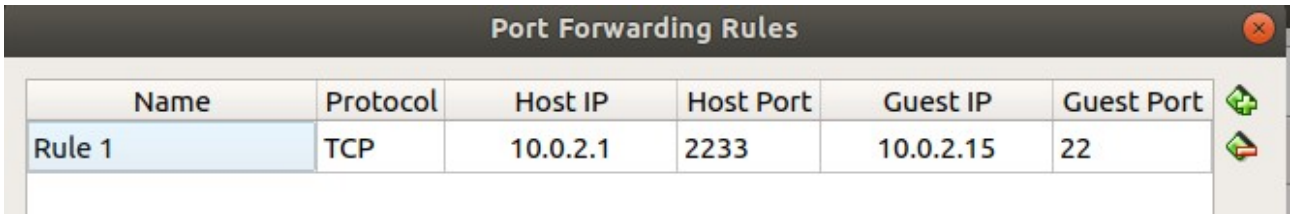
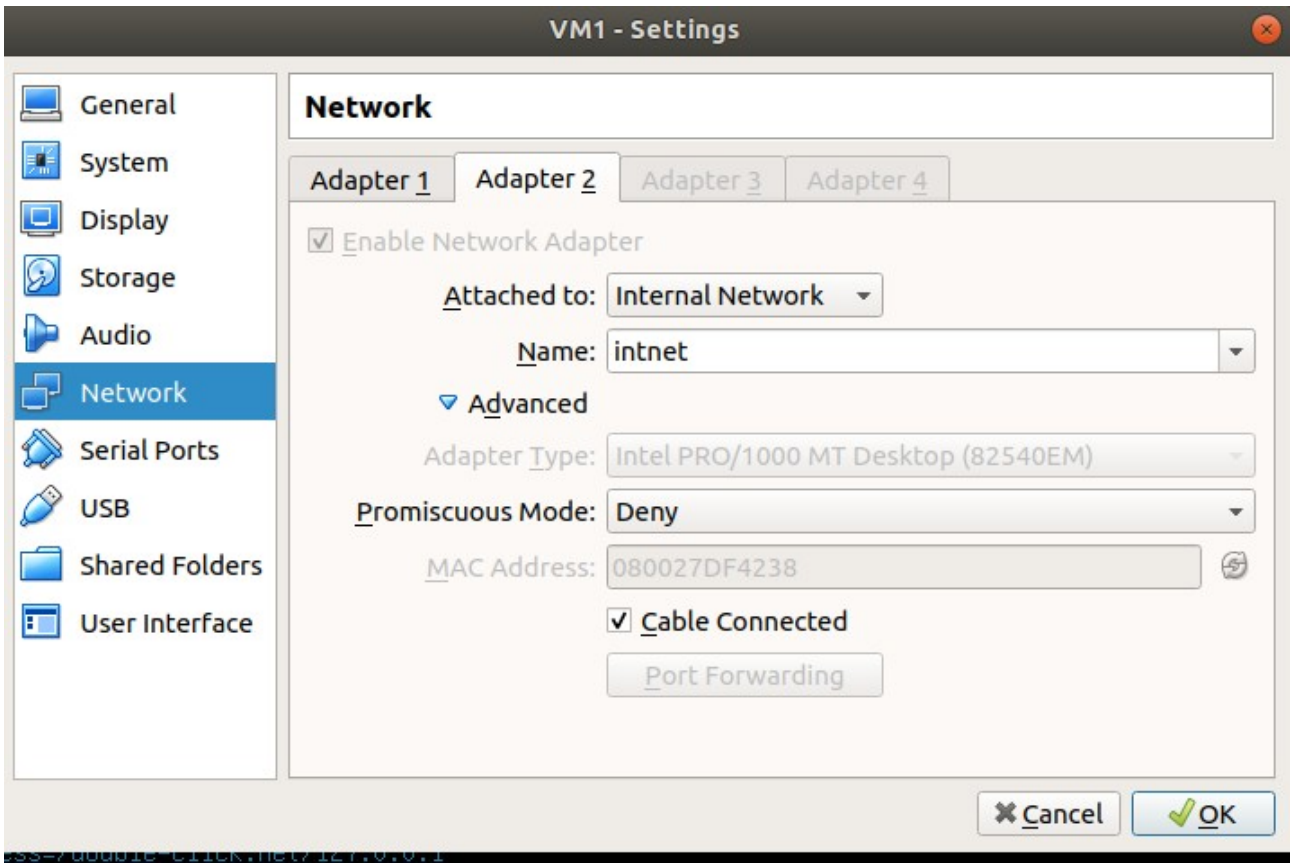
Bilohur Oleksii

