

1.

Create a virtual machine having the os centos.

- a) Install firewall in the vm(centos might have a firewall installed by default).(firewalld or iptables)

Answer:

To install firewall in the VM(Centos), we use following command;

- **sudo yum install firewalld**

And to verify that firewall is running or not we use following command;

- **sudo firewall -cmd --state**

```
aashish@localhost:~  
File Edit View Search Terminal Help  
[aashish@localhost ~]$ sudo firewall-cmd --state  
We trust you have received the usual lecture from the local System  
Administrator. It usually boils down to these three things:  
#1) Respect the privacy of others.  
#2) Think before you type.  
#3) With great power comes great responsibility.  
[sudo] password for aashish:  
running  
[aashish@localhost ~]$ █
```

- b) Block certain ip range/subnet using firewalld.

To block certain ip range/subnet using firewalld, we use following command;

- **firewall -cmd --permanent --add-rich-rule="rule family='ipv4' source address='192.168.1.0/24' reject"**

```
aashish@localhost:~  
File Edit View Search Terminal Help  
[aashish@localhost ~]$ firewall-cmd --permanent --add-rich-rule="rule family='ipv4' sou  
rce address='192.168.1.0/24' reject"  
success  
[aashish@localhost ~]$ █
```

c) Allow http, https and ssh connection using firewall.

To allow http, https and ssh connection using firewall, we use following command;

- **firewall -cmd --permanent --zone=public --add-service=http**
- **firewall -cmd --permanent --zone=public --add-service=https**
- **firewall -cmd --permanent --zone=public --add-service=ssh**

The screenshot shows a terminal window titled 'Terminal' with the command line interface 'aashish@localhost:~'. The user has run three commands to add services to the 'public' zone:

```
[aashish@localhost ~]$ firewall-cmd --permanent --zone=public --add-service=http
success
[aashish@localhost ~]$ firewall-cmd --permanent --zone=public --add-service=https
success
[aashish@localhost ~]$ firewall-cmd --permanent --zone=public --add-service=ssh
Warning: ALREADY_ENABLED: ssh
success
[aashish@localhost ~]$
```

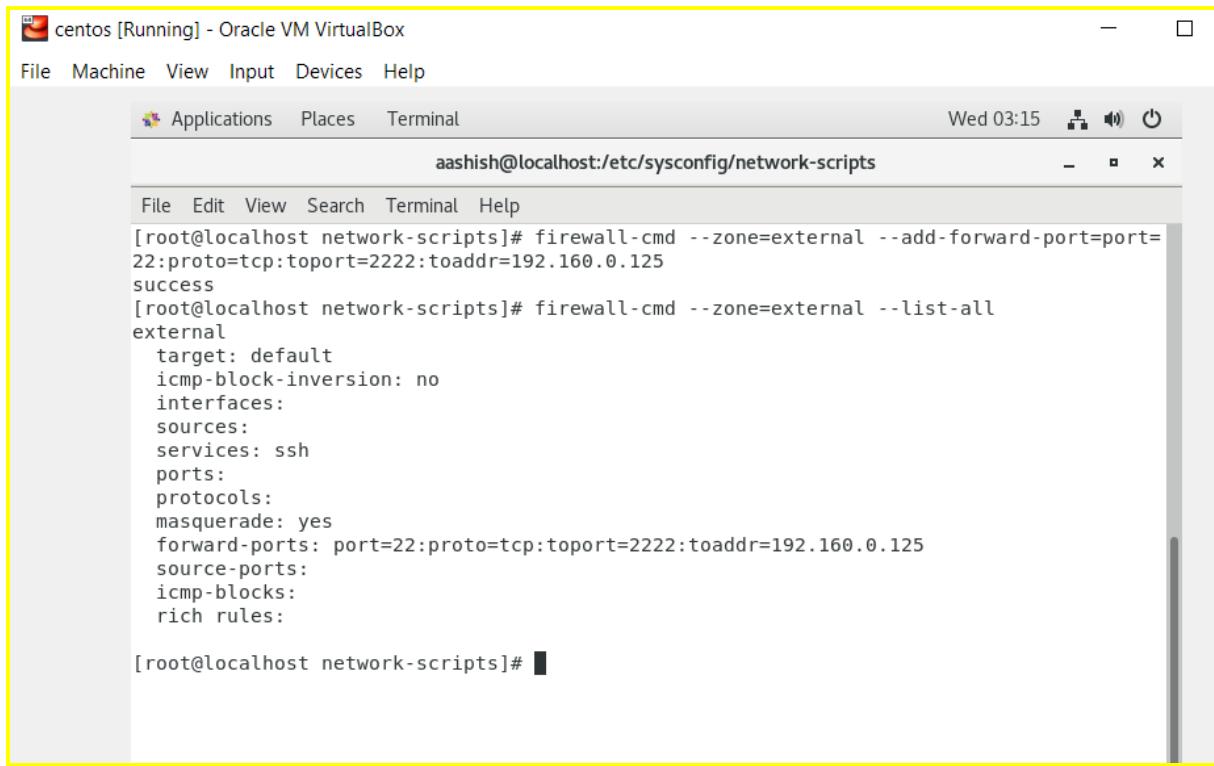
d) You can add other rules as well as you prefer.

