

1. I created 3 VMs running Artix Linux as per the specifications given(NOTE: This is a screen shot of **/etc/rc.local** file after executing these commands on the cmd line).

VM1

```
ifconfig eth0 up
ifconfig eth1 up
ifconfig eth3 up
dhclient eth0
dhclient eth1
dhclient eth3
ifconfig eth2 10.0.0.1/24 up
route add -net 20.0.0.0/24 gw 10.0.0.2
```

VM2

```
ifconfig eth0 up
dhclient eth0
ifconfig eth1 up
dhclient eth1

ifconfig eth2 10.0.0.2/24 up
ifconfig eth3 20.0.0.2/24 up

echo 1 > /proc/sys/net/ipv4/ip_forward
# if [ -e /etc/iptables/iptables.rules ]; then
#   iptables-restore /etc/iptables/iptables.rules
# fi
```

VM3

```
ifconfig eth0 up
ifconfig eth1 up
dhclient eth0
dhclient eth1

ifconfig eth2 20.0.0.3/24 up
route add -net 10.0.0.0/24 gw 20.0.0.2
```

2. The command to configure gateway for 20.0.0.0/24 was difficult to find, I initially tried

ip route add 20.0.0.1/24 via 10.0.0.2 via dev eth2

But it didn't work until I entered the right command(in above screen shot).

3. Then enabled ip forwarding

sysctl -w net.ipv4.ip_forward=1

I also cross checked it in **/etc/sysctl.conf** and in **/proc/sys/net/ipv4/ip_forward** files

4. Then finally tested everything with ping and traceroute. When everything was finally up and running, I made it all persistent using **/etc/rc.local** file (as provided in the first point).
5. I created a Bi-directional NAT keeping everything in mind.

```
[ArtixVM ~]# cat /etc/iptables/iptables.rules
# Generated by iptables-save v1.8.8 on Fri Nov 18 03:49:20 2022
*filter
:INPUT ACCEPT [31:5588]
:FORWARD ACCEPT [12:1565]
:OUTPUT ACCEPT [5:1640]
COMMIT
# Completed on Fri Nov 18 03:49:20 2022
# Generated by iptables-save v1.8.8 on Fri Nov 18 03:49:20 2022
*nat
:PREROUTING ACCEPT [3:536]
:INPUT ACCEPT [3:536]
:OUTPUT ACCEPT [5:1640]
:POSTROUTING ACCEPT [6:1700]
-A PREROUTING -s 10.0.0.1/32 -d 10.0.0.2/32 -i eth2 -j DNAT --to-destination 20.0.0.3
-A PREROUTING -s 20.0.0.3/32 -d 20.0.0.2/32 -i eth3 -j DNAT --to-destination 10.0.0.1
-A POSTROUTING -s 20.0.0.2/32 -d 20.0.0.3/32 -o eth3 -j SNAT --to-source 10.0.0.1
-A POSTROUTING -s 10.0.0.2/32 -d 10.0.0.1/32 -o eth2 -j SNAT --to-source 20.0.0.3
COMMIT
# Completed on Fri Nov 18 03:49:20 2022
```

6. For persistence after reboot, I used **iptables-save** command to save the firewall configuration in **/etc/iptables/iptables.rules**.
7. Then I setup nginx server, by installing nginx and nginx-runit service, and then starting the service.

pacman -Ss nginx nginx-runit

ln -s /etc/runit/sv/nginx/ /run/runit/service/

sv start nginx

8. I sent HTTP requests (using curl) from VM1 to VM3 via VM2 acting as a NAT firewall to make sure everything worked.