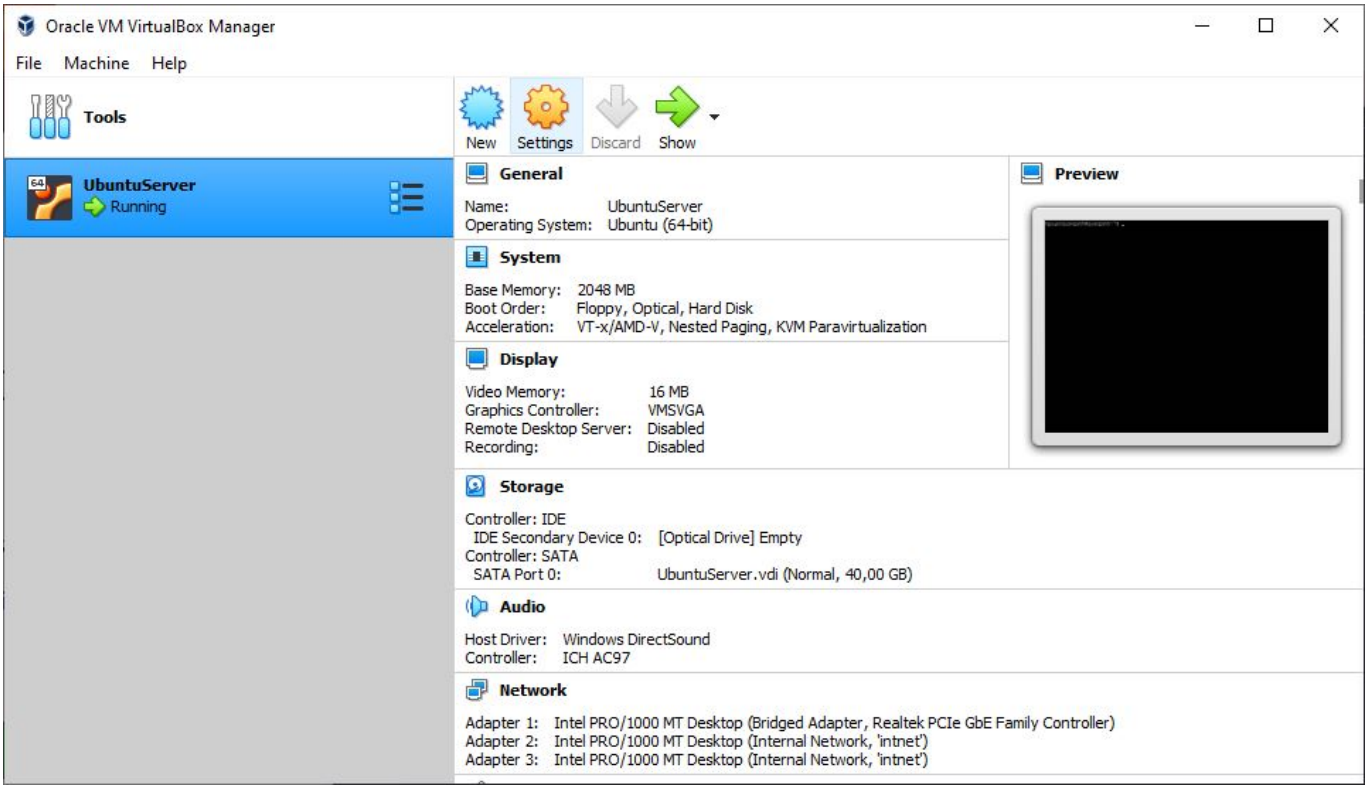
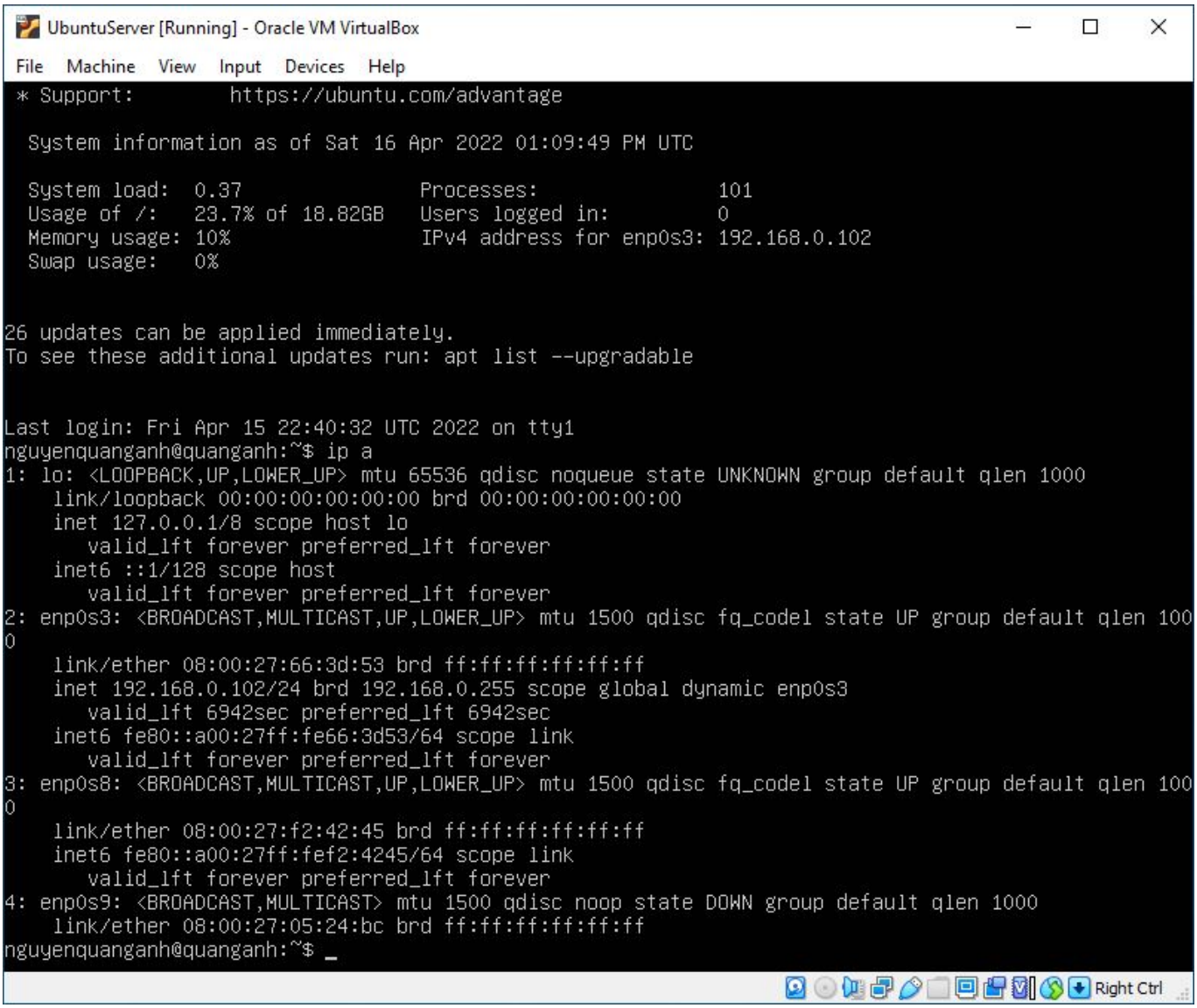
Setup

