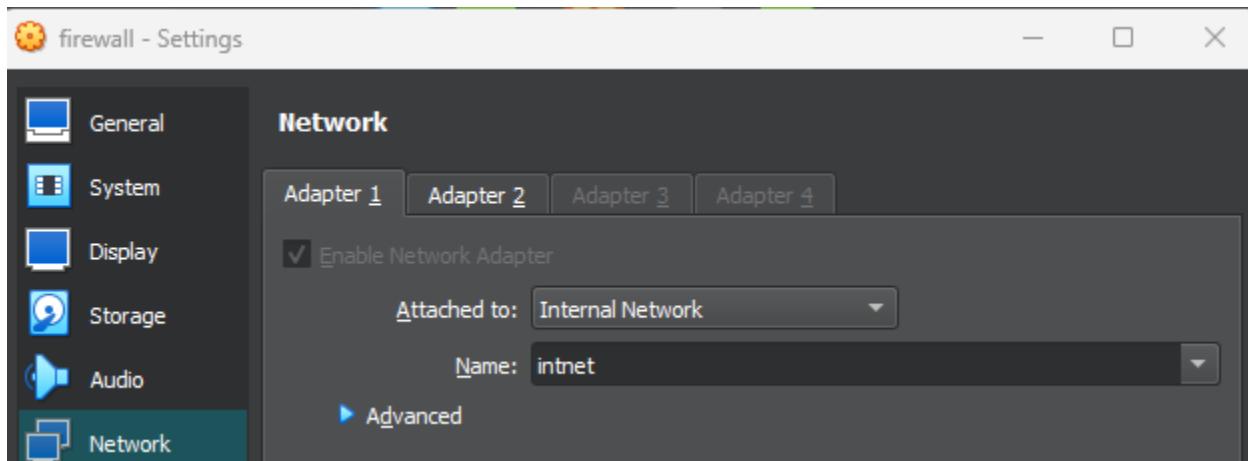


Module:- NDC
(IP_Tables-Masquerade and LoadBalancing)
Name:- Prithviraj Nikam

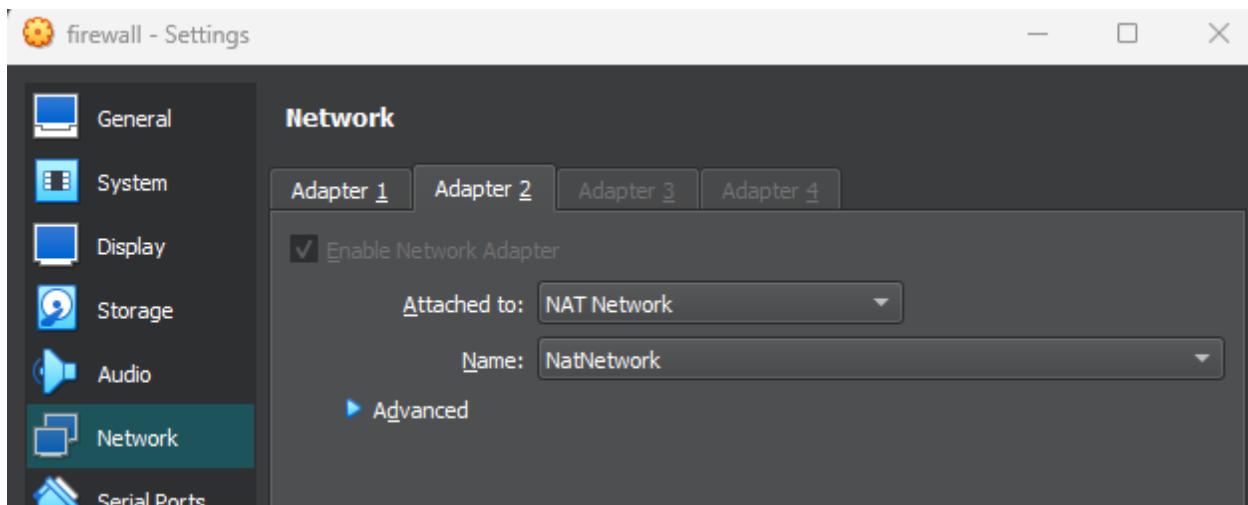
MASQUERADE

FIREWALL Side

Step-1:-Create Firewall Machine and set the Internal Network on Adapter-1



Step-2:-Set the NAT Network on Adapter-2



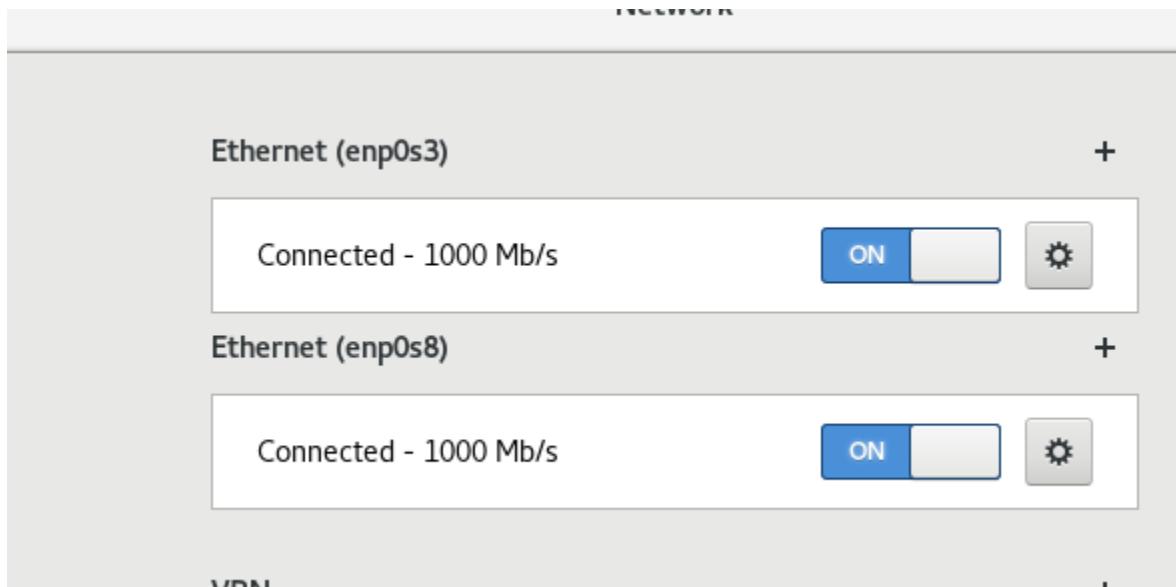
Step-3:-Open the Firewall machine and Install the net tools
#dnf install net-tools

