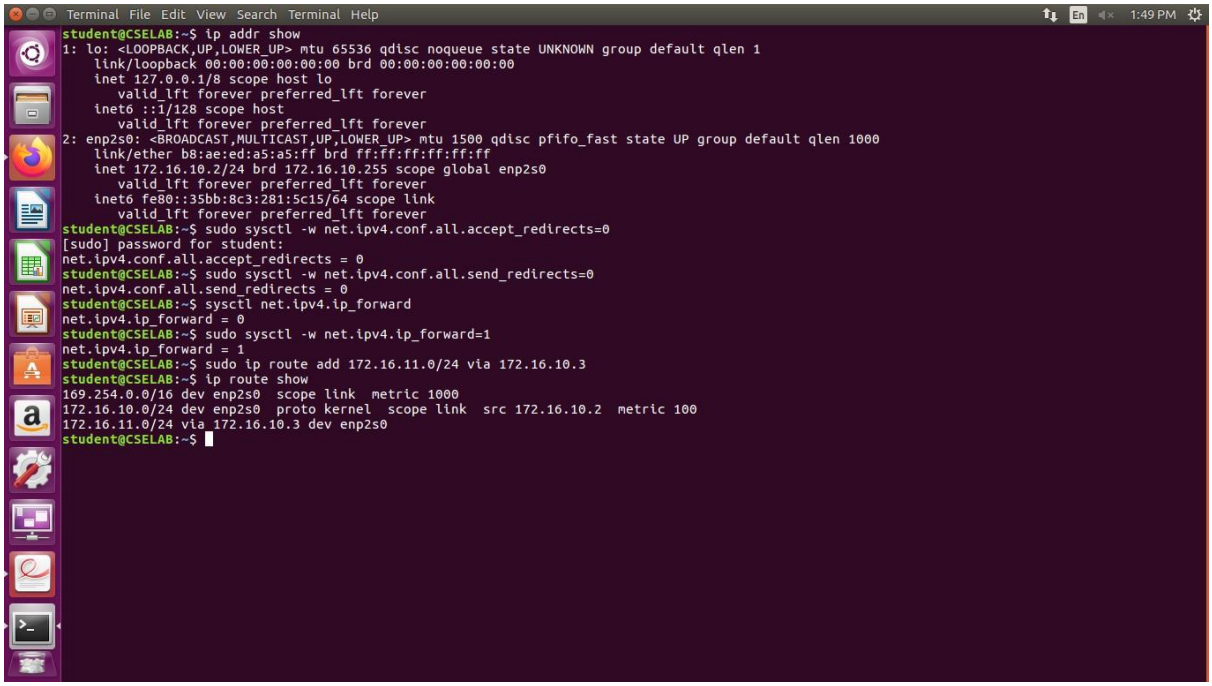
```
student@CSELAB:~$ ping 172.16.11.1
PING 172.16.11.1 (172.16.11.1) 56(84) bytes of data.
64 bytes from 172.16.11.1: icmp_seq=1 ttl=64 time=0.439 ms
64 bytes from 172.16.11.1: icmp_seq=2 ttl=64 time=0.331 ms
64 bytes from 172.16.11.1: icmp_seq=3 ttl=64 time=0.351 ms
64 bytes from 172.16.11.1: icmp_seq=4 ttl=64 time=0.330 ms
64 bytes from 172.16.11.1: icmp_seq=5 ttl=64 time=0.347 ms
64 bytes from 172.16.11.1: icmp_seq=6 ttl=64 time=0.357 ms
^C
--- 172.16.11.1 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 4997ms
rtt min/avg/max/mdev = 0.330/0.359/0.439/0.038 ms
student@CSELAB:~$
```

STEP 4: Inserting routing table entries to direct ipv4 packets At

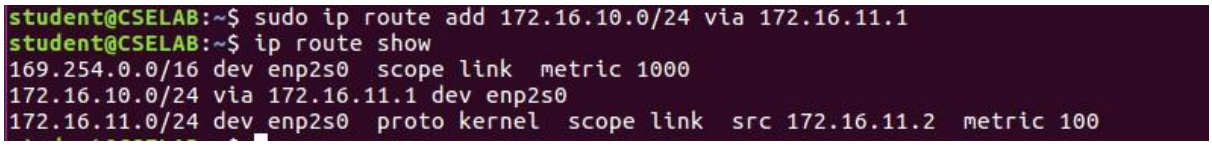
H_a:

```
student@CSELAB:~$ sudo ip route add 172.16.11.0/24 via 172.16.10.2
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 172.16.10.2 dev enp2s0
student@CSELAB:~$
```