To forward all ssh port 22 connections to port 2222 for IP address 192.168.0.132 we use the following command;

- **firewall-cmd**
- zone=external--add-forward-port=port=22:proto=tcp:toport=2222:toaddr=192.168.0.132**

To verify it we use following command;

- **firewall-cmd --zone=external --list-all**



The screenshot shows a terminal window titled 'aashish@localhost:/etc/sysconfig/network-scripts' running on a CentOS VM. The user has run the following commands:

```
[root@localhost network-scripts]# firewall-cmd --zone=external --add-forward-port=port=22:proto=tcp:toport=2222:toaddr=192.160.0.125
success
[root@localhost network-scripts]# firewall-cmd --zone=external --list-all
external
    target: default
    icmp-block-inversion: no
    interfaces:
    sources:
    services: ssh
    ports:
    protocols:
    masquerade: yes
    forward-ports: port=22:proto=tcp:toport=2222:toaddr=192.160.0.125
    source-ports:
    icmp-blocks:
    rich rules:

[root@localhost network-scripts]#
```

2.

Create one vm with 2 network interfaces one should behave as WAN and another as LAN. Create another VM attaching the previously created LAN interface to it.

a) **Implement NAT in the first vm, so that the second vm can access the internet.**

Note: Configure the first vm as a router, so make the LAN interfaces in the first vm as gateway to the LAN network. And in the second vm configure the gateway to the ip of the first vm LAN ip.

Answer:

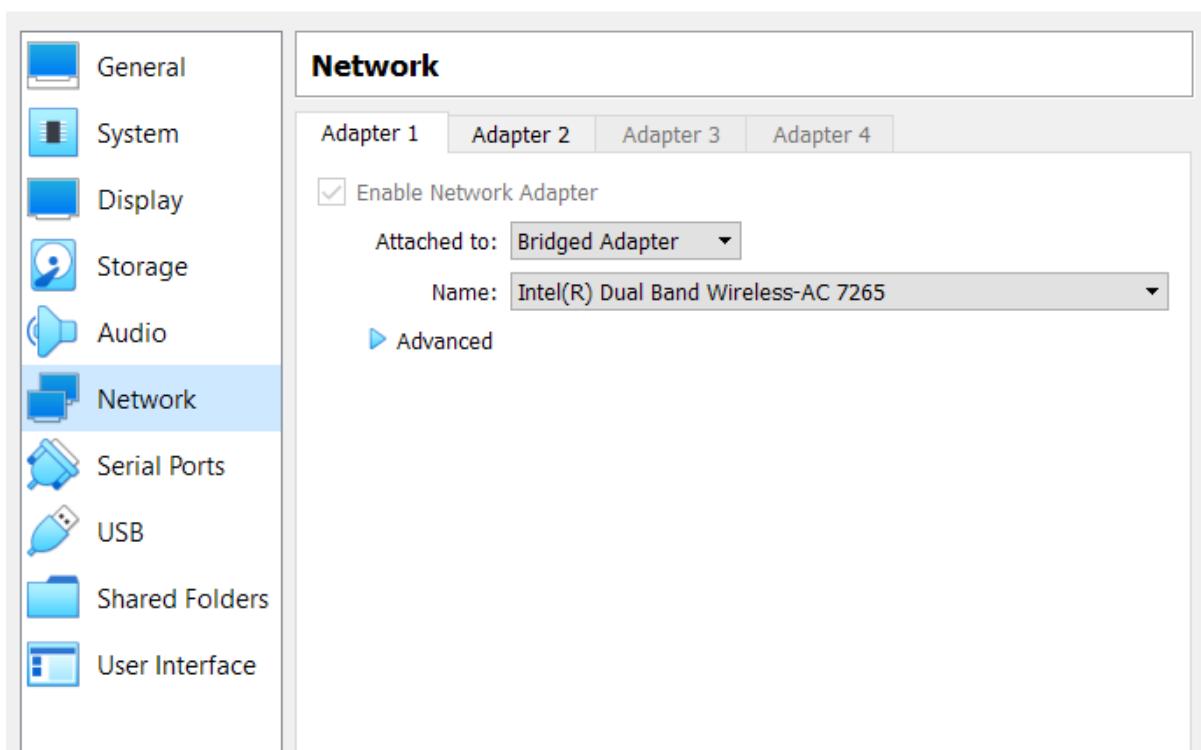
First of all, we create a VM named **Centos** with 2 network interfaces in which one behaves as WAN and another as LAN.

