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.**

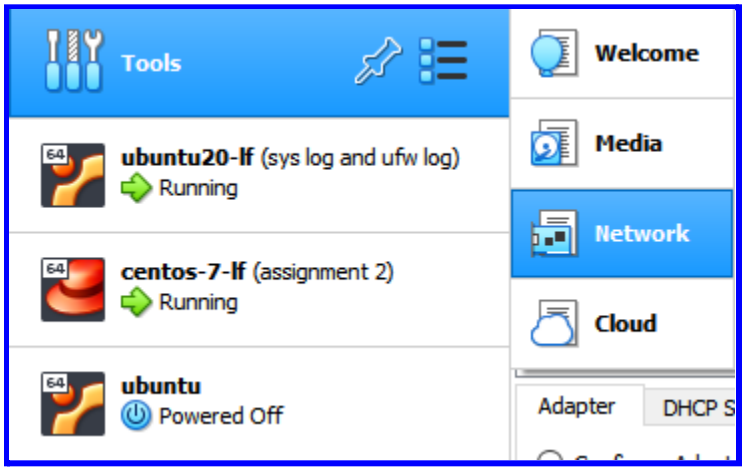
Note: Configure the first vm as a router, so make the LAN interfaces in the first vm as gateway to the LAN network. And in the second vm configure the gateway to the ip of the first vm LAN ip

