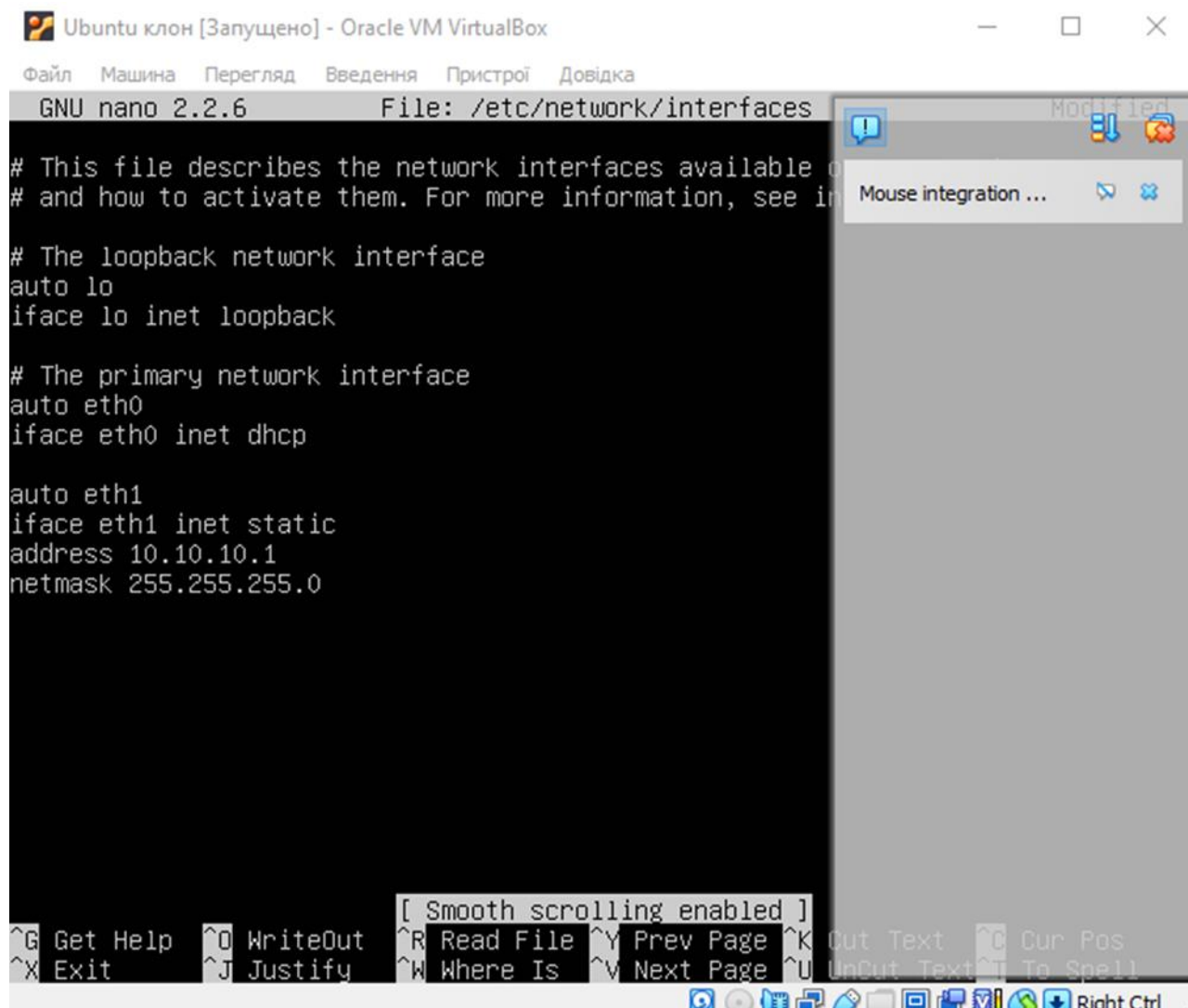


Configuring DHCP, DNS servers and dynamic routing using OSPF protocol

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.

VM1 settings:



The screenshot shows a VirtualBox window titled "Ubuntu клон [Запущено] - Oracle VM VirtualBox". Inside the VM, the GNU nano 2.2.6 text editor is open, editing the file `/etc/network/interfaces`. The file content is as follows:

```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see the man page of ifupdown.

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet dhcp

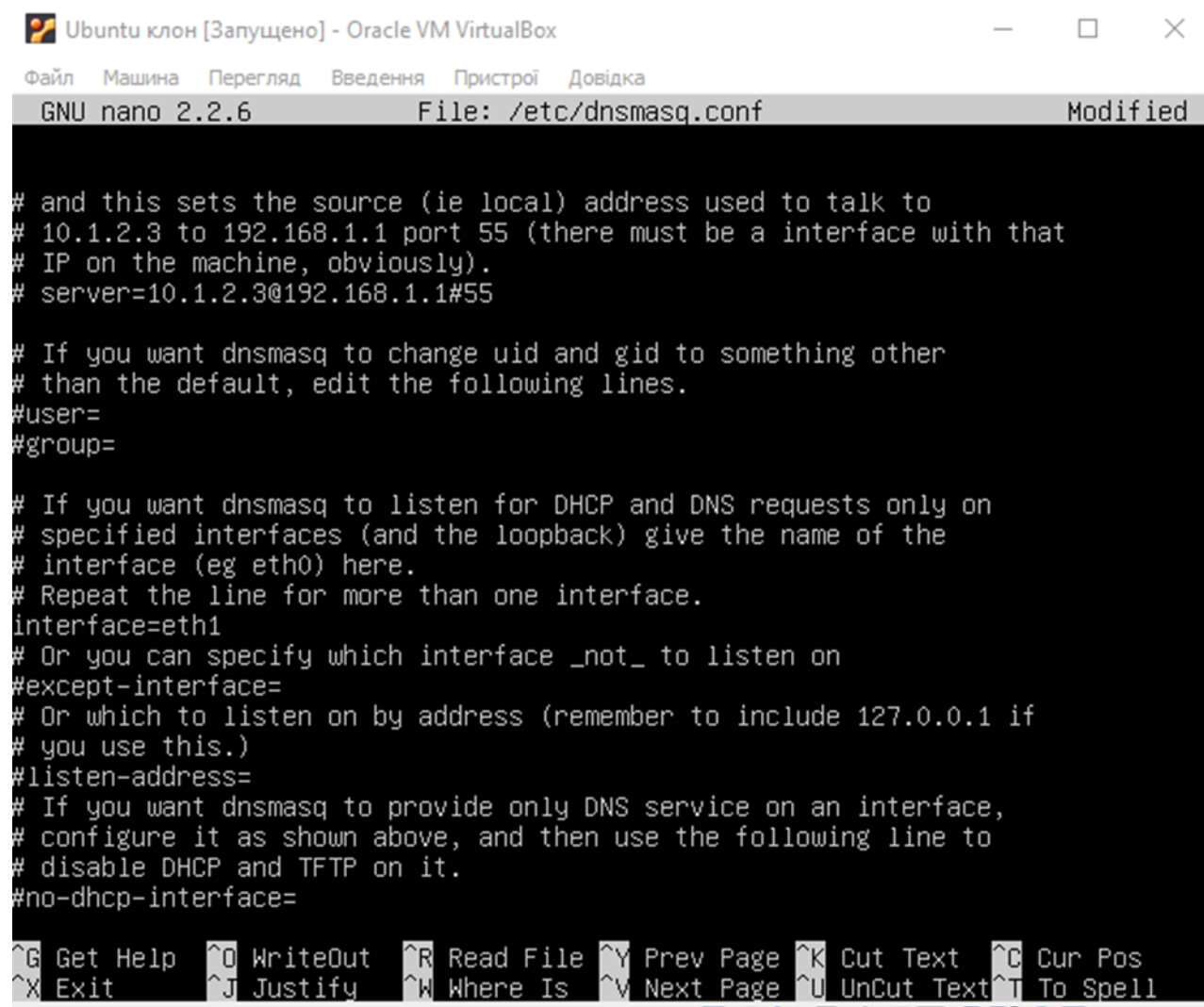
auto eth1
iface eth1 inet static
address 10.10.10.1
netmask 255.255.255.0
```

The nano editor's status bar at the bottom shows the following information:

- Left: `^G Get Help`, `^X Exit`
- Middle: `[Smooth scrolling enabled]`, `^O WriteOut`, `^J Justify`
- Right: `^R Read File`, `^W Where Is`, `^Y Prev Page`, `^V Next Page`, `^K Cut Text`, `^C Cur Pos`, `^U UnCut Text`, `^T To Spell`

The VirtualBox window also shows a "Mouse integration ..." dialog box on the right side.

