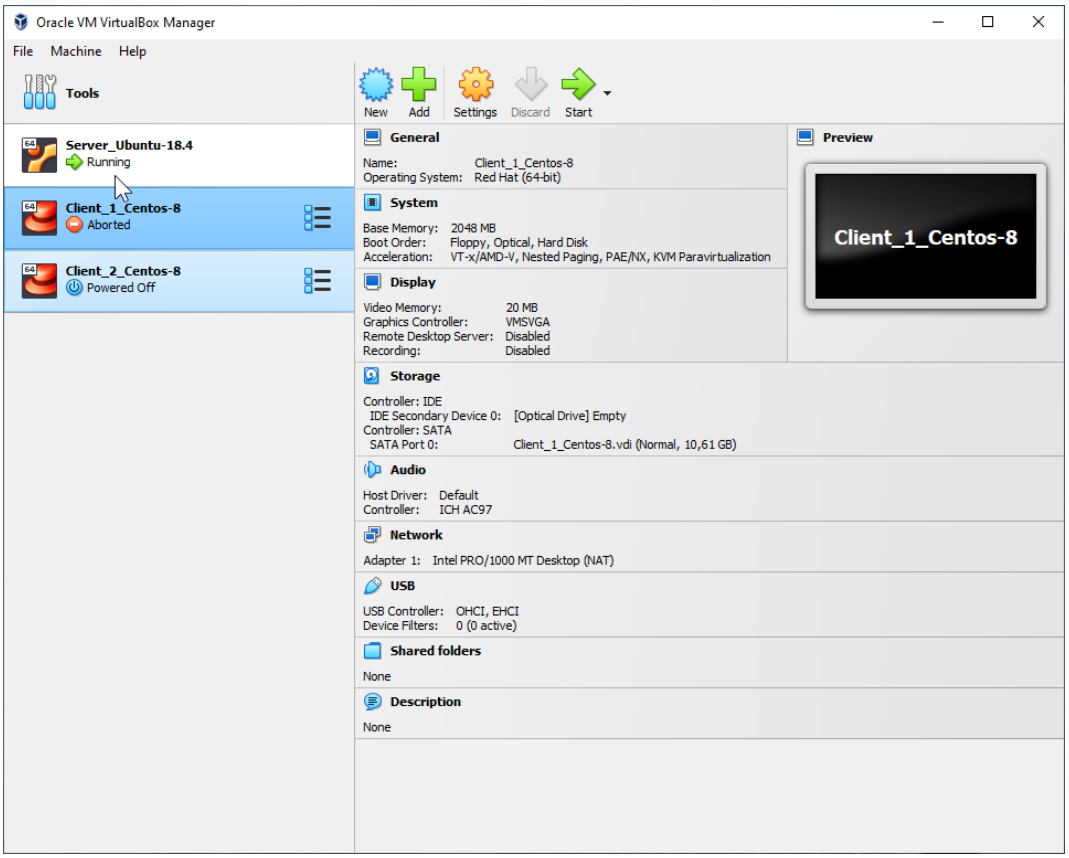
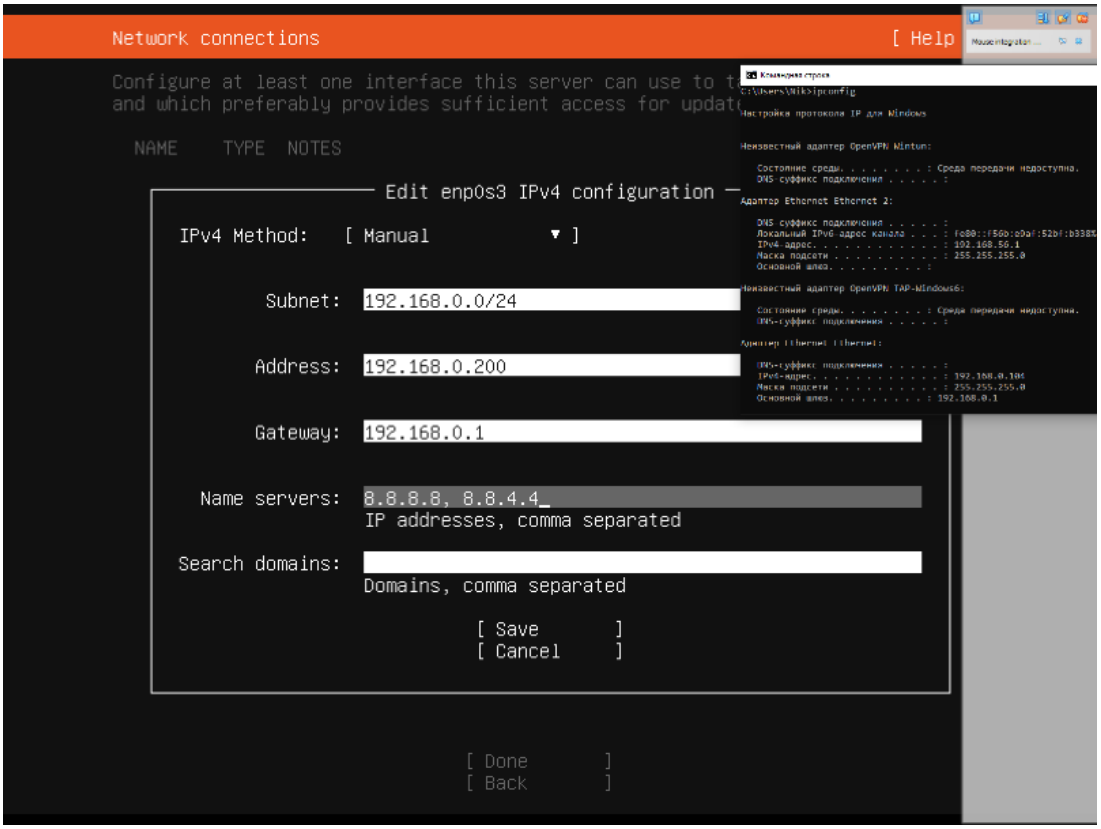
EPAM University Programs DevOps external course

Module – Linux Networking



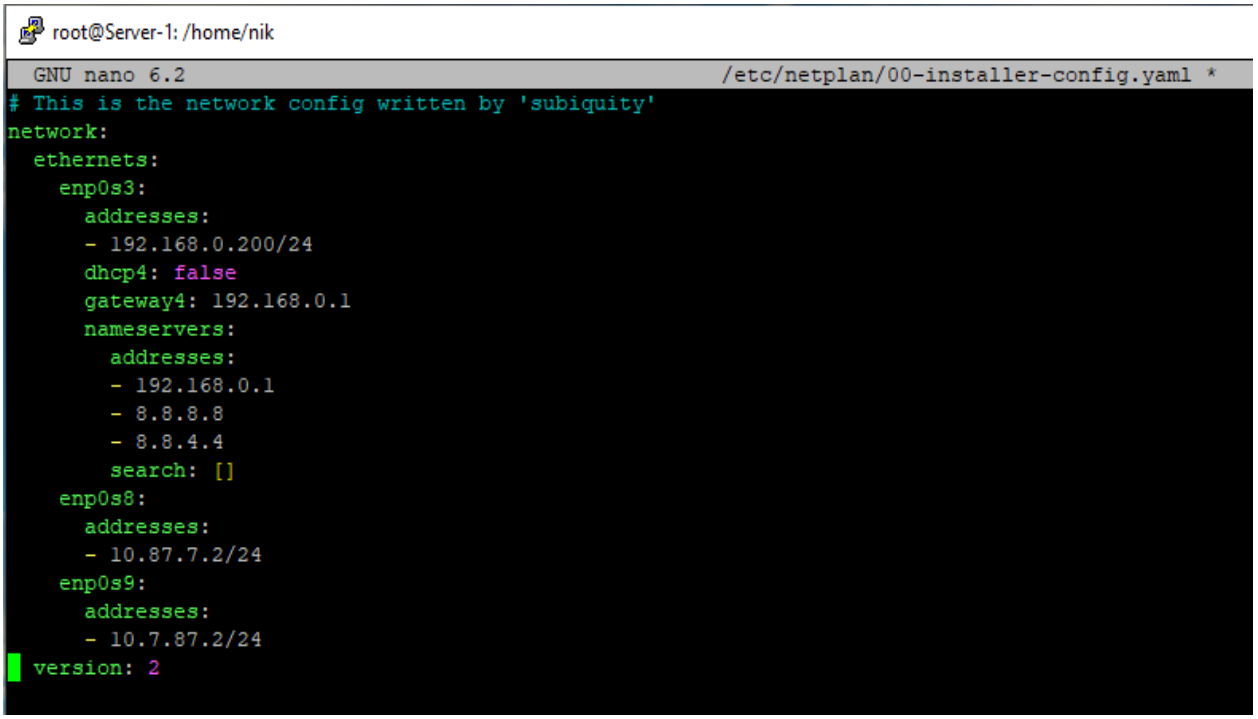
Configuring DHCP server



Client_1 та Client_2 – Віртуальні машини, на яких розгорнуто ОС Linux (бажано різні дистрибутиви, наприклад Ubuntu та CentOS). Інтерфейси підключені в режимі «Внутрішня мережа» до мереж Net2, Net3 та Net4 як показано на рисунку 1. Адреса мережі Net2 – 10.Y.D.0/24, де Y – дві останні цифри з вашого року народження, D – дата народження. Адреса мережі Net3 – 10.M.Y.0/24, де M – номер місяця народження. Адреса мережі Net4 – 172.16.D.0/24. Увага! Якщо, адресний простір Net2, Net3 або Net4 перетинається з адресним простором Net1 – відповідну адресу можна змінити на власний розсуд.

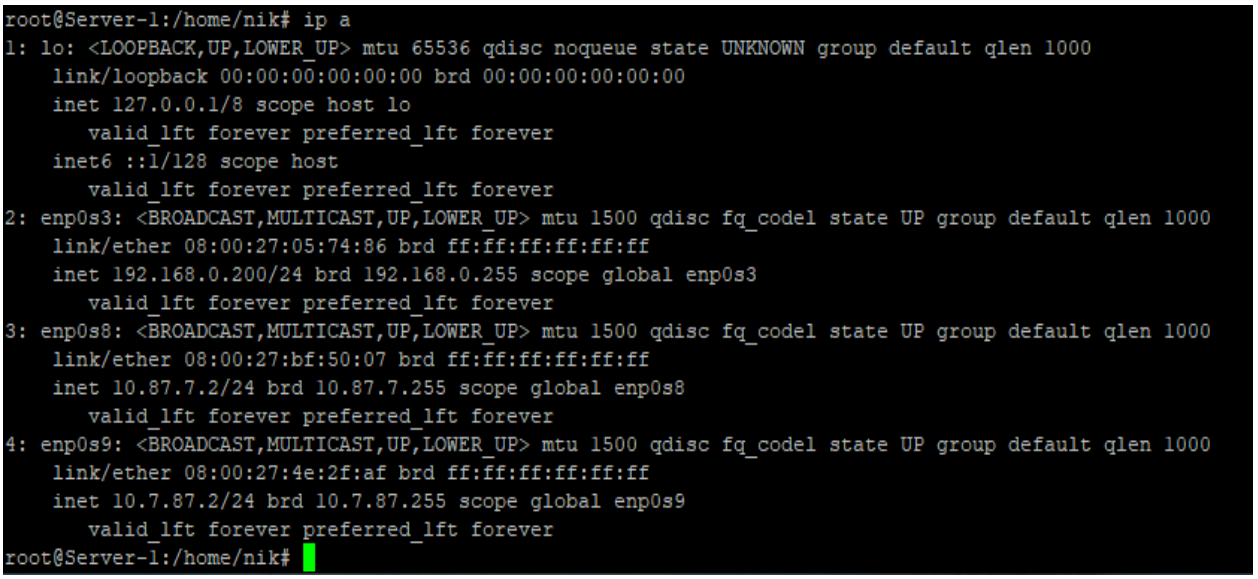
1. На Server_1 налаштувати статичні адреси на всіх інтерфейсах.

