IP routing

1. Create virtual machines connection according to figure 1:

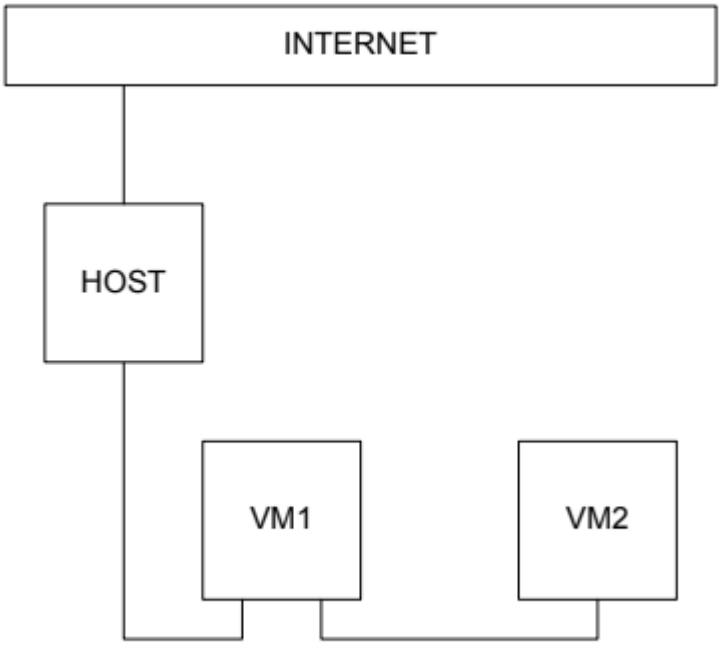
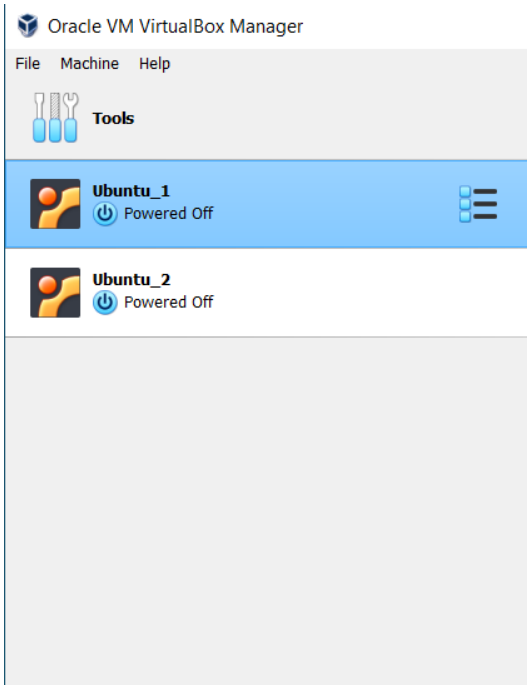
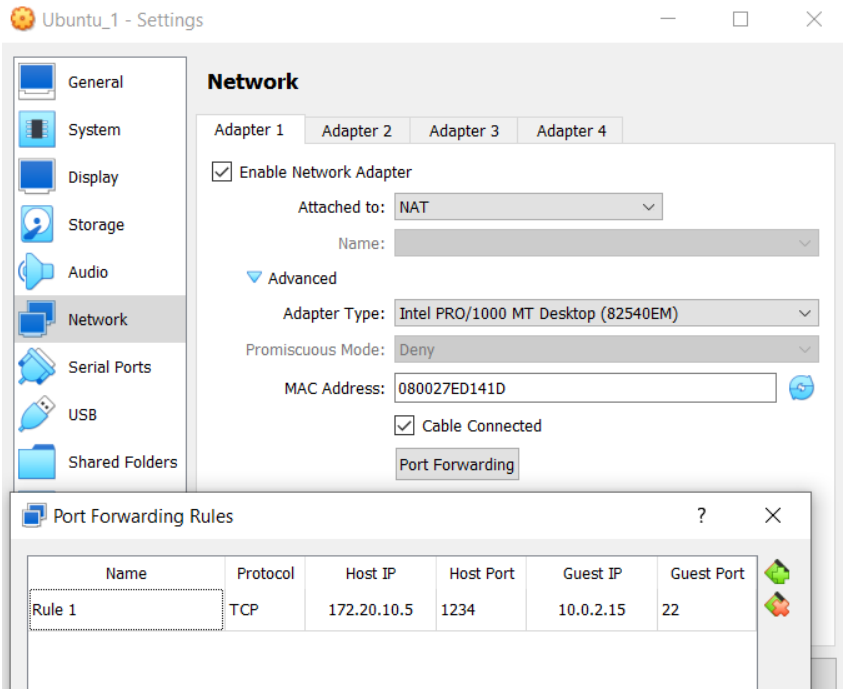
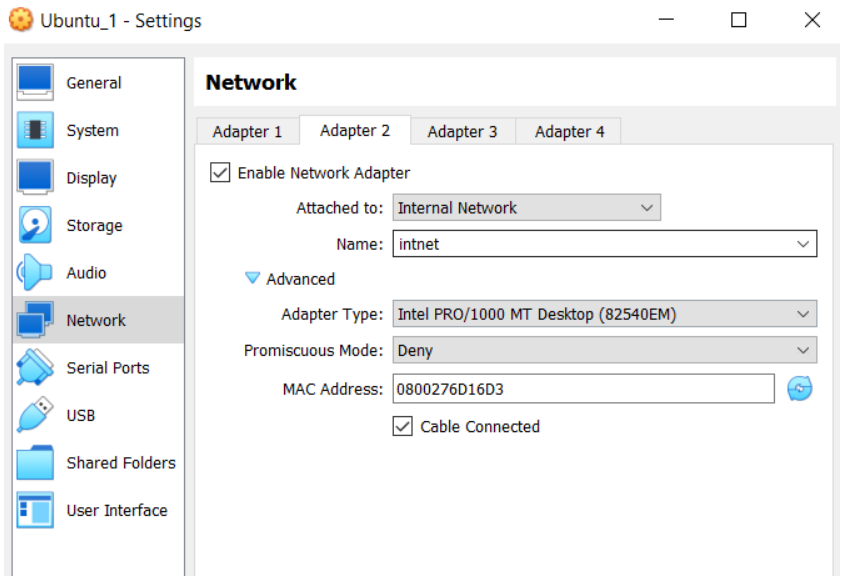