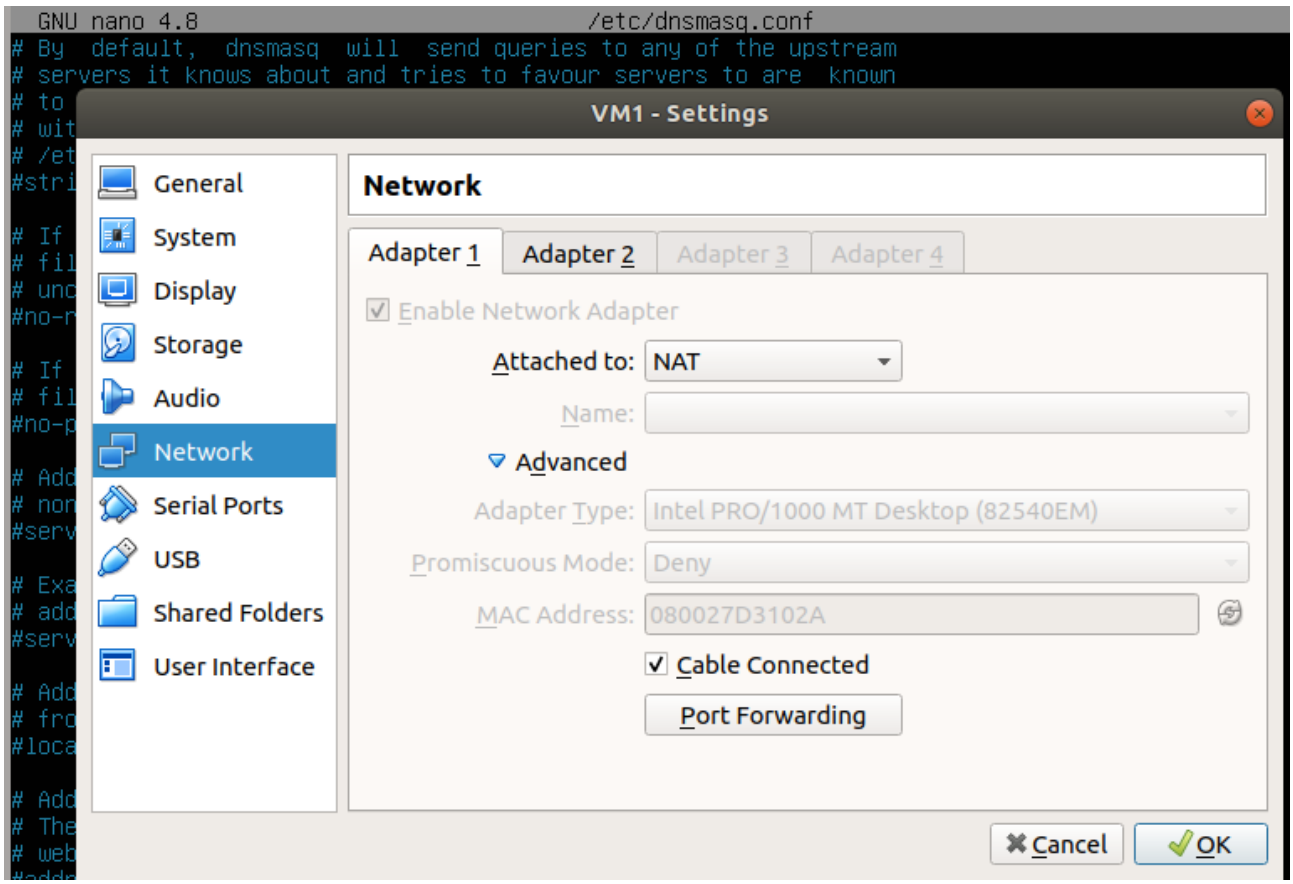
Task 6.2

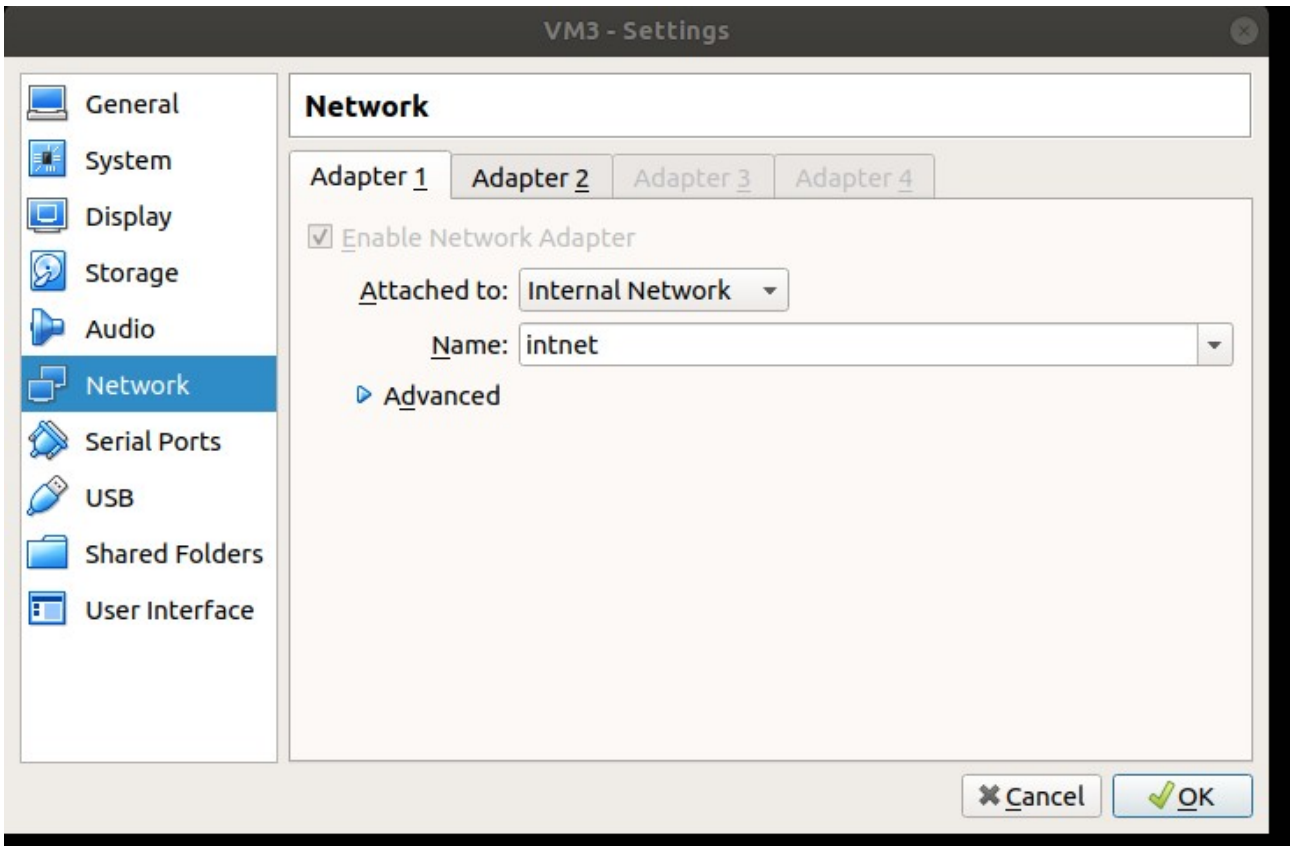
Configuring DHCP, DNS servers
and dynamic routing using OSPF protocol