nano /etc/netplan/00-installer-config.yaml



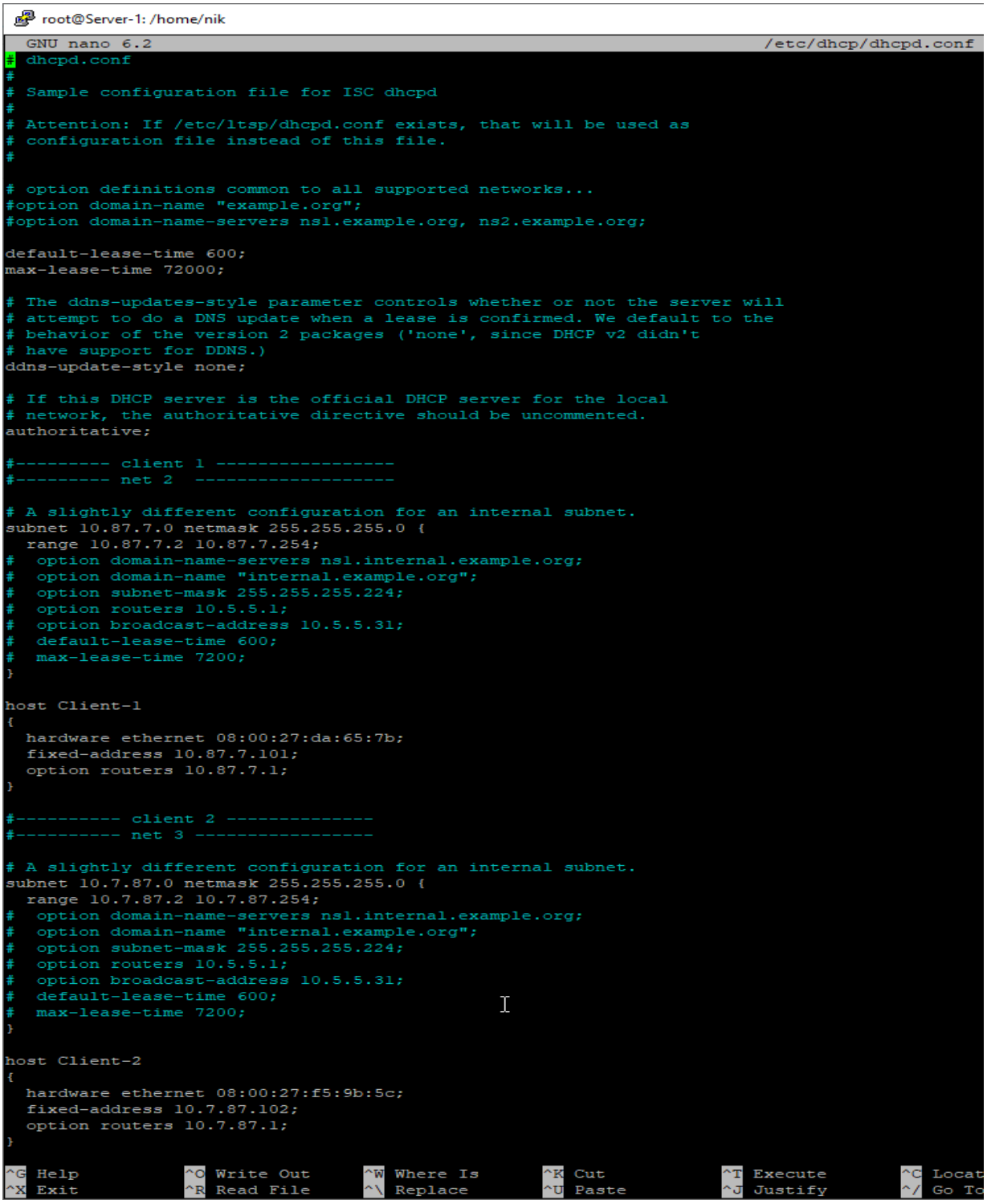
Ip interface can't finish on "0" – addr subnet and "1" - gateway

Netplan apply



2. На Server_1 налаштувати DHCP сервіс, який буде конфігурувати адреси Int1 Client_1 та Client_2