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# dnf install net-tools  
Last metadata expiration check: 3:56:27 ago on Friday 23 December 2022 01:15:06  
PM IST.  
Resolving Dependencies
```

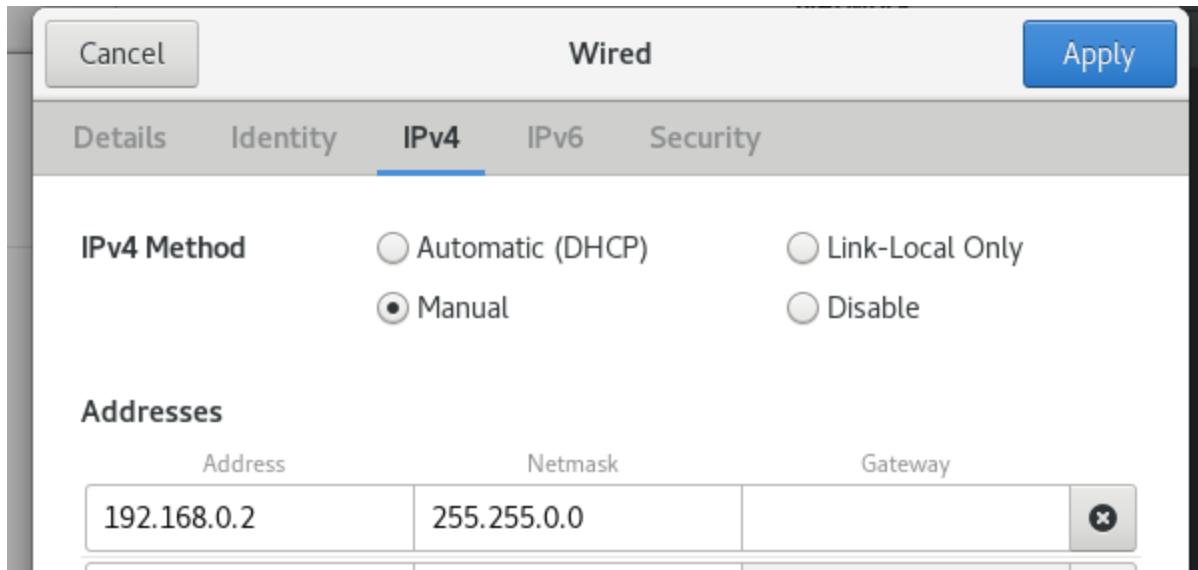
Step - 4:-check ip of Firewall machine

```
Activities Terminal ▾ Dec 23 16:35  
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# ifconfig  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
        inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255  
              inet6 fe80::a00:27ff:fe7e:39e2 prefixlen 64 scopeid 0x20<link>  
                ether 08:00:27:7e:39:e2 txqueuelen 1000 (Ethernet)  
                  RX packets 56818 bytes 85318313 (81.3 MiB)  
                  RX errors 0 dropped 0 overruns 0 frame 0  
                  TX packets 20330 bytes 1266717 (1.2 MiB)  
                  TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
        inet 10.0.2.7 netmask 255.255.255.0 broadcast 10.0.2.255  
              inet6 fe80::2a14:d98e:1bf:65d1 prefixlen 64 scopeid 0x20<link>
```

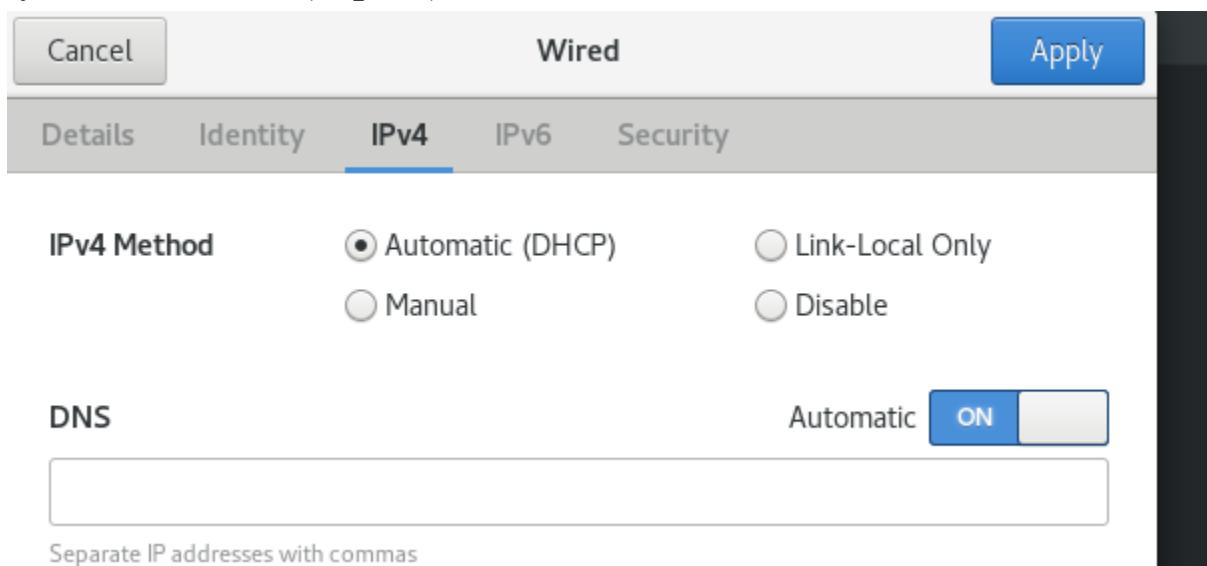
Step-5:- Go to network Setting and set ip



**Go to Ethernet (enp0s3) and Set IP Manually Because in my system
Ethernet (enp0s3) work as Internal Network**



Go to Ethernet (enp0s8) and Set IP Automatic(DHCP) Because in my system Ethernet (enp0s3) work as NAT Network



Then go to Terminal check the ip

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# ifconfig  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
        inet 192.168.0.2 netmask 255.255.0.0 broadcast 192.168.255.255  
        inet6 fe80::a00:27ff:fe7e:39e2 prefixlen 64 scopeid 0x20<link>  
          ether 08:00:27:7e:39:e2 txqueuelen 1000 (Ethernet)  
            RX packets 56939 bytes 85341012 (81.3 MiB)  
            RX errors 0 dropped 0 overruns 0 frame 0  
            TX packets 20823 bytes 1339662 (1.2 MiB)  
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
        inet 10.0.2.7 netmask 255.255.255.0 broadcast 10.0.2.255  
        inet6 fe80::2a14:d98e:1bf:65d1 prefixlen 64 scopeid 0x20<link>  
          ether 08:00:27:70:67:5c txqueuelen 1000 (Ethernet)
```

[OR]

You Can set IP through Command Line

```
#ifconfig enp0s3 down  
#ifconfig enp0s3 192.168.0.2  
#ifconfig enp0s8 down  
#ifconfig enp0s8 10.0.2.7
```