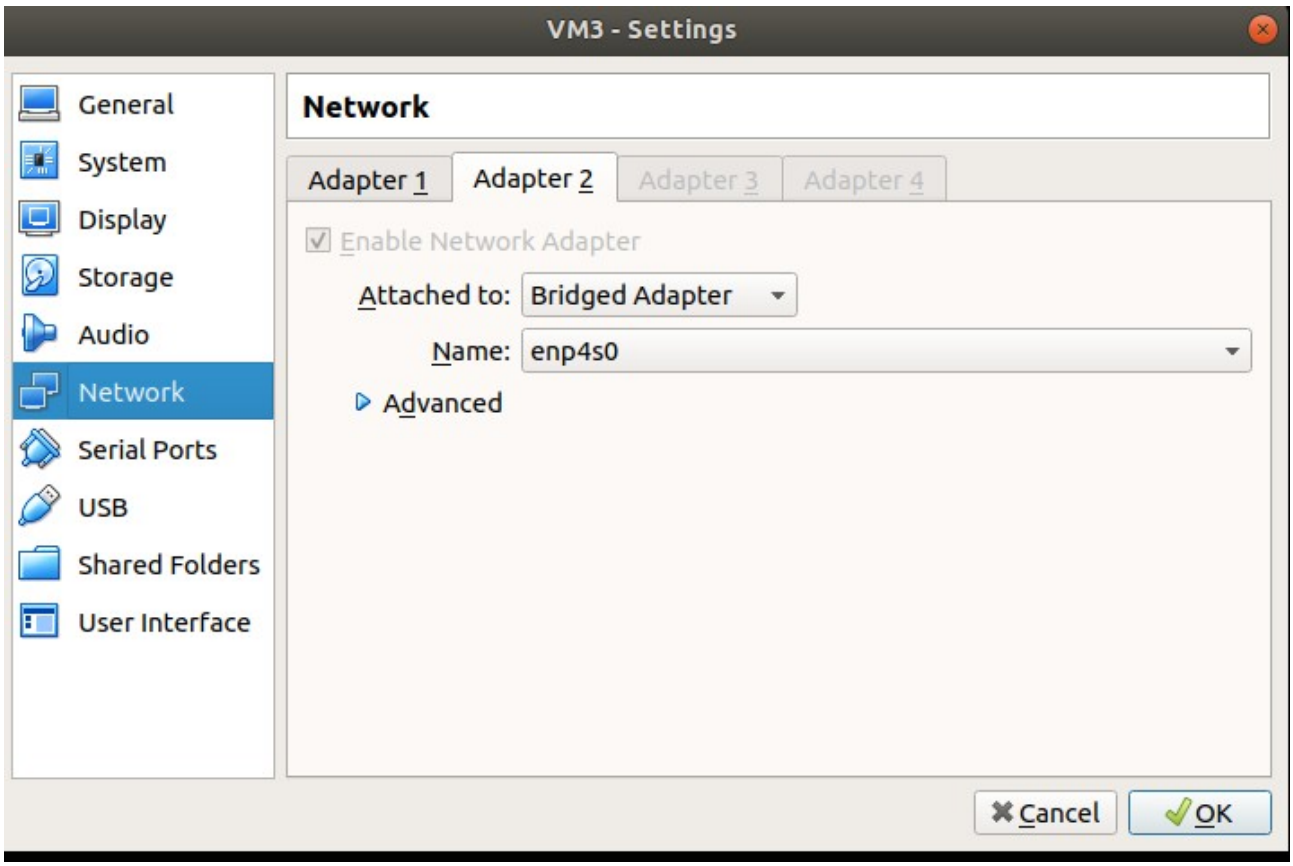
1. Use already created internal-network for three VMs (VM1-VM3). VM1 has NAT and internal, VM2, VM3 – internal only interfaces.

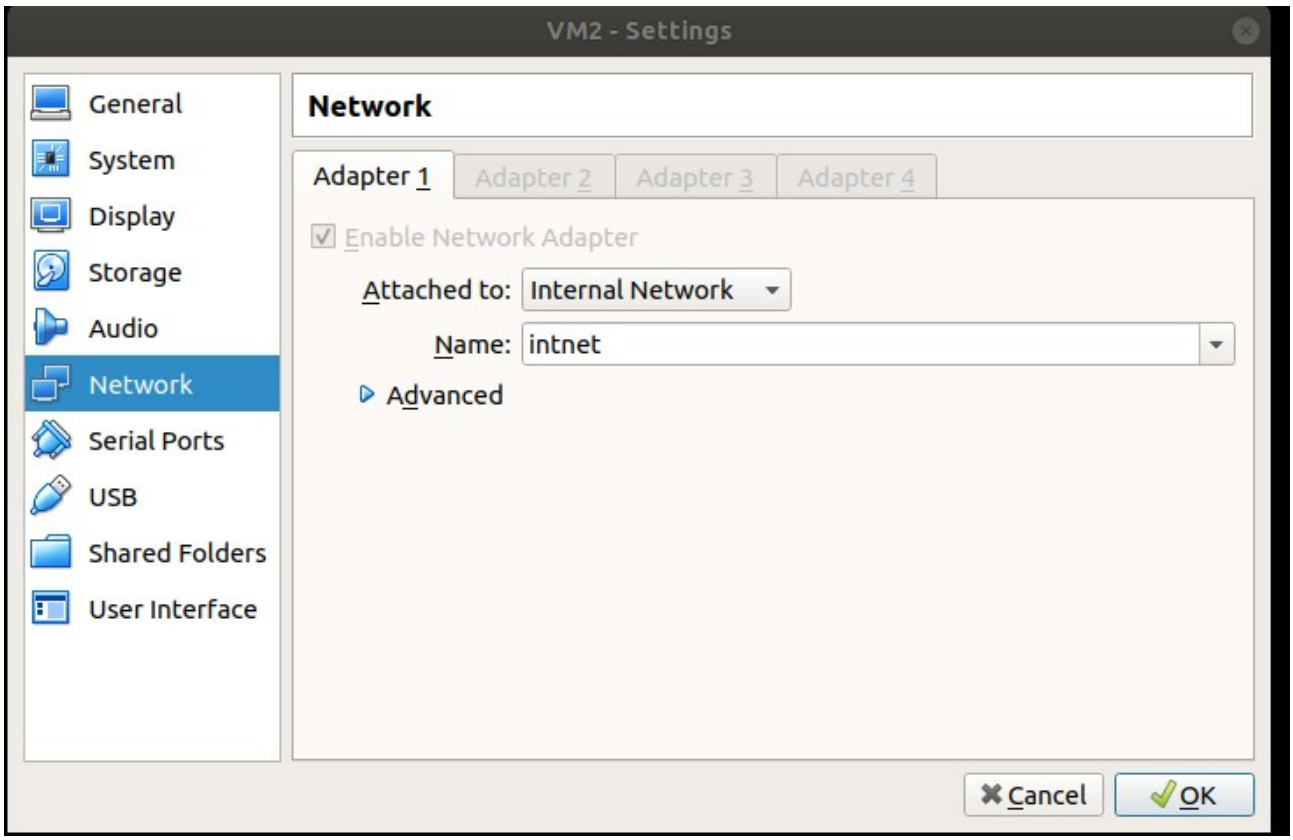





GNU nano 4.8 /etc/dnsmasq.conf
By default, dnsmasq will send queries to any of the upstream
servers it knows about and tries to favour servers to are known
VM1 - Settings
General
System
Display
Storage
Audio
Network
Serial Ports
USB
Shared Folders
User Interface
Network
Adapter 1
Adapter 2
Adapter 3
Adapter 4
Enable Network Adapter
Attached to: NAT
Name:
Advanced
Adapter Type: Intel PRO/1000 MT Desktop (82540EM)
Promiscuous Mode: Deny
MAC Address: 080027D3102A
Cable Connected
Port Forwarding
Cancel
OK


VM3 - Settings
General
System
Display
Storage
Audio
Network
Serial Ports
USB
Shared Folders
User Interface
Network
Adapter 1
Adapter 2
Adapter 3
Adapter 4
Enable Network Adapter
Attached to: Internal Network
Name: intnet
Advanced
Cancel
OK





2. Install and configure DHCP server on VM1. (3 ways: using VBoxManage, DNSMASQ and ISC-DHSPSERVER). You should use at least 2 of them.