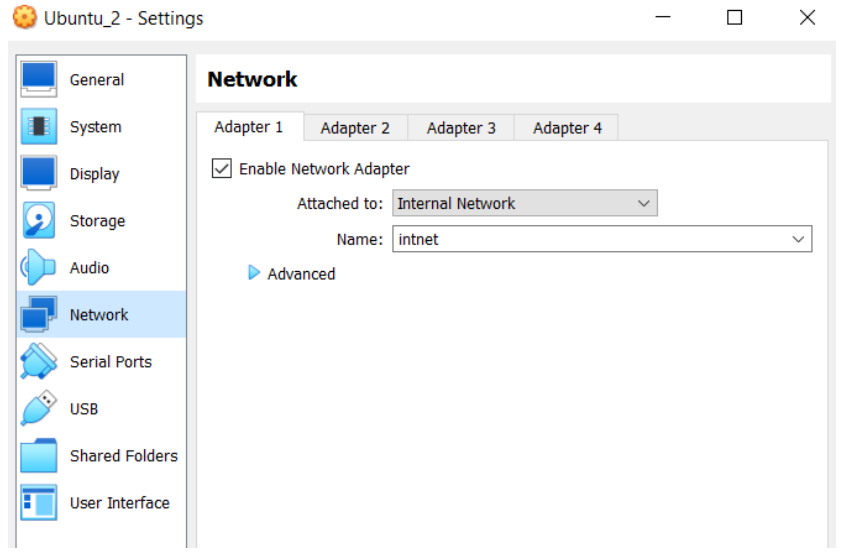
Figure 1 – VMs connection

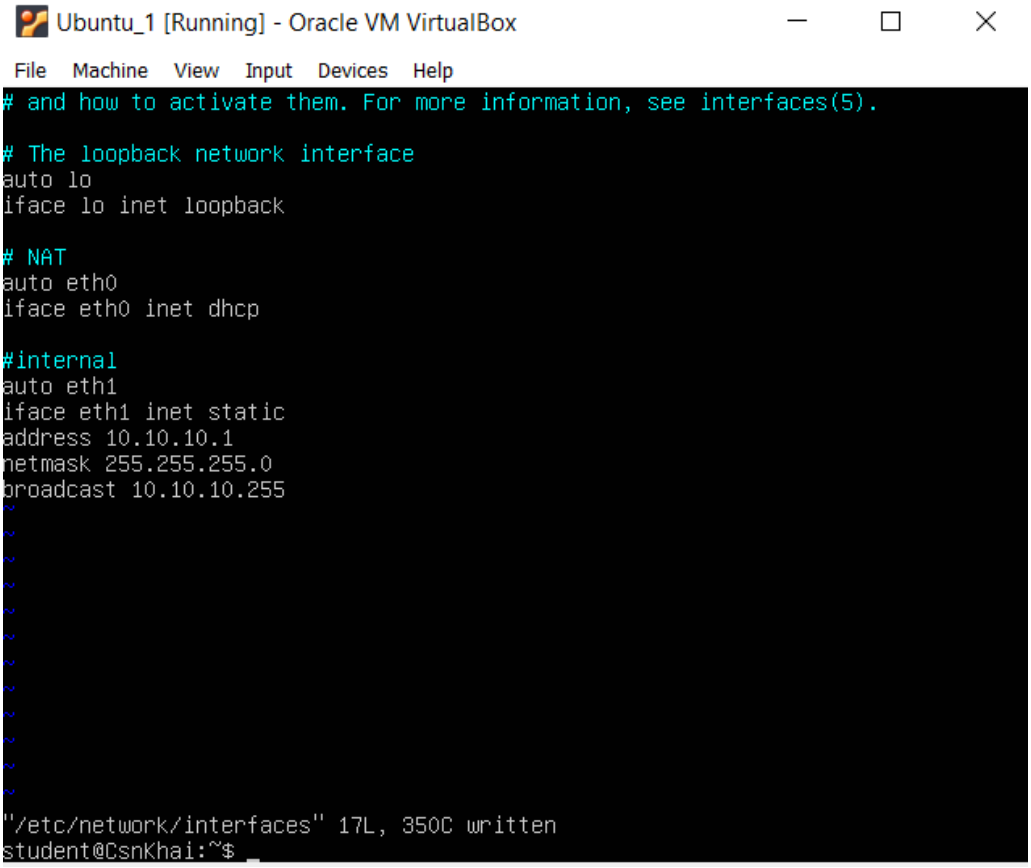
2. VM2 has one interface (internal), VM1 has 2 interfaces (NAT and internal). Configure all network interfaces in order to make VM2 has an access to the Internet (iptables, forward, masquerade).

