

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.

Configuring VM3:

```
GNU nano 2.2.6      File: /etc/network/interfaces

# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
address 10.10.10.3
netmask 255.255.255.0
broadcast 10.10.10.255
gateway 10.10.10.1

student@CsnKhai:~$ sudo ifdown eth0
student@CsnKhai:~$ sudo ifup eth0
student@CsnKhai:~$ route
Kernel IP routing table
Destination      Gateway         Genmask         Flags Metric Ref    Use Iface
default          10.10.10.1     0.0.0.0         UG    0      0      0 eth0
10.10.10.0       *              255.255.255.0   U      0      0      0 eth0
student@CsnKhai:~$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=114 time=32.2 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=114 time=30.3 ms
^C
--- 8.8.8.8 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 30.348/31.319/32.290/0.971 ms
```

2. Install and configure DHCP server on VM1.
(3 ways: using VBoxManage, DNSMASQ and ISC-DHSPSERVER).

You should use at least 2 of them.

Installing DNSMASQ on VM1:

```
student@CsnKhai:~$ sudo apt-get install dnsmasq
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libpvm3 libreadline-dev libreadline6-dev libtinfo-dev pvm
Use 'apt-get autoremove' to remove them.
The following extra packages will be installed:
  dnsmasq-base libmnl0 libnetfilter-conntrack3
The following NEW packages will be installed:
  dnsmasq dnsmasq-base libmnl0 libnetfilter-conntrack3
0 upgraded, 4 newly installed, 0 to remove and 195 not upgraded.
Need to get 325 kB of archives.
After this operation, 970 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
```

Configuring on VM1:

```
GNU nano 2.2.6 File: /etc/network/interfaces

# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
address 10.10.10.1
netmask 255.255.255.0
```

```
GNU nano 2.2.6 File: /etc/dnsmasq.conf

# Add domains which you want to force to an IP address here.
# The example below send any host in double-click.net to a local
# web-server.
#address=/double-click.net/127.0.0.1

# --address (and --server) work with IPv6 addresses too.
#address=/www.thekelleys.org.uk/fe80::20d:60ff:fe36:f83

# Add the IPs of all queries to yahoo.com, google.com, and their
# subdomains to the vpn and search ipsets:
#ipset=/yahoo.com/google.com/vpn,search

# You can control how dnsmasq talks to a server: this forces
# queries to 10.1.2.3 to be routed via eth1
#server=10.1.2.3@eth1

# and this sets the source (ie local) address used to talk to
# 10.1.2.3 to 192.168.1.1 port 55 (there must be a interface with that
# IP on the machine, obviously).
#server=10.1.2.3@192.168.1.1#55

# If you want dnsmasq to change uid and gid to something other
# than the default, edit the following lines.
#user=
#group=

# If you want dnsmasq to listen for DHCP and DNS requests only on
# specified interfaces (and the loopback) give the name of the
# interface (eg eth0) here.
# Repeat the line for more than one interface.
interface=eth1

# Or you can specify which interface _not_ to listen on
#except-interface=

# Or which to listen on by address (remember to include 127.0.0.1 if
# you use this.)
#listen-address=

# If you want dnsmasq to provide only DNS service on an interface,
# configure it as shown above, and then use the following line to
# disable DHCP and TFTP on it.
#no-dhcp-interface=

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

```
GNU nano 2.2.6 File: /etc/dnsmasq.conf Modified

# 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

# Set a different domain for a particular subnet
#domain=wireless.thekelleys.org.uk,192.168.2.0/24

# Same idea, but range rather than subnet
#domain=reserved.thekelleys.org.uk,192.168.3.100,192.168.3.200

# Uncomment this to enable the integrated DHCP server, you need
# to supply the range of addresses available for lease and optionally
# a lease time. If you have more than one network, you will need to
# repeat this for each network on which you want to supply DHCP
# service.
#dhcp-range=10.10.10.10,10.10.10.20,12h

# This is an example of a DHCP range where the netmask is given. This
# is needed for networks we reach the dnsmasq DHCP server via a relay
# agent. If you don't know what a DHCP relay agent is, you probably
# don't need to worry about this.
#dhcp-range=192.168.0.50,192.168.0.150,255.255.255.0,12h

# This is an example of a DHCP range which sets a tag, so that
# some DHCP options may be set only for this network.
#dhcp-range=set:red,192.168.0.50,192.168.0.150

# Use this DHCP range only when the tag "green" is set.
#dhcp-range=tag:green,192.168.0.50,192.168.0.150,12h

# Specify a subnet which can't be used for dynamic address allocation,
# is available for hosts with matching --dhcp-host lines. Note that
# dhcp-host declarations will be ignored unless there is a dhcp-range
# of some type for the subnet in question.
# In this case the netmask is implied (it comes from the network
# configuration on the machine running dnsmasq) it is possible to give
# an explicit netmask instead.