- Download VirtualBox
- Download Ubuntu Server: https://ubuntu.com/download/server
- Setup initial virtual machine

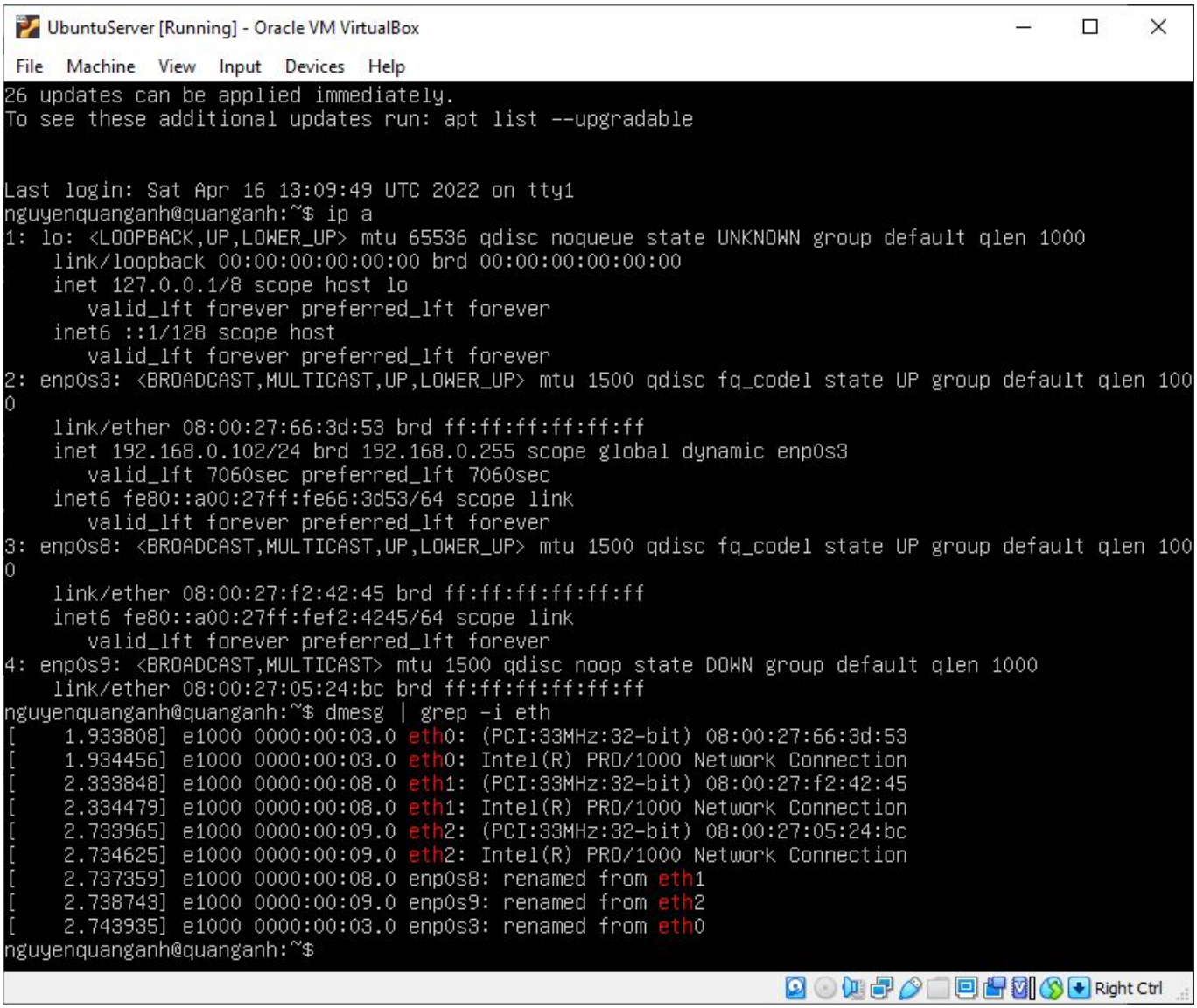


- To change network name to "eth0" for convenience, first to get the interface's information, use `ip a`