At R_1:


Terminal File Edit View Search Terminal Help
1:49 PM
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:a5:ff brd ff:ff:ff:ff:ff:ff
inet 172.16.10.2/24 brd 172.16.10.255 scope global enp2s0
valid_lft forever preferred_lft forever
inet6 fe80::35bb:8c3:281:5c15/64 scope link
valid_lft forever preferred_lft forever
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.accept_redirects=0
[sudo] password for student:
net.ipv4.conf.all.accept_redirects = 0
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
net.ipv4.conf.all.send_redirects = 0
student@CSELAB:~$ sysctl net.ipv4.ip_forward
net.ipv4.ip_forward = 0
student@CSELAB:~$ sudo sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
student@CSELAB:~$ sudo ip route add 172.16.11.0/24 via 172.16.10.3
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 172.16.10.2 metric 100
172.16.11.0/24 via 172.16.10.3 dev enp2s0
student@CSELAB:~$

At H_b:

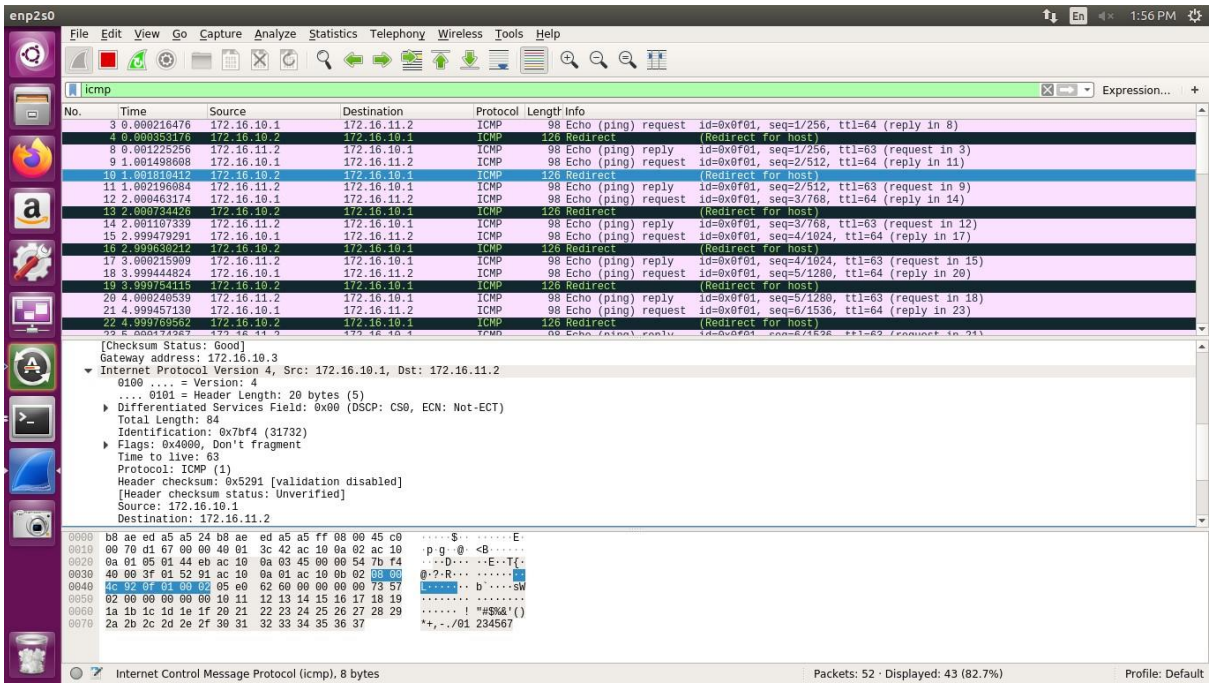

student@CSELAB:~$ sudo ip route add 172.16.10.0/24 via 172.16.11.1
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0 scope link metric 1000
172.16.10.0/24 via 172.16.11.1 dev enp2s0
172.16.11.0/24 dev enp2s0 proto kernel scope link src 172.16.11.2 metric 100