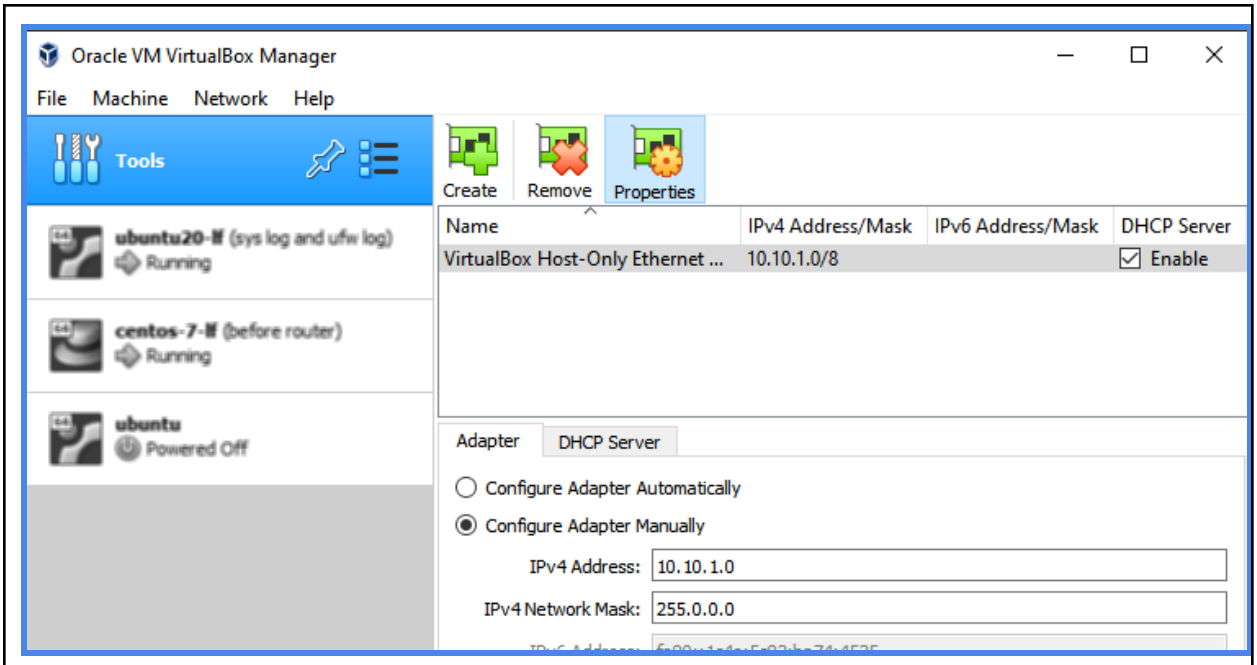
VM1: centos 7

VM2: ubuntu

Answer

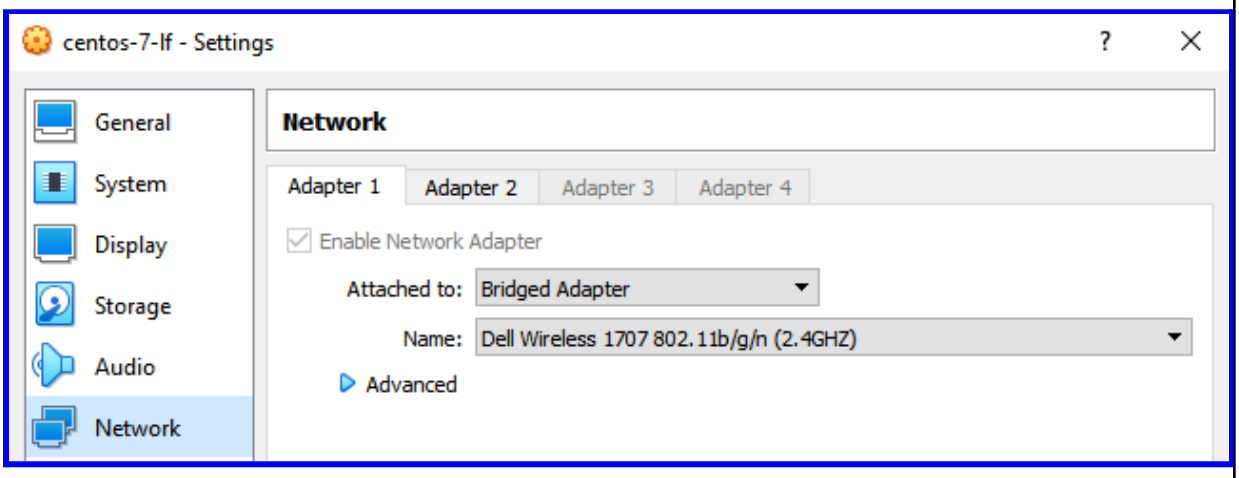
First I create host-only Network adapter in VirtualBox