- From the `dmesg` command, you can see that the device got renamed during the system boot

```
dmesg | grep -i eth
```



- To get an ethX back, edit the grub file:

```
sudo nano /etc/default/grub
```

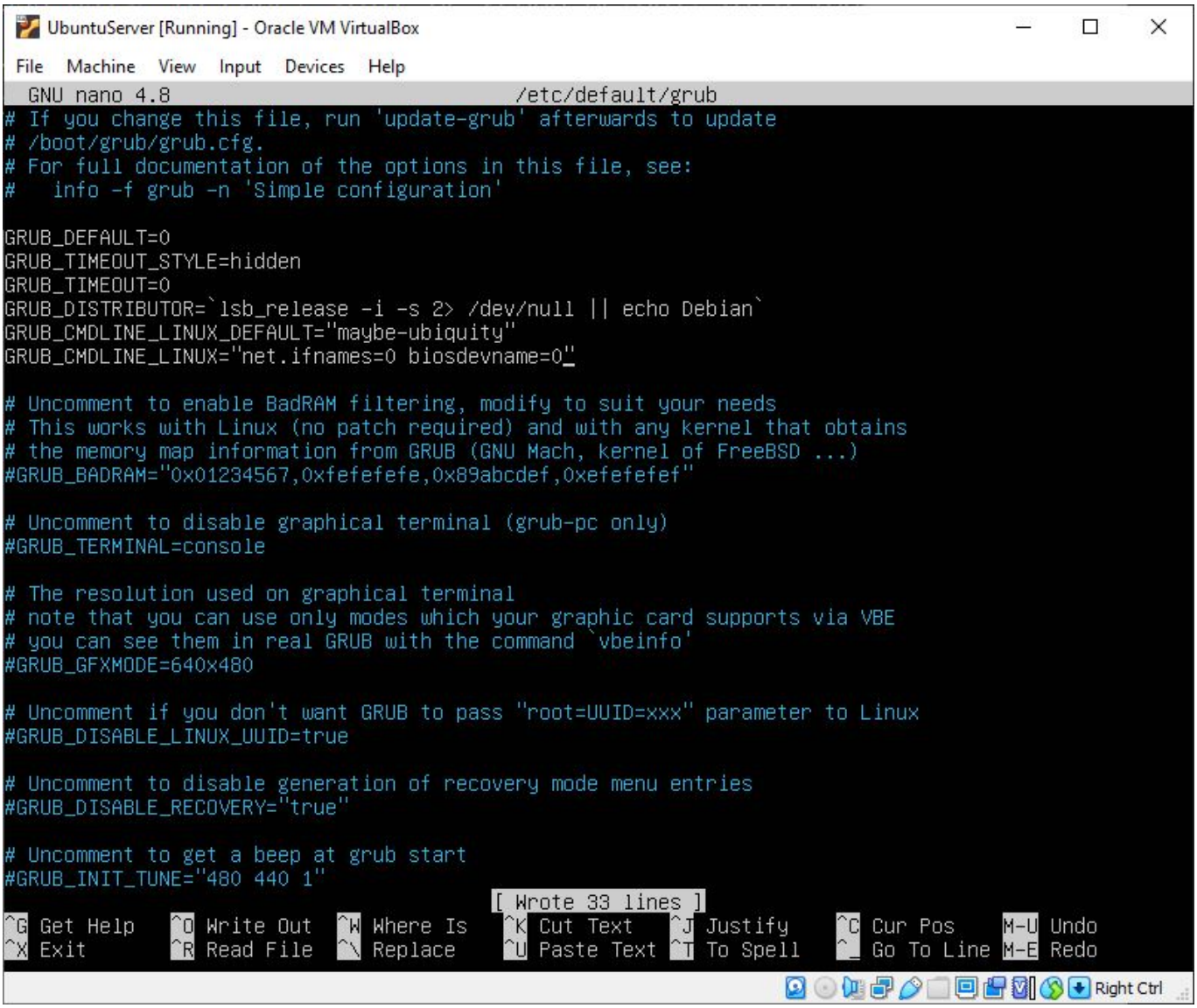
Enter your password, look for "GRUB_CMDLINE_LINUX" then change