nano /etc/dhcp/dhcpd.conf

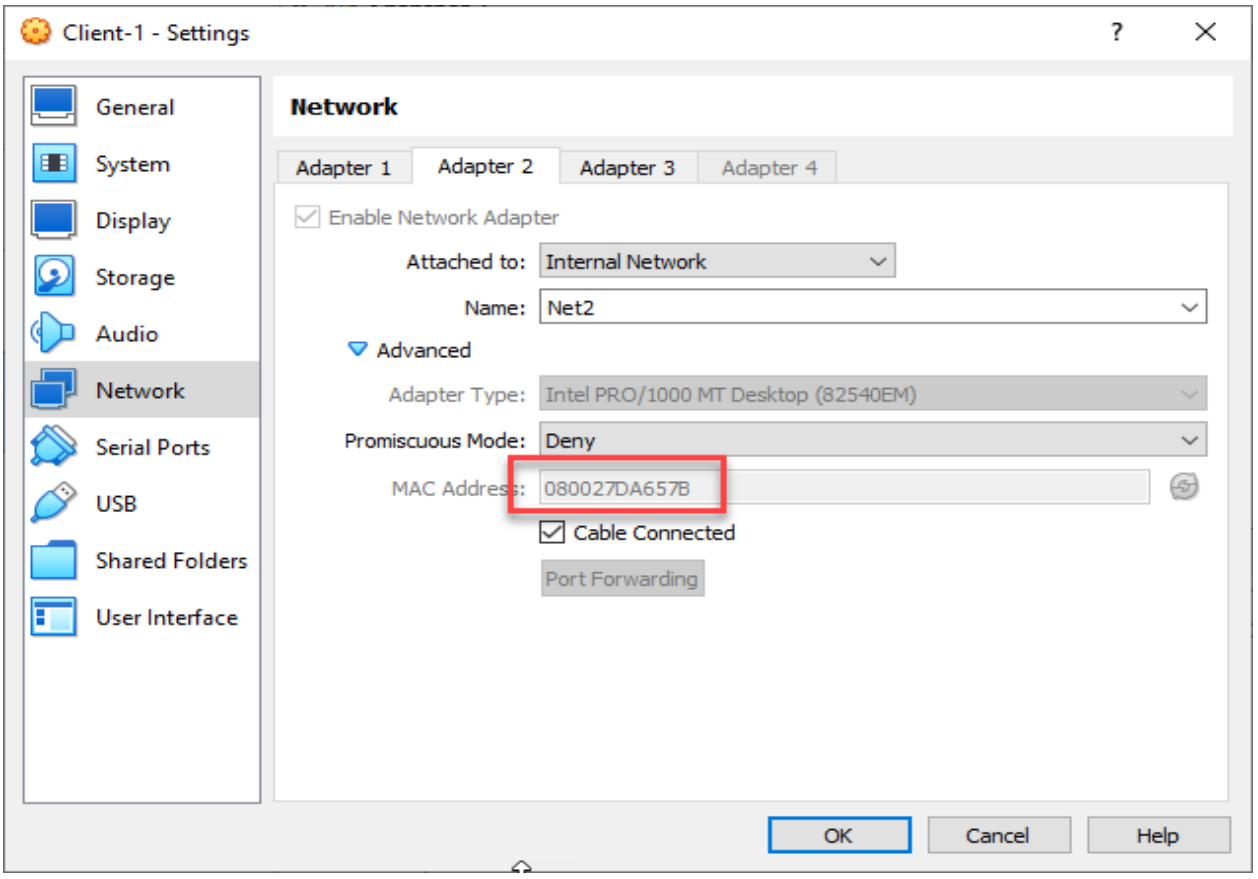


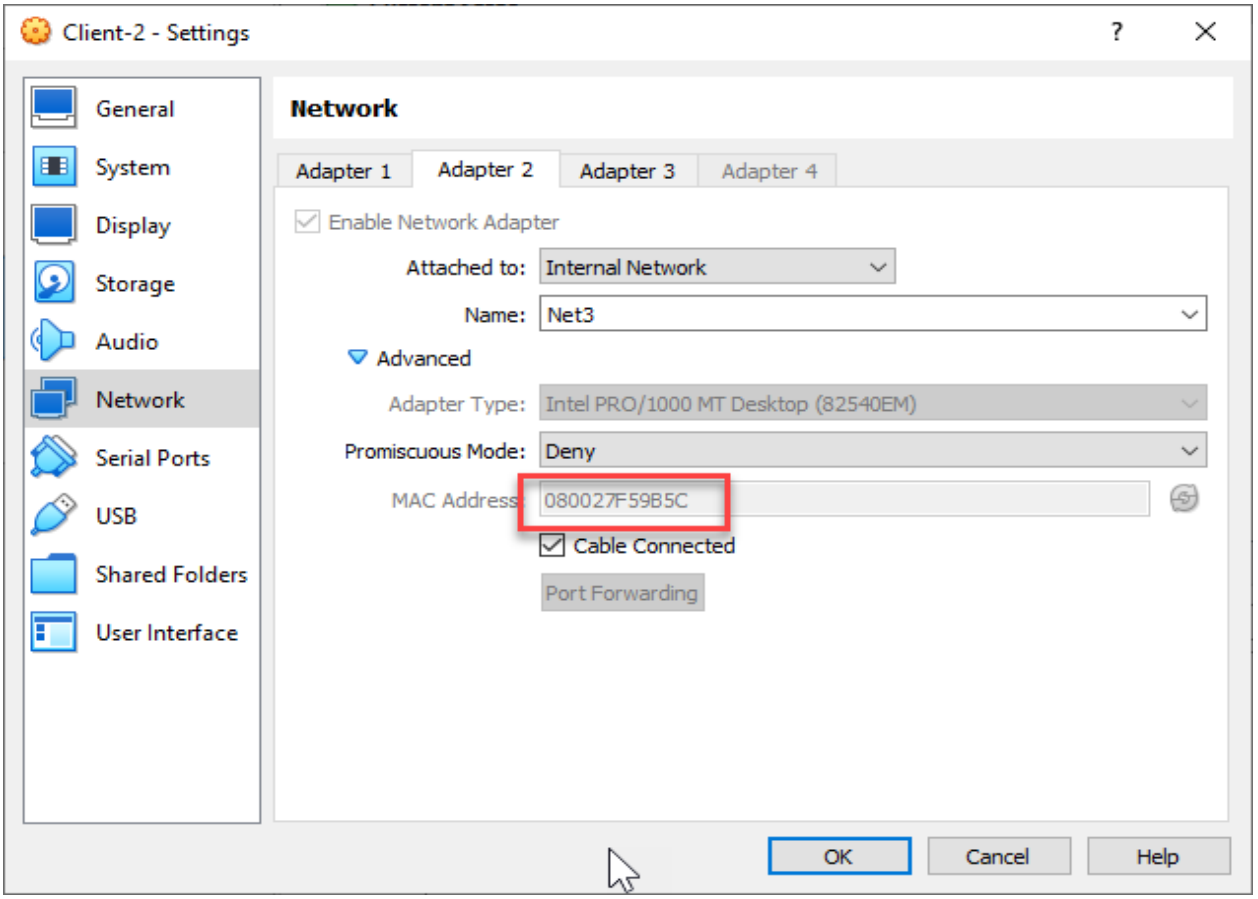
systemctl restart isc-dhcp-server

hardware ethernet – MAC address of interface client VM

fixed-address - IP address of interface client VM

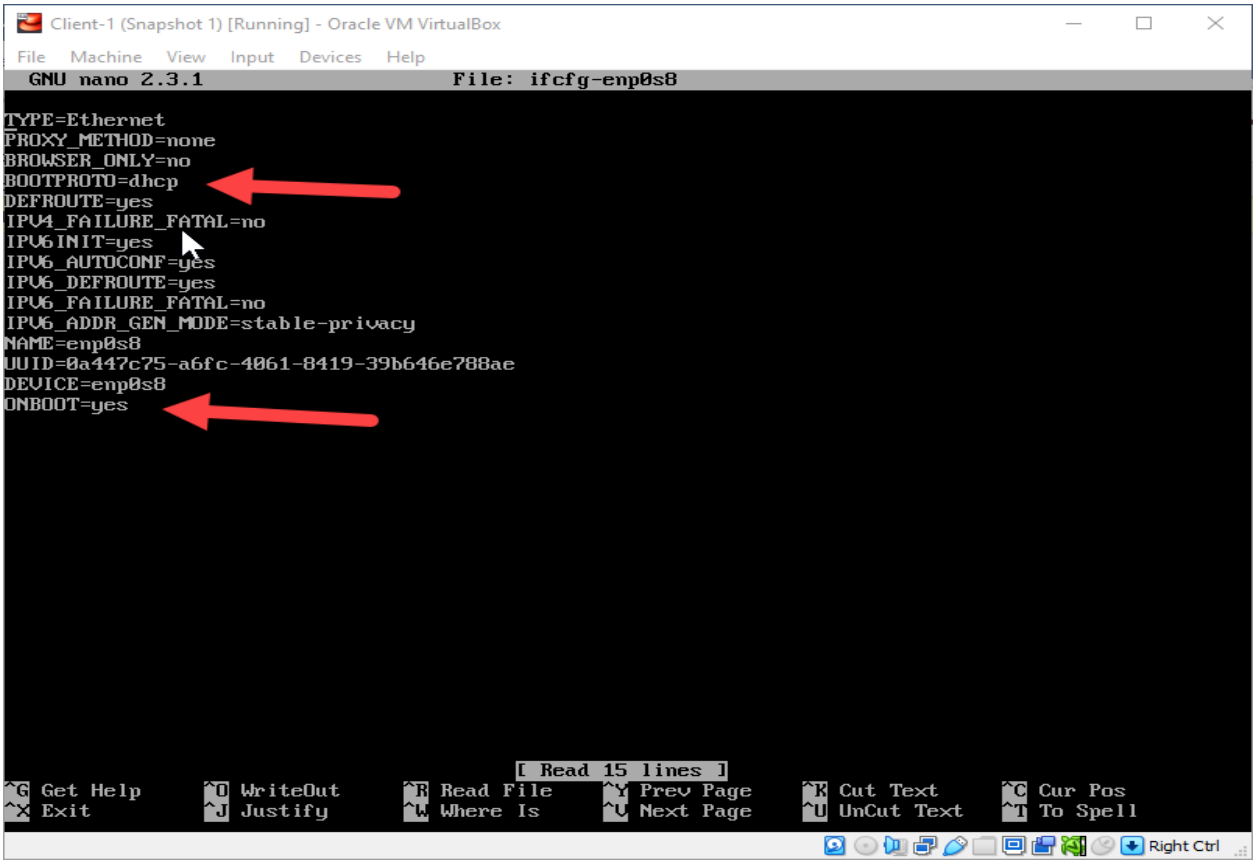
option routers - gateway address of interface client VM