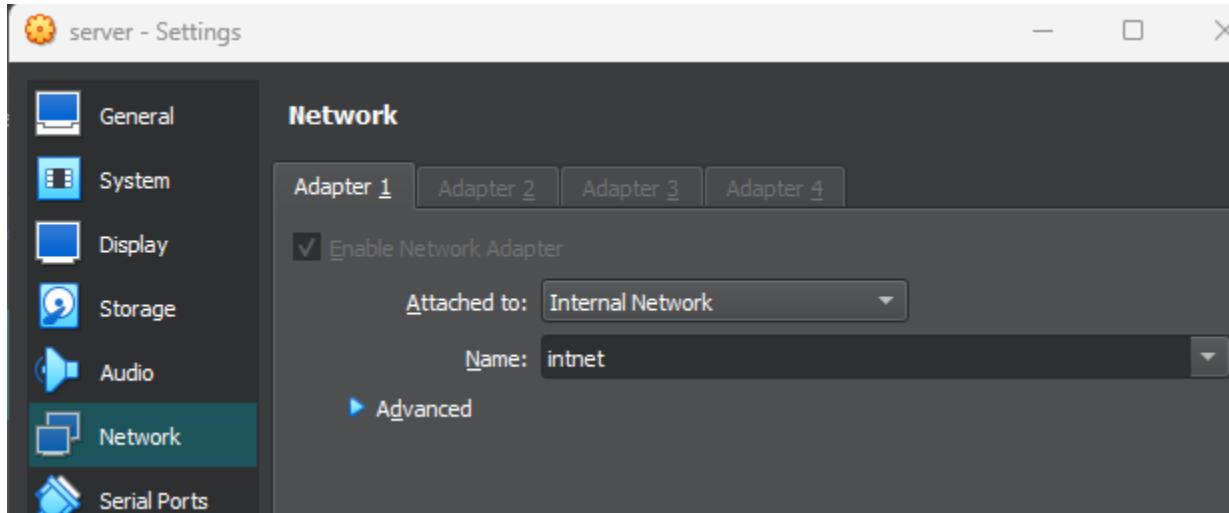
Step -6:- Now Add rule in ip tables

```
#iptables -S -t nat  
#iptables -A POSTROUTING -t nat -s 10.0.0.0/24 -d 192.168.0.0/24 -j  
MASQUERADE
```

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# iptables -S -t nat  
-P PREROUTING ACCEPT  
-P INPUT ACCEPT  
-P POSTROUTING ACCEPT  
-P OUTPUT ACCEPT  
-N LIBVIRT_PRT  
[root@localhost ~]# iptables -A POSTROUTING -t nat -s 10.0.0.0/24 -d 192.168.0.0/24 -j  
MASQUERADE  
[root@localhost ~]# iptables -S -t nat  
-P PREROUTING ACCEPT  
-P INPUT ACCEPT  
-P POSTROUTING ACCEPT  
-P OUTPUT ACCEPT  
-N LIBVIRT_PRT  
-A POSTROUTING -s 10.0.0.0/24 -d 192.168.0.0/24 -j MASQUERADE  
[root@localhost ~]#
```

Server Side

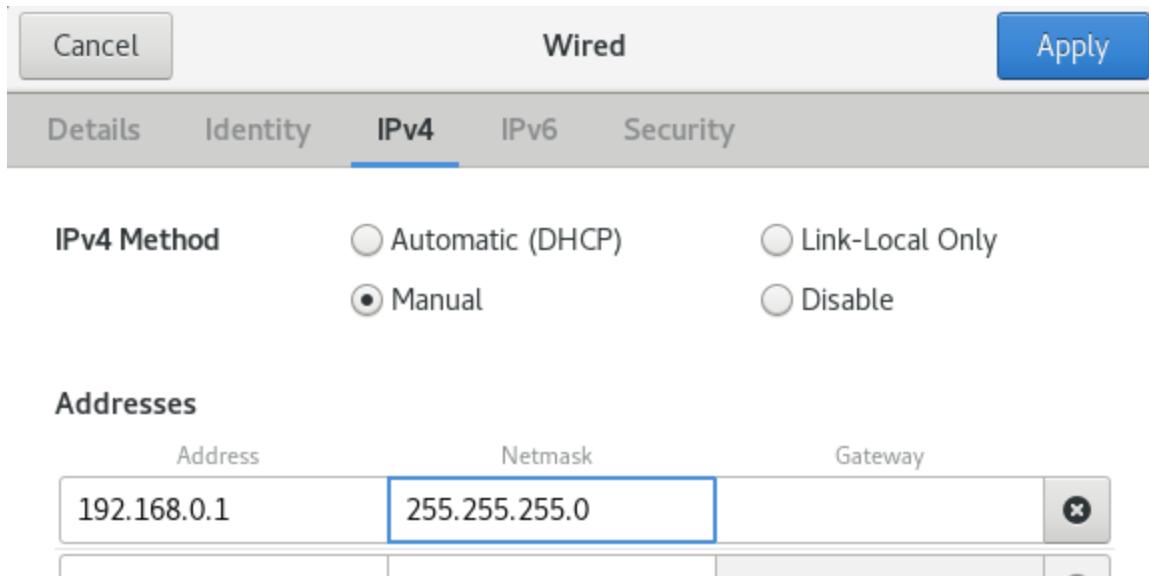
Step-1:-Create Server Machine and set the Internal network on Adapter-1



**Step-2:- Open the server machine and Install the net tools
#dnf install net-tools**

A screenshot of a terminal window with a dark theme. The title bar says 'root@localhost:~'. The menu bar includes File, Edit, View, Search, Terminal, and Help. The command entered is '#dnf install net-tools'. The output shows: 'Last metadata expiration check: 3:56:27 ago on Friday 23 December 2022 01:15:06 PM IST.' followed by a message indicating that net-tools-2.8-53.el8_6.x86_64 is already installed.

Step-3:-Go to Ethernet (enp0s3) and Set IP Manually Because in my system Ethernet (enp0s3) work as Internal Network



```
File Machine View Input Devices Help
Activities Terminal ▾ Dec 23 17:01
root@localhost:~#
File Edit View Search Terminal Help
[root@localhost ~]# ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.0.1 netmask 255.255.255.0 broadcast 192.168.0.255
        inet6 fe80::a00:27ff:fe2b:c0a3 prefixlen 64 scopeid 0x20<link>
          ether 08:00:27:2b:c0:a3 txqueuelen 1000 (Ethernet)
            RX packets 61342 bytes 91888568 (87.6 MiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 24292 bytes 1510295 (1.4 MiB)
```

[OR]

You Can set IP through Command Line