From:

```
GRUB_CMDLINE_LINUX=""
```

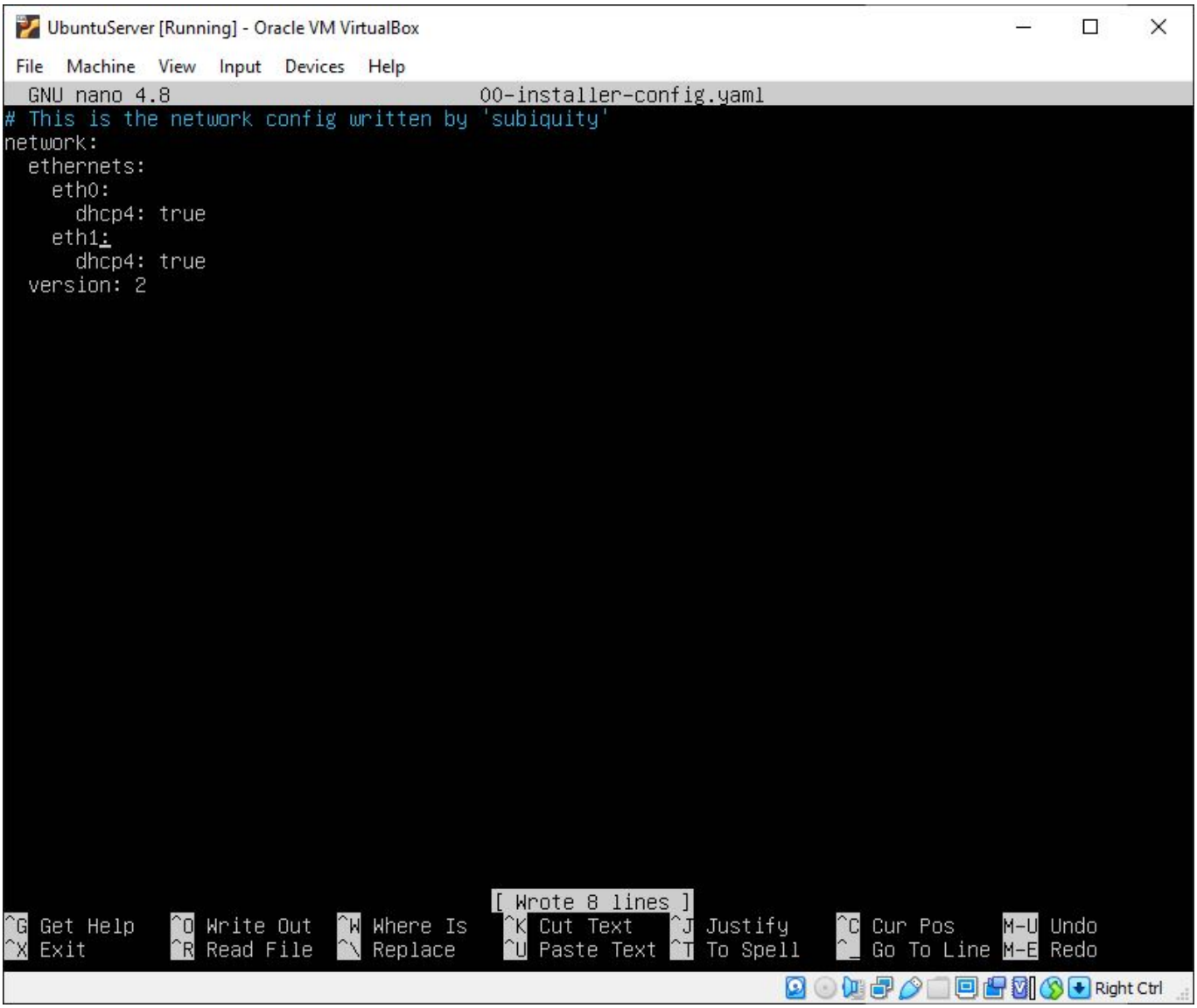
Change to:

```
GRUB_CMDLINE_LINUX="net.ifnames=0 biosdevname=0"
```