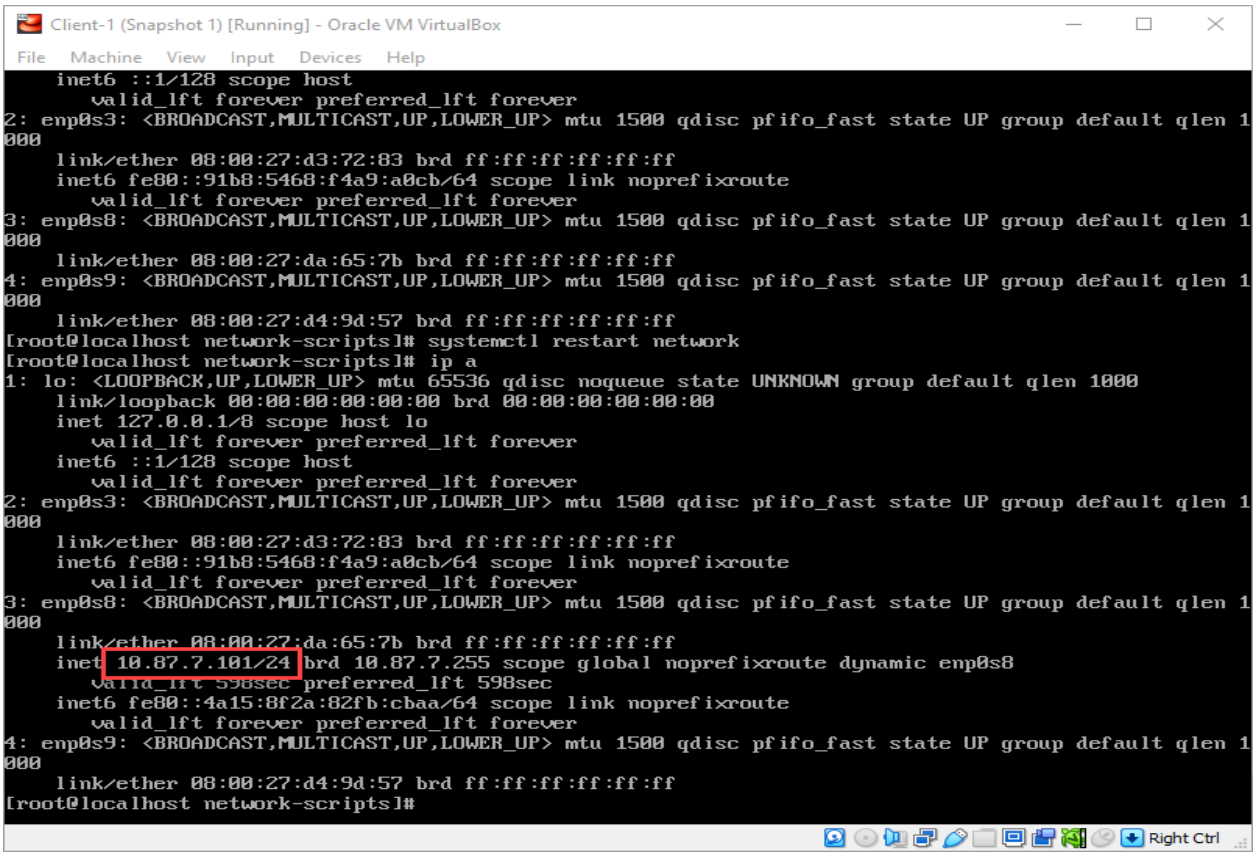




Client-1

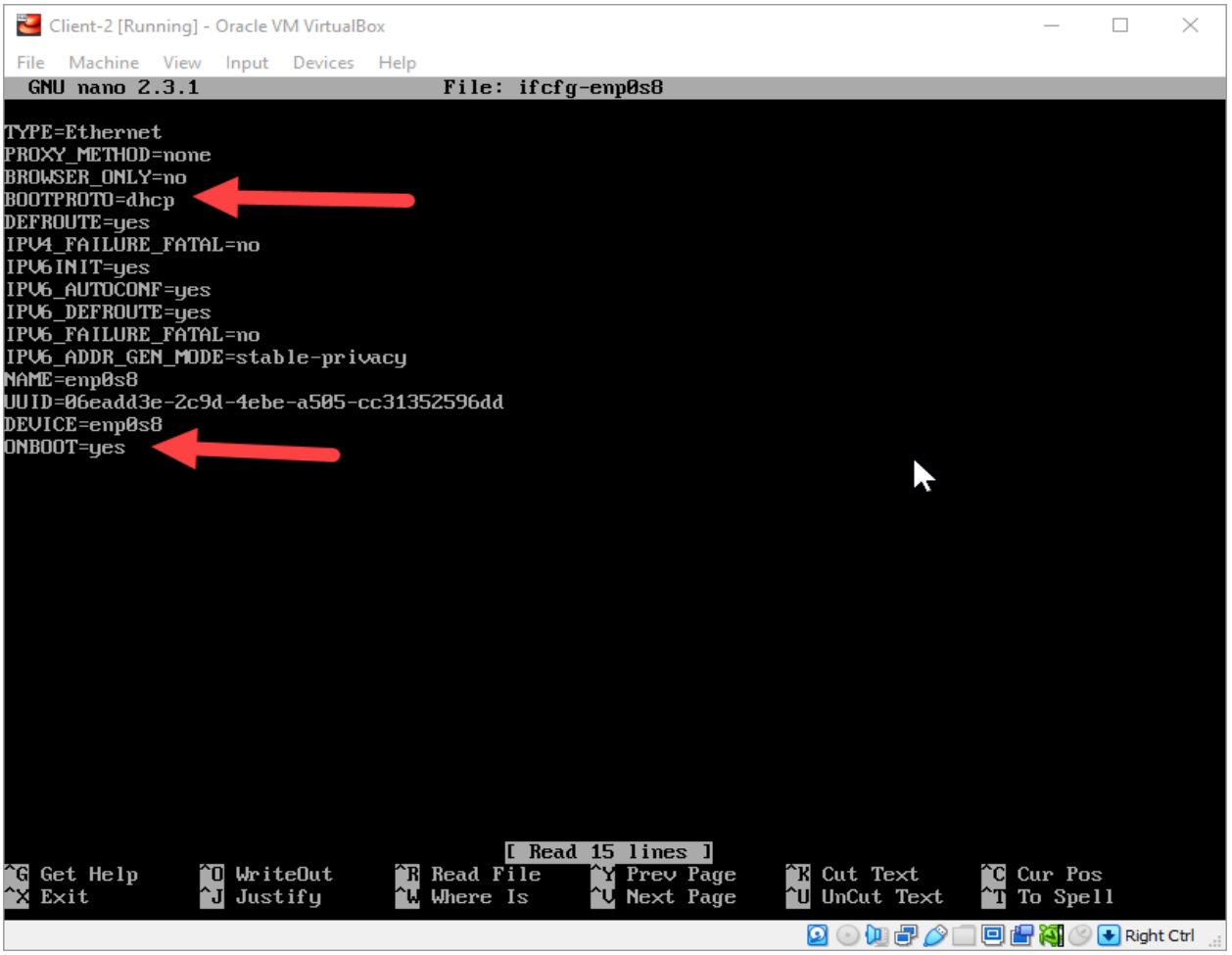
cd /etc/sysconfig/network-scripts

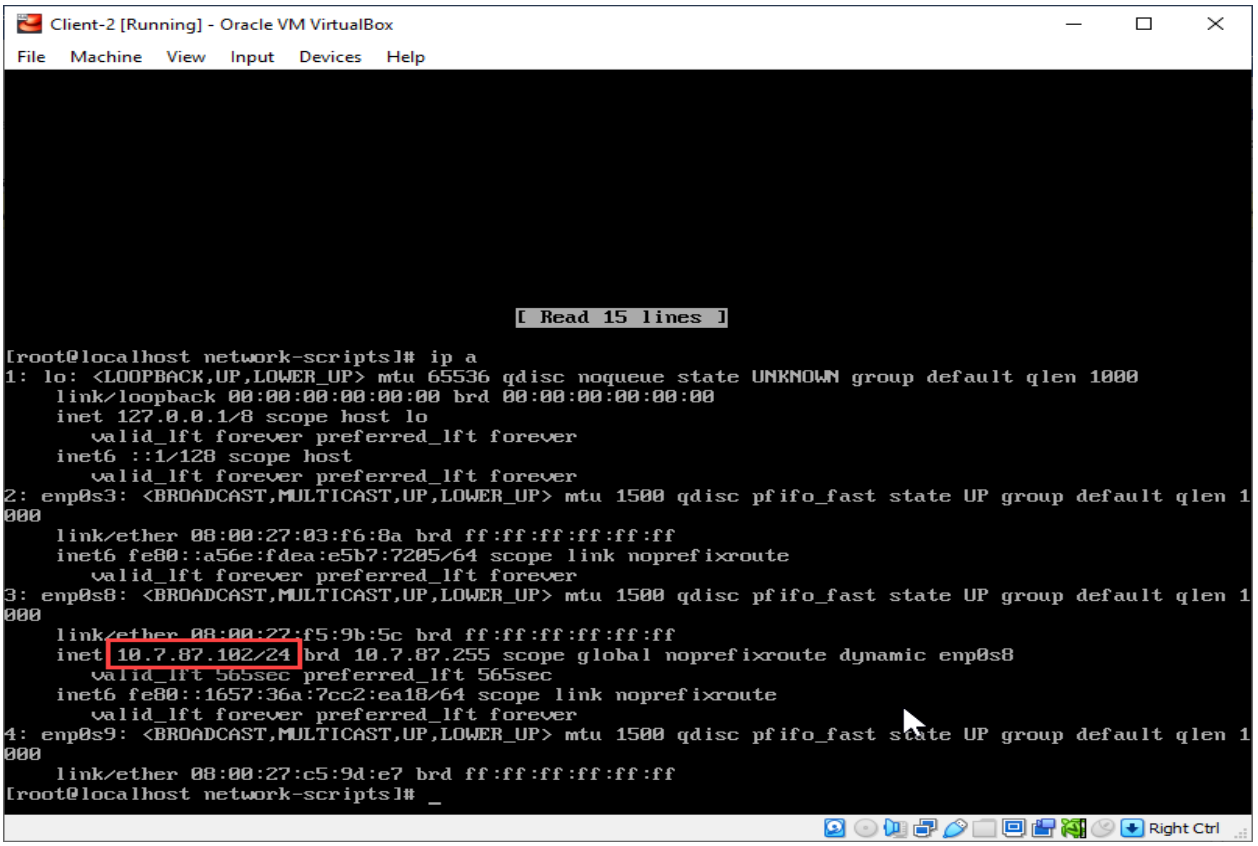




systemctl restart network

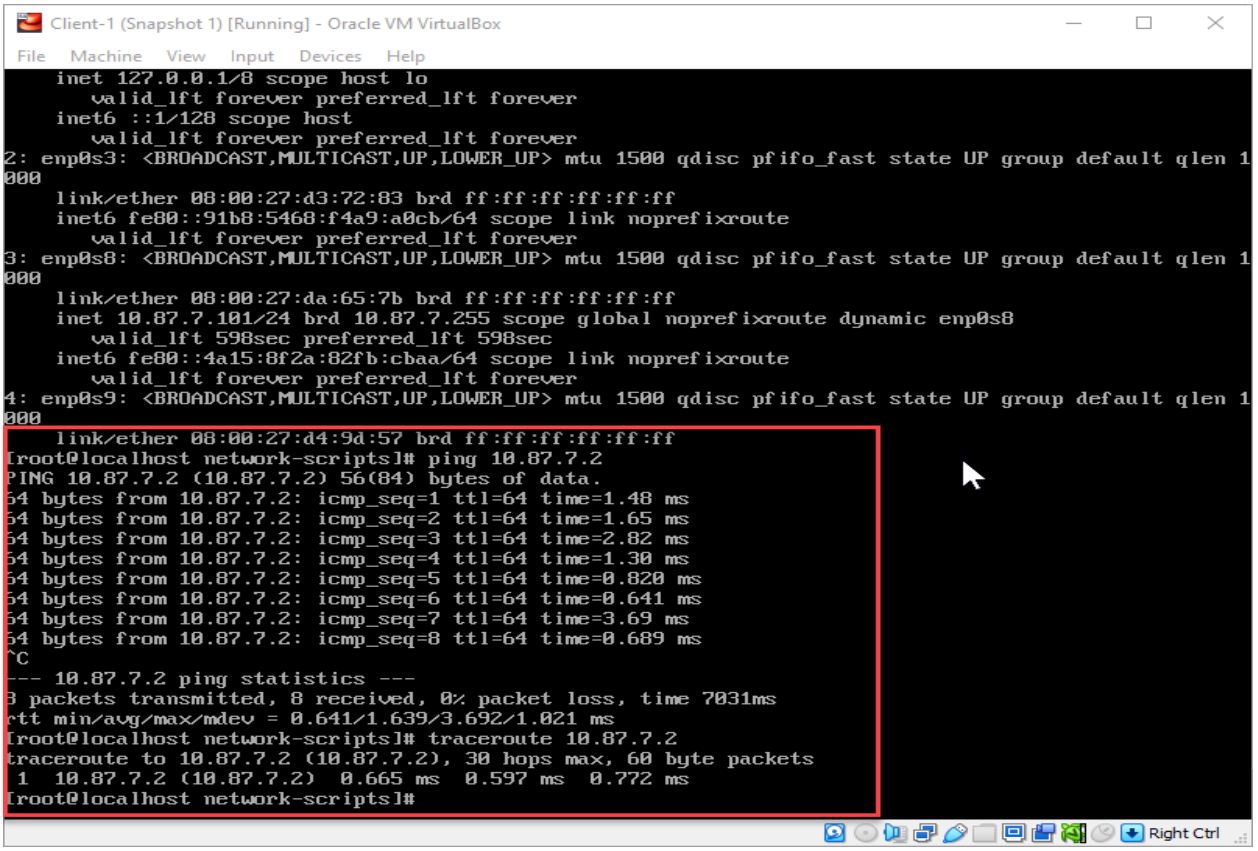
Client-2



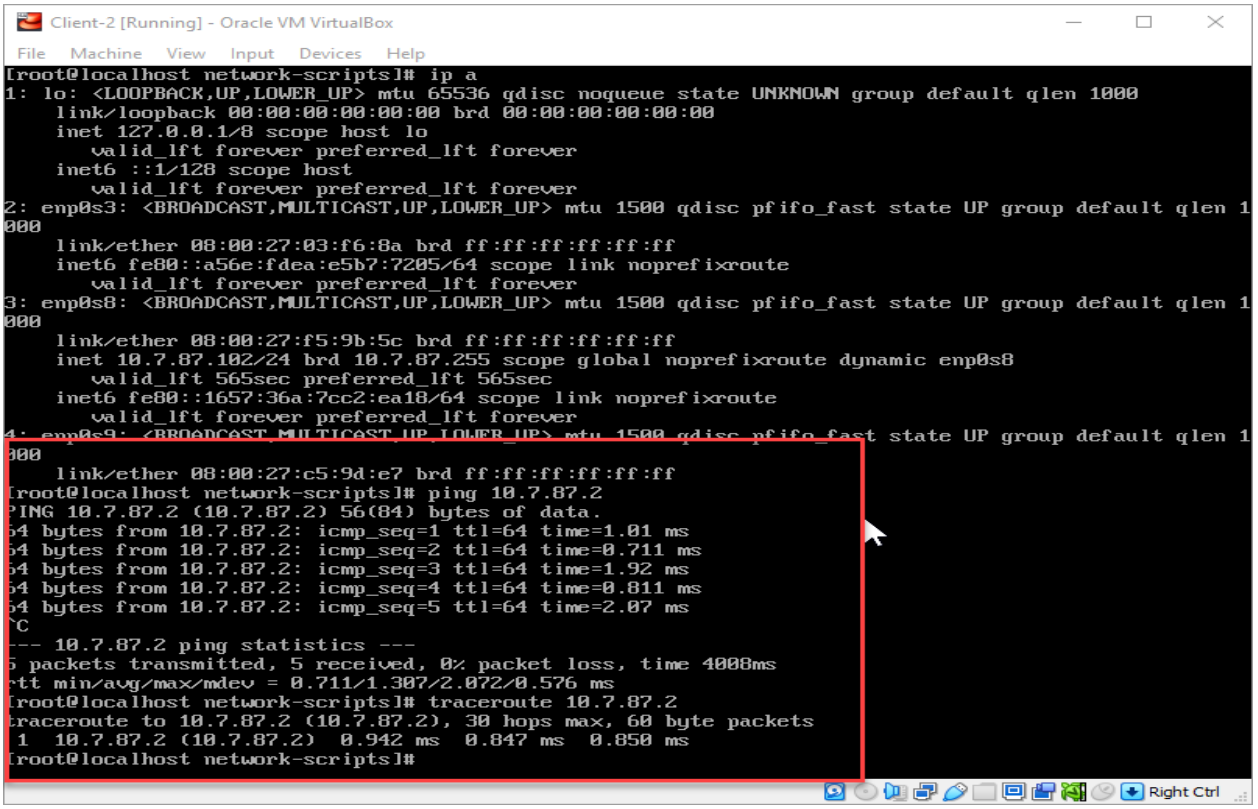


3. За допомогою команд ping та traceroute перевірити зв'язок між віртуальними машинами. Результат пояснити.