interface=eth1



```
Ubuntu клон [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка
GNU nano 2.2.6      File: /etc/dnsmasq.conf      Modified

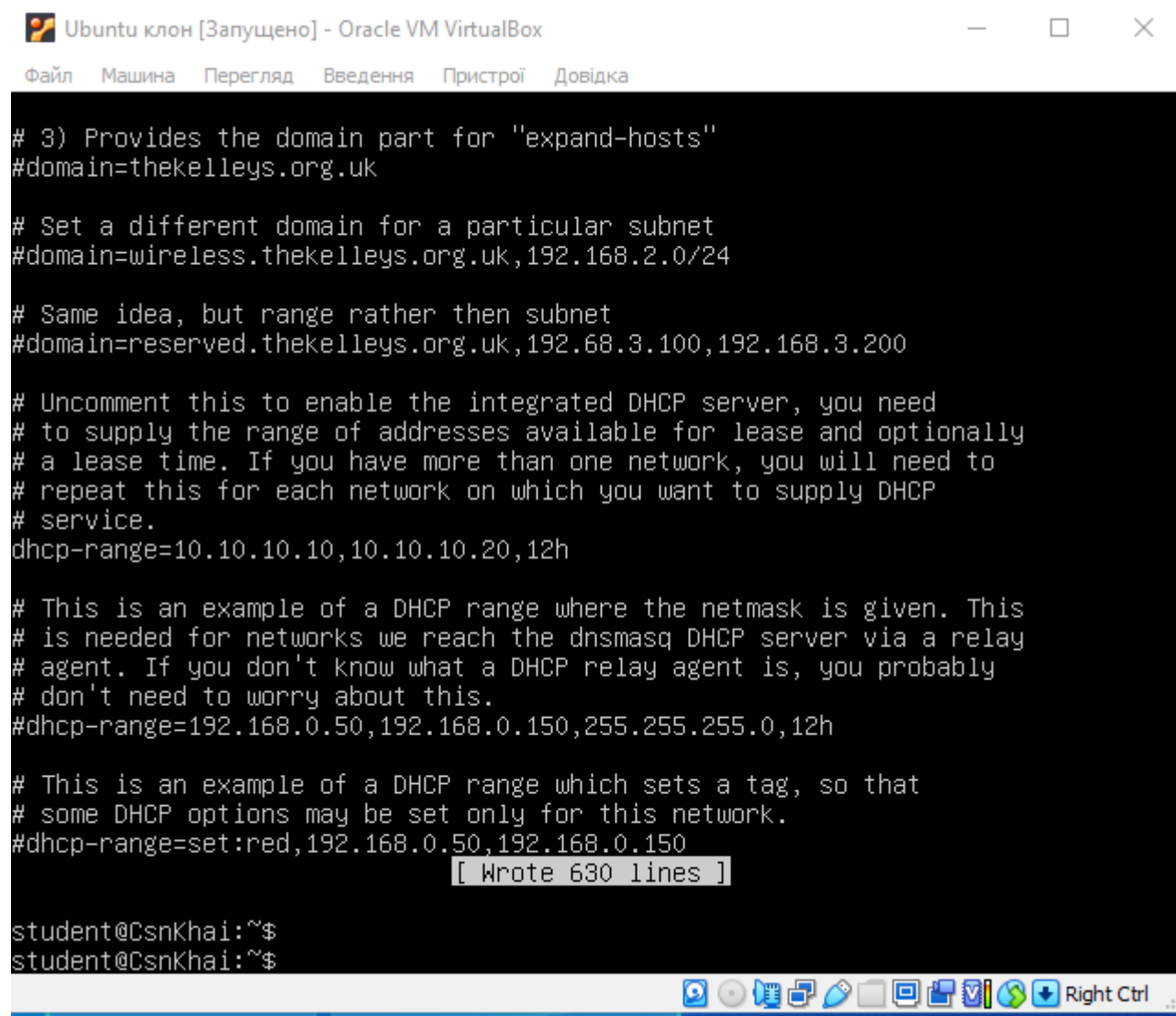
# and this sets the source (ie local) address used to talk to
# 10.1.2.3 to 192.168.1.1 port 55 (there must be a interface with that
# IP on the machine, obviously).
# server=10.1.2.3@192.168.1.1#55

# 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  ^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
```

dhcp-range=10.10.10.10, 10.10.10.20, 12h



The screenshot shows a terminal window titled "Ubuntu клон [Запущено] - Oracle VM VirtualBox". The terminal displays a configuration file for a DHCP server. The configuration includes comments explaining the purpose of each line and the syntax for the `dhcp-range` directive. The `dhcp-range` directive is used to specify the range of IP addresses available for lease and the lease time. The configuration is shown in a terminal window with a dark background and a light-colored text. The terminal window has a menu bar with options: Файл, Машина, Перегляд, Введення, Пристрої, Довідка. The terminal output shows the following configuration lines:

```
# 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,192.68.3.100,192.168.3.200

# 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

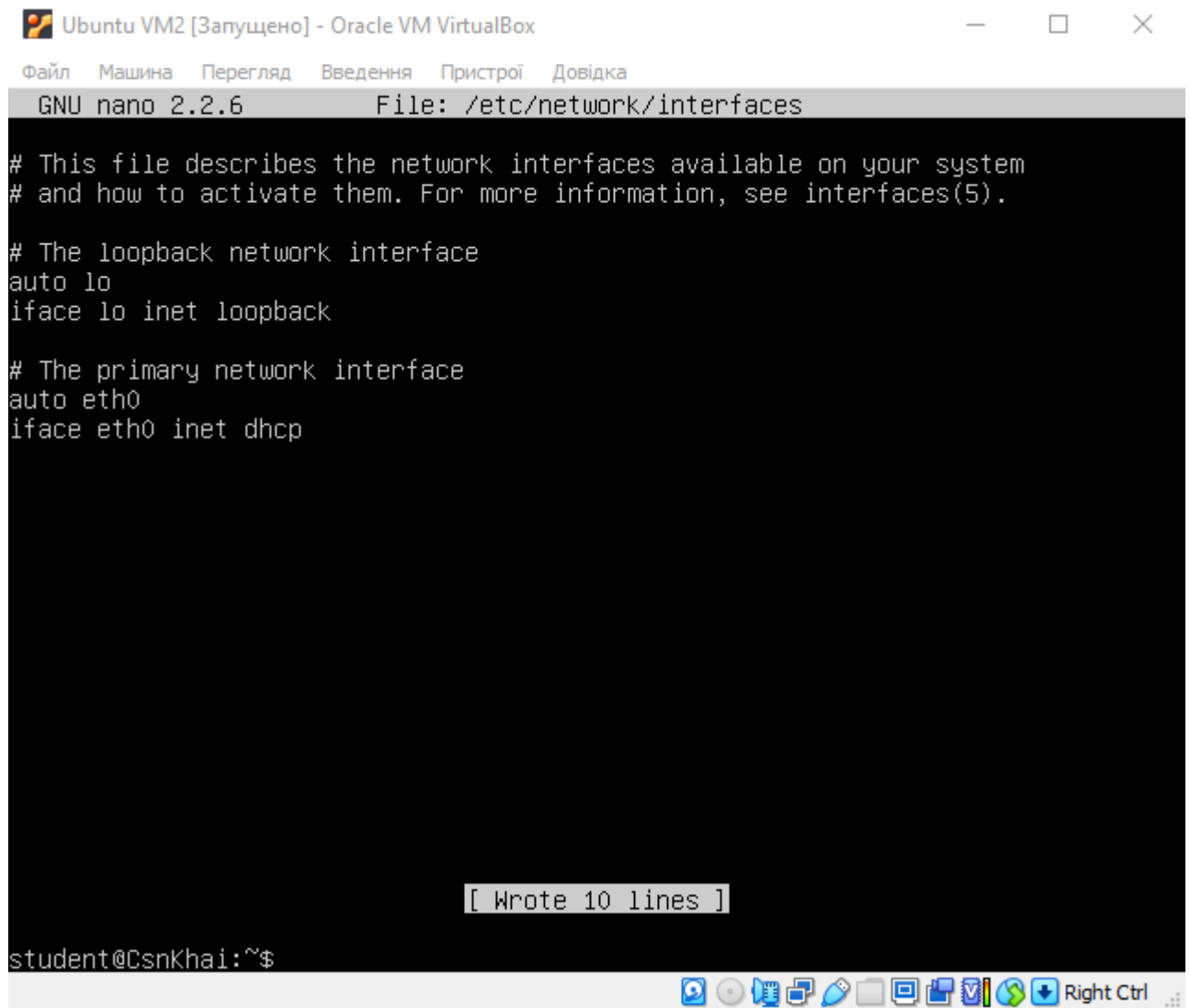
# This is an example of a DHCP range where the netmask is given. This
# is needed for networks we reach the dnsmasq DHCP server via a relay
# agent. If you don't know what a DHCP relay agent is, you probably
# don't need to worry about this.
#dhcp-range=192.168.0.50,192.168.0.150,255.255.255.0,12h

# 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
[ Wrote 630 lines ]

student@CsnKhai:~$
student@CsnKhai:~$
```