STEP 5: Capturing packets on Wireshark

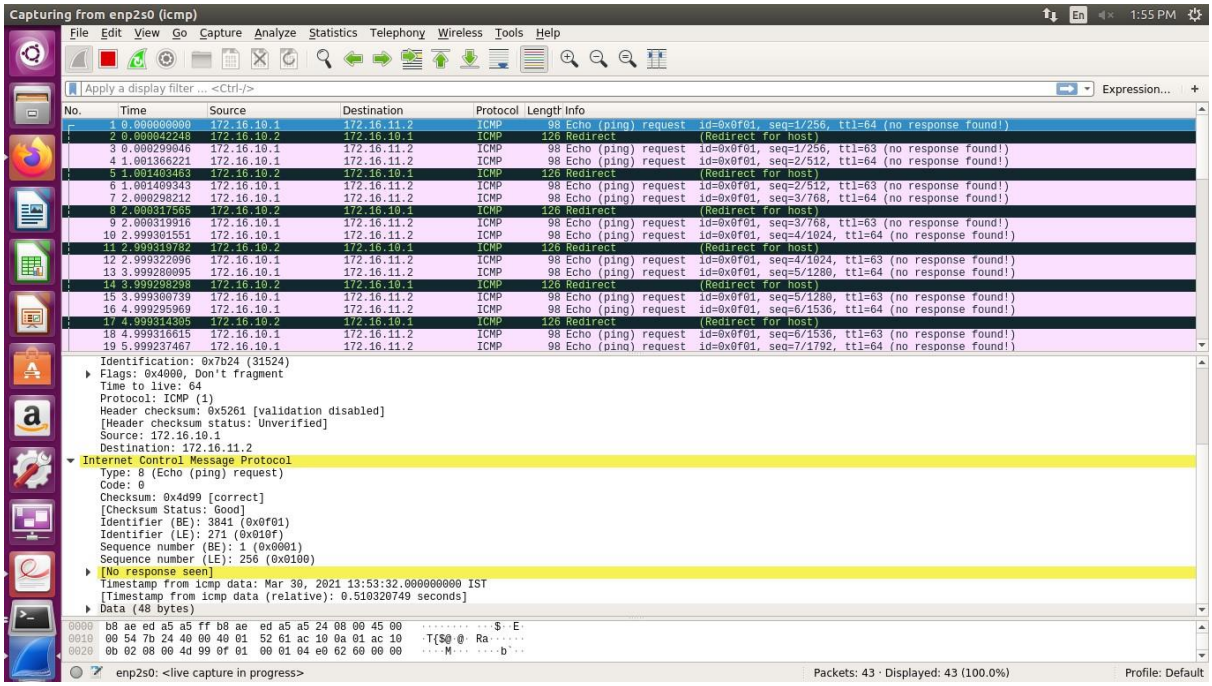
Pinging H_b from H_a:

```
student@CSELAB:~$ ping 172.16.11.2
PING 172.16.11.2 (172.16.11.2) 56(84) bytes of data.
From 172.16.10.2: icmp_seq=1 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=1 ttl=63 time=1.32 ms
From 172.16.10.2: icmp_seq=2 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=2 ttl=63 time=0.761 ms
From 172.16.10.2: icmp_seq=3 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=3 ttl=63 time=0.670 ms
From 172.16.10.2: icmp_seq=4 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=4 ttl=63 time=0.774 ms
From 172.16.10.2: icmp_seq=5 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=5 ttl=63 time=0.831 ms
From 172.16.10.2: icmp_seq=6 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=6 ttl=63 time=0.763 ms
64 bytes from 172.16.11.2: icmp_seq=7 ttl=63 time=0.768 ms
From 172.16.10.2: icmp_seq=8 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=8 ttl=63 time=0.678 ms
64 bytes from 172.16.11.2: icmp_seq=9 ttl=63 time=0.615 ms
64 bytes from 172.16.11.2: icmp_seq=10 ttl=63 time=0.688 ms
From 172.16.10.2: icmp_seq=11 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=11 ttl=63 time=0.724 ms
64 bytes from 172.16.11.2: icmp_seq=12 ttl=63 time=0.672 ms
64 bytes from 172.16.11.2: icmp_seq=13 ttl=63 time=0.671 ms
64 bytes from 172.16.11.2: icmp_seq=14 ttl=63 time=0.723 ms
64 bytes from 172.16.11.2: icmp_seq=15 ttl=63 time=0.593 ms
64 bytes from 172.16.11.2: icmp_seq=16 ttl=63 time=0.656 ms
From 172.16.10.2: icmp_seq=17 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=17 ttl=63 time=0.493 ms
^C
--- 172.16.11.2 ping statistics ---
17 packets transmitted, 17 received, 0% packet loss, time 15999ms
rtt min/avg/max/mdev = 0.493/0.729/1.326/0.171 ms
student@CSELAB:~$
```