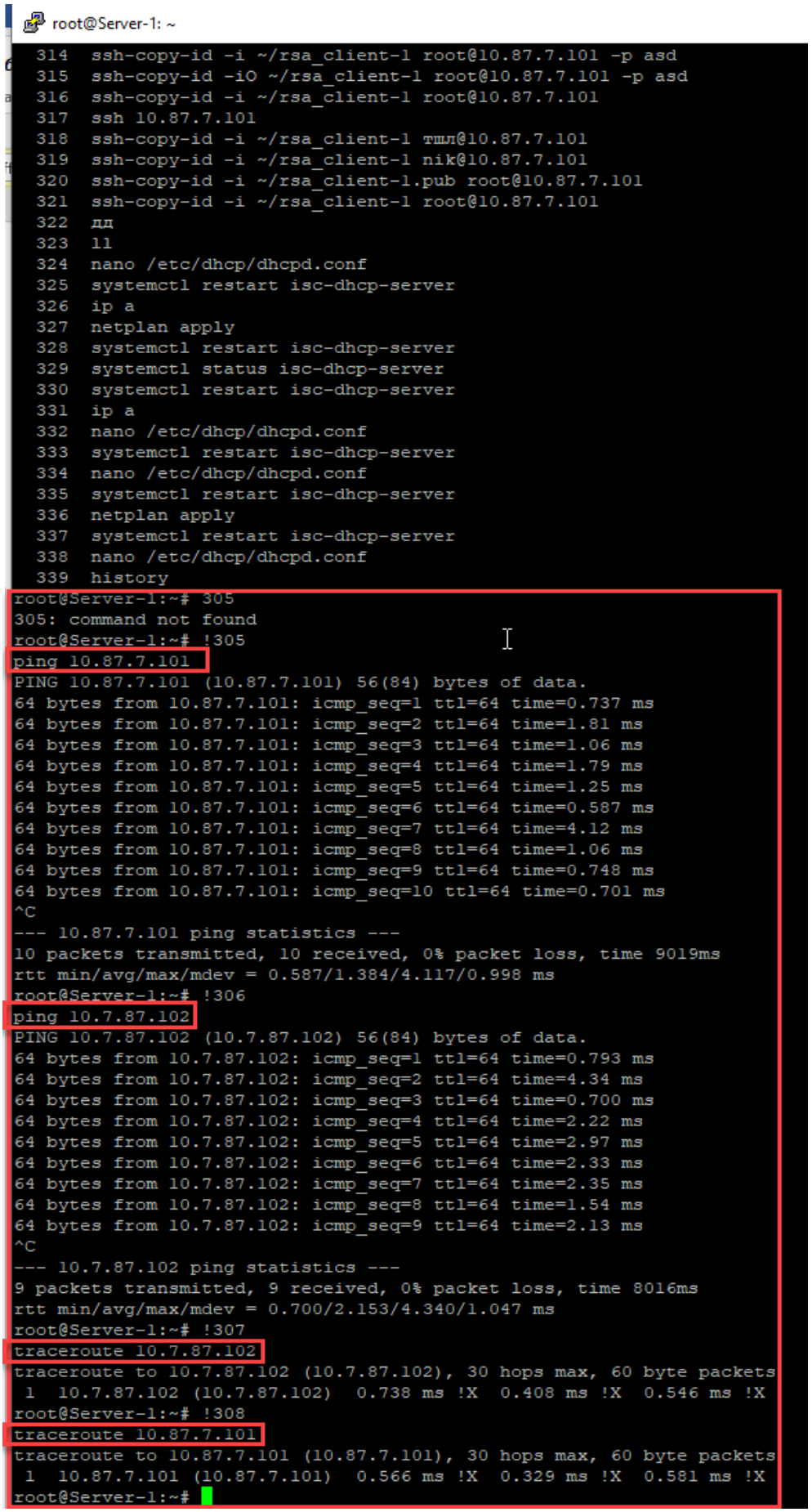
Client-1 Ping to Server-1



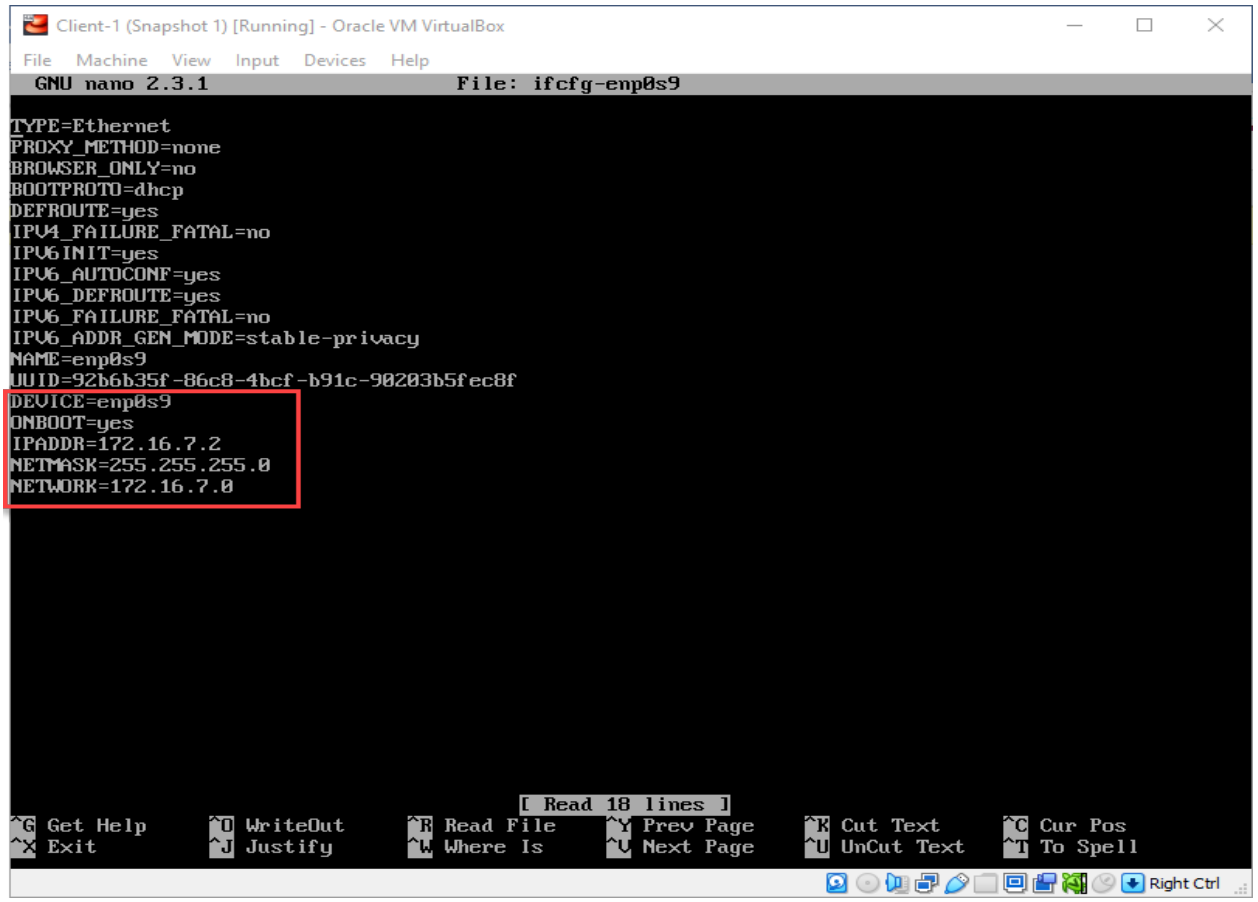
Client-2 Ping to Server-1

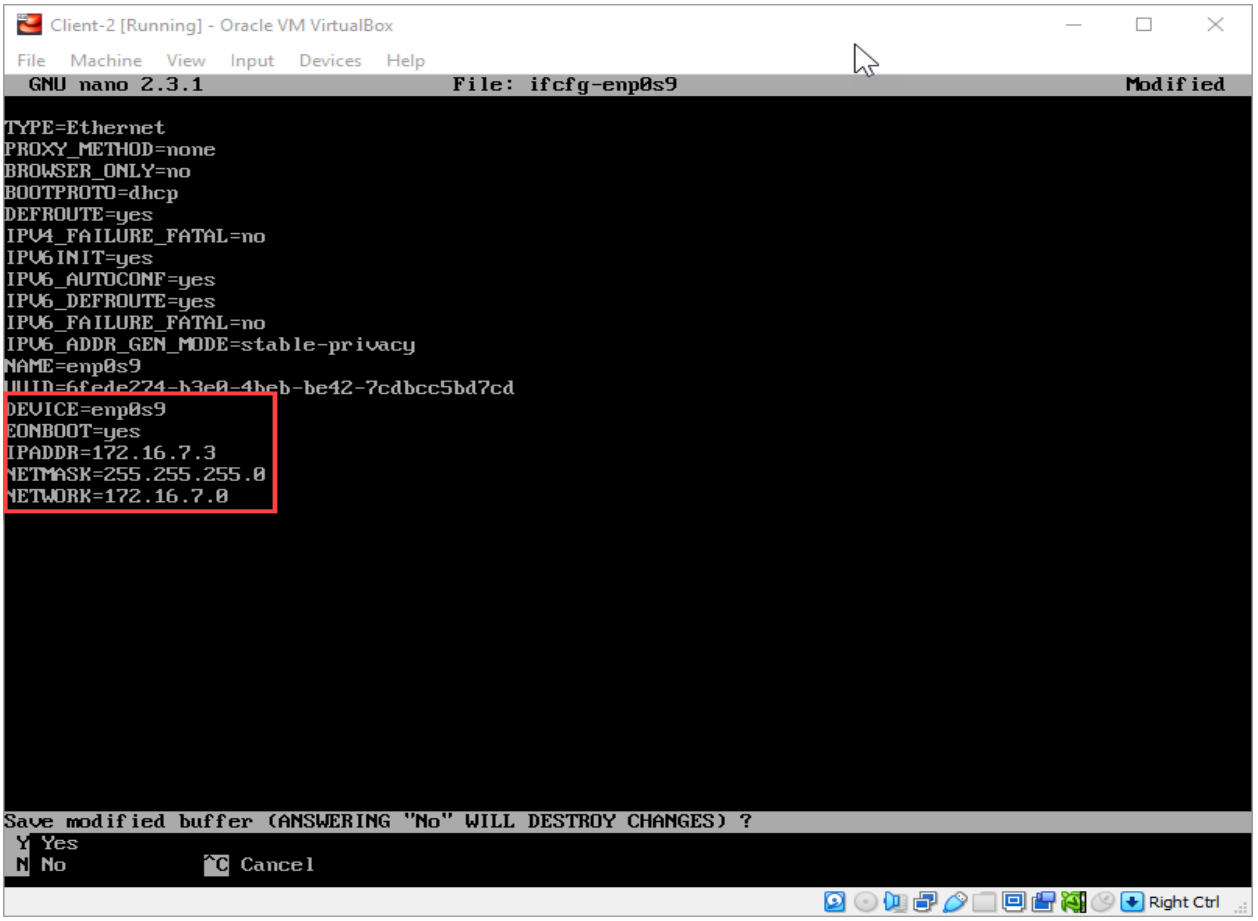


Ping and traceroute to Client-1 and Client-2 from Server-1

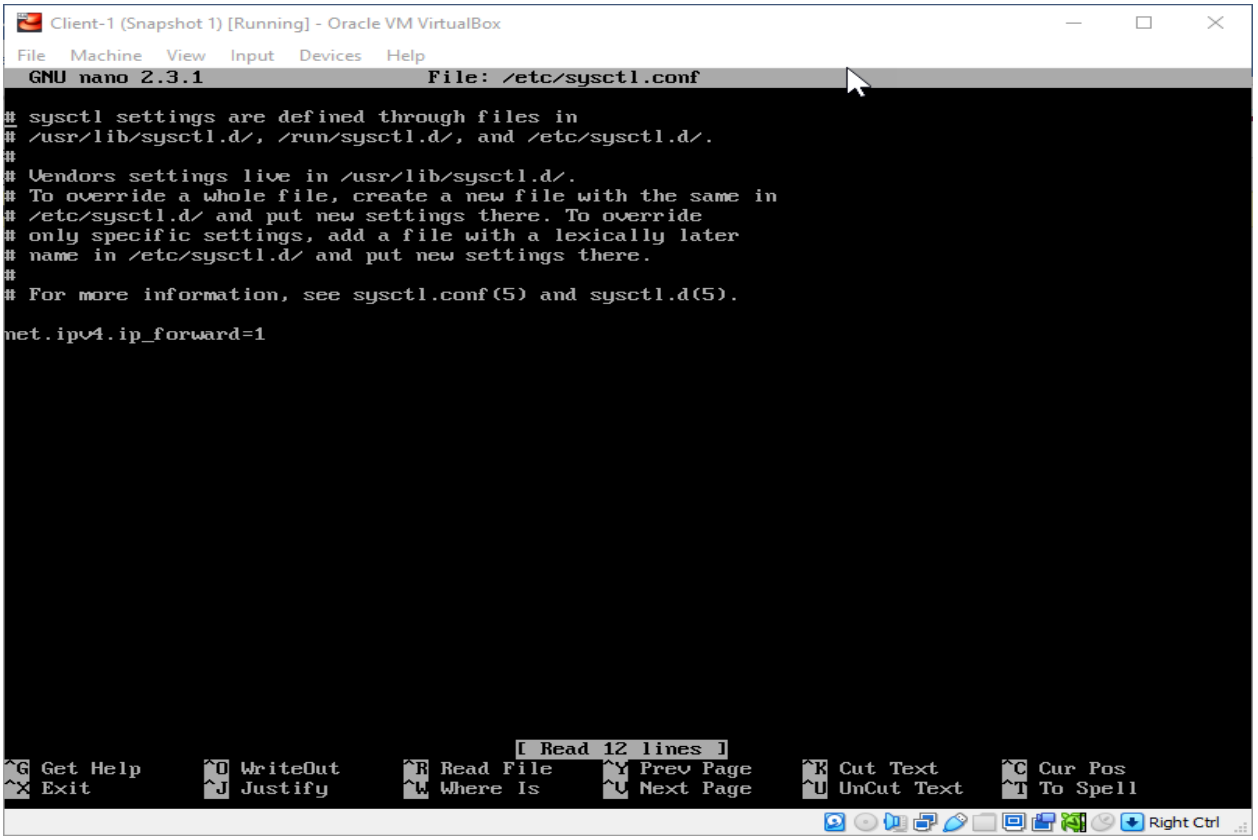

root@Server-1: ~
314 ssh-copy-id -i ~/rsa_client-1 root@10.87.7.101 -p asd
315 ssh-copy-id -iO ~/rsa_client-1 root@10.87.7.101 -p asd
316 ssh-copy-id -i ~/rsa_client-1 root@10.87.7.101
317 ssh 10.87.7.101
318 ssh-copy-id -i ~/rsa_client-1 тшл@10.87.7.101
319 ssh-copy-id -i ~/rsa_client-1 nik@10.87.7.101
320 ssh-copy-id -i ~/rsa_client-1.pub root@10.87.7.101
321 ssh-copy-id -i ~/rsa_client-1 root@10.87.7.101
322 дд
323 ll
324 nano /etc/dhcp/dhcpd.conf
325 systemctl restart isc-dhcp-server
326 ip a
327 netplan apply
328 systemctl restart isc-dhcp-server
329 systemctl status isc-dhcp-server
330 systemctl restart isc-dhcp-server
331 ip a
332 nano /etc/dhcp/dhcpd.conf
333 systemctl restart isc-dhcp-server
334 nano /etc/dhcp/dhcpd.conf
335 systemctl restart isc-dhcp-server
336 netplan apply
337 systemctl restart isc-dhcp-server
338 nano /etc/dhcp/dhcpd.conf
339 history
root@Server-1:~# 305
305: command not found
root@Server-1:~# !305
ping 10.87.7.101
PING 10.87.7.101 (10.87.7.101) 56(84) bytes of data.
64 bytes from 10.87.7.101: icmp_seq=1 ttl=64 time=0.737 ms
64 bytes from 10.87.7.101: icmp_seq=2 ttl=64 time=1.81 ms
64 bytes from 10.87.7.101: icmp_seq=3 ttl=64 time=1.06 ms
64 bytes from 10.87.7.101: icmp_seq=4 ttl=64 time=1.79 ms
64 bytes from 10.87.7.101: icmp_seq=5 ttl=64 time=1.25 ms
64 bytes from 10.87.7.101: icmp_seq=6 ttl=64 time=0.587 ms
64 bytes from 10.87.7.101: icmp_seq=7 ttl=64 time=4.12 ms
64 bytes from 10.87.7.101: icmp_seq=8 ttl=64 time=1.06 ms
64 bytes from 10.87.7.101: icmp_seq=9 ttl=64 time=0.748 ms
64 bytes from 10.87.7.101: icmp_seq=10 ttl=64 time=0.701 ms
^C
--- 10.87.7.101 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9019ms
rtt min/avg/max/mdev = 0.587/1.384/4.117/0.998 ms
root@Server-1:~# !306
ping 10.7.87.102
PING 10.7.87.102 (10.7.87.102) 56(84) bytes of data.
64 bytes from 10.7.87.102: icmp_seq=1 ttl=64 time=0.793 ms
64 bytes from 10.7.87.102: icmp_seq=2 ttl=64 time=4.34 ms
64 bytes from 10.7.87.102: icmp_seq=3 ttl=64 time=0.700 ms
64 bytes from 10.7.87.102: icmp_seq=4 ttl=64 time=2.22 ms
64 bytes from 10.7.87.102: icmp_seq=5 ttl=64 time=2.97 ms
64 bytes from 10.7.87.102: icmp_seq=6 ttl=64 time=2.33 ms
64 bytes from 10.7.87.102: icmp_seq=7 ttl=64 time=2.35 ms
64 bytes from 10.7.87.102: icmp_seq=8 ttl=64 time=1.54 ms
64 bytes from 10.7.87.102: icmp_seq=9 ttl=64 time=2.13 ms
^C
--- 10.7.87.102 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8016ms
rtt min/avg/max/mdev = 0.700/2.153/4.340/1.047 ms
root@Server-1:~# !307
traceroute 10.7.87.102
traceroute to 10.7.87.102 (10.7.87.102), 30 hops max, 60 byte packets
1 10.7.87.102 (10.7.87.102) 0.738 ms !X 0.408 ms !X 0.546 ms !X
root@Server-1:~# !308
traceroute 10.87.7.101
traceroute to 10.87.7.101 (10.87.7.101), 30 hops max, 60 byte packets
1 10.87.7.101 (10.87.7.101) 0.566 ms !X 0.329 ms !X 0.581 ms !X
root@Server-1:~#