For that we have installed Centos as first VM with 2 interfaces;

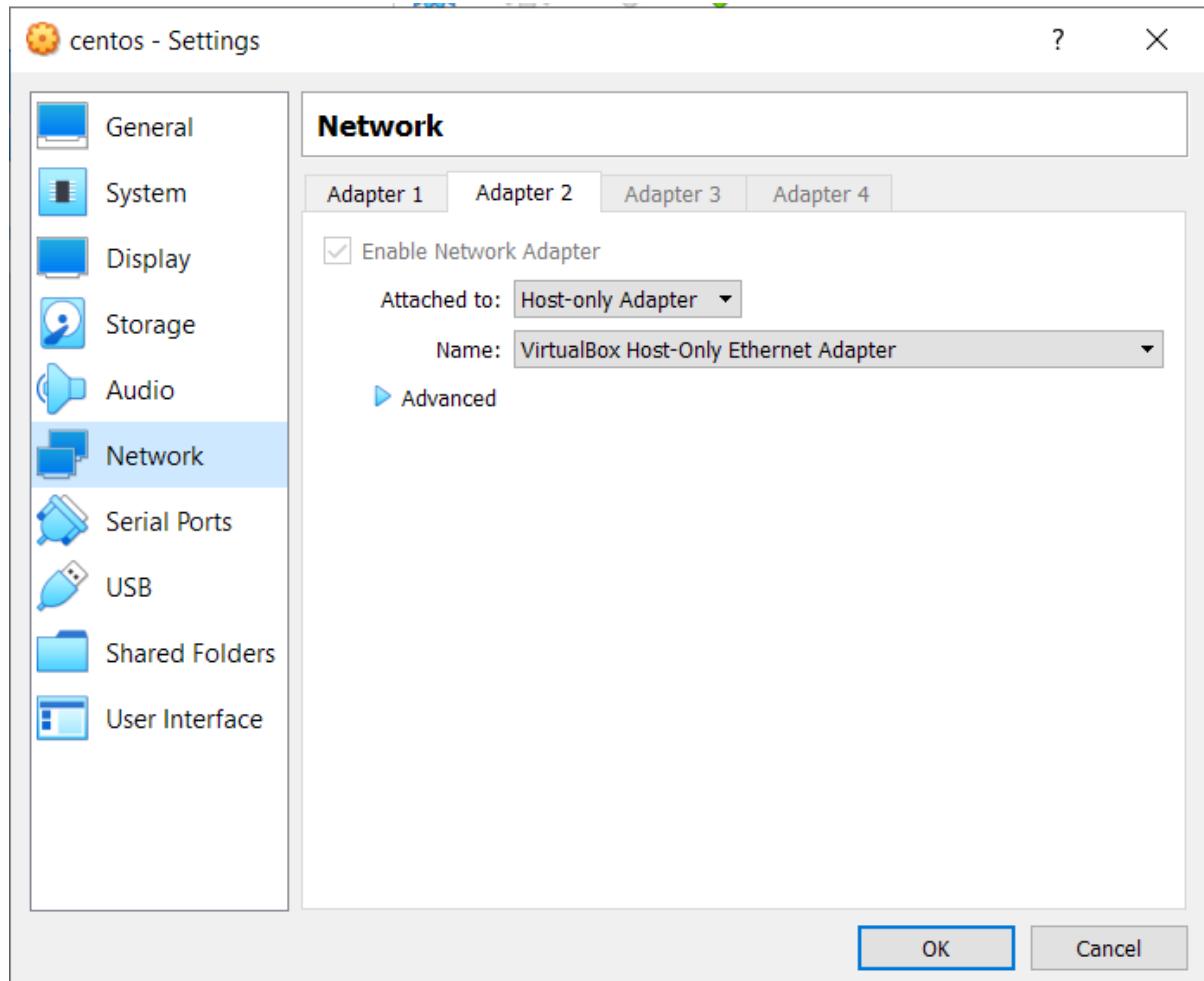
- **Bridged Adapter (enp0s3)**

centos - Settings

? X



- Host-Only adapter (enp0s8)



After that we check the ip addresses from both the network interfaces using command;
- **Ifconfig**

```
[aashish@localhost ~]$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.18.38  netmask 255.255.255.0  broadcast 192.168.18.255
              inet6 fe80::3861:9dc6:148b:dd27  prefixlen 64  scopeid 0x20<link>
                ether 08:00:27:6e:ce:58  txqueuelen 1000  (Ethernet)
                  RX packets 117  bytes 26534 (25.9 KiB)
                  RX errors 0  dropped 0  overruns 0  frame 0
                  TX packets 353  bytes 31565 (30.8 KiB)
                  TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.56.1  netmask 255.255.255.0  broadcast 192.168.56.255