```
#ifconfig enp0s3 down
#ifconfig enp0s3 192.168.0.1
```

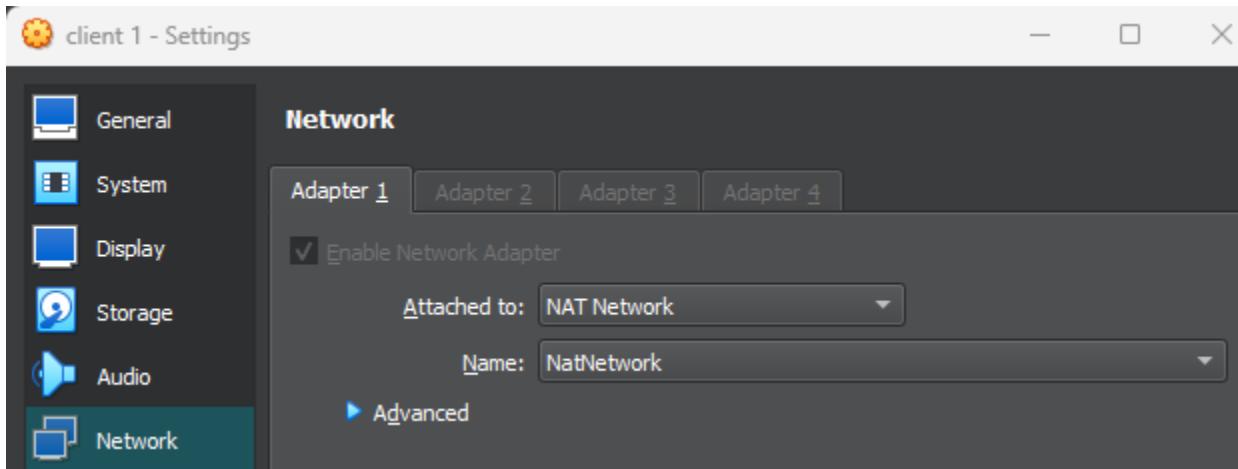
Step-4:- Now add the gateway

```
#route add -net default gw 10.0.2.7
#netstat -rn
#route del -net default gw 10.0.2.1
```

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# route add -net default gw 192.168.0.2  
[root@localhost ~]# netstat -rn  
Kernel IP routing table  
Destination      Gateway          Genmask         Flags MSS Window irtt Iface  
0.0.0.0        192.168.0.2    0.0.0.0        UG    0 0        0 enp0s3  
192.168.0.0     0.0.0.0        255.255.255.0   U     0 0        0 enp0s3  
192.168.122.0   0.0.0.0        255.255.255.0   U     0 0        0 virbr0  
[root@localhost ~]#
```

Client -1 Side

Step-1:- Create Client Machine and set the NAT Network on Adapter-1



Step-2:- Open the Client-1 machine and Install the net tools

```
#dnf install net-tools
```

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# dnf install net-tools  
Last metadata expiration check: 3:56:27 ago on Friday 23 December 2022 01:15:06  
PM IST.  
Resolving Dependencies... done
```

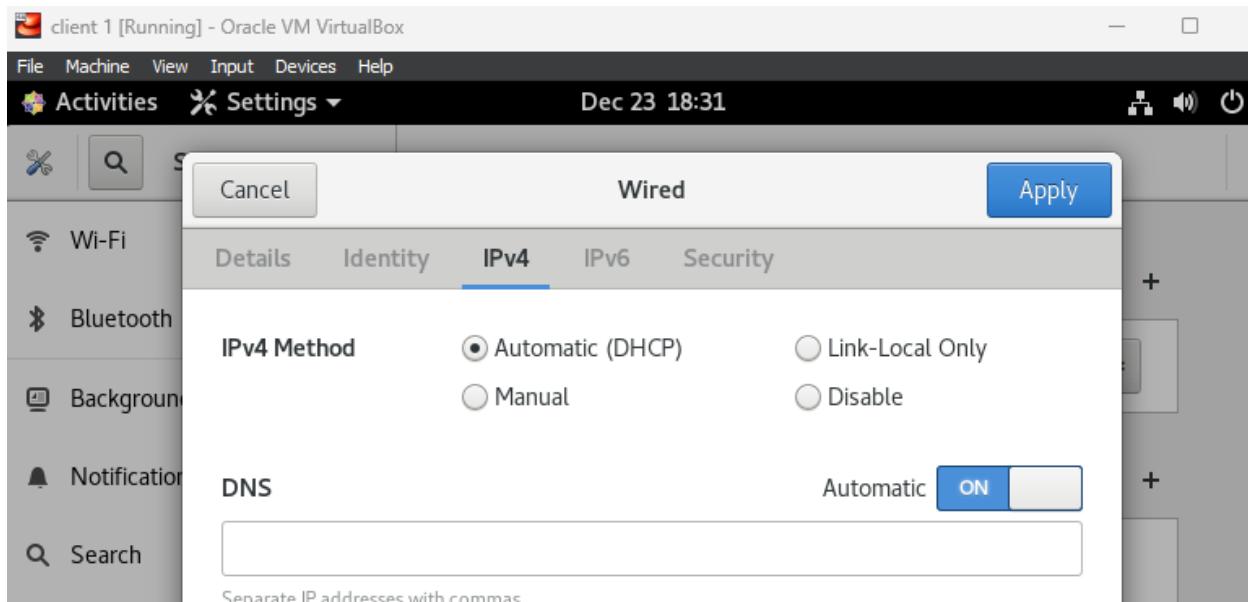
A screenshot of a terminal window titled 'root@localhost:~'. The window has a dark theme. The title bar says 'root@localhost:~'. The menu bar includes 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The command '#dnf install net-tools' is entered at the prompt. The output shows the system checking metadata and resolving dependencies.

Step-3:-check ip of client -1 machine

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# ifconfig  
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 40 bytes 3404 (3.3 KiB)  
                RX errors 0 dropped 0 overruns 0 frame 0
```

A screenshot of a terminal window titled 'root@localhost:~'. The window has a dark theme. The title bar says 'root@localhost:~'. The menu bar includes 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The command 'ifconfig' is entered at the prompt. The output shows the configuration of the 'lo' interface, which is the loopback interface.

Step-4:- Go to network Setting Ethernet (enp0s8) and set ip is Automatic(DHCP)



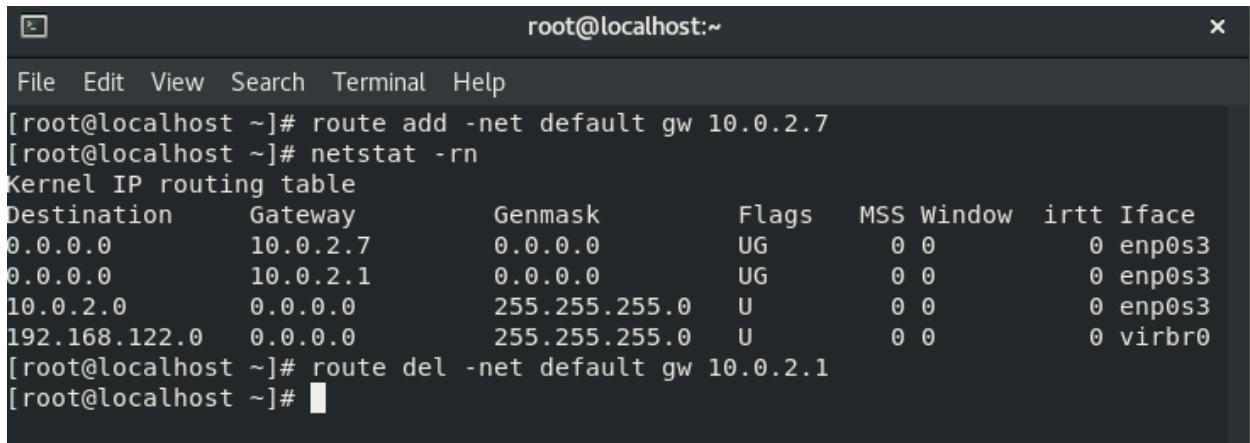
[OR]