Using DNSMASQ

Installing dnsmasq: systemd-resolv conflicts with dnsmasq, because they use the same port 53. First it need to be disabled.

```
uservm1@vm1: $ sudo systemctl disbale systemd-resolved
[sudo] password for uservm1:
Unknown operation disbale.
uservm1@vm1:~$ sudo systemctl disable systemd-resolved
Removed /etc/systemd/system/multi-user.target.wants/systemd-resolved.service.
Removed /etc/systemd/system/dbus-org.freedesktop.resolve1.service.
uservm1@vm1:~$ sudo systemctl stop systemd-resolved
uservm1@vm1:~$ ls -lh /etc/resolv.conf
lrwxrwxrwx 1 root root 39 Aug 24 08:42 /etc/resolv.conf -> ../run/systemd/resolve/stub-resolv.conf
uservm1@vm1:~$ sudo rm /etc/resolv.conf
uservm1@vm1:~$ echo "nameserver 8.8.8.8" > /etc/resolv.conf
-bash: /etc/resolv.conf: Permission denied
uservm1@vm1:~$ sudo echo "nameserver 8.8.8.8" > /etc/resolv.conf
-bash: /etc/resolv.conf: Permission denied
uservm1@vm1:~$ sudo su
root@vm1:/home/uservm1# echo "nameserver 8.8.8.8" > /etc/resolv.conf
root@vm1:/home/uservm1#
```

Network configuration vm1:

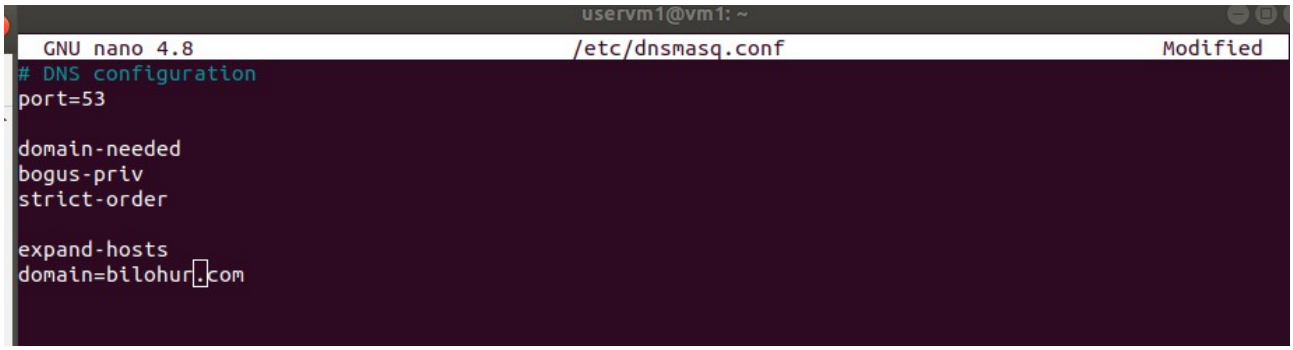
sudo nano /etc/netplan/00-installer-config.yaml

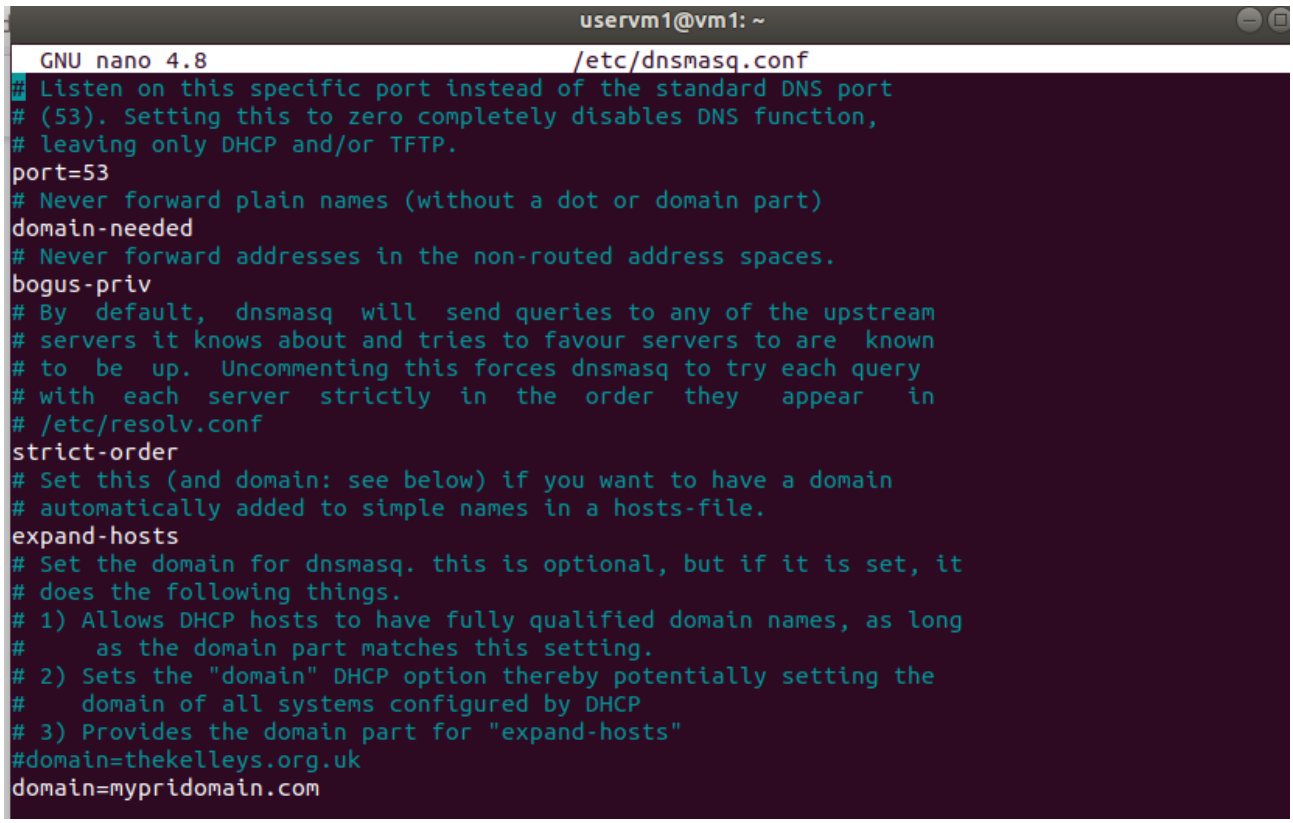
```
 GNU nano 4.8                /etc/netplan/00-installer-config.yaml                Modified
# This is the network config written by 'subiquity'
network:
  ethernets:
    enp0s3:
      dhcp4: true
    enp0s8:
      dhcp4: no
      addresses: [192.168.10.1/24]
      gateway4: 10.0.2.1
      nameservers:
          addresses: [192.168.10.1]
  version: 2
```

```
uservm1@vm1:~$ 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:fed3:102a  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:d3:10:2a  txqueuelen 1000  (Ethernet)
        RX packets 109  bytes 19705 (19.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 113  bytes 13801 (13.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.10.1  netmask 255.255.255.0  broadcast 192.168.10.255
        inet6 fe80::a00:27ff:fedf:4238  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:df:42:38  txqueuelen 1000  (Ethernet)
        RX packets 1  bytes 329 (329.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 5  bytes 446 (446.0 B)
        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 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
```

