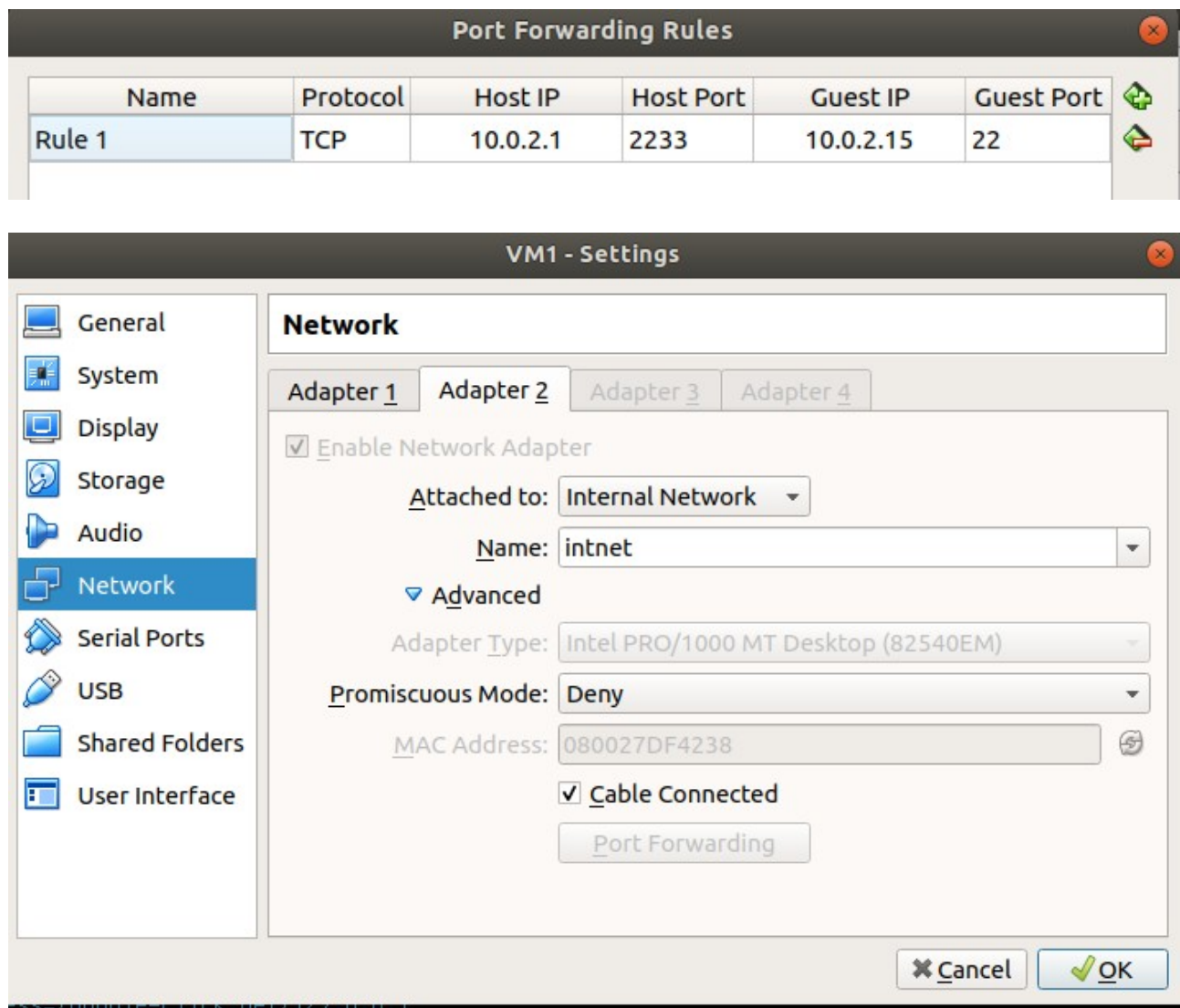
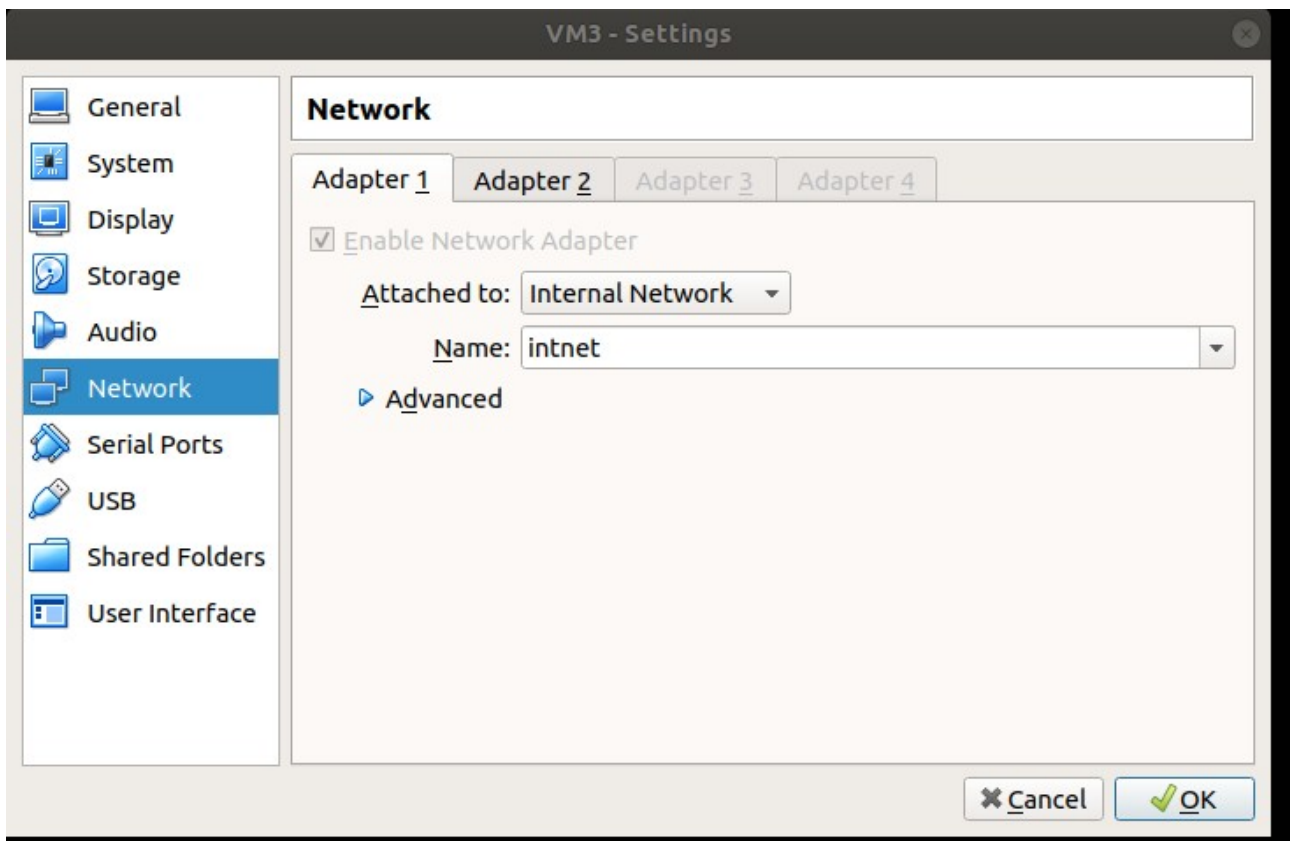