Net 4


Client-1 (Snapshot 1) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
GNU nano 2.3.1 File: ifcfg-enp0s9
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=dhcp
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
IPV6_ADDR_GEN_MODE=stable-privacy
NAME=enp0s9
UUID=92b6b35f-86c8-4bcf-b91c-90203b5fec8f
DEVICE=enp0s9
ONBOOT=yes
IPADDR=172.16.7.2
NETMASK=255.255.255.0
NETWORK=172.16.7.0
[Read 18 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
Right Ctrl


Client-2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
GNU nano 2.3.1 File: ifcfg-enp0s9 Modified
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=dhcp
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
IPV6_ADDR_GEN_MODE=stable-privacy
NAME=enp0s9
UUID=6fede224-b3e0-4beb-be42-7cdbcc5bd7cd
DEVICE=enp0s9
ONBOOT=yes
IPADDR=172.16.7.3
NETMASK=255.255.255.0
NETWORK=172.16.7.0
Save modified buffer (ANSWERING "No" WILL DESTROY CHANGES) ?
Y Yes
N No ^C Cancel
Right Ctrl

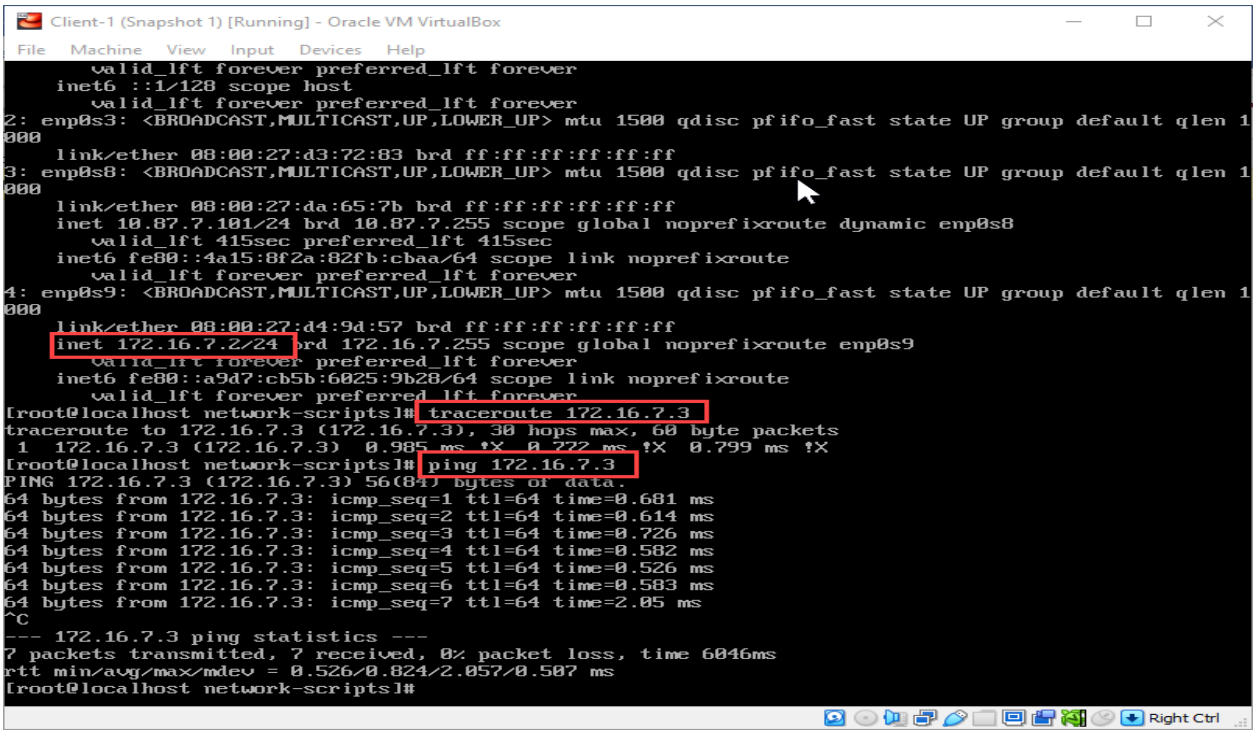
nano /etc/sysctl.conf



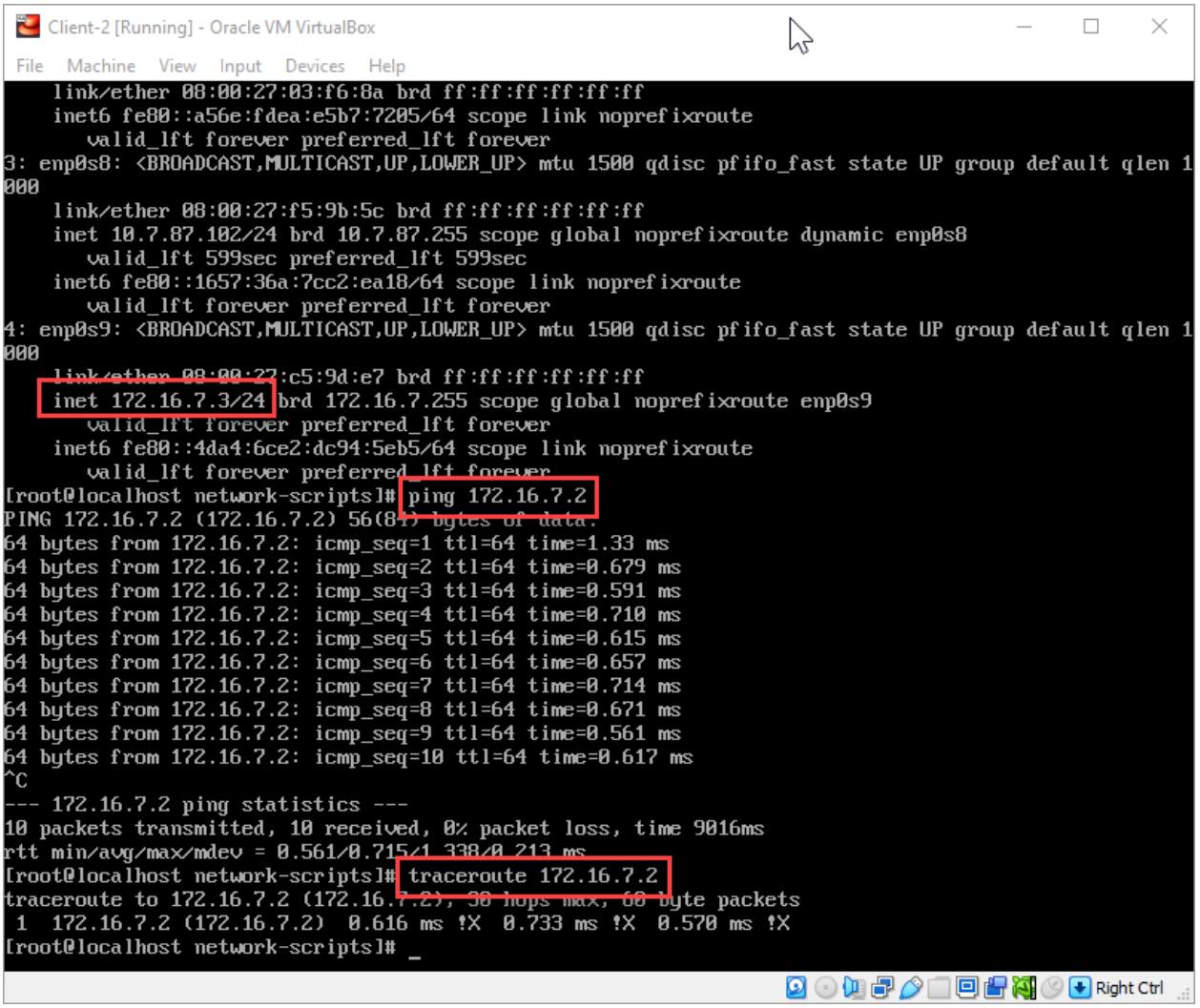
net.ipv4.ip_forward=1

net.ipv6.conf.all.forwarding=1

systemctl restart network



For work connection between two VM you need set forward=1 all VM !!!