              inet6 fe80::f263:cbf2:1a88:4313  prefixlen 64  scopeid 0x20<link>
                ether 08:00:27:48:2b:6a  txqueuelen 1000  (Ethernet)
                  RX packets 454  bytes 41595 (40.6 KiB)
                  RX errors 0  dropped 0  overruns 0  frame 0
                  TX packets 159  bytes 16486 (16.0 KiB)
                  TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

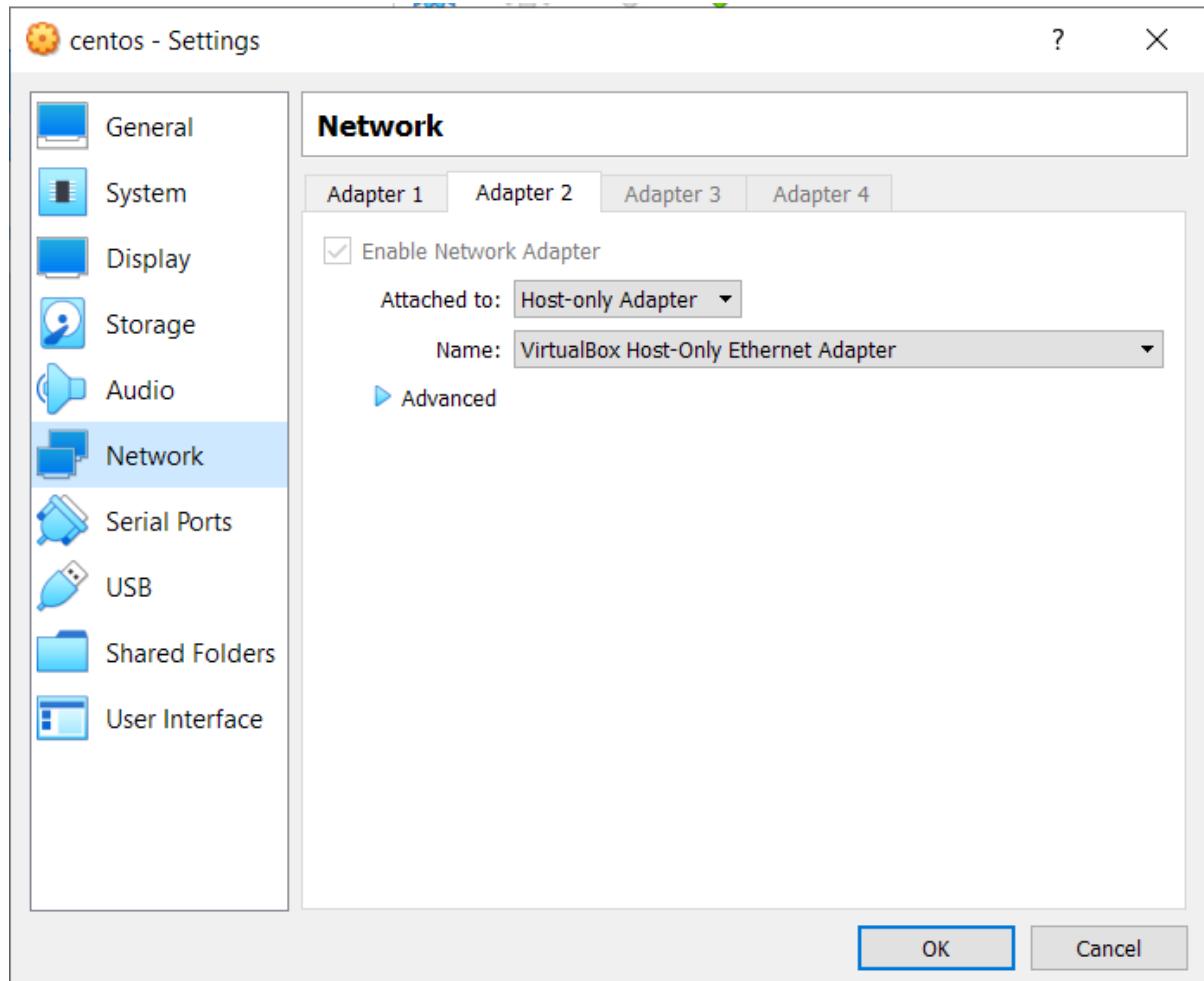
lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
              inet6 ::1  prefixlen 128  scopeid 0x10<host>
                loop  txqueuelen 1000  (Local Loopback)
                  RX packets 64  bytes 5444 (5.3 KiB)
                  RX errors 0  dropped 0  overruns 0  frame 0
                  TX packets 64  bytes 5444 (5.3 KiB)
```