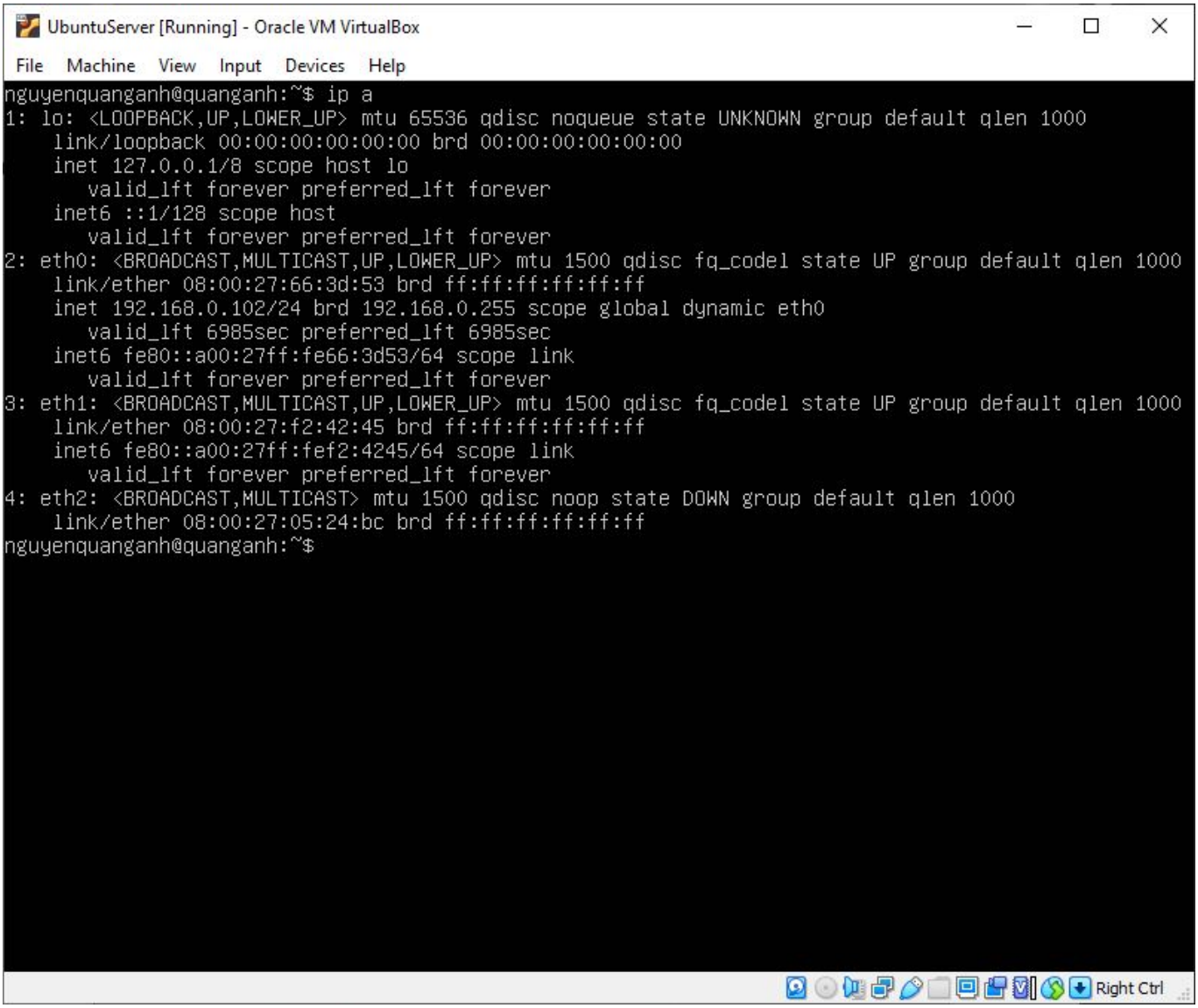
Note: save file

- Finally, edit the interface file in /etc/netplan (using `cd /`, then `cd etc/netplan/` and `ls` to get filename `00-network-manager-all.yaml`) and change the network device name so that you will have a DHCP or static IP address for eth0, eth1 and eth2 (using `sudo nano 00-network-manager-all.yaml`)



Reboot device after changing

The result is:



Configure 6 interfaces by the command

- Flush the device before bringing it up

```
sudo ip addr flush dev eth0
```

- You should clone virtual machine to 4 VMs, choose Generate new MAC addresses for all network adapters
- Configure 6 interfaces by the command:

```
PCA: sudo ip -6 addr add 2001:2::10/64 dev eth1
PCB: sudo ip -6 addr add 2001:3::10/64 dev eth1
Router1: sudo ip -4 addr add 129.175.1.1 dev eth2
         sudo ip -6 addr add 2001:2::1/64 dev eth1
Router2: sudo ip -4 addr add 129.175.1.2 dev eth2
         sudo ip -6 addr add 2001:3::1/64 dev eth1
```

where -6 represents the ipv6 network, eth0 is the device's name and `2001:2::/64` is the inet6 prefix.