Then installing and configuring dnsmasq:

sudo apt install dnsmasq
sudo nano /etc/dnsmasq





# DNS configuration
port=53

domain-needed
bogus-priv
strict-order

expand-hosts
domain=example.com

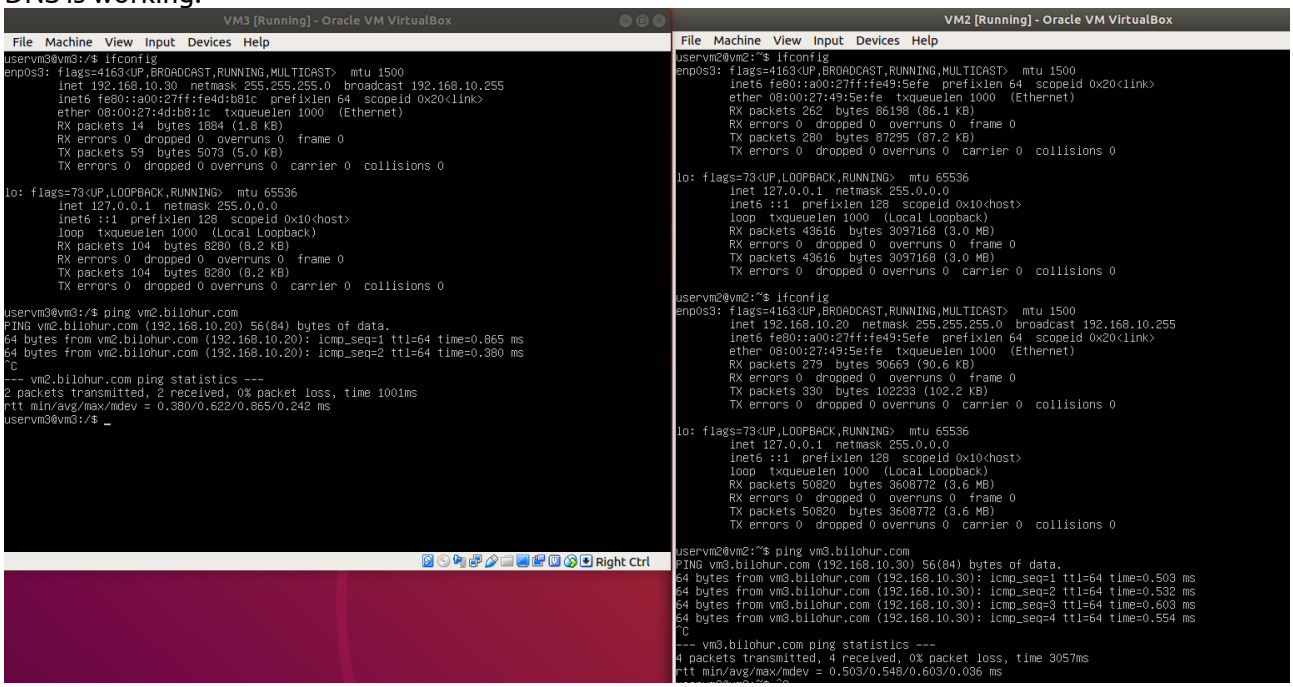
set **192.168.10.1** as the default DNS server address in the **/etc/resolv.conf**.

Adding DNS Records

```
  GNU nano 4.8                                  /etc/hosts
127.0.0.1 localhost
127.0.1.1 vm1

#DNS records
192.168.10.1 router.bilohur.com
192.168.10.20 vm2.bilohur.com
192.168.10.30 vm3.bilohur.com

# The following lines are desirable for IPv6 capable hosts
::1     ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
```

sudo systemctl restart dnsmasq

DNS is working:



```
uservm1@vm1:~$ sudo dig router.bilohur.com

; <<>> DiG 9.16.1-Ubuntu <<>> router.bilohur.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 36252
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;router.bilohur.com.            IN      A

;; ANSWER SECTION:
router.bilohur.com.     0       IN      A       192.168.10.1

;; Query time: 0 msec
;; SERVER: 192.168.10.1#53(192.168.10.1)
;; WHEN: Mon Dec 20 14:58:39 UTC 2021
;; MSG SIZE  rcvd: 63

uservm1@vm1:~$ dig google.com

; <<>> DiG 9.16.1-Ubuntu <<>> google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 59452
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;google.com.                    IN      A

;; ANSWER SECTION:
google.com.             45      IN      A       142.250.180.206

;; Query time: 76 msec
;; SERVER: 192.168.10.1#53(192.168.10.1)
;; WHEN: Mon Dec 20 14:58:51 UTC 2021
;; MSG SIZE  rcvd: 55
```

Configuring DHCP:
sudo nano /etc/dnsmasq.conf

DHCP configuration
dhcp-range=192.168.10.20,192.168.10.100,255.255.255.0,24h
dhcp-option=option:router,192.168.10.1
dhcp-option=option:dns-server,192.168.10.1
dhcp-option=option:netmask,255.255.255.0

dhcp-host=08:00:27:49:5E:FE,192.168.10.20
dhcp-host=08:00:27:4D:B8:1C,192.168.10.30
dhcp-host=00:0C:29:A5:BD:6C,192.168.10.40

```
  GNU nano 4.8                          /etc/dnsmasq.conf
# DNS configuration
port=53

domain-needed
bogus-priv
strict-order

expand-hosts
domain=bilohur.com

# DHCP configuration
dhcp-range=192.168.10.20,192.168.10.100,255.255.255.0,24h
dhcp-option=option:router,192.168.10.1
dhcp-option=option:dns-server,192.168.10.1
dhcp-option=option:netmask,255.255.255.0

dhcp-host=08:00:27:49:5E:FE,192.168.10.20
dhcp-host=08:00:27:4D:B8:1C,192.168.10.30
dhcp-host=00:0C:29:A5:BD:6C,192.168.10.40
```

dhcp-range is used to set the range of IP addresses that the DHCP server will assign to hosts.

dhcp-option is used to set the gateway (**option:router**), DNS server address (**option:dns-server**), and netmask (**option:netmask**)
dhcp-host is used to set specific IP addresses to hosts depending on the specified MAC addresses.