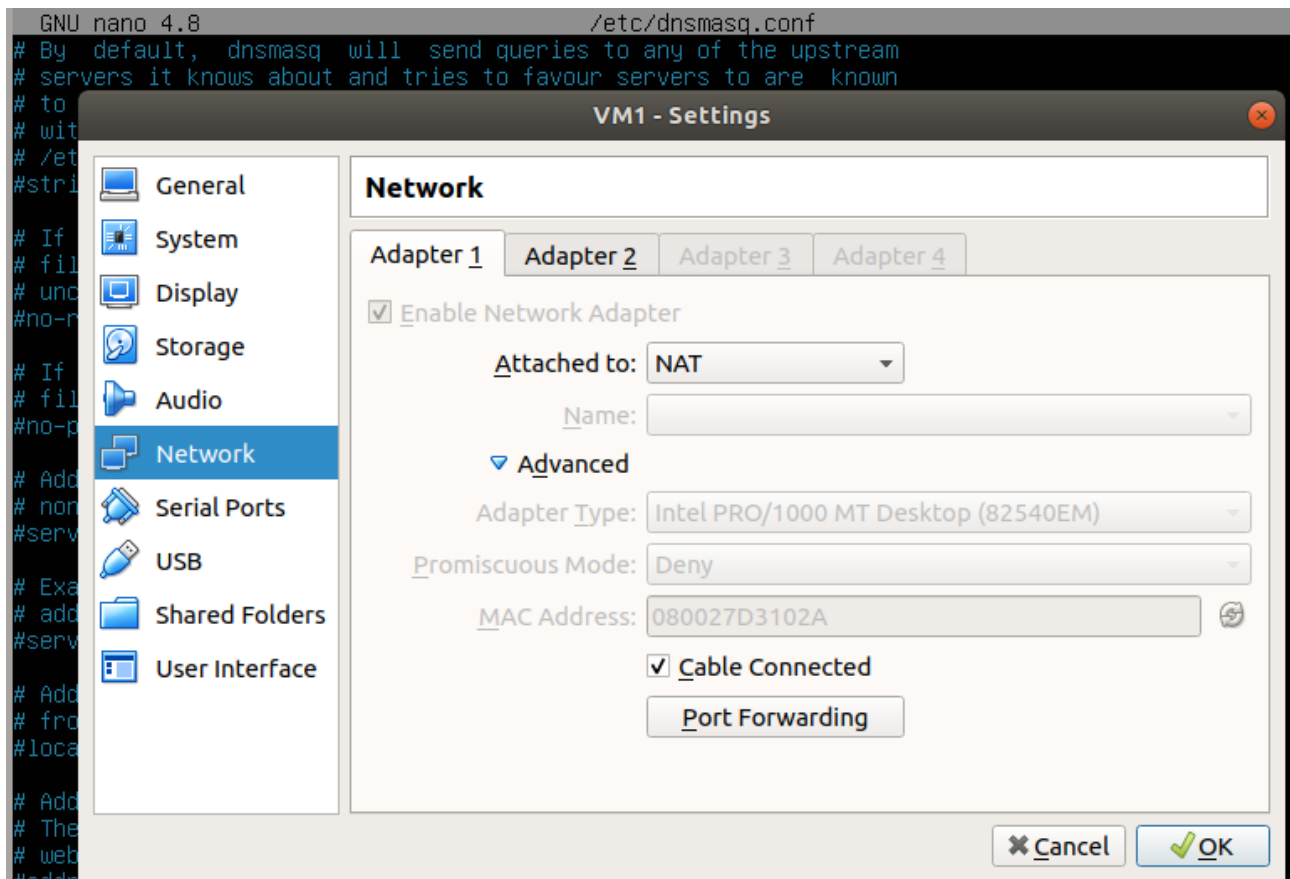