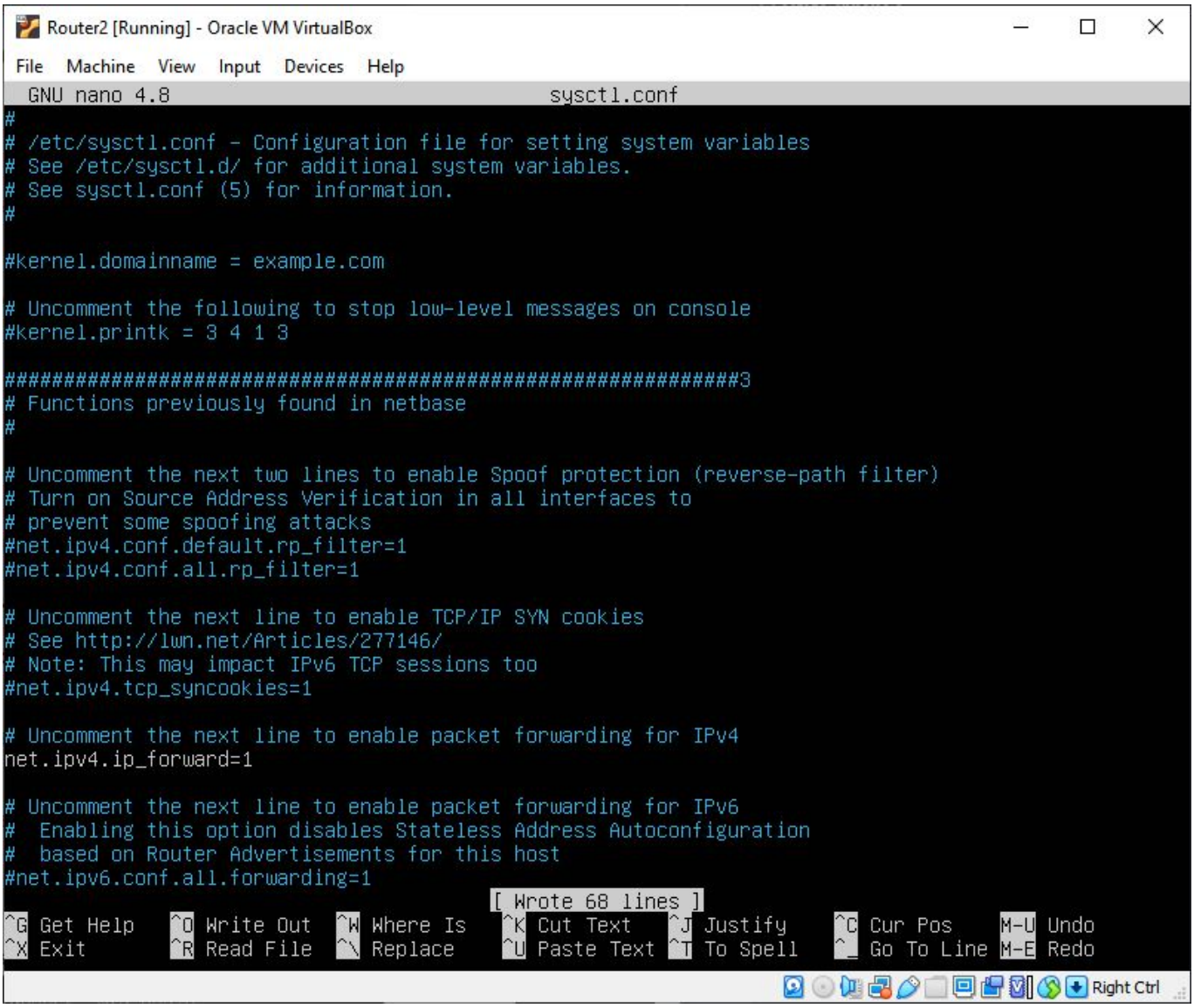
Activate devices (both Router1 and Router2)

```
sudo ip link set eth1 up
sudo ip link set eth2 up
```

Enable forwarding:

```
cd /
cd etc/
sudo nano sysctl.conf
```

Uncomment `net.ipv4.ip_forward=1` by delete # before that line



Configure the tunnel between the two border routers

Write the command line to add the remote of IPv4 address to the tunnel in order to create a IPv6-in-IPv4 tunnel

- Router1: `$ sudo ip tunnel add tunnell mode sit remote 129.175.1.2 local 129.175.1.1 ttl 255`
- Router2: `$ sudo ip tunnel add tunnell mode sit remote 129.175.1.1 local 129.175.1.2 ttl 255`

To activate the tunnel, we use the command:

```
ip link set tunnell up
```

When finish, the tunnel will be show as an interface in ifconfig

- To add ipv6 address to the tunnel, use `sudo ip addr add 2001:2::/64 dev tunnell`

Configure routing tables on all PCs

To flush all routes on the routing tables, the ip command options route flush table main are used. The full commands to run are:

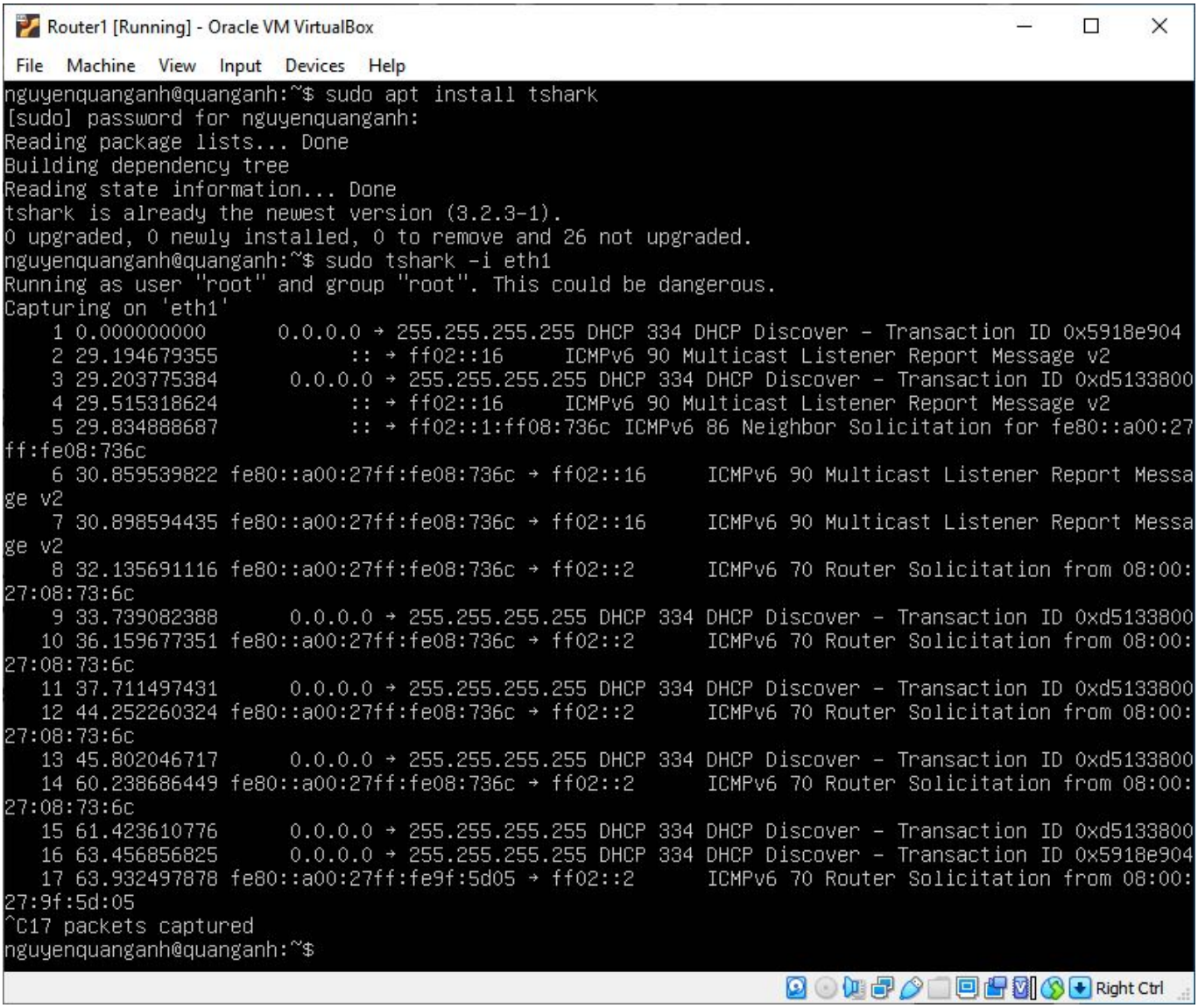
```
sudo ip route flush table main
ip route show
```