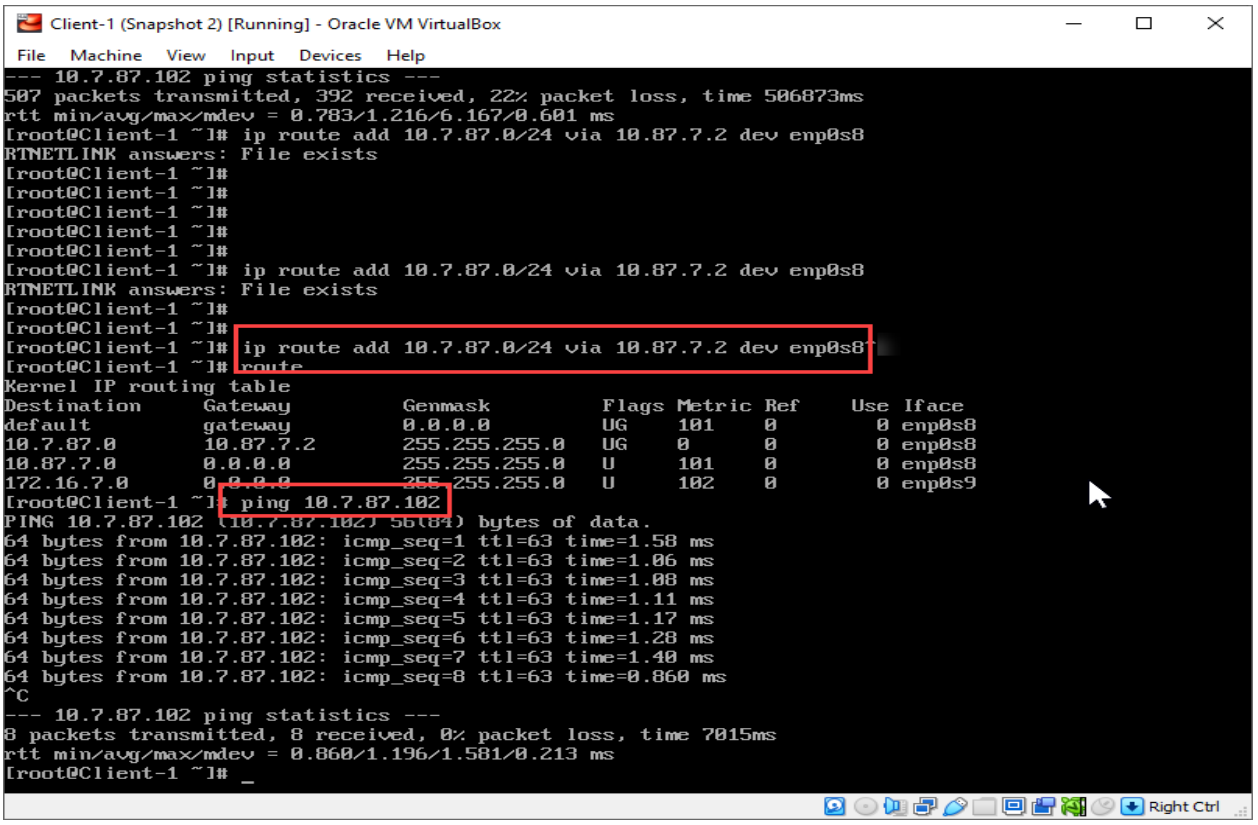


Ping Client-1 Server-1 Client-2

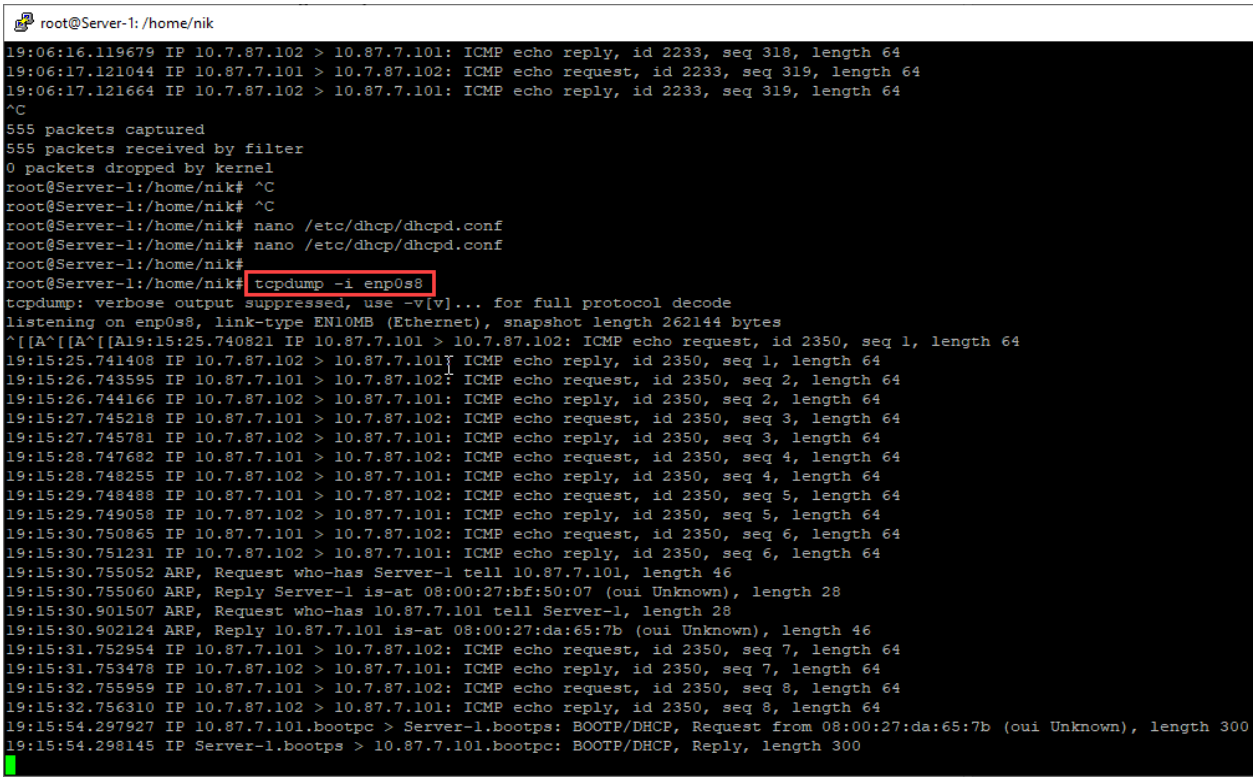
Ip route add 10.7.87.0/24 via 10.87.7.2 dev enp0s8

10.7.87.0/24 – subnet which we want to go

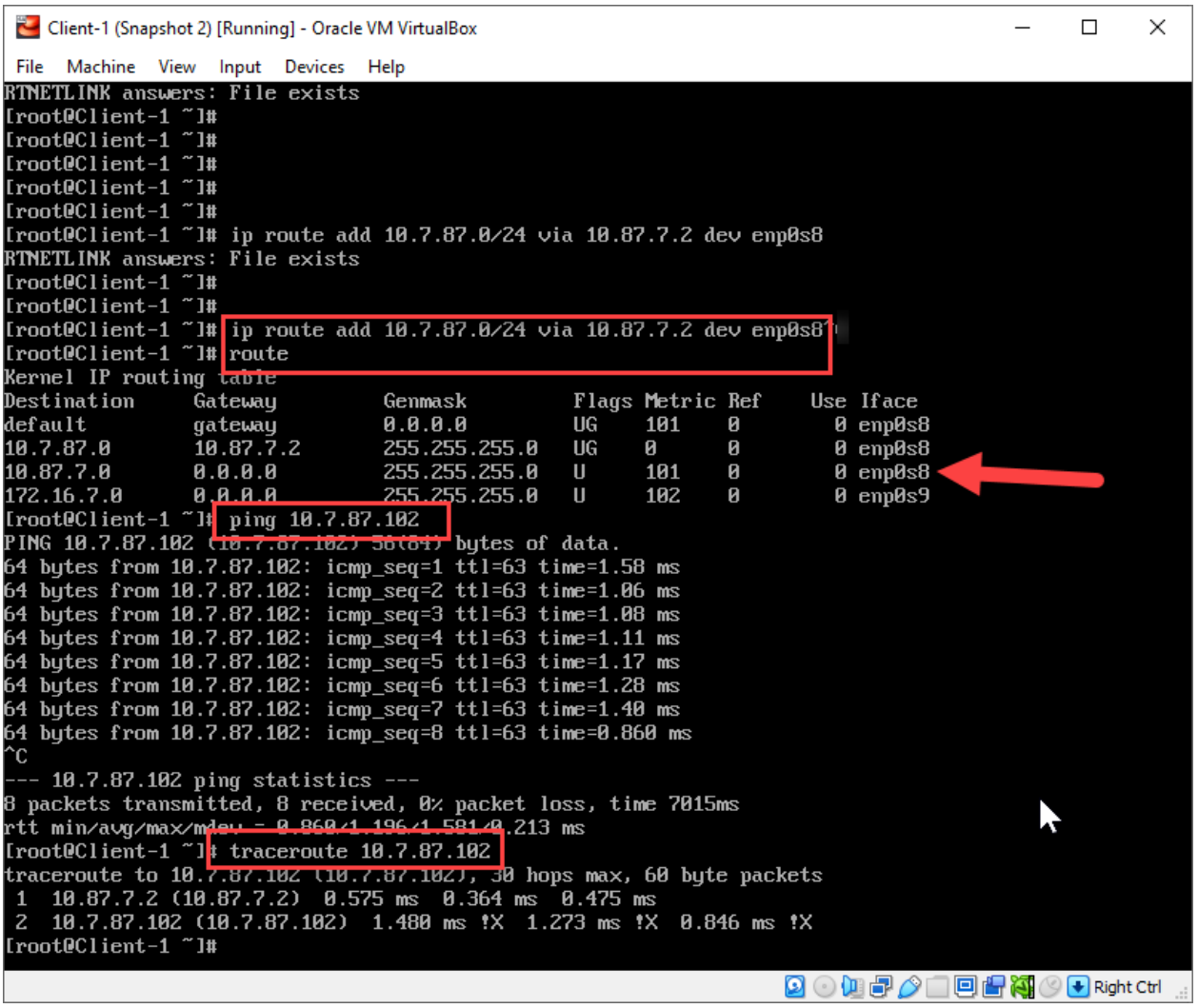
10.87.7.2 – IP addr of interface on Server for Client-1 subnet



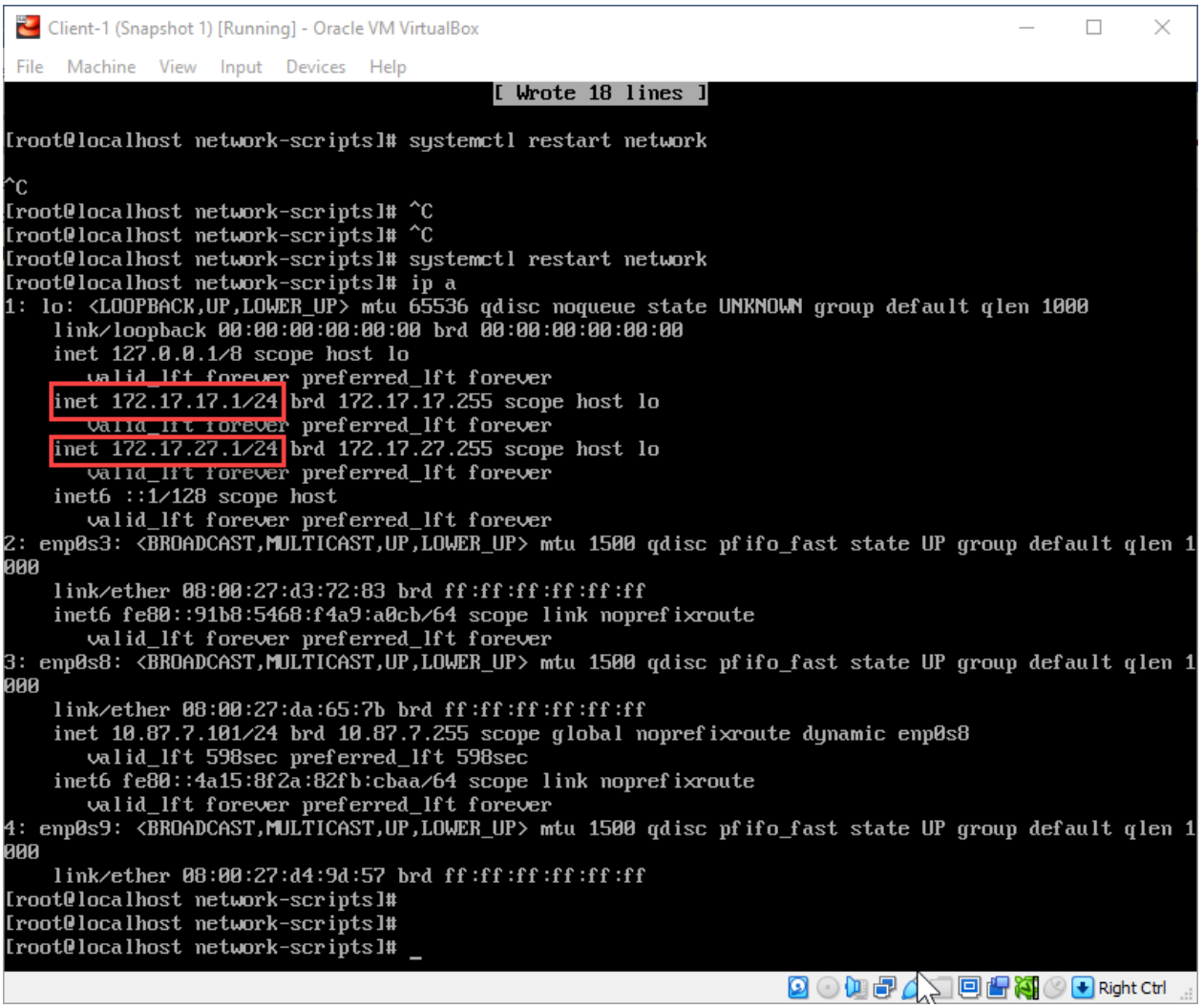
Check receiving tcp packages: tcpdump -i enp0s8



Client-2 Where we want to go



4 На віртуальному інтерфейсу lo Client_1 призначити дві IP адреси за таким правилом: 172.17.D+10.1/24 та 172.17.D+20.1/24.