From the above figure we have IP addresses as follows for two interfaces respectively ;

- **enp0s3 IP = 192.168.18.38**
- **enp0s8 IP = 192.168.56.1**

Likewise, we need to set up another network interface in the second VM named **Centos2**.

- **Host-Only adapter (enp0s3)**



To check the IP address associate with the network interface we use;

- **Ifconfig**

```
[aashish@localhost ~]$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.56.105 netmask 255.255.255.0 broadcast 192.168.56.255
              inet6 fe80::3a2d:1e97:f5ac:79bc prefixlen 64 scopeid 0x20<link>
                ether 08:00:27:65:9d:02 txqueuelen 1000 (Ethernet)
                  RX packets 147 bytes 15122 (14.7 KiB)
                  RX errors 0 dropped 0 overruns 0 frame 0
                  TX packets 494 bytes 43273 (42.2 KiB)
                  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 310 bytes 26538 (25.9 KiB)
                  RX errors 0 dropped 0 overruns 0 frame 0
                  TX packets 310 bytes 26538 (25.9 KiB)
                  TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

virbr0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
        inet 192.168.122.1 netmask 255.255.255.0 broadcast 192.168.122.255
              ether 52:54:00:8b:c2:d8 txqueuelen 1000 (Ethernet)
                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
```

From the above figure, the IP address is shown as;

- **enp0s3 IP = 192.168.56.105**

Now, to configure **enp0s8** we need to edit **/etc/sysconfig/network-scripts/ifcfg-enp0s8** file.

```
aashish@localhost:/etc/sysconfig/network-scripts
```

```
File Edit View Search Terminal Help
```

```
GNU nano 2.3.1          File: ifcfg-enp0s8
```

```
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=static
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
IPV6_ADDR_GEN_MODE=stable-privacy
NAME=enp0s8
UUID=52d80088-9c1e-4fc1-a557-7b1c76853eb4
DEVICE=enp0s8
ONBOOT=yes
IPADDR=192.168.56.1
NETMASK=255.255.255.0
```

```
[ Read 18 lines ]
```

```
^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
^X Exit      ^J Justify   ^W Where Is  ^V Next Page ^U Uncut Text ^T To Spell
```

In the above figure IP address and netmask is added into the file.