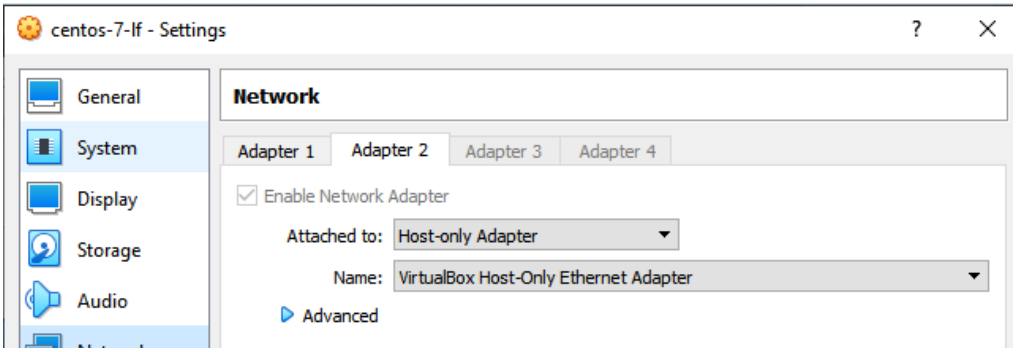


Two network interfaces of **Centos 7**

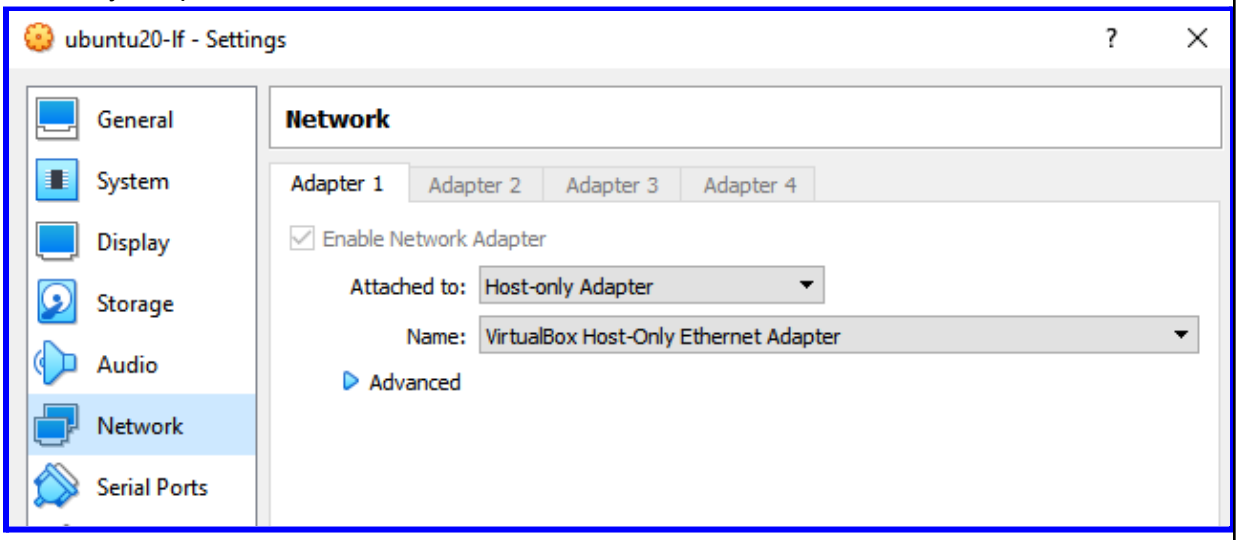
Bridge Adapter



Host-only Adapter



Host-only adapter of **Ubuntu**



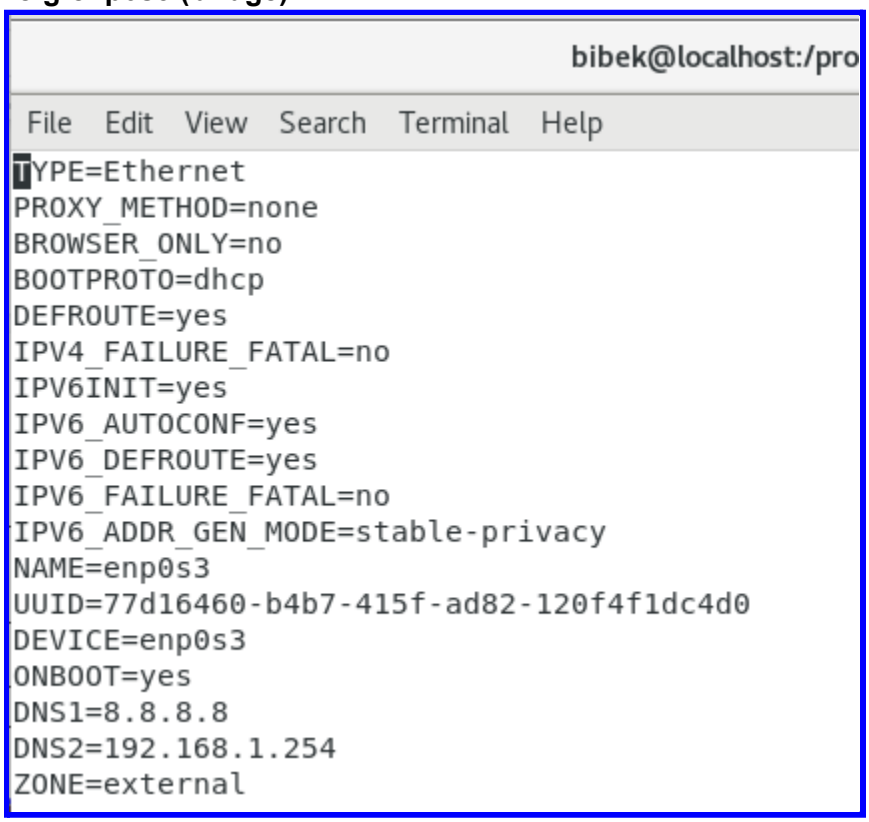
Command:
ip a - of centos

```
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group d
efault qlen 1000
    link/ether 08:00:27:61:1c:77 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.139/24 brd 192.168.1.255 scope global noprefixroute dynamic enp0s3
       valid_lft 86091sec preferred_lft 86091sec
    inet6 fe80::f233:a532:bbba:d155/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group d
efault qlen 1000
    link/ether 08:00:27:02:0e:ac brd ff:ff:ff:ff:ff:ff
    inet 10.10.1.1/8 brd 10.255.255.255 scope global noprefixroute enp0s8
       valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe02:eac/64 scope link
       valid_lft forever preferred_lft forever
4: virbr0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN group
default qlen 1000
    link/ether 52:54:00:9c:8c:02 brd ff:ff:ff:ff:ff:ff
    inet 192.168.122.1/24 brd 192.168.122.255 scope global virbr0
       valid_lft forever preferred_lft forever
5: virbr0-nic: <BROADCAST,MULTICAST> mtu 1500 qdisc pfifo_fast master virbr0 state DOWN
 group default qlen 1000
    link/ether 52:54:00:9c:8c:02 brd ff:ff:ff:ff:ff:ff
[root@localhost ipv4]# >
```