The terminal window has a taskbar at the bottom with various icons and a "Right Ctrl" button.

VM2 settings:



The screenshot shows a VirtualBox window titled "Ubuntu VM2 [Запущено] - Oracle VM VirtualBox". The window contains a terminal window running the nano text editor. The editor is editing the file `/etc/network/interfaces`. The content of the file is as follows:

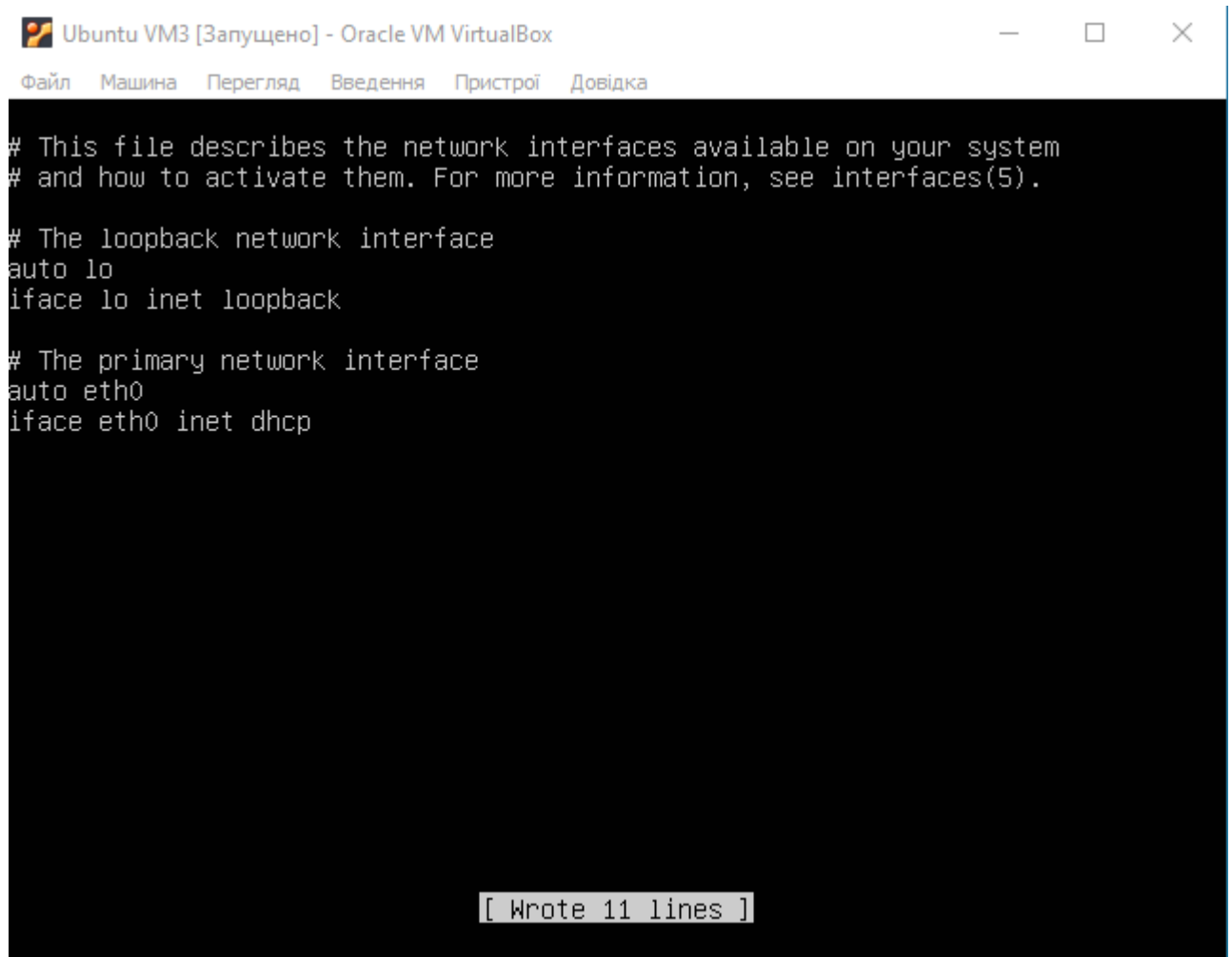
```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet dhcp
```