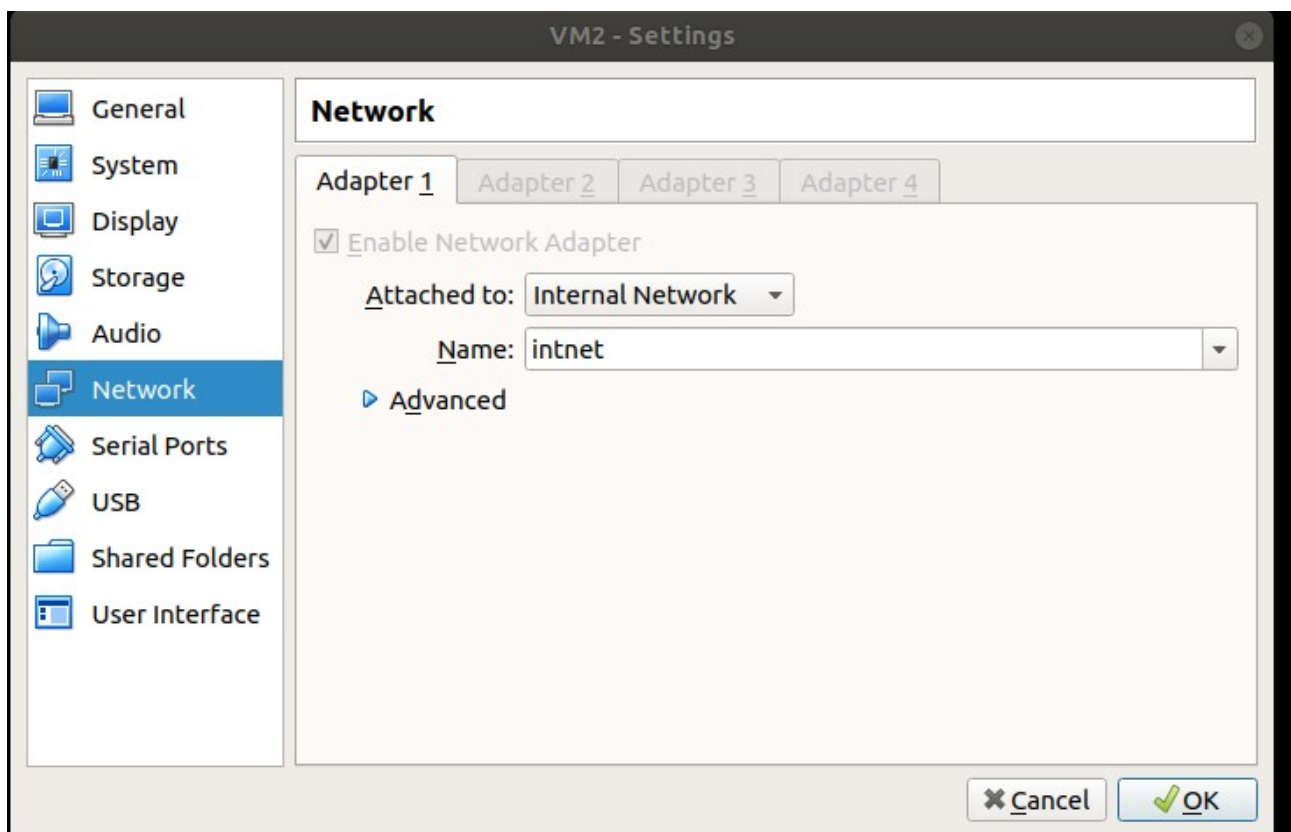