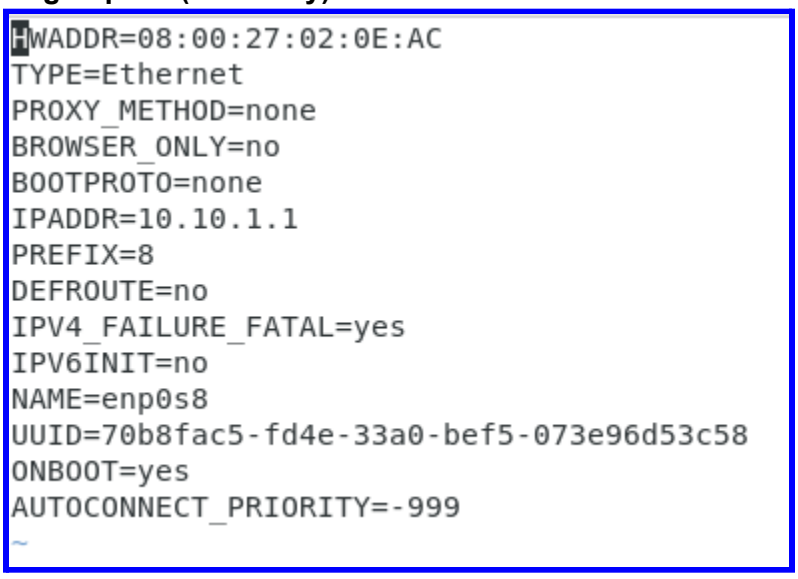
We have two ip of **Centos**

- **192.168.1.139** for Bridge adapter
- **10.10.1.1** for host-only network

Ifcfg-enp0s3 (bridge)



Ifcfg-enp0s8 (host-only)



For **Ubuntu**

```
^C
bibek@bibek-lf:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt qlen 1000
    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: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:ac:66:0c brd ff:ff:ff:ff:ff:ff
    inet 10.10.1.100/8 brd 10.255.255.255 scope global noprefixroute enp0s3
       valid_lft forever preferred_lft forever
    inet6 fe80::2e38:a04c:f66d:d337/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
bibek@bibek-lf:~$
```

We have one ip - 10.10.10.100

Both can ping each other too through **host-only IP**

Centos to Ubuntu

```
[root@localhost ipv4]# ping 10.10.1.100
PING 10.10.1.100 (10.10.1.100) 56(84) bytes of data.
64 bytes from 10.10.1.100: icmp_seq=1 ttl=64 time=0.441 ms
64 bytes from 10.10.1.100: icmp_seq=2 ttl=64 time=1.75 ms
64 bytes from 10.10.1.100: icmp_seq=3 ttl=64 time=1.85 ms
^C
--- 10.10.1.100 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 0.441/1.350/1.851/0.643 ms
[root@localhost ipv4]#
```