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

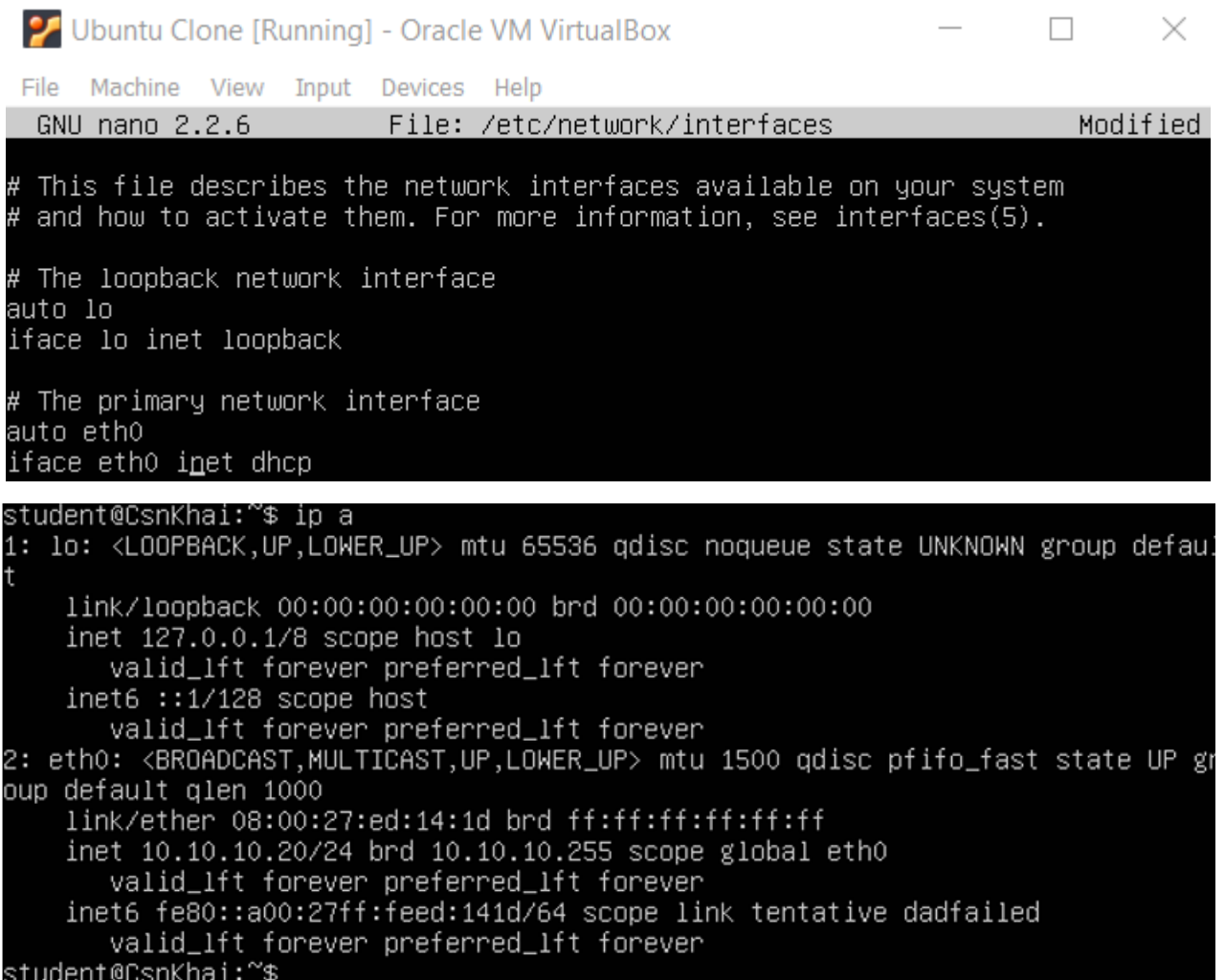
Or by VBoxManage:

```
D:\Program Files\Oracle\VirtualBox>VBoxManage list dhcpservers
NetworkName:      HostInterfaceNetworking-VirtualBox Host-Only Ethernet Adapter
Dhcpd IP:         192.168.56.100
LowerIPAddress:   192.168.56.101
UpperIPAddress:   192.168.56.254
NetworkMask:      255.255.255.0
Enabled:          Yes
Global Configuration:
  minLeaseTime:    default
  defaultLeaseTime: default
  maxLeaseTime:    default
  Forced options:  None
  Suppressed opts.: None
  1/legacy: 255.255.255.0
Groups:           None
Individual Configs: None

NetworkName:      labnet
Dhcpd IP:         10.0.0.1
LowerIPAddress:   10.0.0.100
UpperIPAddress:   10.0.0.200
NetworkMask:      255.255.255.0
Enabled:          Yes
Global Configuration:
  minLeaseTime:    default
  defaultLeaseTime: default
  maxLeaseTime:    default
  Forced options:  None
  Suppressed opts.: None
  1/legacy: 255.255.255.0
Groups:           None
Individual Configs: None
```