In the same way, we need to configure the **enp0s3** in **Centos2** as well.
So, again, we need to edit the **/etc/sysconfig/network-scripts/ifcfg-enp0s3** file.



```
Centos2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places Terminal Wed 02:10
aashish@localhost:/home/aashish
File Edit View Search Terminal Help
GNU nano 2.3.1 File: /etc/sysconfig/network-scripts/ifcfg-enp0s3

TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=static
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
IPV6_ADDR_GEN_MODE=stable-privacy
NAME=enp0s3
UUID=0c1d1732-6e8d-42da-aa8f-dfb9b547ae81
DEVICE=enp0s3
ONBOOT=yes
GATEWAY=192.168.56.1
IPADDR=192.168.56.105
NETMASK=255.255.255.0

[ Read 19 lines ]
^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell
```

In the config file, we added IP address, subnet mask and gateway IP.

Since, the IPs of **enp0s8** of first VM (**Centos**) and **enp0s3** of second VM (**Centos2**) fall under the same network ID i.e. **192.168.56.0**, they should be able to communicate with each other.

IP of First VM(Centos) = 192.168.56.1

IP of Second VM(Centos2) = 192.168.56.105

Ping reports are provided below;

```
[aashish@localhost network-scripts]$ ping 192.168.56.105
PING 192.168.56.105 (192.168.56.105) 56(84) bytes of data.
64 bytes from 192.168.56.105: icmp_seq=1 ttl=64 time=0.349 ms
64 bytes from 192.168.56.105: icmp_seq=2 ttl=64 time=0.341 ms
64 bytes from 192.168.56.105: icmp_seq=3 ttl=64 time=0.339 ms
64 bytes from 192.168.56.105: icmp_seq=4 ttl=64 time=0.311 ms
64 bytes from 192.168.56.105: icmp_seq=5 ttl=64 time=0.348 ms
64 bytes from 192.168.56.105: icmp_seq=6 ttl=64 time=0.343 ms
64 bytes from 192.168.56.105: icmp_seq=7 ttl=64 time=0.344 ms
64 bytes from 192.168.56.105: icmp_seq=8 ttl=64 time=0.342 ms
64 bytes from 192.168.56.105: icmp_seq=9 ttl=64 time=0.349 ms
64 bytes from 192.168.56.105: icmp_seq=10 ttl=64 time=0.348 ms
^C
--- 192.168.56.105 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9002ms
rtt min/avg/max/mdev = 0.311/0.341/0.349/0.019 ms
[aashish@localhost network-scripts]$
```

Fig 1: Pinging to Centos2

```
[root@localhost aashish]# ping 192.168.56.1
PING 192.168.56.1 (192.168.56.1) 56(84) bytes of data.
64 bytes from 192.168.56.1: icmp_seq=1 ttl=64 time=0.326 ms
64 bytes from 192.168.56.1: icmp_seq=2 ttl=64 time=0.354 ms
64 bytes from 192.168.56.1: icmp_seq=3 ttl=64 time=0.416 ms
64 bytes from 192.168.56.1: icmp_seq=4 ttl=64 time=0.363 ms
64 bytes from 192.168.56.1: icmp_seq=5 ttl=64 time=0.354 ms
64 bytes from 192.168.56.1: icmp_seq=6 ttl=64 time=0.327 ms
64 bytes from 192.168.56.1: icmp_seq=7 ttl=64 time=0.405 ms
^C
--- 192.168.56.1 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6007ms
rtt min/avg/max/mdev = 0.326/0.363/0.416/0.038 ms
[root@localhost aashish]#
```

Fig 2: Pinging to Centos

Now, we need to tell **Centos2** that we want to use the card **enp0s8** from **Centos**. So, for that gateway IP(**192.168.56.1**) is added to the config file of **enp0s3** of **Centos2**.