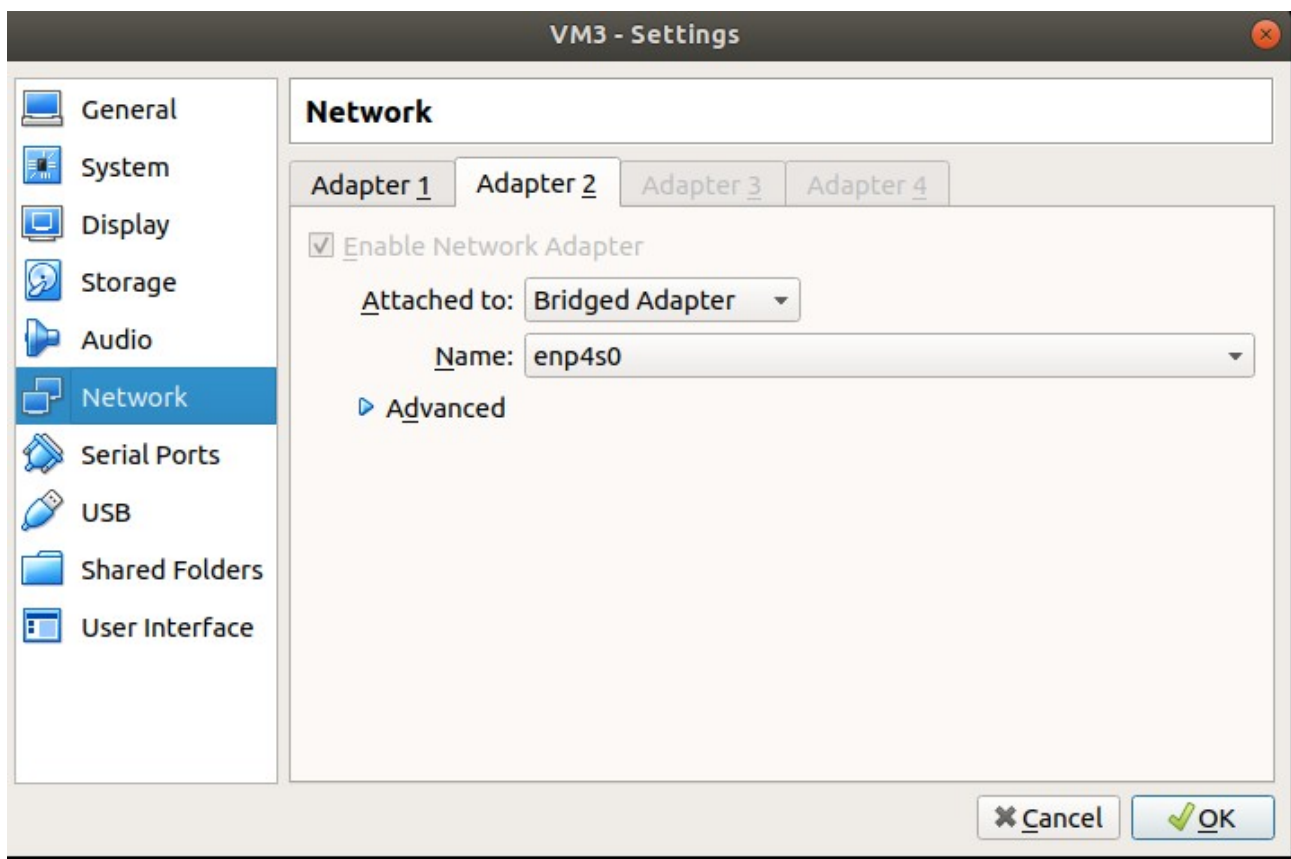
Task 6.2