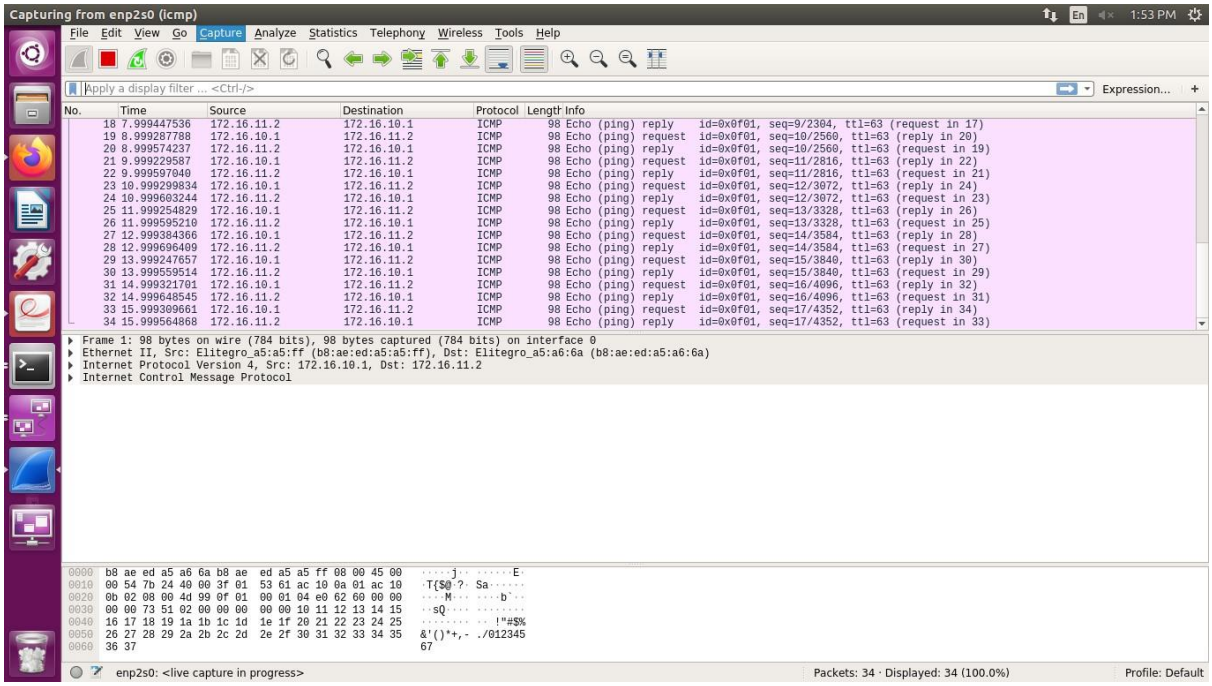
Capturing packets at H_a:



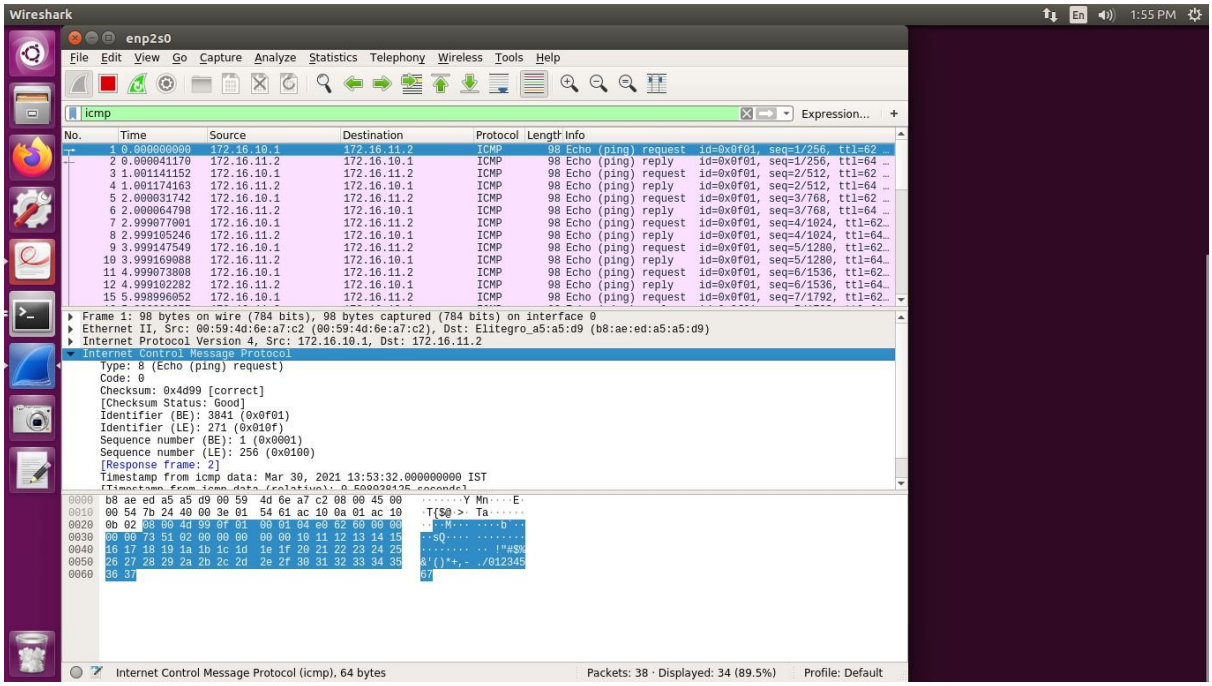
Capturing packets at R_1:



Capturing packets at R_2:



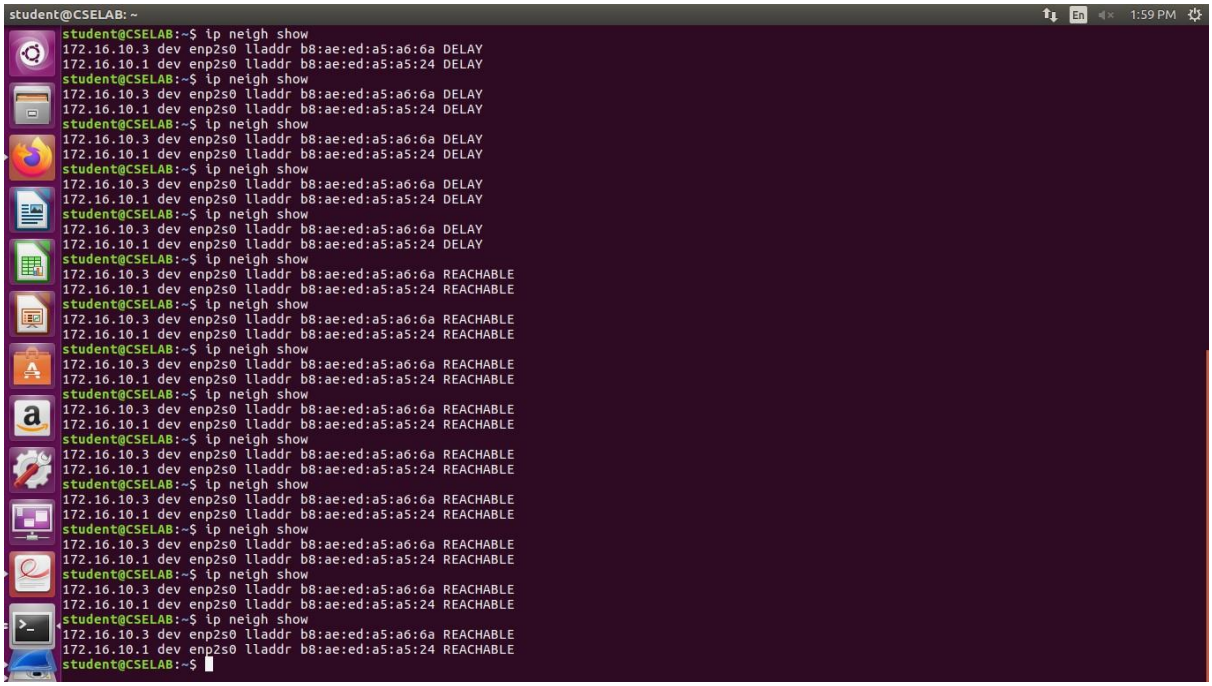
Capturing packets at H_b:



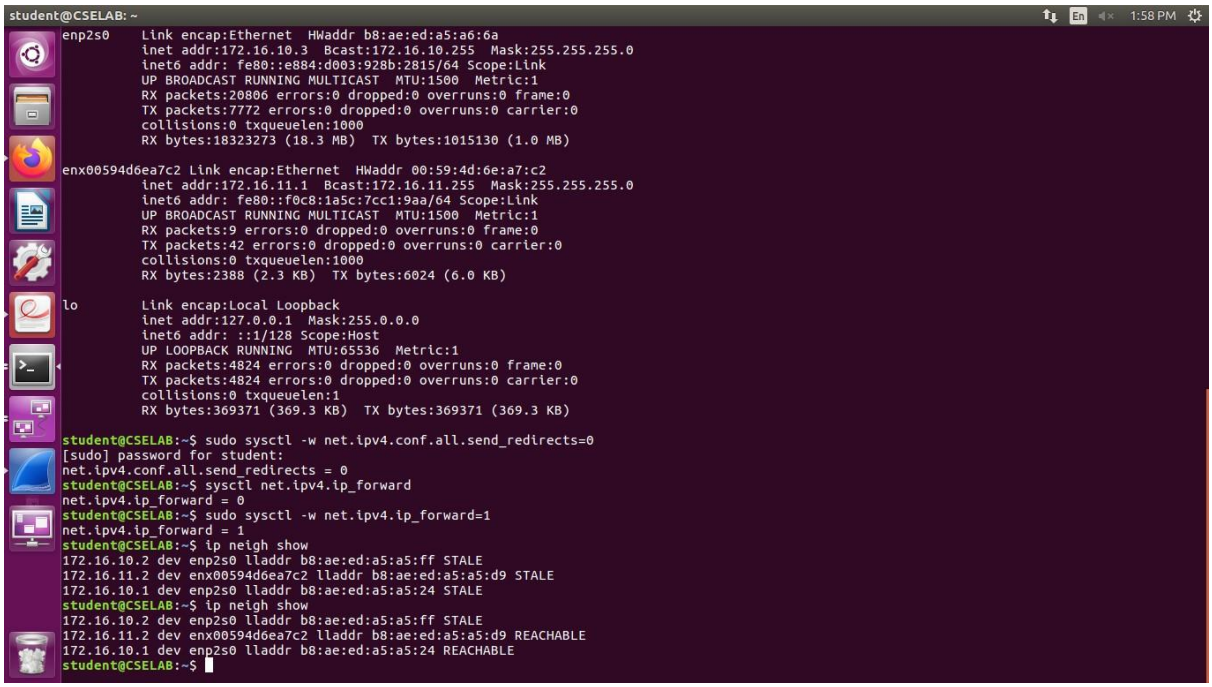
STEP 6: Checking each system neighbours to verify the connection At H_a:

```
^C
--- 172.16.11.2 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5000ms
rtt min/avg/max/mdev = 0.621/0.673/0.709/0.037 ms
student@CSELAB:~$ ping 172.16.11.2
PING 172.16.11.2 (172.16.11.2) 56(84) bytes of data.
From 172.16.10.2: icmp_seq=1 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=1 ttl=63 time=0.742 ms
From 172.16.10.2: icmp_seq=2 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=2 ttl=63 time=0.616 ms
From 172.16.10.2: icmp_seq=3 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=3 ttl=63 time=0.602 ms
From 172.16.10.2: icmp_seq=4 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=4 ttl=63 time=0.724 ms
From 172.16.10.2: icmp_seq=5 Redirect Host(New nexthop: 172.16.10.3)
64 bytes from 172.16.11.2: icmp_seq=5 ttl=63 time=0.644 ms
^C
--- 172.16.11.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 3997ms
rtt min/avg/max/mdev = 0.602/0.665/0.742/0.063 ms
student@CSELAB:~$ ip neigh show
172.16.10.3 dev enp2s0 lladdr 00:59:4d:6e:9f:de STALE
172.16.10.2 dev enp2s0 lladdr b8:ae:ed:a5:a5:ff STALE
student@CSELAB:~$
```