The screenshot shows a terminal window titled "Centos2 [Running] - Oracle VM VirtualBox". The window title bar includes standard icons for minimize, maximize, and close. Below the title bar is a menu bar with "File", "Machine", "View", "Input", "Devices", "Help", "Applications", "Places", and "Terminal". The status bar at the bottom right shows the date and time as "Wed 02:10" along with system icons. The main terminal area has a prompt "aashish@localhost:/home/aashish" and displays the command "GNU nano 2.3.1 File: /etc/sysconfig/network-scripts/ifcfg-enp0s3". The content of the file is as follows:

```
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=static
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
IPV6_ADDR_GEN_MODE=stable-privacy
NAME=enp0s3
UUID=0c1d1732-6e8d-42da-aa8f-dfb9b547ae81
DEVICE=enp0s3
ONBOOT=yes
GATEWAY=192.168.56.1
IPADDR=192.168.56.105
NETMASK=255.255.255.0
```

At the bottom of the terminal window, there is a status bar with various keyboard shortcuts: ^G Get Help, ^O WriteOut, ^R Read File, ^Y Prev Page, ^K Cut Text, ^C Cur Pos, ^X Exit, ^J Justify, ^W Where Is, ^V Next Page, ^U UnCut Text, ^T To Spell. A message "[Read 19 lines]" is displayed above the status bar.

Since, we have connection from **Centos** to **Centos2**, we can tell **Centos** to share internet connection with **Centos2** by using following commands;

- **modprobe iptable_nat**
- **echo 1 > /proc/sys/net/ipv4/ip_forward**
- **iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE**
- **iptables -A FORWARD -i eth1 -j ACCEPT**