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.







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 disable systemd-resolved
[sudo] password for uservm1:
Unknown operation disable.
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

```

```

uservm1@vm1: ~
GNU nano 4.8 /etc/dnsmasq.conf Modified
# DNS configuration
port=53

domain-needed
bogus-priv
strict-order

expand-hosts
domain=bilohur.com

```

```
uservm1@vm1: ~  
GNU nano 4.8 /etc/dnsmasq.conf  
## Listen on this specific port instead of the standard DNS port  
## (53). Setting this to zero completely disables DNS function,  
## leaving only DHCP and/or TFTP.  
port=53  
# Never forward plain names (without a dot or domain part)  
domain-needed  
# Never forward addresses in the non-routed address spaces.  
bogus-priv  
# By default, dnsmasq will send queries to any of the upstream  
# servers it knows about and tries to favour servers to are known  
# to be up. Uncommenting this forces dnsmasq to try each query  
# with each server strictly in the order they appear in  
# /etc/resolv.conf  
strict-order  
# Set this (and domain: see below) if you want to have a domain  
# automatically added to simple names in a hosts-file.  
expand-hosts  
# Set the domain for dnsmasq. this is optional, but if it is set, it  
# does the following things.  
# 1) Allows DHCP hosts to have fully qualified domain names, as long  
# as the domain part matches this setting.  
# 2) Sets the "domain" DHCP option thereby potentially setting the  
# domain of all systems configured by DHCP  
# 3) Provides the domain part for "expand-hosts"  
#domain=thekelleys.org.uk  
domain=mypridomain.com
```

# 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**.

```
uservm1@vm1:~$ sudo nano /etc/resolv.conf  
uservm1@vm1:~$ cat /etc/resolv.conf  
nameserver 192.168.10.1  
nameserver 8.8.8.8  
uservm1@vm1:~$
```



## Adding DNS Records

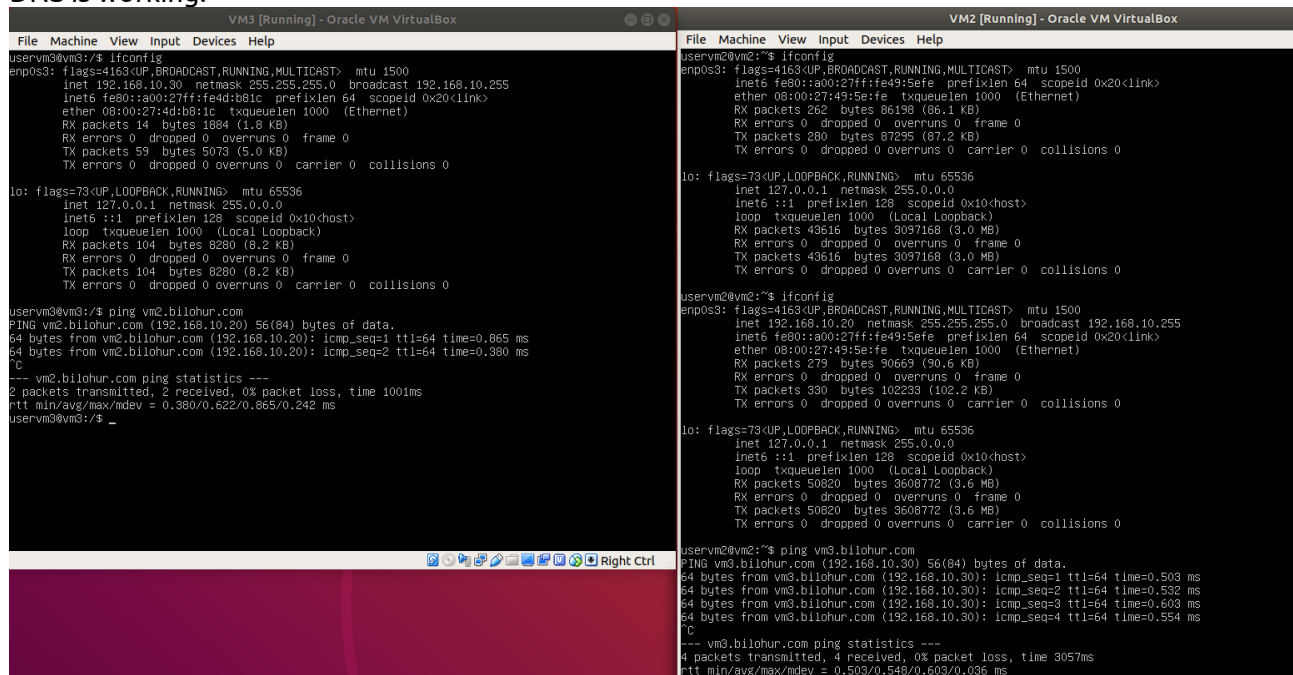
```
GNU nano 4.8 /etc/hosts
127.0.0.1 localhost
127.0.1.1 vm1