Get mac addresses of vm2 vm3 for dnmasq settings.

```
user@pc:~$ VBoxManage showvminfo VM2 | grep MAC
NIC 1:           MAC: 080027495EFE, Attachment: Internal Network 'intnet', Cable connected: on, Trace
: off (file: none), Type: 82540EM, Reported speed: 0 Mbps, Boot priority: 0, Promisc Policy: deny, Ba
ndwidth group: none
```

```
user@pc:~$ VBoxManage showvminfo VM3 |  grep MAC
NIC 1:           MAC: 0800274DB81C, Attachment: Internal Network 'intnet', Cable connected: on, Trace
: off (file: none), Type: 82540EM, Reported speed: 0 Mbps, Boot priority: 0, Promisc Policy: deny, Ba
ndwidth group: none
NIC 2:           MAC: 080027878BD0, Attachment: Bridged Interface 'enp4s0', Cable connected: on, Trac
e: off (file: none), Type: 82540EM, Reported speed: 0 Mbps, Boot priority: 0, Promisc Policy: deny, B
andwidth group: none
```

Restart dhcp server:

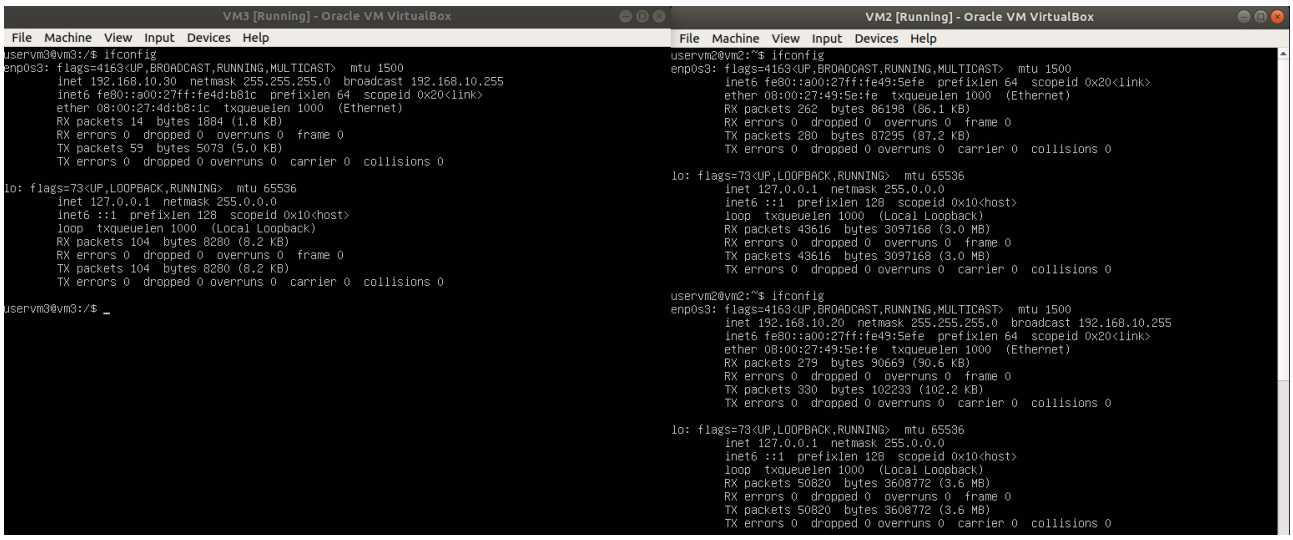
`sudo systemctl restart dnsmasq`

VM1 has new ip:

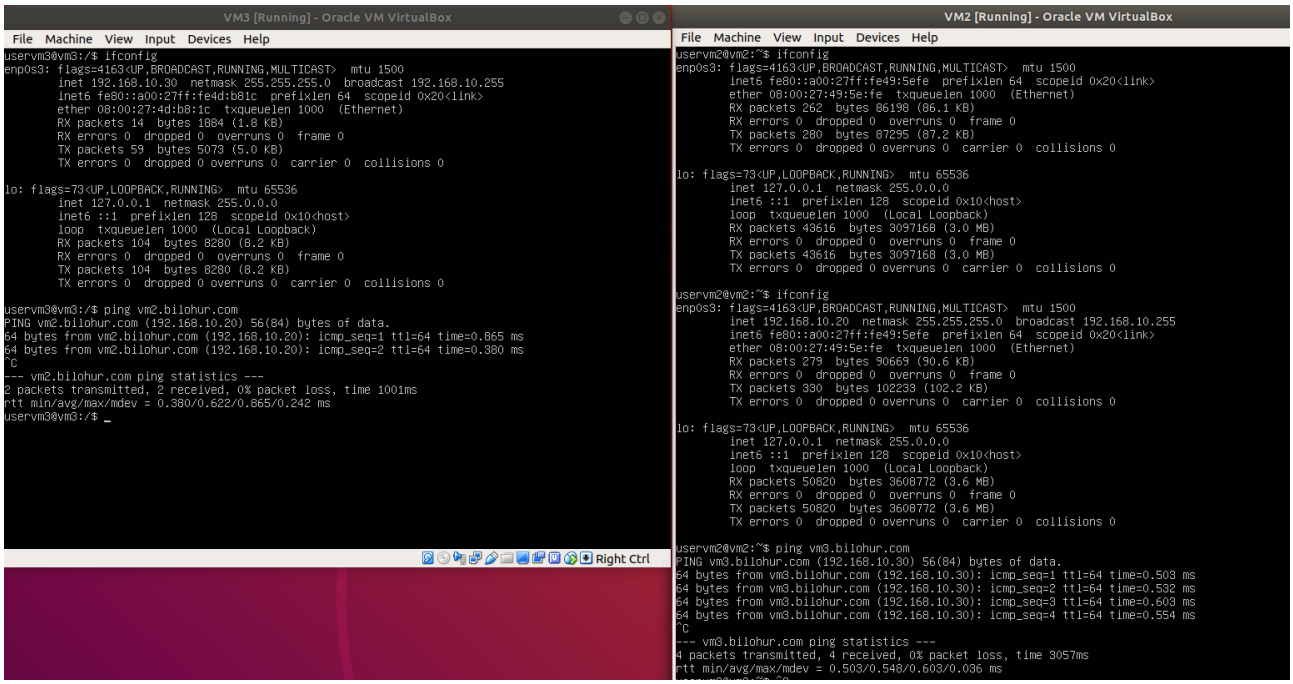
```
uservm1@vm1:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
        inet6 fe80::a00:27ff:fed3:102a  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:d3:10:2a  txqueuelen 1000  (Ethernet)
        RX packets 1937  bytes 153413 (153.4 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1259  bytes 147949 (147.9 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.10.1  netmask 255.255.255.0  broadcast 192.168.10.255
        inet6 fe80::a00:27ff:fedf:4238  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:df:42:38  txqueuelen 1000  (Ethernet)
        RX packets 190  bytes 23370 (23.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 52  bytes 6164 (6.1 KB)
        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 8  bytes 496 (496.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 8  bytes 496 (496.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

3.Check VM2 and VM3 for obtaining network addresses from DHCP server.

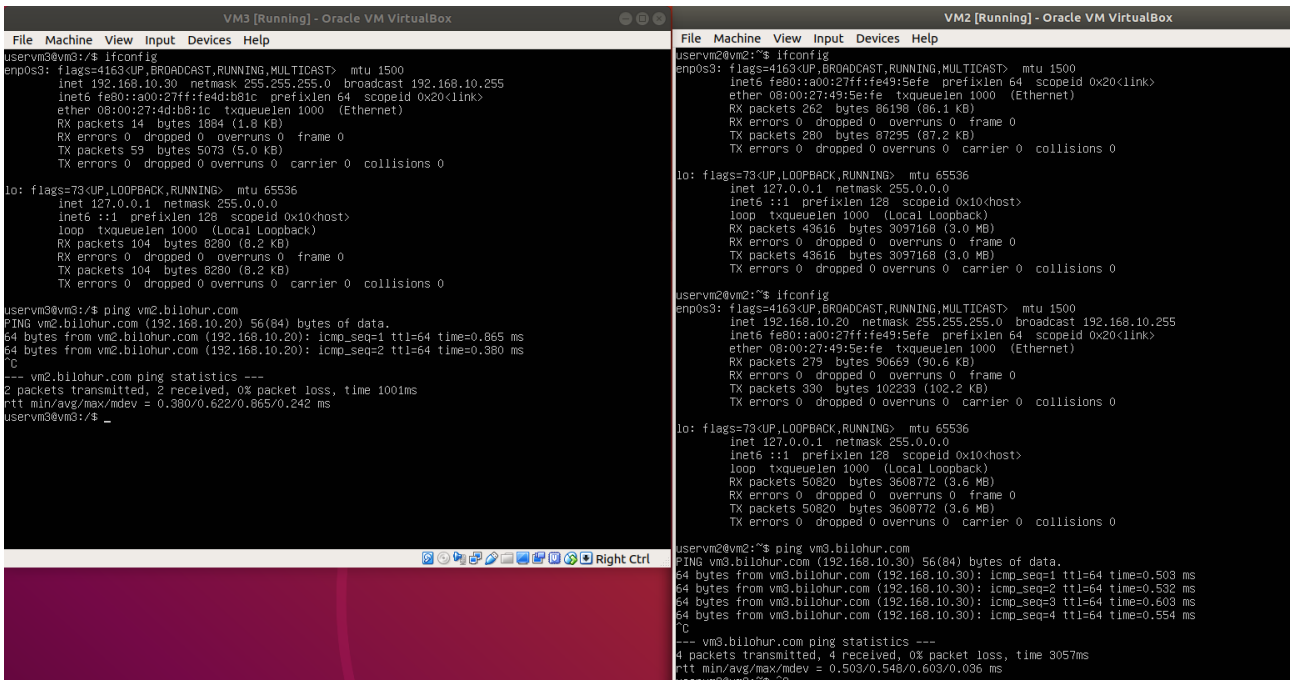
VM2, VM3 has obtained ip using dhcp server:



4. Using existed network for three VMs (from p.1) install and configure DNS server on VM1. (You can use DNSMASQ, BIND9 or something else).



5. Check VM2 and VM3 for gaining access to DNS server (naming services).



Using isc-dhcp-server

sudo apt install isc-dhcp-server

sudo nano /etc/dhcp/dhcpd.conf

Content of dhcpd.conf :