At the bottom of the terminal window, the prompt `student@CsnKhai:~$` is visible. A status bar at the bottom of the terminal window indicates "[Wrote 10 lines]". The bottom of the VirtualBox window shows a taskbar with various icons and a "Right Ctrl" button.

VM3 settings:



The screenshot shows a terminal window titled "Ubuntu VM3 [Запущено] - Oracle VM VirtualBox". The window has a menu bar with options: "Файл", "Машина", "Перегляд", "Введення", "Пристрої", and "Довідка". The terminal displays the following text:

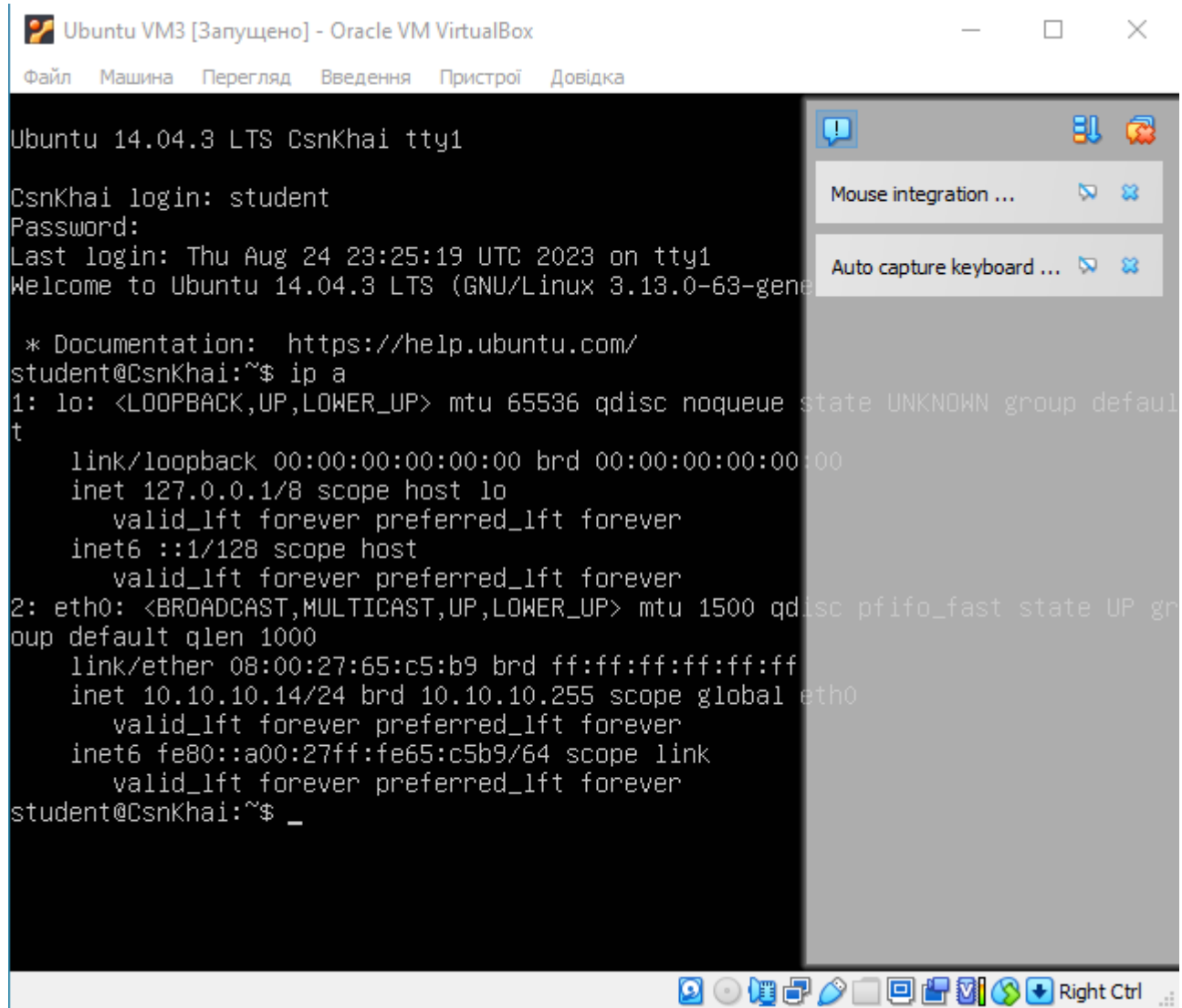
```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet dhcp
```

At the bottom of the terminal, there is a status bar that reads "[Wrote 11 lines]".