#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
fe80::0      ip6-localnet
ff00::0      ip6-mcastprefix
ff02::1      ip6-allnodes
ff02::2      ip6-allrouters
```

sudo systemctl restart dnsmasq

DNS is working:



The image shows two side-by-side screenshots of Oracle VM VirtualBox terminal windows. The left window, titled 'VM3 [Running] - Oracle VM VirtualBox', shows the configuration of the 'enp0s3' interface in VM3, including IP address 192.168.10.20 and netmask 255.255.255.0. It also shows the configuration of the 'lo' interface with IP 127.0.0.1. The user then runs a ping command to vm2.bilohur.com, which successfully connects to 192.168.10.20. The right window, titled 'VM2 [Running] - Oracle VM VirtualBox', shows the configuration of the 'enp0s3' interface in VM2, including IP address 192.168.10.30 and netmask 255.255.255.0. It also shows the configuration of the 'lo' interface with IP 127.0.0.1. The user then runs a ping command to vm3.bilohur.com, which successfully connects to 192.168.10.30. Both windows show the output of the 'ifconfig' command for the 'enp0s3' and 'lo' interfaces.

```
File Machine View Input Devices Help
uservm3@vm3:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.10.20  netmask 255.255.255.0  broadcast 192.168.10.255
        inet6 fe80::a00:27ff:fe4d:b81c  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:4d:b8:1c  txqueuelen 1000  (Ethernet)
        RX packets 14  bytes 1884 (1.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 59  bytes 5073 (5.0 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 104  bytes 8280 (8.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 104  bytes 8280 (8.2 KB)
        TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

uservm3@vm3:~$ ping vm2.bilohur.com
PING vm2.bilohur.com (192.168.10.20) 56(84) bytes of data.
64 bytes from vm2.bilohur.com (192.168.10.20): icmp_seq=1 ttl=64 time=0.865 ms
64 bytes from vm2.bilohur.com (192.168.10.20): icmp_seq=2 ttl=64 time=0.380 ms
^C
--- vm2.bilohur.com ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.380/0.622/0.865/0.242 ms
uservm3@vm3:~$ _

File Machine View Input Devices Help
uservm2@vm2:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.10.20  netmask 255.255.255.0  broadcast 192.168.10.255
        inet6 fe80::a00:27ff:fe49:5efe  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:49:5e:fe  txqueuelen 1000  (Ethernet)
        RX packets 279  bytes 90669 (90.6 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 330  bytes 102233 (102.2 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 50820  bytes 3608772 (3.6 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 50820  bytes 3608772 (3.6 MB)
        TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

uservm2@vm2:~$ ping vm3.bilohur.com
PING vm3.bilohur.com (192.168.10.30) 56(84) bytes of data.
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=1 ttl=64 time=0.503 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=2 ttl=64 time=0.532 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=3 ttl=64 time=0.603 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=4 ttl=64 time=0.554 ms
^C
--- vm3.bilohur.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3057ms
rtt min/avg/max/mdev = 0.503/0.548/0.603/0.036 ms
```

```

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 dnsmasq 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:

```
VM3 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
uservm3@vm3:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.10.30 netmask 255.255.255.0 broadcast 192.168.10.255
    inet6 fe80::a00:27ff:fe4d:b81c prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:4d:b8:1c txqueuelen 1000 (Ethernet)
    RX packets 14 bytes 1884 (1.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 59 bytes 5073 (5.0 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 104 bytes 8280 (8.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 104 bytes 8280 (8.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm3@vm3:/$ _

VM2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
uservm2@vm2:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::a00:27ff:fe49:5efe prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:49:5e:fe txqueuelen 1000 (Ethernet)
    RX packets 262 bytes 86198 (86.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 280 bytes 87295 (87.2 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 43616 bytes 3097168 (3.0 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 43616 bytes 3097168 (3.0 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm2@vm2:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.10.20 netmask 255.255.255.0 broadcast 192.168.10.255
    inet6 fe80::a00:27ff:fe49:5efe prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:49:5e:fe txqueuelen 1000 (Ethernet)
    RX packets 279 bytes 90669 (90.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 330 bytes 102233 (102.2 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 50820 bytes 3608772 (3.6 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 50820 bytes 3608772 (3.6 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm2@vm2:/$
```