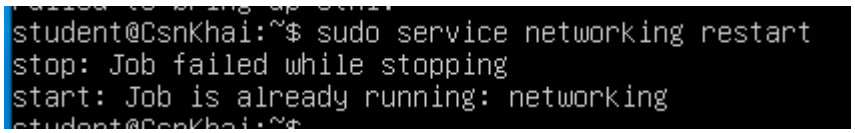


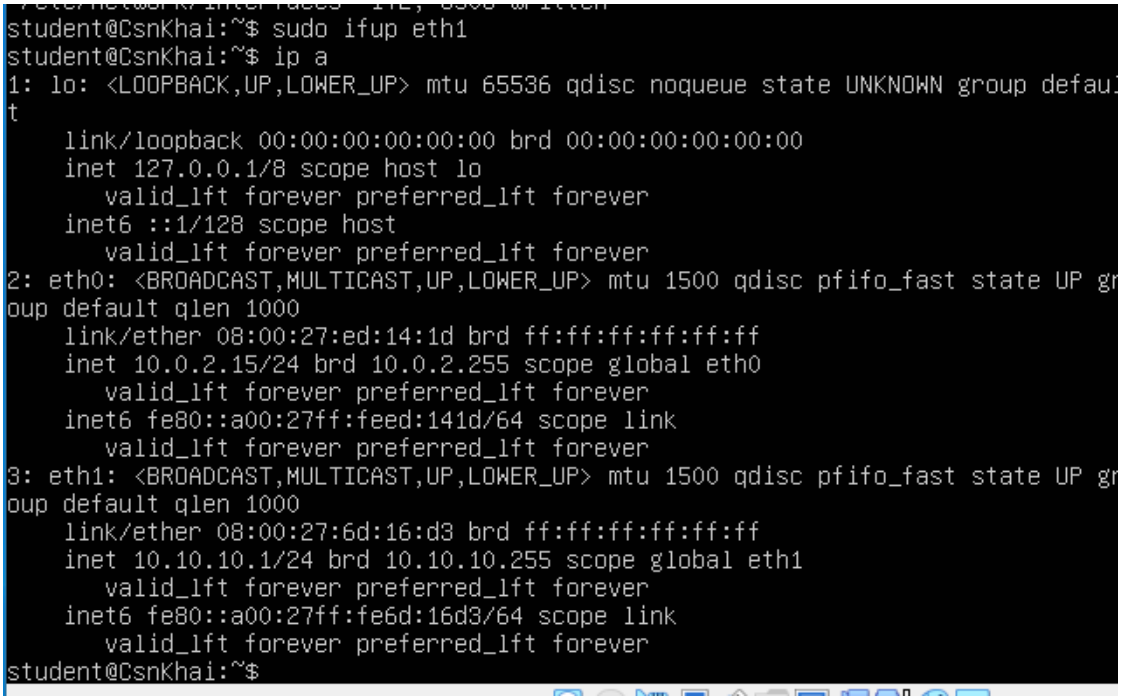

Ubuntu_1 - Settings
General
System
Display
Storage
Audio
Network
Serial Ports
USB
Shared Folders
Network
Adapter 1
Adapter 2
Adapter 3
Adapter 4
Enable Network Adapter
Attached to: NAT
Name:
Advanced
Adapter Type: Intel PRO/1000 MT Desktop (82540EM)
Promiscuous Mode: Deny
MAC Address: 080027ED141D
Cable Connected
Port Forwarding
Port Forwarding Rules
Name
Protocol
Host IP