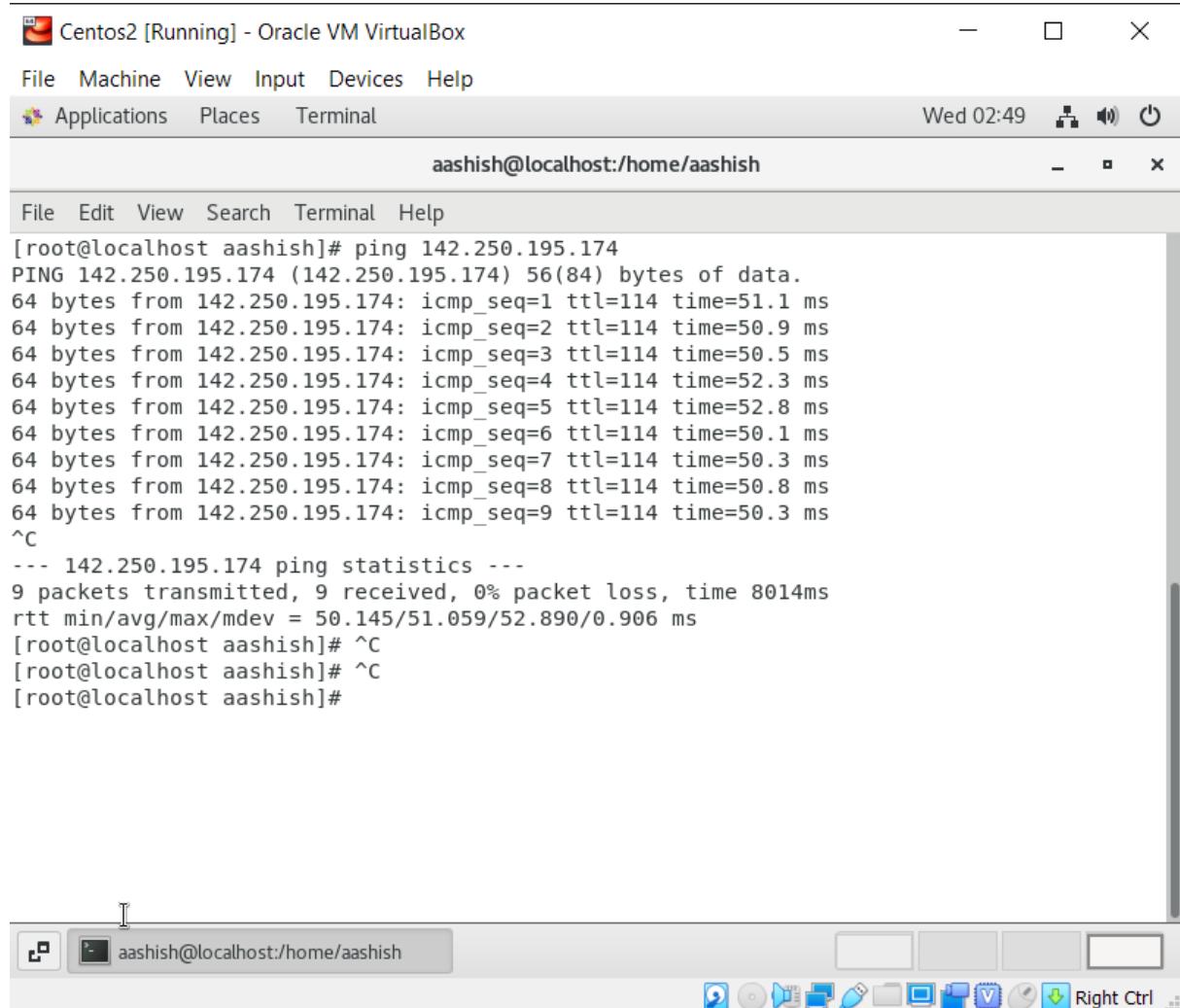
The screenshot shows a terminal window titled "centos [Running] - Oracle VM VirtualBox". The window title bar includes standard icons for minimize, maximize, and close. Below the title bar is a menu bar with "File", "Machine", "View", "Input", "Devices", "Help", "Applications", "Places", and "Terminal". The status bar at the bottom right shows the date and time as "Wed 02:10" along with system icons. The main terminal area has a prompt "aashish@localhost:/etc/sysconfig/ne..." and displays the command "rtt min/avg/max/mdev = 0.311/0.341/0.349/0.019 ms [aashish@localhost network-scripts]\$ su". It then shows the root password prompt, followed by the execution of the following commands:

```
[root@localhost network-scripts]# modprobe iptable_nat
[root@localhost network-scripts]# echo 1 > /proc/sys/net/ipv4/ip_forward
[root@localhost network-scripts]# iptables -t nat -A POSTROUTING -o enp0s3 -j MASQUERADE
[root@localhost network-scripts]# iptables -A FORWARD -i enp0s8 -j ACCEPT
[root@localhost network-scripts]#
```

A yellow border highlights the entire terminal window.

So, through the above processes we shared the network connection from **Centos** to **Centos2** via **NAT**.

To verify it we can ping to **google.com** IP address i.e.**142.250.195.174** from **Centos2**.



```
[root@localhost aashish]# ping 142.250.195.174
PING 142.250.195.174 (142.250.195.174) 56(84) bytes of data.
64 bytes from 142.250.195.174: icmp_seq=1 ttl=114 time=51.1 ms
64 bytes from 142.250.195.174: icmp_seq=2 ttl=114 time=50.9 ms
64 bytes from 142.250.195.174: icmp_seq=3 ttl=114 time=50.5 ms
64 bytes from 142.250.195.174: icmp_seq=4 ttl=114 time=52.3 ms
64 bytes from 142.250.195.174: icmp_seq=5 ttl=114 time=52.8 ms
64 bytes from 142.250.195.174: icmp_seq=6 ttl=114 time=50.1 ms
64 bytes from 142.250.195.174: icmp_seq=7 ttl=114 time=50.3 ms
64 bytes from 142.250.195.174: icmp_seq=8 ttl=114 time=50.8 ms
64 bytes from 142.250.195.174: icmp_seq=9 ttl=114 time=50.3 ms
^C
--- 142.250.195.174 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8014ms
rtt min/avg/max/mdev = 50.145/51.059/52.890/0.906 ms
[root@localhost aashish]# ^C
[root@localhost aashish]# ^C
[root@localhost aashish]#
```

So, the above figure shows that **Centos2** is using the internet via **Centos** using **NAT**.

Thank You.