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).

```
VM3 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
uservm3@vm3:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.10.30 netmask 255.255.255.0 broadcast 192.168.10.255
    inet6 fe80::a00:27ff:fe4d:b81c prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:4d:b8:1c txqueuelen 1000 (Ethernet)
    RX packets 14 bytes 1884 (1.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 59 bytes 5073 (5.0 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 104 bytes 8280 (8.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 104 bytes 8280 (8.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm3@vm3:/$ ping vm2.bilohur.com
PING vm2.bilohur.com (192.168.10.20) 56(84) bytes of data.
64 bytes from vm2.bilohur.com (192.168.10.20): icmp_seq=1 ttl=64 time=0.865 ms
64 bytes from vm2.bilohur.com (192.168.10.20): icmp_seq=2 ttl=64 time=0.380 ms
--- vm2.bilohur.com ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.380/0.622/0.865/0.242 ms
uservm3@vm3:/$ _

VM2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
uservm2@vm2:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::a00:27ff:fe49:5efe prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:49:5e:fe txqueuelen 1000 (Ethernet)
    RX packets 262 bytes 86198 (86.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 280 bytes 87295 (87.2 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 43616 bytes 3097168 (3.0 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 43616 bytes 3097168 (3.0 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm2@vm2:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.10.20 netmask 255.255.255.0 broadcast 192.168.10.255
    inet6 fe80::a00:27ff:fe49:5efe prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:49:5e:fe txqueuelen 1000 (Ethernet)
    RX packets 279 bytes 90669 (90.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 330 bytes 102233 (102.2 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 50820 bytes 3608772 (3.6 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 50820 bytes 3608772 (3.6 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm2@vm2:/$ ping vm3.bilohur.com
PING vm3.bilohur.com (192.168.10.30) 56(84) bytes of data.
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=1 ttl=64 time=0.503 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=2 ttl=64 time=0.532 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=3 ttl=64 time=0.603 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=4 ttl=64 time=0.554 ms
--- vm3.bilohur.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3057ms
rtt min/avg/max/mdev = 0.503/0.548/0.603/0.036 ms
uservm2@vm2:/$
```

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

The image shows two terminal windows from Oracle VM VirtualBox. The left window is titled 'VM3 [Running] - Oracle VM VirtualBox' and shows the output of 'ifconfig' and 'ping' commands for VM3. The right window is titled 'VM2 [Running] - Oracle VM VirtualBox' and shows the output of 'ifconfig' and 'ping' commands for VM2. Both windows show network statistics and configuration details for their respective interfaces.

```
VM3 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
uservm3@vm3:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.10.30 netmask 255.255.255.0 broadcast 192.168.10.255
    inet6 fe80::200:27ff:fe4d:b81c prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:4d:b8:1c txqueuelen 1000 (Ethernet)
    RX packets 14 bytes 1884 (1.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 59 bytes 5073 (5.0 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 104 bytes 8280 (8.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 104 bytes 8280 (8.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm3@vm3:/$ ping vm2.bilohur.com
PING vm2.bilohur.com (192.168.10.20) 56(84) bytes of data.
64 bytes from vm2.bilohur.com (192.168.10.20): icmp_seq=1 ttl=64 time=0.865 ms
64 bytes from vm2.bilohur.com (192.168.10.20): icmp_seq=2 ttl=64 time=0.380 ms
^C
--- vm2.bilohur.com ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.380/0.622/0.865/0.242 ms
uservm3@vm3:/$ _

VM2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
uservm2@vm2:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::a00:27ff:fe49:5efe prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:49:5e:fe txqueuelen 1000 (Ethernet)
    RX packets 262 bytes 86198 (86.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 280 bytes 87295 (87.2 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 43616 bytes 3097168 (3.0 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 43616 bytes 3097168 (3.0 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm2@vm2:/$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.10.20 netmask 255.255.255.0 broadcast 192.168.10.255
    inet6 fe80::a00:27ff:fe49:5efe prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:49:5e:fe txqueuelen 1000 (Ethernet)
    RX packets 279 bytes 90669 (90.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 330 bytes 102233 (102.2 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 50820 bytes 3608772 (3.6 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 50820 bytes 3608772 (3.6 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

uservm2@vm2:/$ ping vm3.bilohur.com
PING vm3.bilohur.com (192.168.10.30) 56(84) bytes of data.
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=1 ttl=64 time=0.503 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=2 ttl=64 time=0.532 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=3 ttl=64 time=0.603 ms
64 bytes from vm3.bilohur.com (192.168.10.30): icmp_seq=4 ttl=64 time=0.554 ms
^C
--- vm3.bilohur.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3057ms
rtt min/avg/max/mdev = 0.503/0.548/0.603/0.036 ms
```

## 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 192.168.33.100 192.168.33.254;
    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.