Host Port
Guest IP
Guest Port
Rule 1
TCP
172.20.10.5
1234
10.0.2.15
22

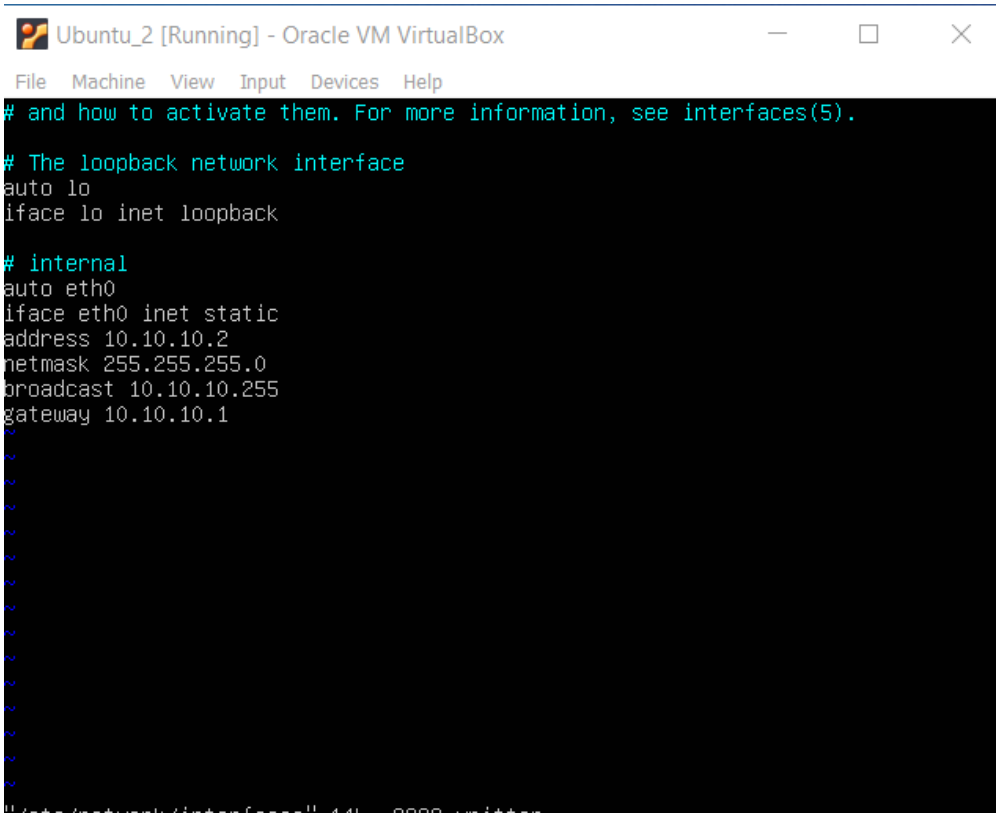

Ubuntu_1 - Settings
General
System
Display
Storage
Audio
Network
Serial Ports
USB
Shared Folders
User Interface
Network
Adapter 1
Adapter 2
Adapter 3
Adapter 4
Enable Network Adapter
Attached to: Internal Network
Name: intnet
Advanced
Adapter Type: Intel PRO/1000 MT Desktop (82540EM)
Promiscuous Mode: Deny
MAC Address: 0800276D16D3
Cable Connected