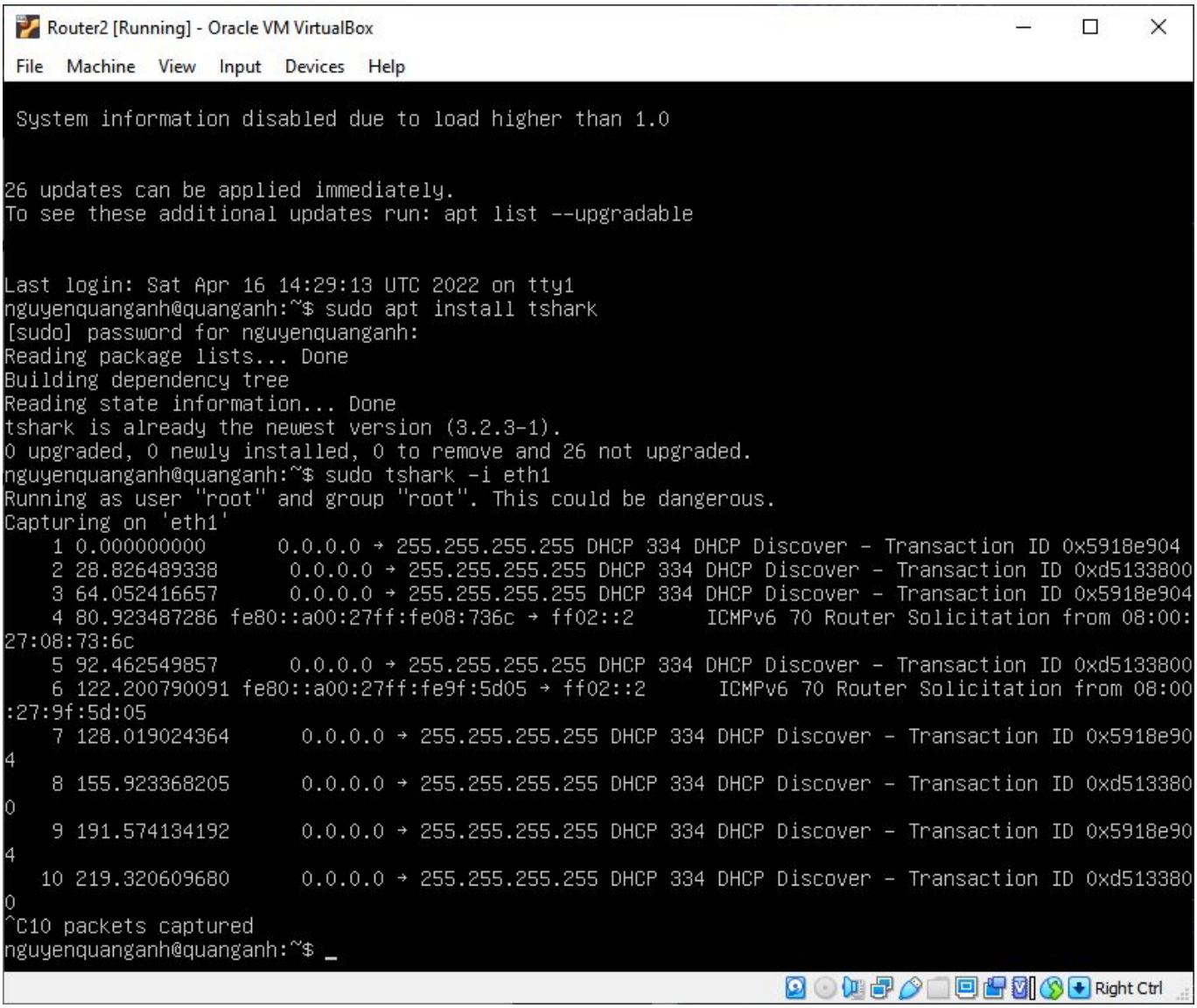
Observe with Wireshark

For Router1 or Router2

```
sudo apt install tshark
sudo tshark -i eth1
```

The results are:




Router2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
System information disabled due to load higher than 1.0
26 updates can be applied immediately.
To see these additional updates run: apt list --upgradable
Last login: Sat Apr 16 14:29:13 UTC 2022 on tty1
nguyenquanganh@quanganh:~$ sudo apt install tshark
[sudo] password for nguyenquanganh:
Reading package lists... Done
Building dependency tree
Reading state information... Done
tshark is already the newest version (3.2.3-1).
0 upgraded, 0 newly installed, 0 to remove and 26 not upgraded.
nguyenquanganh@quanganh:~$ sudo tshark -i eth1
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eth1'
1 0.000000000 0.0.0.0 → 255.255.255.255 DHCP 334 DHCP Discover - Transaction ID 0x5918e904
2 28.826489338 0.0.0.0 → 255.255.255.255 DHCP 334 DHCP Discover - Transaction ID 0xd5133800
3 64.052416657 0.0.0.0 → 255.255.255.255 DHCP 334 DHCP Discover - Transaction ID 0x5918e904
4 80.923487286 fe80::a00:27ff:fe08:736c → ff02::2 ICMPv6 70 Router Solicitation from 08:00:27:08:73:6c
5 92.462549857 0.0.0.0 → 255.255.255.255 DHCP 334 DHCP Discover - Transaction ID 0xd5133800
6 122.200790091 fe80::a00:27ff:fe9f:5d05 → ff02::2 ICMPv6 70 Router Solicitation from 08:00:27:9f:5d:05
7 128.019024364 0.0.0.0 → 255.255.255.255 DHCP 334 DHCP Discover - Transaction ID 0x5918e904
8 155.923368205 0.0.0.0 → 255.255.255.255 DHCP 334 DHCP Discover - Transaction ID 0xd5133800
9 191.574134192 0.0.0.0 → 255.255.255.255 DHCP 334 DHCP Discover - Transaction ID 0x5918e904
10 219.320609680 0.0.0.0 → 255.255.255.255 DHCP 334 DHCP Discover - Transaction ID 0xd5133800
^C10 packets captured
nguyenquanganh@quanganh:~$
Right Ctrl