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



Ubuntu VM3 [Занущено] - Oracle VM VirtualBox

Файл Машина Перегляд Введення Пристрої Довідка

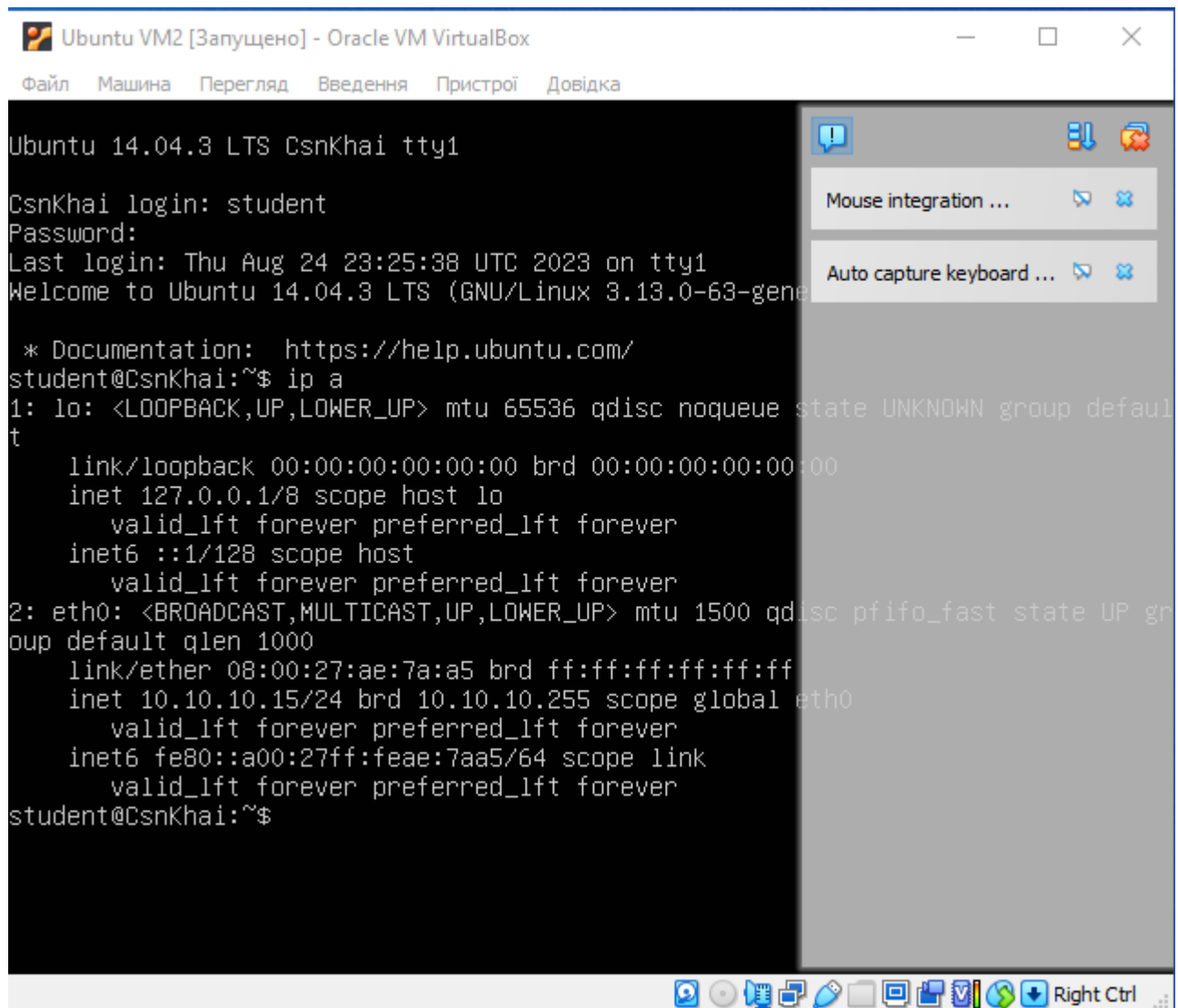
```
Ubuntu 14.04.3 LTS CsnKhai tty1
CsnKhai login: student
Password:
Last login: Thu Aug 24 23:25:19 UTC 2023 on tty1
Welcome to Ubuntu 14.04.3 LTS (GNU/Linux 3.13.0-63-generic)

 * Documentation:  https://help.ubuntu.com/
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 08:00:27:65:c5:b9 brd ff:ff:ff:ff:ff:ff
    inet 10.10.10.14/24 brd 10.10.10.255 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe65:c5b9/64 scope link
        valid_lft forever preferred_lft forever
student@CsnKhai:~$ _
```

Mouse integration ...