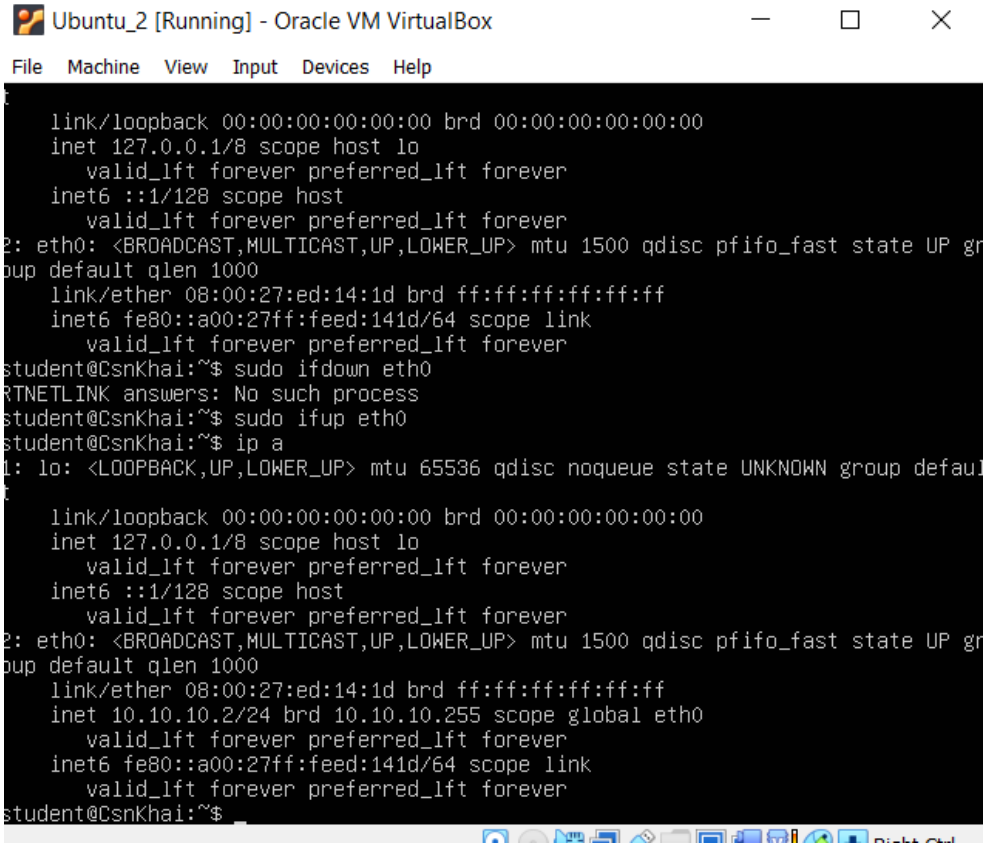

Ubuntu_2 - Settings
General
System
Display
Storage
Audio
Network
Serial Ports
USB
Shared Folders
User Interface
Network
Adapter 1
Adapter 2
Adapter 3
Adapter 4
Enable Network Adapter
Attached to: Internal Network
Name: intnet
Advanced