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

Configuring VM2:



```
GNU nano 2.2.6      File: /etc/network/interfaces      Modified

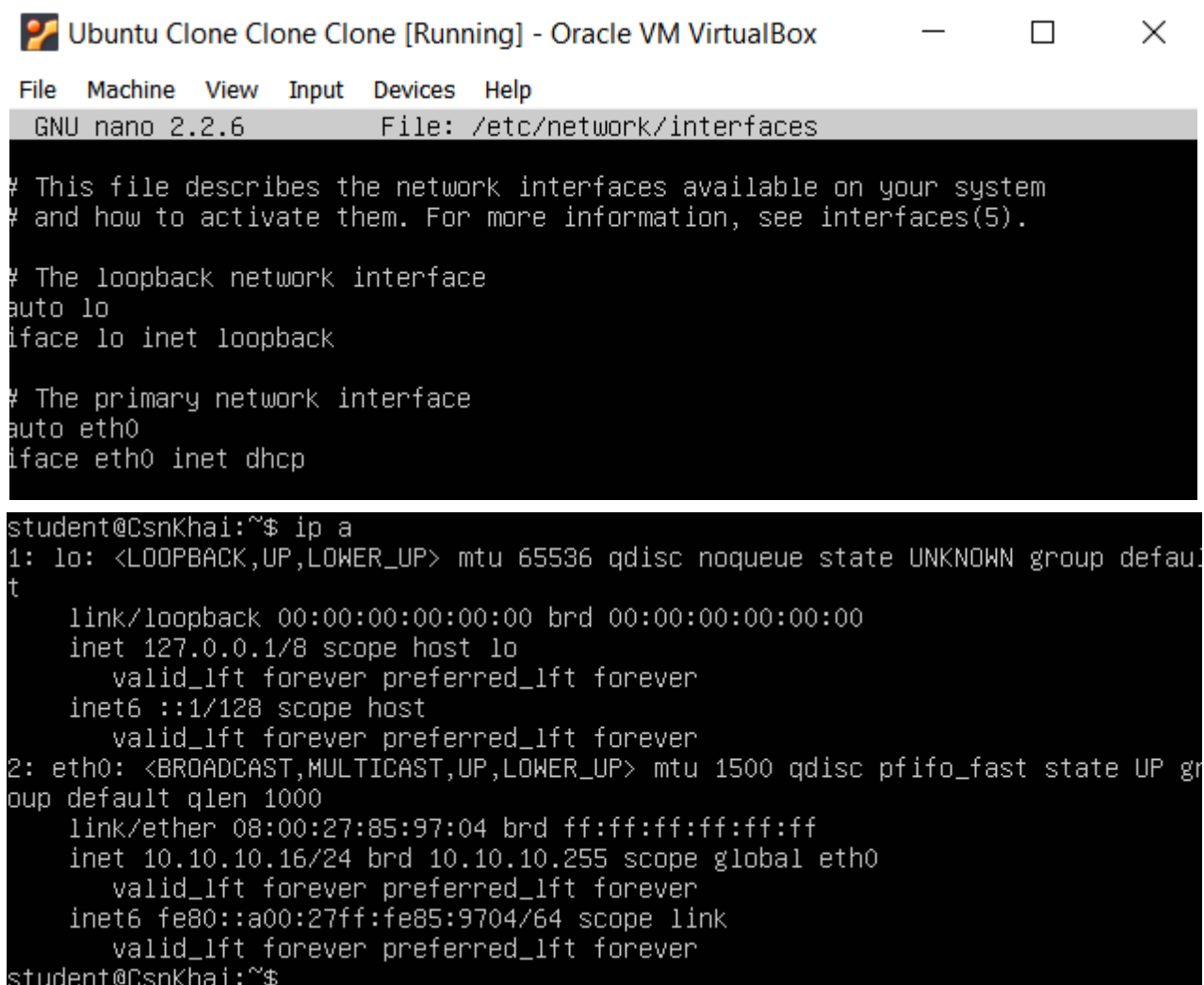
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet dhcp

student@CsnKhai:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
    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: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:ed:14:1d brd ff:ff:ff:ff:ff:ff
    inet 10.10.10.20/24 brd 10.10.10.255 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:feed:141d/64 scope link tentative dadfailed
        valid_lft forever preferred_lft forever
student@CsnKhai:~$
```