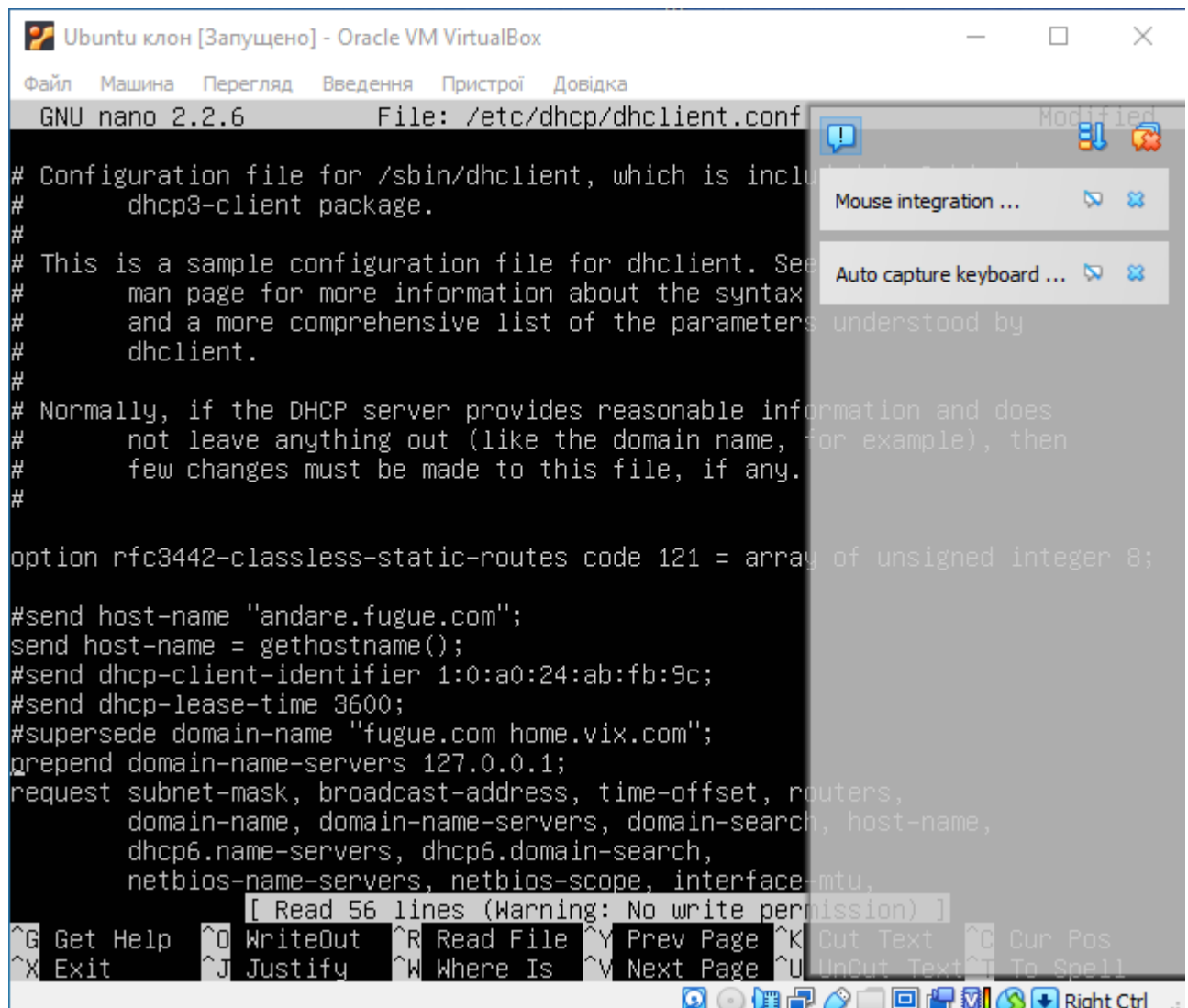
Auto capture keyboard ...

Right Ctrl



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

Enabling DNS:



The screenshot shows a VirtualBox window titled "Ubuntu клон [Запущено] - Oracle VM VirtualBox". Inside the VM, the GNU nano 2.2.6 text editor is open, editing the file /etc/dhcp/dhclient.conf. The file contains a sample configuration for the dhclient program, including comments and configuration options like host-name, dhcp-client-identifier, lease-time, domain-name, and domain-name-servers. The nano editor's status bar at the bottom shows various keyboard shortcuts and a warning about write permissions. On the right side of the window, there are two floating panels: "Mouse integration ..." and "Auto capture keyboard ...". The bottom of the window shows the Ubuntu desktop environment with various icons in the taskbar.