The image shows two side-by-side screenshots of Oracle VM VirtualBox windows. The left window is titled 'VM2 [Running] - Oracle VM VirtualBox' and shows the terminal output of the 'ifconfig' command for the 'enp0s3' interface. It displays the IP address 192.168.33.100, netmask 255.255.255.0, and broadcast address 192.168.33.255. The right window is titled 'VM3 [Running] - Oracle VM VirtualBox' and shows the terminal output of the 'ifconfig' command for the 'enp0s3' interface. It displays the IP address 192.168.33.101, netmask 255.255.255.0, and broadcast address 192.168.33.255. Both windows also show the configuration for the 'lo' (loopback) interface.

```

VM2 [Running] - Oracle VM VirtualBox
user@vm2:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.33.100 netmask 255.255.255.0 broadcast 192.168.33.255
    inet6 fe80::a00:27ff:fe49:5efe prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:49:5e:fe txqueuelen 1000 (Ethernet)
    RX packets 8 bytes 1046 (1.0 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 54 bytes 4714 (4.7 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 168 bytes 13230 (13.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 168 bytes 13230 (13.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

user@vm2:~$

VM3 [Running] - Oracle VM VirtualBox
user@vm3:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.33.101 netmask 255.255.255.0 broadcast 192.168.33.255
    inet6 fe80::a00:27ff:fe4d:b81c prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:4d:b8:1c txqueuelen 1000 (Ethernet)
    RX packets 103 bytes 9380 (9.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 656 bytes 55541 (55.5 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 181 bytes 14972 (14.9 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 181 bytes 14972 (14.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

user@vm3:~$

```

Configuring dns:

sudo nano /etc/hosts

```
GNU nano 4.8 /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
```

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).



```

uservm1@vm1:~$ sudo nano /etc/hosts
uservm1@vm1:~$ systemctl restart isc-dhcp-server
==== AUTHENTICATING FOR org.freedesktop.systemd1.manage-units ====
Authentication is required to restart 'isc-dhcp-server.service'.
Authenticating as: uservm1
Password:
==== AUTHENTICATION COMPLETE ====
uservm1@vm1:~$ ping vm2.bilohur.com
PING vm2.bilohur.com (192.168.33.100) 56(84) bytes of data.
64 bytes from vm2.bilohur.com (192.168.33.100): icmp_seq=1 ttl=64 time=0.572 ms
64 bytes from vm2.bilohur.com (192.168.33.100): icmp_seq=2 ttl=64 time=0.596 ms
64 bytes from vm2.bilohur.com (192.168.33.100): icmp_seq=3 ttl=64 time=0.548 ms
^C
--- vm2.bilohur.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 0.548/0.572/0.596/0.019 ms
uservm1@vm1:~$
uservm1@vm1:~$ sudo nano /etc/hosts
uservm1@vm1:~$ ping vm3.bilohur.com
PING vm3.bilohur.com (192.168.33.101) 56(84) bytes of data.
64 bytes from vm3.bilohur.com (192.168.33.101): icmp_seq=1 ttl=64 time=0.657 ms
64 bytes from vm3.bilohur.com (192.168.33.101): icmp_seq=2 ttl=64 time=0.627 ms
64 bytes from vm3.bilohur.com (192.168.33.101): icmp_seq=3 ttl=64 time=0.527 ms
^X64 bytes from vm3.bilohur.com (192.168.33.101): icmp_seq=4 ttl=64 time=0.514 ms
64 bytes from vm3.bilohur.com (192.168.33.101): icmp_seq=5 ttl=64 time=0.554 ms
64 bytes from vm3.bilohur.com (192.168.33.101): icmp_seq=6 ttl=64 time=0.526 ms
64 bytes from vm3.bilohur.com (192.168.33.101): icmp_seq=7 ttl=64 time=0.391 ms
^[[64 bytes from vm3.bilohur.com (192.168.33.101): icmp_seq=8 ttl=64 time=0.413 ms
^X

```

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

Sources:

[https://linuxhint.com/dnsmasq\\_ubuntu\\_server/](https://linuxhint.com/dnsmasq_ubuntu_server/)

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