Configuring VM3:



```
GNU nano 2.2.6 File: /etc/network/interfaces

# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

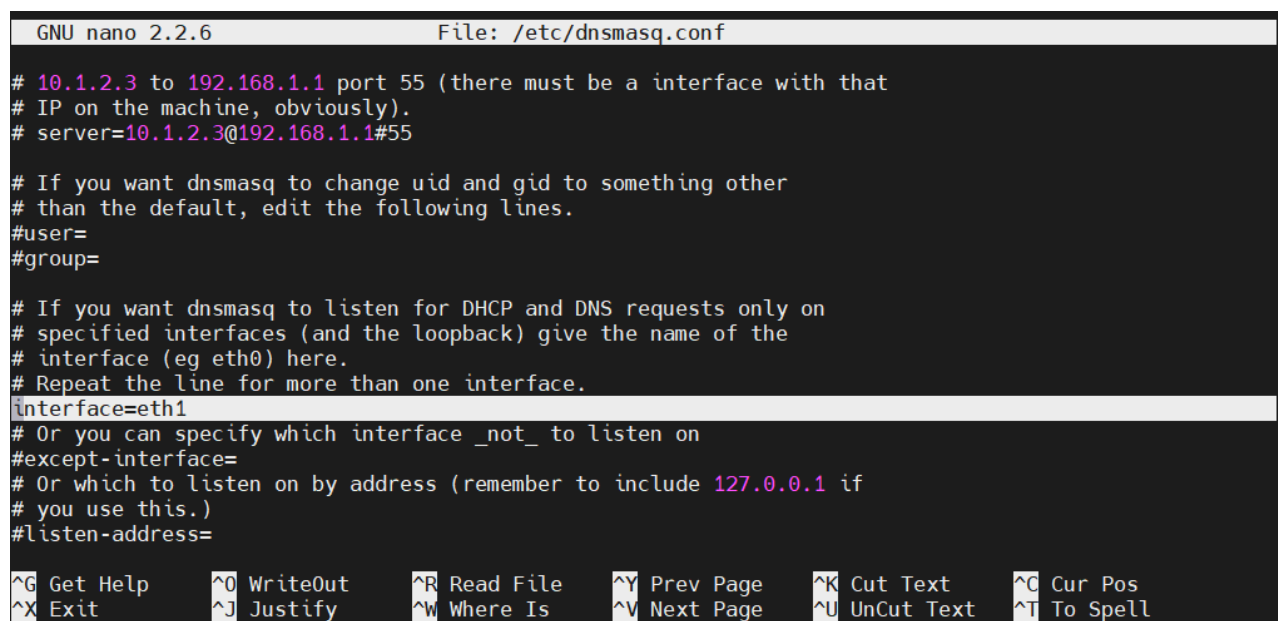
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet dhcp

student@CsnKhai:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
    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: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:85:97:04 brd ff:ff:ff:ff:ff:ff
    inet 10.10.10.16/24 brd 10.10.10.255 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe85:9704/64 scope link
        valid_lft forever preferred_lft forever
student@CsnKhai:~$
```

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).