You Can set IP through Command Line

```
#ifconfig enp0s3 down  
#ifconfig enp0s3 10.0.2.8
```

Step-5:- Now add the gateway

```
#route add -net default gw 10.0.2.7  
#netstat -rn  
#route del -net default gw 10.0.2.1
```

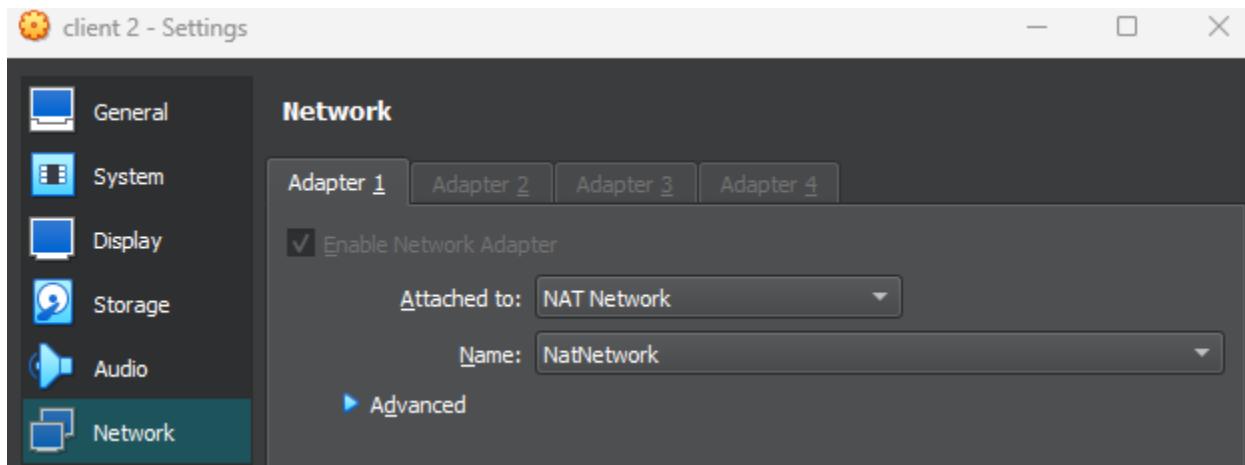


The screenshot shows a terminal window titled "root@localhost:~". The window contains the following command-line session:

```
File Edit View Search Terminal Help  
[root@localhost ~]# route add -net default gw 10.0.2.7  
[root@localhost ~]# netstat -rn  
Kernel IP routing table  
Destination      Gateway          Genmask         Flags MSS Window irtt Iface  
0.0.0.0        10.0.2.7        0.0.0.0        UG    0 0          0 enp0s3  
0.0.0.0        10.0.2.1        0.0.0.0        UG    0 0          0 enp0s3  
10.0.2.0        0.0.0.0        255.255.255.0   U     0 0          0 enp0s3  
192.168.122.0  0.0.0.0        255.255.255.0   U     0 0          0 virbr0  
[root@localhost ~]# route del -net default gw 10.0.2.1  
[root@localhost ~]#
```

Client -2 Side

Step-1:- Create Client Machine and set the NAT Network on Adapter-1



Step-2:- Open the Client-2 machine and Install the net tools

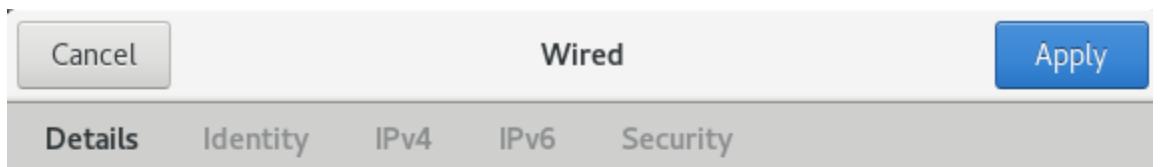
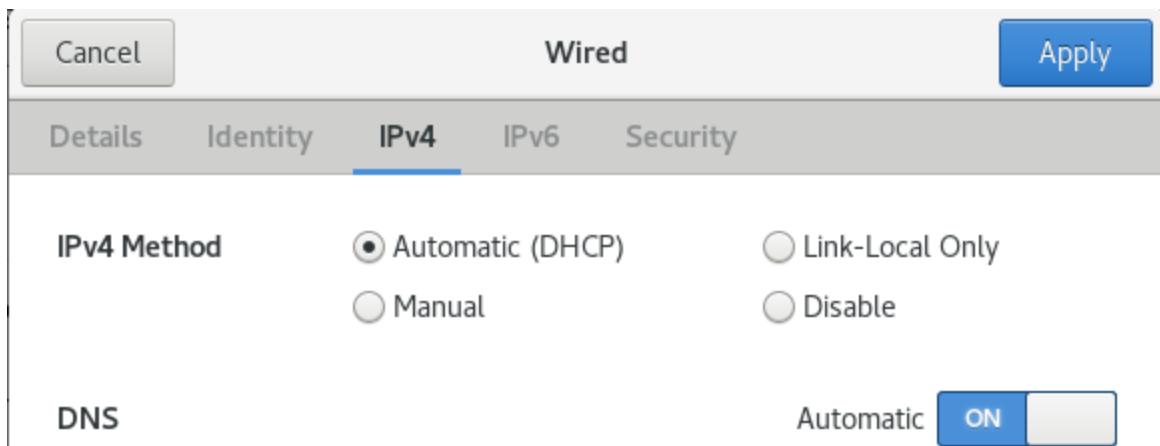
#dnf install net-tools

A screenshot of a terminal window titled 'root@localhost:~'. The window shows the command '#dnf install net-tools' being run. The output indicates a successful installation with the message: 'Last metadata expiration check: 3:56:27 ago on Friday 23 December 2022 01:15:06 PM IST.' The terminal window has a standard Linux-style interface with a title bar, menu bar, and scrollable text area.

Step-3:-check ip of client -2 machine

A screenshot of a terminal window titled 'root@localhost:~'. The window shows the command '# ifconfig' being run. The output displays information for the 'lo' interface: 'flags=73<UP,LOOPBACK,RUNNING> mtu 65536', 'inet 127.0.0.1 netmask 255.0.0.0', 'inet6 ::1 prefixlen 128 scopeid 0x10<host>', and 'loop txqueuelen 1000 (Local Loopback)'. The terminal window has a standard Linux-style interface with a title bar, menu bar, and scrollable text area.