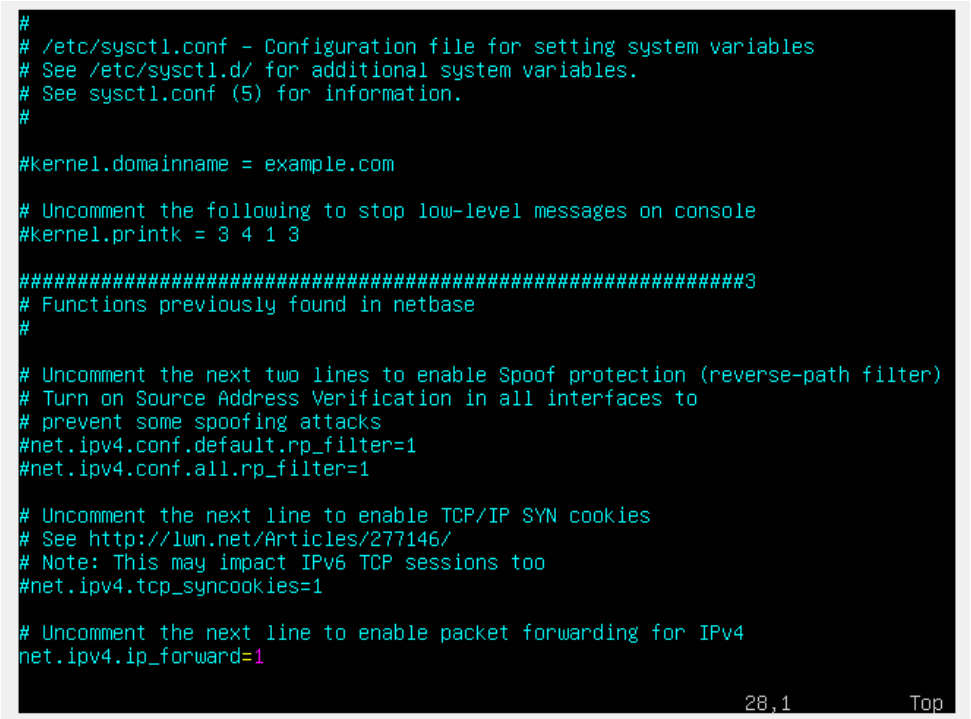

Ubuntu_1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
and how to activate them. For more information, see interfaces(5).
The loopback network interface
auto lo
iface lo inet loopback
NAT
auto eth0
iface eth0 inet dhcp
#internal
auto eth1
iface eth1 inet static
address 10.10.10.1
netmask 255.255.255.0
broadcast 10.10.10.255
"/etc/network/interfaces" 17L, 350C written
student@CsnKhai:~$


student@CsnKhai:~$ sudo service networking restart
stop: Job failed while stopping
start: Job is already running: networking


student@CsnKhai:~$ sudo ifup eth1
student@CsnKhai:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t
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 gr
oup default qlen 1000
link/ether 08:00:27:ed:14:1d brd ff:ff:ff:ff:ff:ff
inet 10.0.2.15/24 brd 10.0.2.255 scope global eth0
valid_lft forever preferred_lft forever
inet6 fe80::a00:27ff:feed:141d/64 scope link
valid_lft forever preferred_lft forever
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP gr
oup default qlen 1000
link/ether 08:00:27:6d:16:d3 brd ff:ff:ff:ff:ff:ff
inet 10.10.10.1/24 brd 10.10.10.255 scope global eth1
valid_lft forever preferred_lft forever
inet6 fe80::a00:27ff:fe6d:16d3/64 scope link
valid_lft forever preferred_lft forever
student@CsnKhai:~$


Ubuntu_2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
and how to activate them. For more information, see interfaces(5).
The loopback network interface
auto lo
iface lo inet loopback
internal
auto eth0
iface eth0 inet static
address 10.10.10.2
netmask 255.255.255.0
broadcast 10.10.10.255
gateway 10.10.10.1


Ubuntu_2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
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 gr
oup default qlen 1000
link/ether 08:00:27:ed:14:1d brd ff:ff:ff:ff:ff:ff
inet6 fe80::a00:27ff:feed:141d/64 scope link
valid_lft forever preferred_lft forever
student@CsnKhai:~$ sudo ifdown eth0
RTNETLINK answers: No such process
student@CsnKhai:~$ sudo ifup eth0
student@CsnKhai:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t
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 gr
oup default qlen 1000
link/ether 08:00:27:ed:14:1d brd ff:ff:ff:ff:ff:ff
inet 10.10.10.2/24 brd 10.10.10.255 scope global eth0
valid_lft forever preferred_lft forever
inet6 fe80::a00:27ff:feed:141d/64 scope link
valid_lft forever preferred_lft forever
student@CsnKhai:~$




```
student@CsnKhai:~$ sudo sysctl -p
net.ipv4.ip_forward = 1
student@CsnKhai:~$
```

```
student@CsnKhai:~$ sudo iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
```