Installing DNS server on VM1:



```
GNU nano 2.2.6 File: /etc/dnsmasq.conf

# 10.1.2.3 to 192.168.1.1 port 55 (there must be a interface with that
# IP on the machine, obviously).
# server=10.1.2.3@192.168.1.1#55

# If you want dnsmasq to change uid and gid to something other
# than the default, edit the following lines.
#user=
#group=

# If you want dnsmasq to listen for DHCP and DNS requests only on
# specified interfaces (and the loopback) give the name of the
# interface (eg eth0) here.
# Repeat the line for more than one interface.
interface=eth1

# Or you can specify which interface _not_ to listen on
#except-interface=
# Or which to listen on by address (remember to include 127.0.0.1 if
# you use this.)
#listen-address=

^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
```

```
GNU nano 2.2.6 File: /etc/dnsmasq.conf

# 3) Provides the domain part for "expand-hosts"
#domain=thekelleys.org.uk

# Set a different domain for a particular subnet
#domain=wireless.thekelleys.org.uk,192.168.2.0/24

# Same idea, but range rather than subnet
#domain=reserved.thekelleys.org.uk,192.168.3.100,192.168.3.200

# Uncomment this to enable the integrated DHCP server, you need
# to supply the range of addresses available for lease and optionally
# a lease time. If you have more than one network, you will need to
# repeat this for each network on which you want to supply DHCP
# service.
dhcp-range=10.10.10.10,10.10.10.20,12h

# This is an example of a DHCP range where the netmask is given. This
# is needed for networks we reach the dnsmasq DHCP server via a relay
# agent. If you don't know what a DHCP relay agent is, you probably

^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
```

```
GNU nano 2.2.6 File: /etc/resolv.conf

## Dynamic resolv.conf(5) file for glibc resolver(3) generated by resolvconf(8)
#     DO NOT EDIT THIS FILE BY HAND -- YOUR CHANGES WILL BE OVERWRITTEN
nameserver 127.0.0.1

[ Read 3 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
```

```
GNU nano 2.2.6 File: /etc/dhcp/dhclient.conf

#       few changes must be made to this file, if any.
#

option rfc3442-classless-static-routes code 121 = array of unsigned integer 8;

#send host-name "andare.fugue.com";
send host-name = gethostname();
#send dhcp-client-identifier 1:0:a0:24:ab:fb:9c;
#send dhcp-lease-time 3600;
#supersede domain-name "fugue.com home.vix.com";
prepend domain-name-servers 127.0.0.1;
request subnet-mask, broadcast-address, time-offset, routers,
       domain-name, domain-name-servers, domain-search, host-name,
       dhcp6.name-servers, dhcp6.domain-search,
       netbios-name-servers, netbios-scope, interface-mtu,
       rfc3442-classless-static-routes, ntp-servers,
       dhcp6.fqdn, dhcp6.sntp-servers;
#require subnet-mask, domain-name-servers;
#timeout 60;

[ Read 56 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
```

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

VM2:

```
Ubuntu Clone [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
;; ANSWER SECTION:
google.com.          30      IN      A       172.217.16.206

;; Query time: 61 msec
;; SERVER: 10.10.10.1#53(10.10.10.1)
;; WHEN: Mon Aug 21 05:41:19 UTC 2023
;; MSG SIZE rcvd: 55

student@CsnKhai:~$ dig g.co

;<<>> DiG 9.9.5-3ubuntu0.5-Ubuntu <<>> g.co
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 23909
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;g.co.                  IN      A

;; ANSWER SECTION:
g.co.                   30      IN      A       142.250.186.110

;; Query time: 13 msec
;; SERVER: 10.10.10.1#53(10.10.10.1)
;; WHEN: Mon Aug 21 05:51:17 UTC 2023
;; MSG SIZE rcvd: 49

student@CsnKhai:~$
```

VM3:

```
Ubuntu Clone Clone Clone [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Sending on LPF/eth0/08:00:27:85:97:04
Sending on Socket/fallback
DHCPDISCOVER on eth0 to 255.255.255.255 port 67 interval 3 (xid=0xfe065903)
DHCPDISCOVER on eth0 to 255.255.255.255 port 67 interval 7 (xid=0xfe065903)
DHCPREQUEST of 10.10.10.16 on eth0 to 255.255.255.255 port 67 (xid=0x35906fe)
DHCPOFFER of 10.10.10.16 from 10.10.10.1
DHCPACK of 10.10.10.16 from 10.10.10.1
bound to 10.10.10.16 -- renewal in 19680 seconds.
student@CsnKhai:~$ dig g.co

;<<>> DiG 9.9.5-3ubuntu0.5-Ubuntu <<>> g.co
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 40829
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

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

;; ANSWER SECTION:
g.co.                   30      IN      A       142.250.186.110

;; Query time: 70 msec
;; SERVER: 10.10.10.1#53(10.10.10.1)
;; WHEN: Mon Aug 21 05:50:44 UTC 2023
;; MSG SIZE rcvd: 49

student@CsnKhai:~$
```