Step-4:- Go to network Setting Ethernet (enp0s8) and set ip is Automatic(DHCP)



```
root@localhost:~  
File Edit View Search Terminal Help  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
        inet 10.0.2.9 netmask 255.255.255.0 broadcast 10.0.2.255  
        inet6 fe80::a00:27ff:fe7e:26eb prefixlen 64 scopeid 0x20<link>  
          ether 08:00:27:7E:26:EB txqueuelen 1000 (Ethernet)  
            RX packets 81074 bytes 119930972 (114.3 MiB)  
            RX errors 0 dropped 0 overruns 0 frame 0  
            TX packets 33209 bytes 2178009 (2.0 MiB)  
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

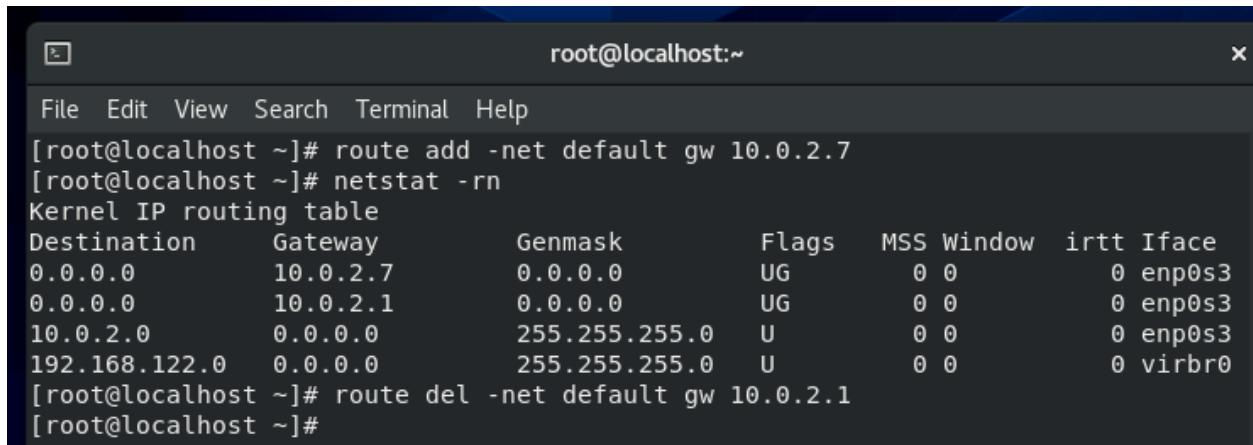
[OR]

You Can set IP through Command Line

```
#ifconfig enp0s3 down  
#ifconfig enp0s3 10.0.2.9
```

Step-5:- Now add the gateway

```
#route add -net default gw 10.0.2.7  
#netstat -rn  
#route del -net default gw 10.0.2.1
```



The screenshot shows a terminal window titled "root@localhost:~". The window contains the following command-line session:

```
File Edit View Search Terminal Help  
[root@localhost ~]# route add -net default gw 10.0.2.7  
[root@localhost ~]# netstat -rn  
Kernel IP routing table  
Destination      Gateway          Genmask         Flags   MSS Window irtt Iface  
0.0.0.0          10.0.2.7        0.0.0.0        UG        0 0          0 enp0s3  
0.0.0.0          10.0.2.1        0.0.0.0        UG        0 0          0 enp0s3  
10.0.2.0          0.0.0.0         255.255.255.0  U        0 0          0 enp0s3  
192.168.122.0    0.0.0.0         255.255.255.0  U        0 0          0 virbr0  
[root@localhost ~]# route del -net default gw 10.0.2.1  
[root@localhost ~]#
```

CHECK the Masquerade Client to server

NOW Go to Client-1 and ping the server

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# ping 192.168.0.1  
PING 192.168.0.1 (192.168.0.1) 56(84) bytes of data.  
64 bytes from 192.168.0.1: icmp_seq=1 ttl=63 time=2.78 ms  
64 bytes from 192.168.0.1: icmp_seq=2 ttl=63 time=1.45 ms  
64 bytes from 192.168.0.1: icmp_seq=3 ttl=63 time=1.53 ms  
64 bytes from 192.168.0.1: icmp_seq=4 ttl=63 time=1.96 ms  
64 bytes from 192.168.0.1: icmp_seq=5 ttl=63 time=1.41 ms  
64 bytes from 192.168.0.1: icmp_seq=6 ttl=63 time=1.54 ms  
^C  
--- 192.168.0.1 ping statistics ---  
6 packets transmitted, 6 received, 0% packet loss, time 5020ms  
rtt min/avg/max/mdev = 1.405/1.775/2.775/0.483 ms  
[root@localhost ~]#
```

Go to Client -2 and Ping the server

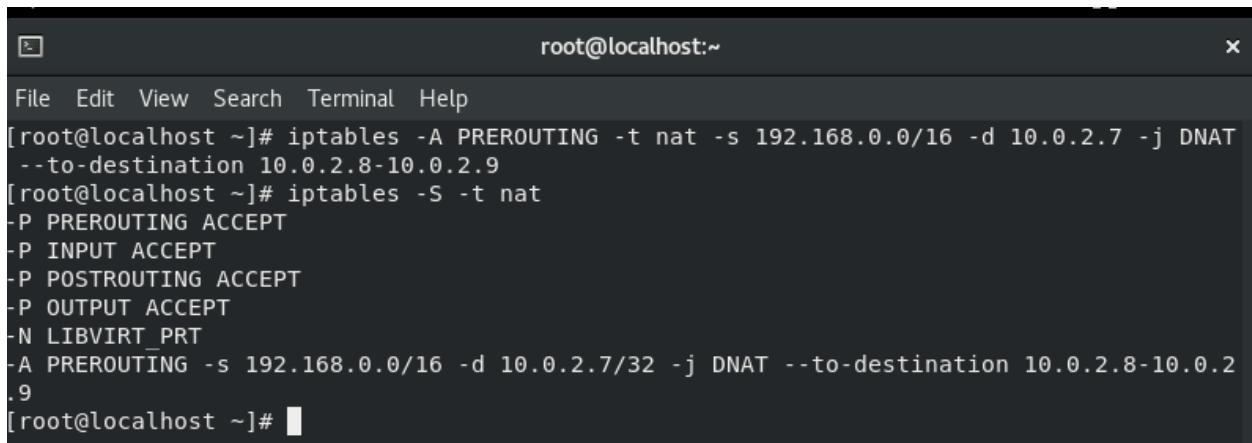
```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# ping 192.168.0.1  
PING 192.168.0.1 (192.168.0.1) 56(84) bytes of data.  
64 bytes from 192.168.0.1: icmp_seq=1 ttl=63 time=2.44 ms  
64 bytes from 192.168.0.1: icmp_seq=2 ttl=63 time=1.51 ms  
64 bytes from 192.168.0.1: icmp_seq=3 ttl=63 time=1.39 ms  
64 bytes from 192.168.0.1: icmp_seq=4 ttl=63 time=1.47 ms  
64 bytes from 192.168.0.1: icmp_seq=5 ttl=63 time=1.47 ms  
^C  
--- 192.168.0.1 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4043ms  
rtt min/avg/max/mdev = 1.390/1.654/2.435/0.395 ms  
[root@localhost ~]#
```