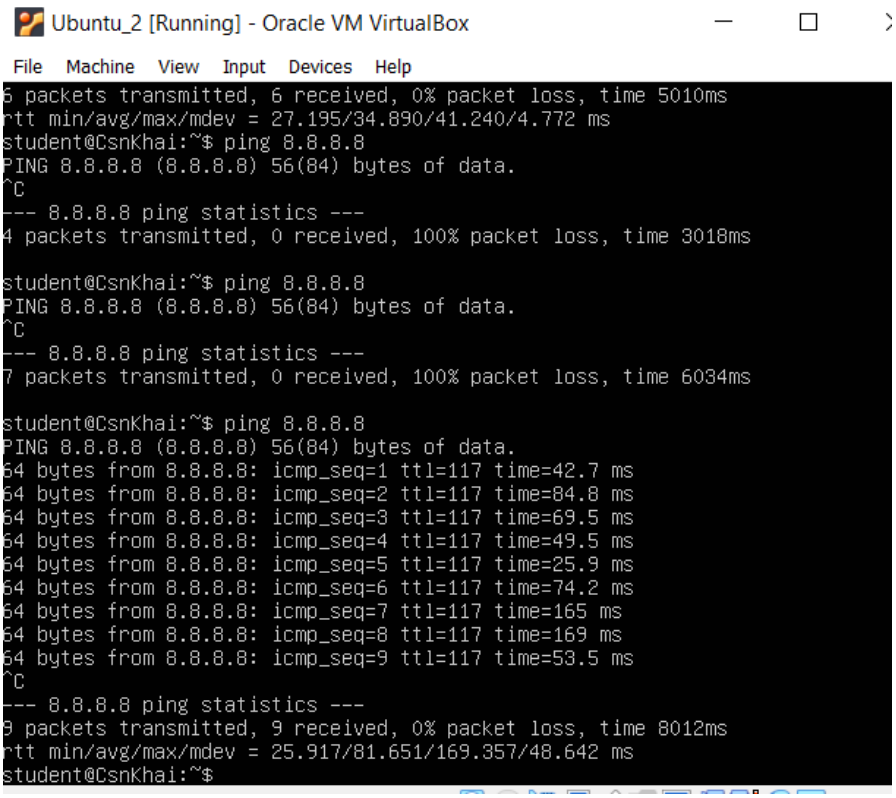
We need to install iptables-persistent and worun the following command to make iptables rules persistent.

```
root@CsnKhai:/home/student# iptables-save > /etc/iptables/rules.v4
```

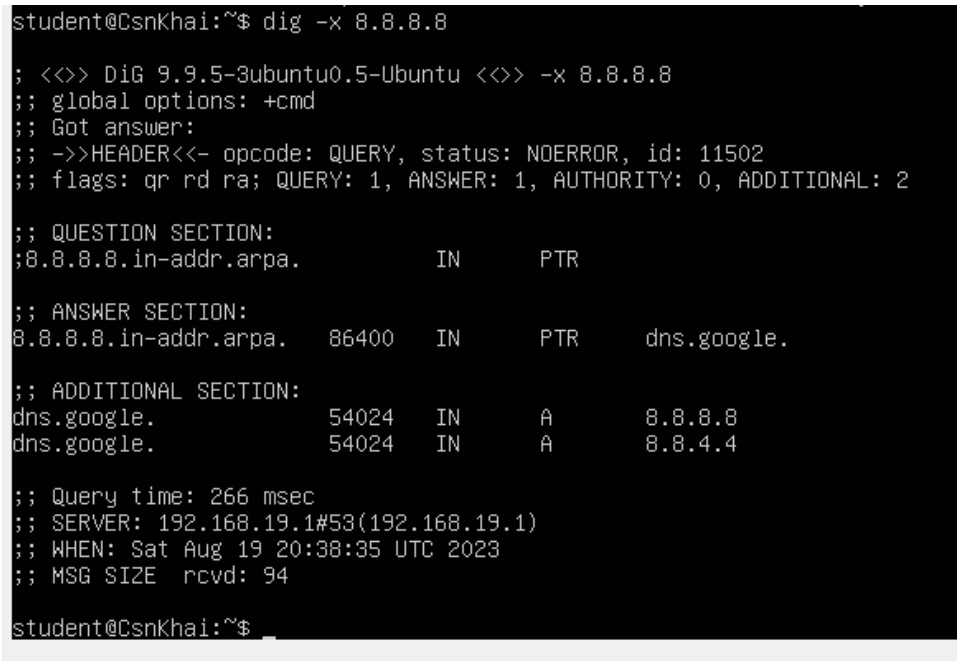
3. Check the route from VM2 to Host.

```
student@CsnKhai:~$ sudo route
[sudo] password for student:
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:~$
```