Ubuntu to centos

```
bibek@bibek-lf:~$ ping 10.10.1.1
PING 10.10.1.1 (10.10.1.1) 56(84) bytes of data.
64 bytes from 10.10.1.1: icmp_seq=1 ttl=64 time=0.451 ms
64 bytes from 10.10.1.1: icmp_seq=2 ttl=64 time=1.26 ms
^C
--- 10.10.1.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1022ms
rtt min/avg/max/mdev = 0.451/0.853/1.256/0.402 ms
bibek@bibek-lf:~$
```

Forwarding ip on centos so that host-only network can forward its packet to Bridge-network

sysctl -w net.ipv4.ip_forward=1 -for temporary ip_forwarding

echo 1 > /proc/sys/net/ipv4/ip_forward

```
[root@localhost ipv4]# cat ip_forward
0
[root@localhost ipv4]# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
[root@localhost ipv4]# vi /etc/sysctl.conf
[root@localhost ipv4]# cat ip_forward
1
```

For permanent ip forwarding

Create ip_forward.conf file in /etc/sysctl.d

vi /etc/sysctl.d/ip_forward.conf

And add **net.ipv4.ip_forward=1**

sysctl -p /etc/sysctl.d/ip_forward.conf

You will get similar output like this

```
[root@localhost ipv4]# vi /etc/sysctl.d/ip_forward.conf
[root@localhost ipv4]# sysctl -p /etc/sysctl.d/ip_forward.conf
net.ipv4.ip_forward = 1
```

Masquerading host only network with bridge network so that source of host network (**enp0s8**)packet can be transferred to destination to bridge network|(**enp0s3**)

```
[root@localhost ipv4]# firewall-cmd --permanent --direct --passthrough ipv4 -t nat -l P
OSTROUTING -o enp0s3 -j MASQUERADE -s enp0s8
success
[root@localhost ipv4]# systemctl restart firewalld.service
```

Command:

firewall-cmd --permanent --direct --passthrough ipv4 -t nat -I POSTROUTING -o enp0s3 -j MASQUERADE -s enp0s8

We have to assign gateway of ubuntu to ip of host-only network of vm1

route add default gw 10.10.1.1

systemctl restart network-manager

Now we can see through **VM2-ubuntu**, we can ping to router IP too

```
root@bibek-lf:~# ping 192.168.1.254
PING 192.168.1.254 (192.168.1.254) 56(84) bytes of data.
64 bytes from 192.168.1.254: icmp_seq=1 ttl=63 time=2.57 ms
64 bytes from 192.168.1.254: icmp_seq=2 ttl=63 time=36.8 ms
^C
--- 192.168.1.254 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 2.572/19.680/36.789/17.108 ms
root@bibek-lf:~# ping 192.168.1.139
PING 192.168.1.139 (192.168.1.139) 56(84) bytes of data.
64 bytes from 192.168.1.139: icmp_seq=1 ttl=64 time=0.428 ms
64 bytes from 192.168.1.139: icmp_seq=2 ttl=64 time=0.525 ms
^C
--- 192.168.1.139 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1030ms
rtt min/avg/max/mdev = 0.428/0.476/0.525/0.048 ms
root@bibek-lf:~# ping 10.10.1.1
PING 10.10.1.1 (10.10.1.1) 56(84) bytes of data.
64 bytes from 10.10.1.1: icmp_seq=1 ttl=64 time=0.517 ms
64 bytes from 10.10.1.1: icmp_seq=2 ttl=64 time=0.486 ms
^C
--- 10.10.1.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1007ms
rtt min/avg/max/mdev = 0.486/0.501/0.517/0.015 ms
```

ip details of **ubuntu**