LOAD BALANCING

FIREWALL Side:-

Step -1:- Open the firewall Machine add the rule in ip tables

```
# iptables -A PREROUTING -t nat -s 192.168.0.0/16 -d 10.0.2.7 -j DNAT  
--to-destination 10.0.2.8-10.0.2.9  
# iptables -S -t nat
```

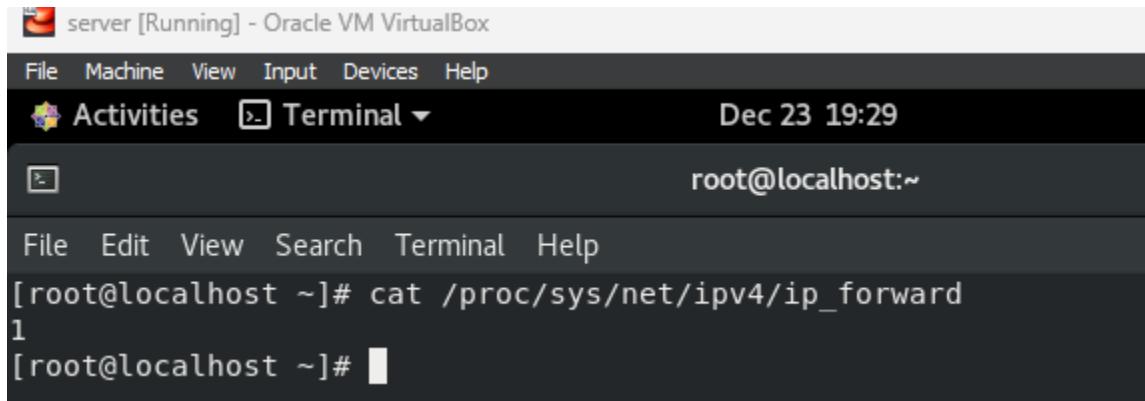


A terminal window titled "root@localhost:~". The window shows the command history of the root user. It includes the configuration of iptables rules for PREROUTING, NAT, and other chains like INPUT, POSTROUTING, and OUTPUT.

```
root@localhost ~]# iptables -A PREROUTING -t nat -s 192.168.0.0/16 -d 10.0.2.7 -j DNAT  
--to-destination 10.0.2.8-10.0.2.9  
[root@localhost ~]# iptables -S -t nat  
-P PREROUTING ACCEPT  
-P INPUT ACCEPT  
-P POSTROUTING ACCEPT  
-P OUTPUT ACCEPT  
-N LIBVIRT_PRT  
-A PREROUTING -s 192.168.0.0/16 -d 10.0.2.7/32 -j DNAT --to-destination 10.0.2.8-10.0.2.9  
[root@localhost ~]#
```

Check the ip Forward Status

```
cat /proc/sys/net/ipv4/ip_forward  
echo 1
```

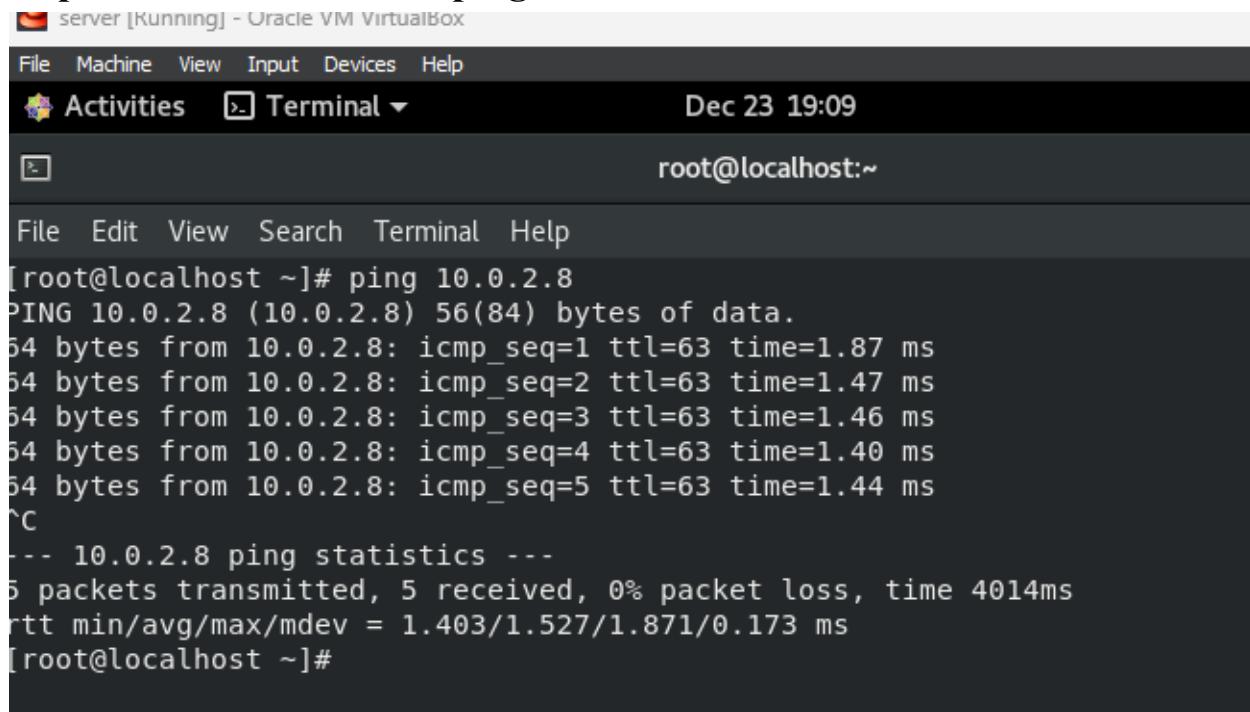


A terminal window titled "root@localhost:~". The window shows the command history of the root user. It includes the output of the cat command on /proc/sys/net/ipv4/ip_forward, which shows the value 1, indicating IP forwarding is enabled.

```
server [Running] - Oracle VM VirtualBox  
File Machine View Input Devices Help  
Activities Terminal Dec 23 19:29  
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# cat /proc/sys/net/ipv4/ip_forward  
1  
[root@localhost ~]#
```

Server Side

Step-1:- Go to Server and ping the Client-1



```
[root@localhost ~]# ping 10.0.2.8
PING 10.0.2.8 (10.0.2.8) 56(84) bytes of data.
64 bytes from 10.0.2.8: icmp_seq=1 ttl=63 time=1.87 ms
64 bytes from 10.0.2.8: icmp_seq=2 ttl=63 time=1.47 ms
64 bytes from 10.0.2.8: icmp_seq=3 ttl=63 time=1.46 ms
64 bytes from 10.0.2.8: icmp_seq=4 ttl=63 time=1.40 ms
64 bytes from 10.0.2.8: icmp_seq=5 ttl=63 time=1.44 ms
^C
--- 10.0.2.8 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4014ms
rtt min/avg/max/mdev = 1.403/1.527/1.871/0.173 ms
[root@localhost ~]#
```