```
subnet 192.168.33.0 netmask 255.255.255.0 {
range 192.168.33.100 192.168.38.254;
option subnet-mask 255.255.255.0;
option broadcast-address 192.168.33.255;
option domain-name-servers 8.8.8.8, 8.8.4.4;
option domain-name "bilohur.com";
option routers 192.168.33.1;
default-lease-time 7200;
max-lease-time 480000;
}
```

Where option-routers is ip of gateway.

New network: 192.168.33.1

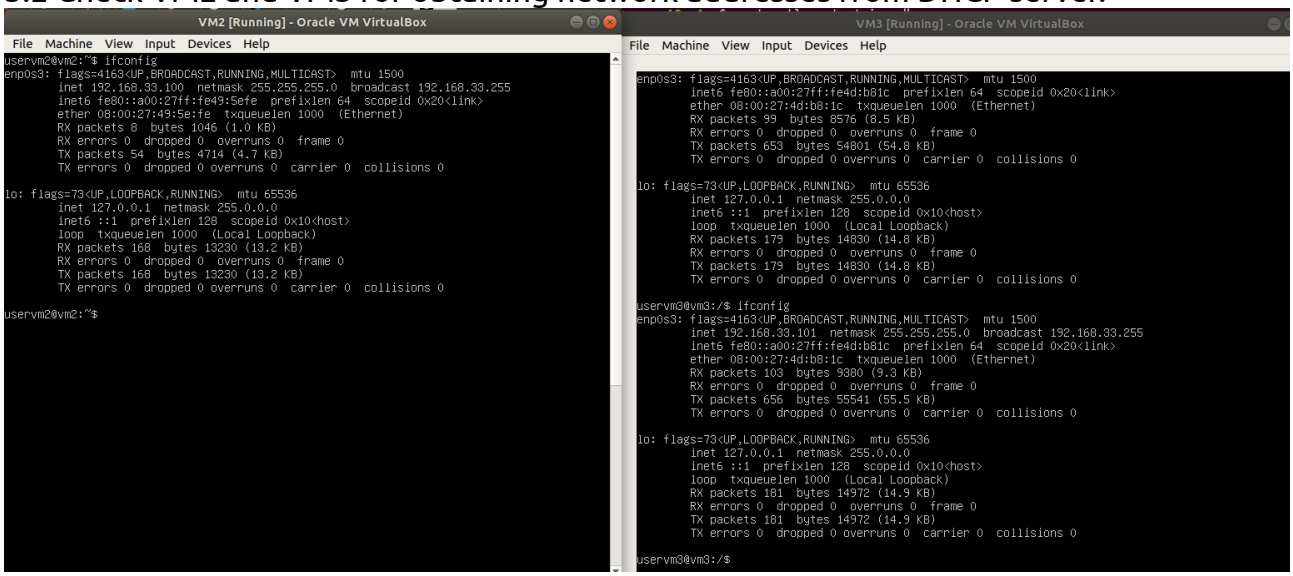
```
  GNU nano 4.8                          /etc/default/isc-dhcp-server
# Defaults for isc-dhcp-server (sourced by /etc/init.d/isc-dhcp-server)

# Path to dhcpd's config file (default: /etc/dhcp/dhcpd.conf).
#DHCPDv4_CONF=/etc/dhcp/dhcpd.conf
#DHCPDv6_CONF=/etc/dhcp/dhcpd6.conf

# Path to dhcpd's PID file (default: /var/run/dhcpd.pid).
#DHCPDv4_PID=/var/run/dhcpd.pid
#DHCPDv6_PID=/var/run/dhcpd6.pid

# Additional options to start dhcpd with.
#       Don't use options -cf or -pf here; use DHCPD_CONF/ DHCPD_PID instead
#OPTIONS=""