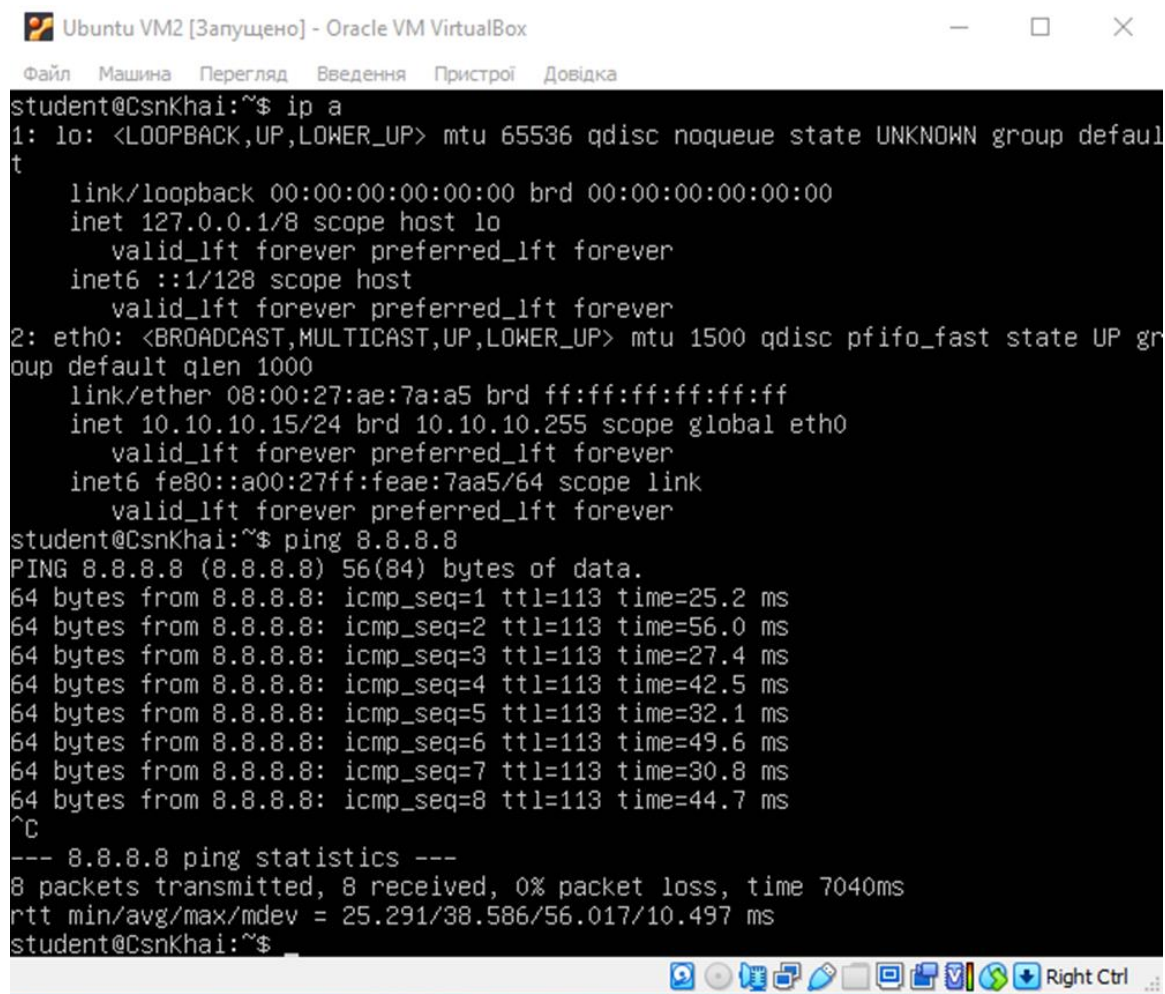
```
GNU nano 2.2.6 File: /etc/dhcp/dhclient.conf

# Configuration file for /sbin/dhclient, which is included by the
# dhcpc3-client package.
#
# This is a sample configuration file for dhclient. See the
# man page for more information about the syntax and a more comprehensive
# list of the parameters understood by dhclient.
#
# Normally, if the DHCP server provides reasonable information and does
# not leave anything out (like the domain name, for example), then
# 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,
        [ Read 56 lines (Warning: No write permission) ]
^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 ^I To Spell
```


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



```
Ubuntu VM2 [Запущено] - Oracle VM VirtualBox
Файл  Машина  Перегляд  Введення  Пристрої  Довідка
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:ae:7a:a5 brd ff:ff:ff:ff:ff:ff
    inet 10.10.10.15/24 brd 10.10.10.255 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:feae:7aa5/64 scope link
        valid_lft forever preferred_lft forever
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=113 time=25.2 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=113 time=56.0 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=113 time=27.4 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=113 time=42.5 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=113 time=32.1 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=113 time=49.6 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=113 time=30.8 ms
64 bytes from 8.8.8.8: icmp_seq=8 ttl=113 time=44.7 ms
^C
--- 8.8.8.8 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7040ms
rtt min/avg/max/mdev = 25.291/38.586/56.017/10.497 ms
student@CsnKhai:~$
```

Файл Машина Перегляд Введення Пристрої Довідка

```
64 bytes from 8.8.8.8: icmp_seq=4 ttl=113 time=25.8 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=113 time=30.9 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=113 time=27.3 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=113 time=25.3 ms
^C
--- 8.8.8.8 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6028ms
rtt min/avg/max/mdev = 25.384/33.085/47.870/8.254 ms
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: 25440
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;g.co.                                IN      A
;; ANSWER SECTION:
g.co.                                300     IN      A      142.250.186.206

;; Query time: 152 msec
;; SERVER: 10.10.10.1#53(10.10.10.1)
;; WHEN: Fri Aug 25 00:50:47 UTC 2023
;; MSG SIZE rcvd: 49

student@CsnKhai:~$
```