Step-2:-Type Firewall IP & Port No

#nc 192.168.0.2 44

Firewall_ip port

```
[root@localhost ~]# nc 192.168.0.2 44
hello
hii
```

Go to Client Side check incoming Message

#nc -l 44

```
[root@localhost ~]# nc -l 44
hello
hii
```

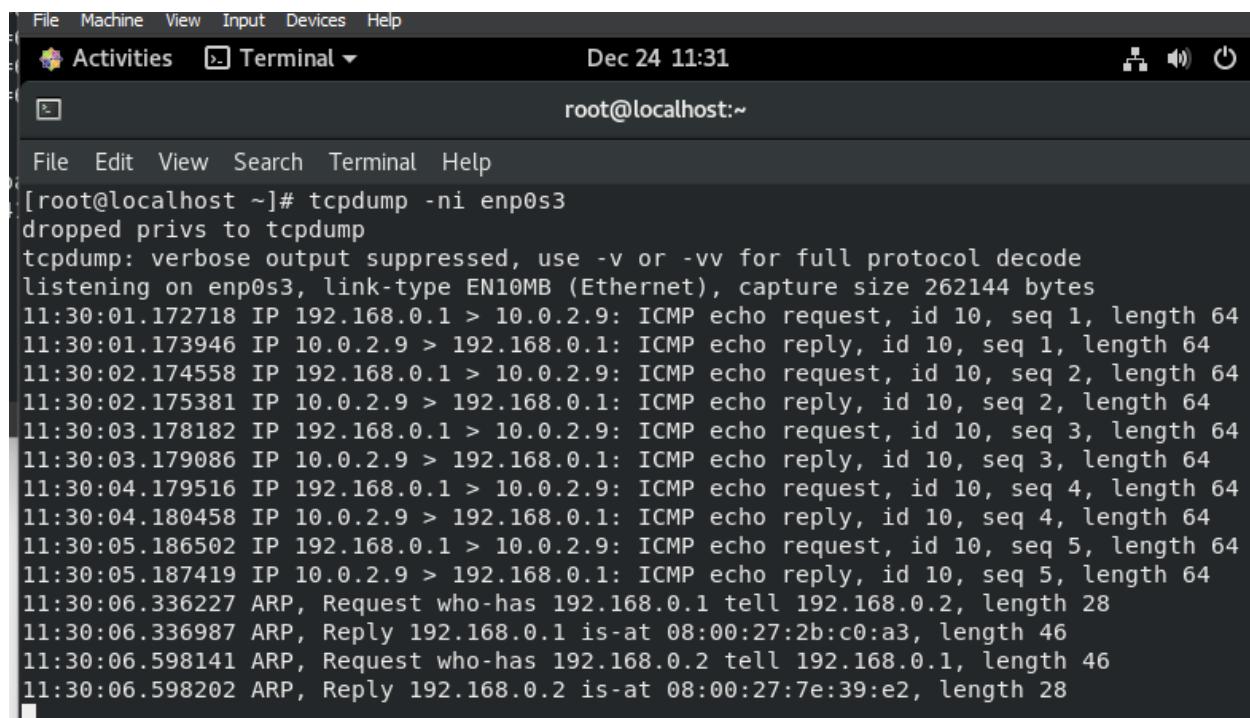
TCPDUMP

Step-1 :-Go to server Ping the Client-1 or client-2

```
[root@localhost ~]# ping 10.0.2.9
PING 10.0.2.9 (10.0.2.9) 56(84) bytes of data.
64 bytes from 10.0.2.9: icmp_seq=1 ttl=63 time=2.04 ms
64 bytes from 10.0.2.9: icmp_seq=2 ttl=63 time=1.59 ms
64 bytes from 10.0.2.9: icmp_seq=3 ttl=63 time=1.70 ms
64 bytes from 10.0.2.9: icmp_seq=4 ttl=63 time=1.72 ms
64 bytes from 10.0.2.9: icmp_seq=5 ttl=63 time=1.66 ms
^C
--- 10.0.2.9 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4014ms
rtt min/avg/max/mdev = 1.586/1.741/2.041/0.160 ms
[root@localhost ~]#
```

Step-2:- Go to Firewall

```
# tcpdump -ni enp0s3
```



The screenshot shows a terminal window with a dark theme. The title bar says "Activities Terminal". The status bar shows "Dec 24 11:31" and "root@localhost:~". The terminal window has a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". Below the menu is a toolbar with icons for Activities, Terminal, and a power button. The main area of the terminal shows the command "# tcpdump -ni enp0s3" being run, followed by a list of network traffic captured on interface enp0s3. The traffic includes ICMP echo requests and replies between 192.168.0.1 and 10.0.2.9, and ARP requests for 192.168.0.1 and 192.168.0.2.

```
[root@localhost ~]# tcpdump -ni enp0s3
dropped privs to tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp0s3, link-type EN10MB (Ethernet), capture size 262144 bytes
11:30:01.172718 IP 192.168.0.1 > 10.0.2.9: ICMP echo request, id 10, seq 1, length 64
11:30:01.173946 IP 10.0.2.9 > 192.168.0.1: ICMP echo reply, id 10, seq 1, length 64
11:30:02.174558 IP 192.168.0.1 > 10.0.2.9: ICMP echo request, id 10, seq 2, length 64
11:30:02.175381 IP 10.0.2.9 > 192.168.0.1: ICMP echo reply, id 10, seq 2, length 64
11:30:03.178182 IP 192.168.0.1 > 10.0.2.9: ICMP echo request, id 10, seq 3, length 64
11:30:03.179086 IP 10.0.2.9 > 192.168.0.1: ICMP echo reply, id 10, seq 3, length 64
11:30:04.179516 IP 192.168.0.1 > 10.0.2.9: ICMP echo request, id 10, seq 4, length 64
11:30:04.180458 IP 10.0.2.9 > 192.168.0.1: ICMP echo reply, id 10, seq 4, length 64
11:30:05.186502 IP 192.168.0.1 > 10.0.2.9: ICMP echo request, id 10, seq 5, length 64
11:30:05.187419 IP 10.0.2.9 > 192.168.0.1: ICMP echo reply, id 10, seq 5, length 64
11:30:06.336227 ARP, Request who-has 192.168.0.1 tell 192.168.0.2, length 28
11:30:06.336987 ARP, Reply 192.168.0.1 is-at 08:00:27:2b:c0:a3, length 46
11:30:06.598141 ARP, Request who-has 192.168.0.2 tell 192.168.0.1, length 46
11:30:06.598202 ARP, Reply 192.168.0.2 is-at 08:00:27:7e:39:e2, length 28
```