# On what interfaces should the DHCP server (dhcpd) serve DHCP requests?
#       Separate multiple interfaces with spaces, e.g. "eth0 eth1".
INTERFACESv4="enp8s0"
INTERFACESv6=""
```

sudo nano /etc/default/isc-dhcp-server

systemctl restart isc-dhcp-server

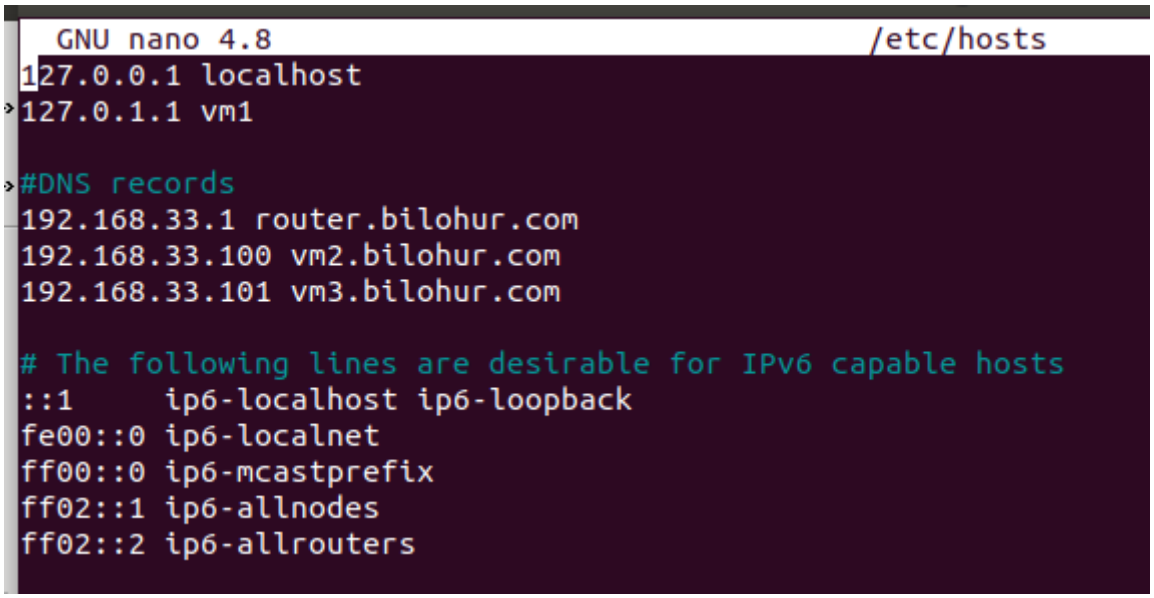
systemctl status isc-dhcp-server

3.2 Check VM2 and VM3 for obtaining network addresses from DHCP server.



Configuring dns:

sudo nano /etc/hosts

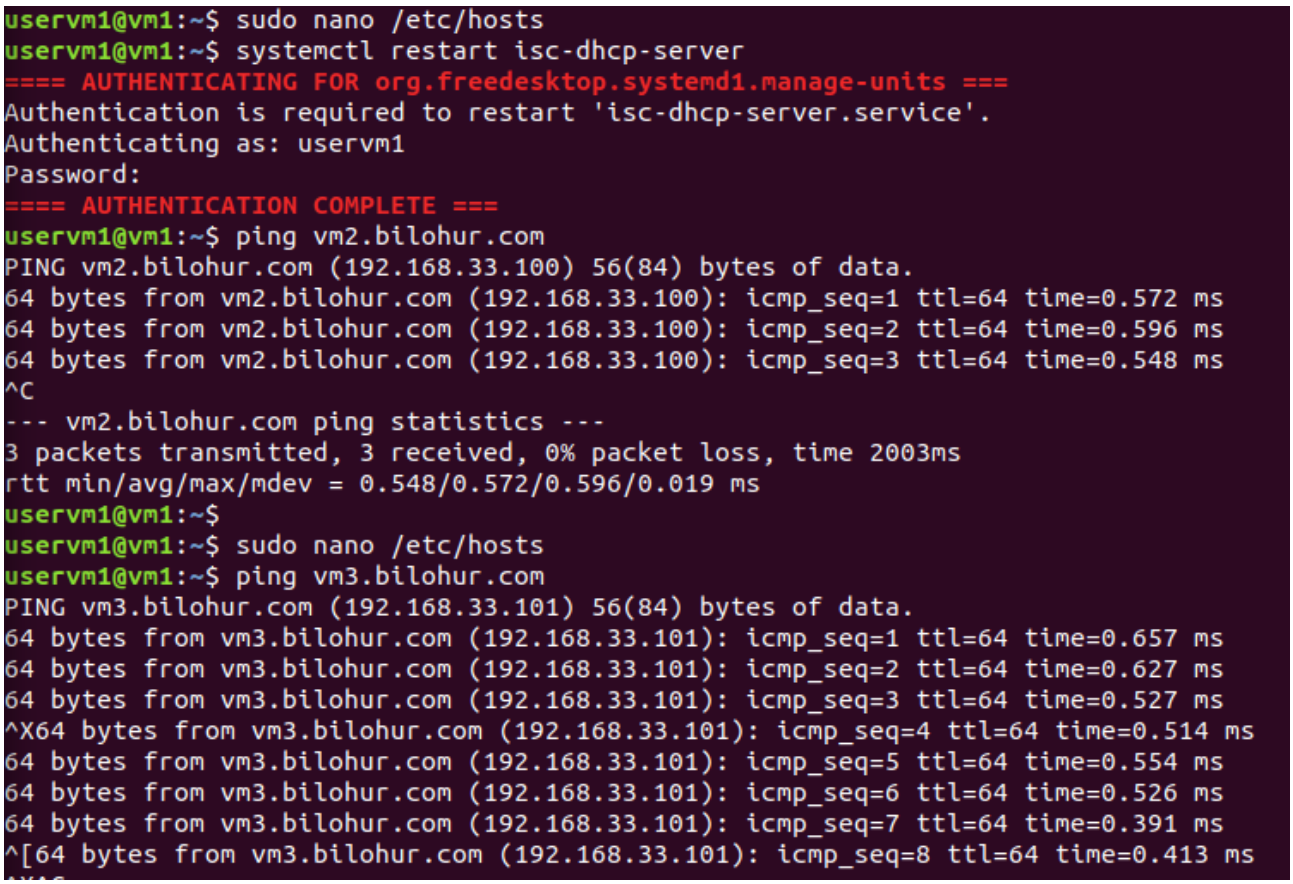


127.0.0.1 localhost
127.0.1.1 vm1

#DNS records
192.168.33.1 router.bilohur.com
192.168.33.100 vm2.bilohur.com
192.168.33.101 vm3.bilohur.com

The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters

5.2 Check VM2 and VM3 for gaining access to DNS server (naming services).



6. ***Using the scheme which follows, configure dynamic routing using OSPF protocol.

Sources:

https://linuxhint.com/dnsmasq_ubuntu_server/

https://admin812.ru/ustanovka-i-nastroyka-servera-isc-dhcp-v-ubuntu-debian.html