At R_1:

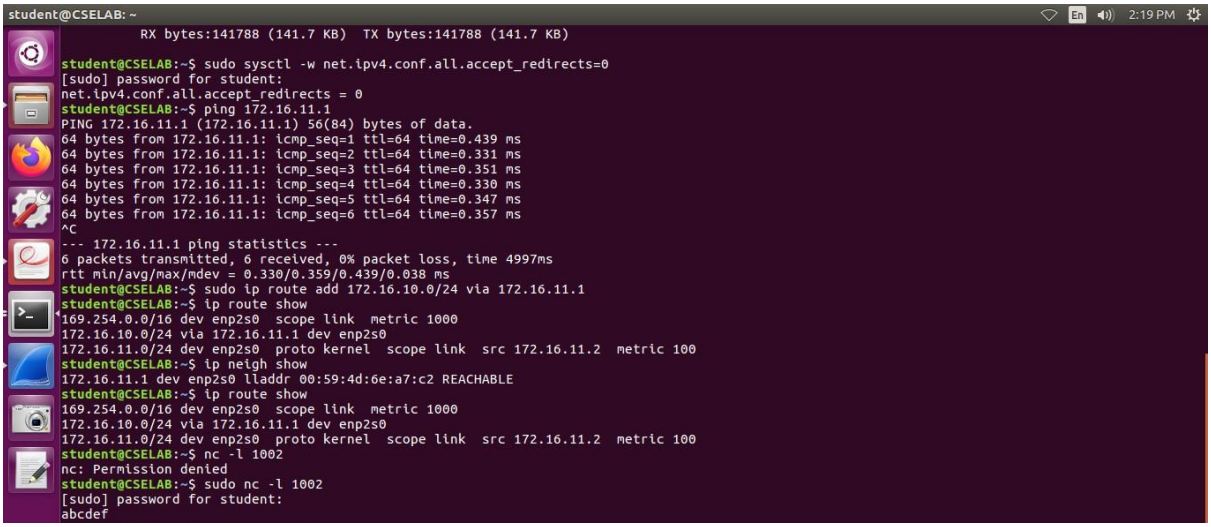


At R_2:

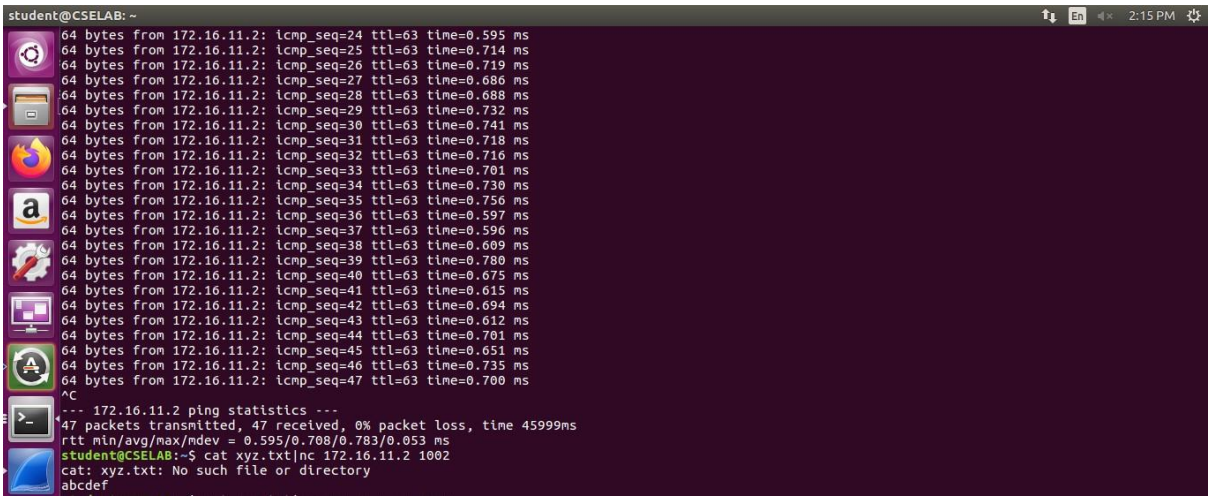


Sending data from H_b to H_a using nc command

At H_b:


student@CSELAB: ~
2:19 PM
RX bytes:141788 (141.7 KB) TX bytes:141788 (141.7 KB)
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.accept_redirects=0
[sudo] password for student:
net.ipv4.conf.all.accept_redirects = 0
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=0.439 ms
64 bytes from 172.16.11.1: icmp_seq=2 ttl=64 time=0.331 ms
64 bytes from 172.16.11.1: icmp_seq=3 ttl=64 time=0.351 ms
64 bytes from 172.16.11.1: icmp_seq=4 ttl=64 time=0.330 ms
64 bytes from 172.16.11.1: icmp_seq=5 ttl=64 time=0.347 ms
64 bytes from 172.16.11.1: icmp_seq=6 ttl=64 time=0.357 ms
^C
--- 172.16.11.1 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 4997ms
rtt min/avg/max/mdev = 0.330/0.359/0.439/0.038 ms
student@CSELAB:~$ sudo ip route add 172.16.10.0/24 via 172.16.11.1
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0 scope link metric 1000
172.16.10.0/24 via 172.16.11.1 dev enp2s0
172.16.11.0/24 dev enp2s0 proto kernel scope link src 172.16.11.2 metric 100
student@CSELAB:~$ ip neigh show
172.16.11.1 dev enp2s0 lladdr 00:59:4d:6e:a7:c2 REACHABLE
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0 scope link metric 1000
172.16.10.0/24 via 172.16.11.1 dev enp2s0
172.16.11.0/24 dev enp2s0 proto kernel scope link src 172.16.11.2 metric 100
student@CSELAB:~$ nc -l 1002
nc: Permission denied
student@CSELAB:~$ sudo nc -l 1002
[sudo] password for student:
abcdef

At H_a:


student@CSELAB: ~
2:15 PM
64 bytes from 172.16.11.2: icmp_seq=24 ttl=63 time=0.595 ms
64 bytes from 172.16.11.2: icmp_seq=25 ttl=63 time=0.714 ms
64 bytes from 172.16.11.2: icmp_seq=26 ttl=63 time=0.719 ms
64 bytes from 172.16.11.2: icmp_seq=27 ttl=63 time=0.686 ms
64 bytes from 172.16.11.2: icmp_seq=28 ttl=63 time=0.688 ms
64 bytes from 172.16.11.2: icmp_seq=29 ttl=63 time=0.732 ms
64 bytes from 172.16.11.2: icmp_seq=30 ttl=63 time=0.741 ms
64 bytes from 172.16.11.2: icmp_seq=31 ttl=63 time=0.718 ms
64 bytes from 172.16.11.2: icmp_seq=32 ttl=63 time=0.716 ms
64 bytes from 172.16.11.2: icmp_seq=33 ttl=63 time=0.701 ms
64 bytes from 172.16.11.2: icmp_seq=34 ttl=63 time=0.730 ms
64 bytes from 172.16.11.2: icmp_seq=35 ttl=63 time=0.756 ms
64 bytes from 172.16.11.2: icmp_seq=36 ttl=63 time=0.597 ms
64 bytes from 172.16.11.2: icmp_seq=37 ttl=63 time=0.596 ms
64 bytes from 172.16.11.2: icmp_seq=38 ttl=63 time=0.609 ms
64 bytes from 172.16.11.2: icmp_seq=39 ttl=63 time=0.780 ms
64 bytes from 172.16.11.2: icmp_seq=40 ttl=63 time=0.675 ms
64 bytes from 172.16.11.2: icmp_seq=41 ttl=63 time=0.615 ms
64 bytes from 172.16.11.2: icmp_seq=42 ttl=63 time=0.694 ms
64 bytes from 172.16.11.2: icmp_seq=43 ttl=63 time=0.612 ms
64 bytes from 172.16.11.2: icmp_seq=44 ttl=63 time=0.701 ms
64 bytes from 172.16.11.2: icmp_seq=45 ttl=63 time=0.651 ms
64 bytes from 172.16.11.2: icmp_seq=46 ttl=63 time=0.735 ms
64 bytes from 172.16.11.2: icmp_seq=47 ttl=63 time=0.700 ms
^C
--- 172.16.11.2 ping statistics ---
47 packets transmitted, 47 received, 0% packet loss, time 45999ms
rtt min/avg/max/mdev = 0.595/0.708/0.783/0.053 ms
student@CSELAB:~$ cat xyz.txt|nc 172.16.11.2 1002
cat: xyz.txt: No such file or directory
abcdef