4. Check the access to the Internet, (just ping, for example, 8.8.8.8).



5. Determine, which resource has an IP address 8.8.8.8.



6. Determine, which IP address belongs to resource epam.com.

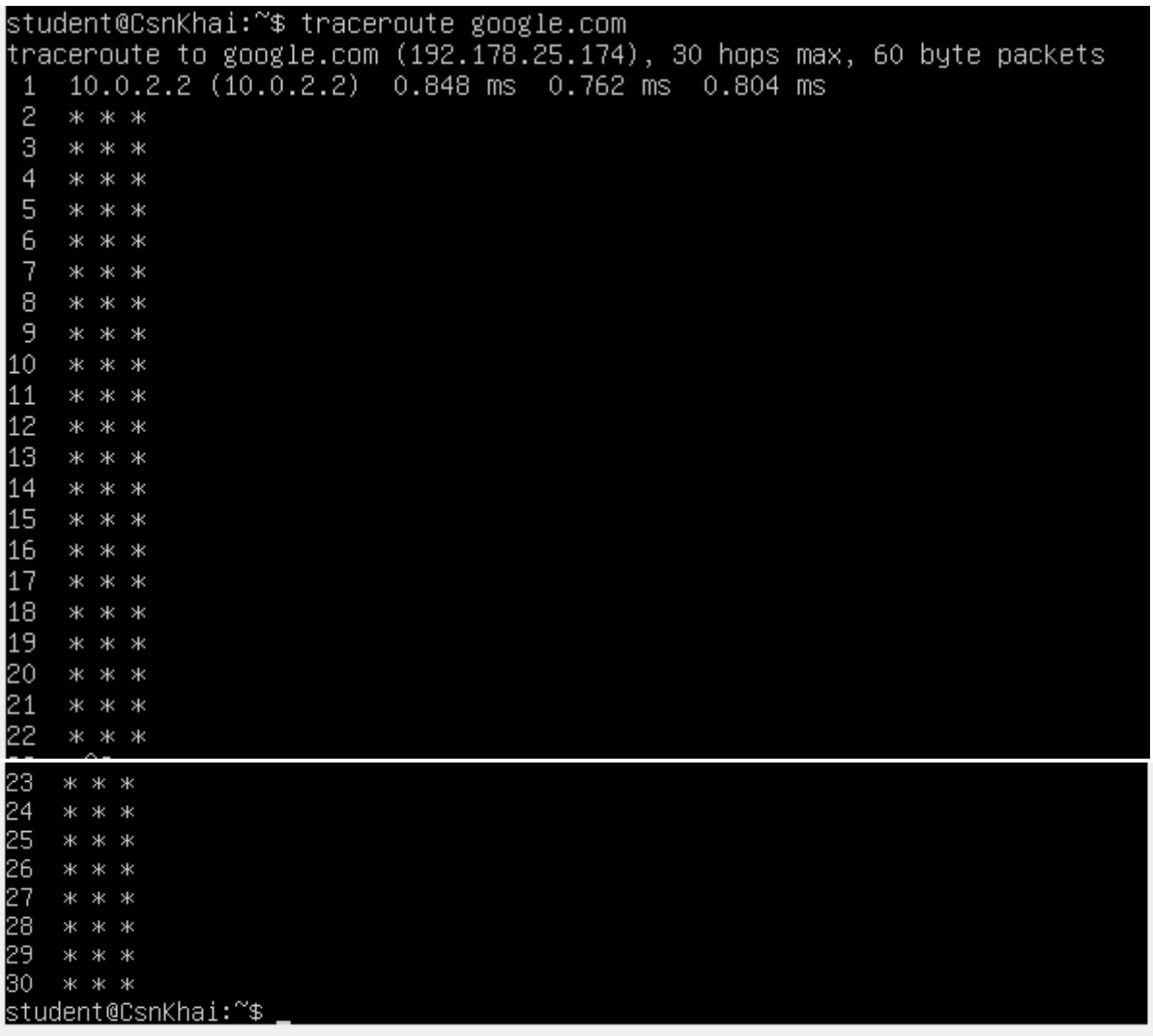
```
student@CsnKhai:~$ dig A epam.com

; <<>> DiG 9.9.5-3ubuntu0.5-Ubuntu <<>> A epam.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 60395
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;epam.com.                      IN      A

;; ANSWER SECTION:
epam.com.               3600    IN      A       3.214.134.159

;; Query time: 167 msec
;; SERVER: 192.168.19.1#53(192.168.19.1)
;; WHEN: Sat Aug 19 20:39:59 UTC 2023
;; MSG SIZE  rcvd: 42

student@CsnKhai:~$
```

7. Determine the default gateway for your HOST and display routing table.

```
student@CsnKhai:~$ ip route
default via 10.0.2.2 dev eth0
```

```
student@CsnKhai:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         10.0.2.2        0.0.0.0         UG    0      0        0 eth0
10.0.2.0        *               255.255.255.0   U     0      0        0 eth0
10.10.10.0      *               255.255.255.0   U     0      0        0 eth1
student@CsnKhai:~$
```

8. Trace the route to google.com.


student@CsnKhai:~$ traceroute google.com
traceroute to google.com (192.178.25.174), 30 hops max, 60 byte packets
1 10.0.2.2 (10.0.2.2) 0.848 ms 0.762 ms 0.804 ms
2 * * *
3 * * *
4 * * *
5 * * *
6 * * *
7 * * *
8 * * *
9 * * *
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
student@CsnKhai:~$