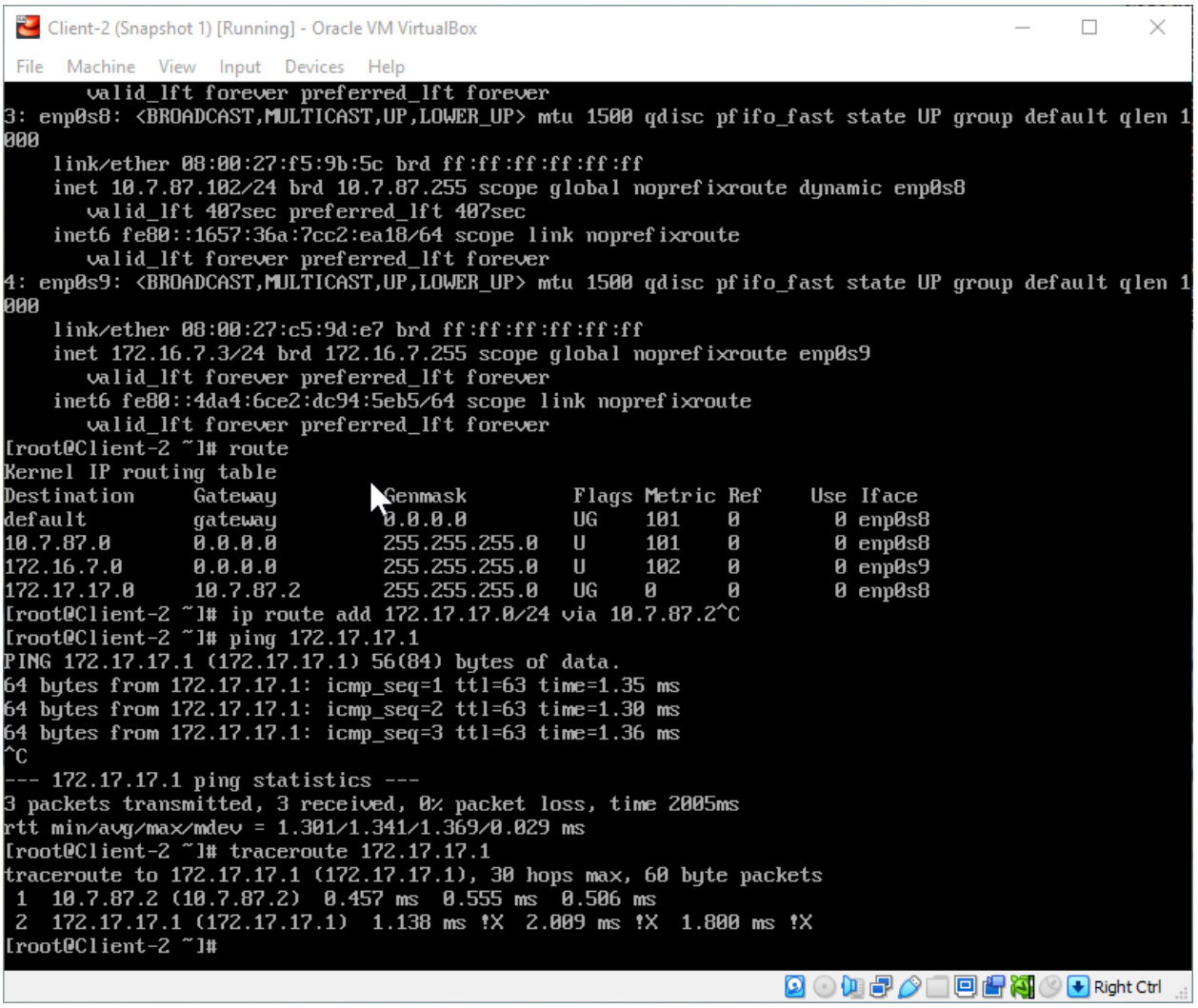
4.1 Налаштувати маршрутизацію таким чином, щоб трафік з Client_2 до 172.17.D+10.1 проходив через Server_1

On client-2:

Ip route add 172.17.17.0/24 via 10.7.87.2

172.17.17.0/24 – subnet on client-1 in interface lo

10.7.87.2 – ip interface for client-2 subnet on server



On Server:

ip route add 172.17.17.0/24 via 10.87.7.101

172.17.17.0/24 – subnet on client-1 in interface lo

10.87.7.101– ip interface – enp0s8 in Client-1

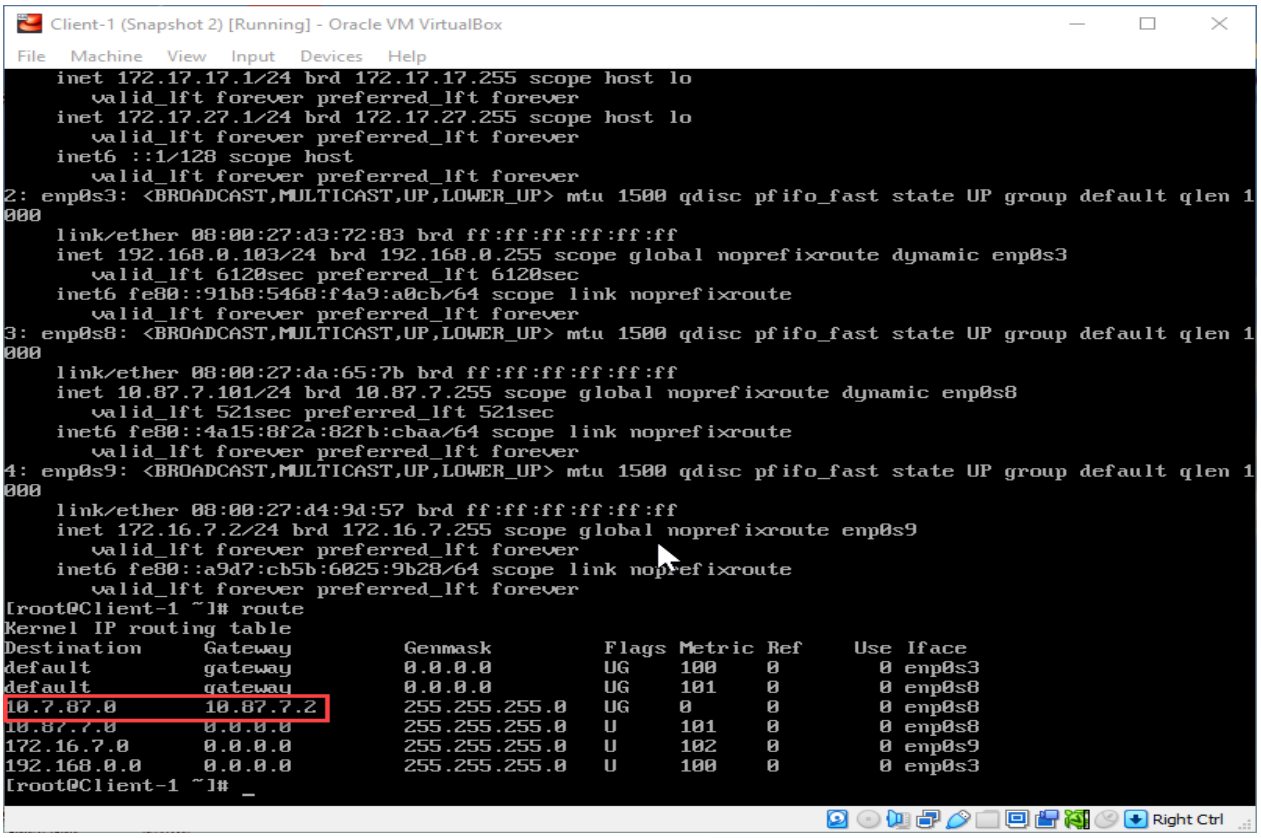
```
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:05:74:86 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.200/24 brd 192.168.0.255 scope global enp0s3
       valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:bf:50:07 brd ff:ff:ff:ff:ff:ff
    inet 10.87.7.2/24 brd 10.87.7.255 scope global enp0s8
       valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:4e:2f:af brd ff:ff:ff:ff:ff:ff
    inet 10.7.87.2/24 brd 10.7.87.255 scope global enp0s9
       valid_lft forever preferred_lft forever
root@Server-1:/home/nik# route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    0      0        0 enp0s3
10.7.87.0       0.0.0.0         255.255.255.0   U     0      0        0 enp0s9
10.87.7.0       0.0.0.0         255.255.255.0   U     0      0        0 enp0s8
172.17.17.0     10.87.7.101     255.255.255.0   UG    0      0        0 enp0s8
192.168.0.0     0.0.0.0         255.255.255.0   U     0      0        0 enp0s3
root@Server-1:/home/nik# ~
```

On Client-1

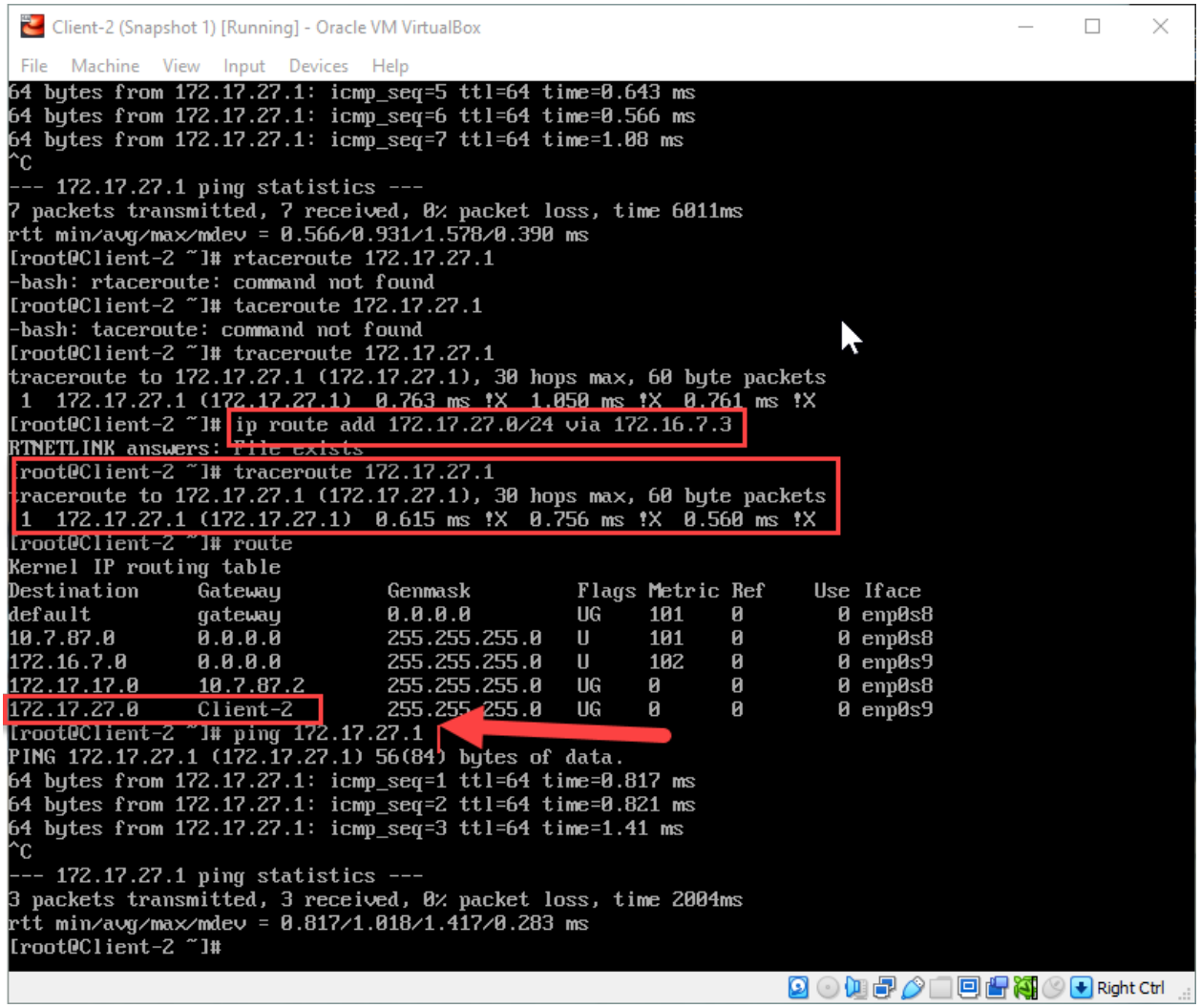
Ip route add 10.7.87.0/24 via 10.87.7.2 dev enp0s8

10.7.87.0/24 – subnet which we want to go

10.87.7.2 – IP addr of interface on Server for Client-1 subnet



4.2 Налаштувати маршрутизацію таким чином, щоб трафік з Client_2 до 172.17.D+10.1 проходив через Net4. Для перевірки використати traceroute.



On client-2:

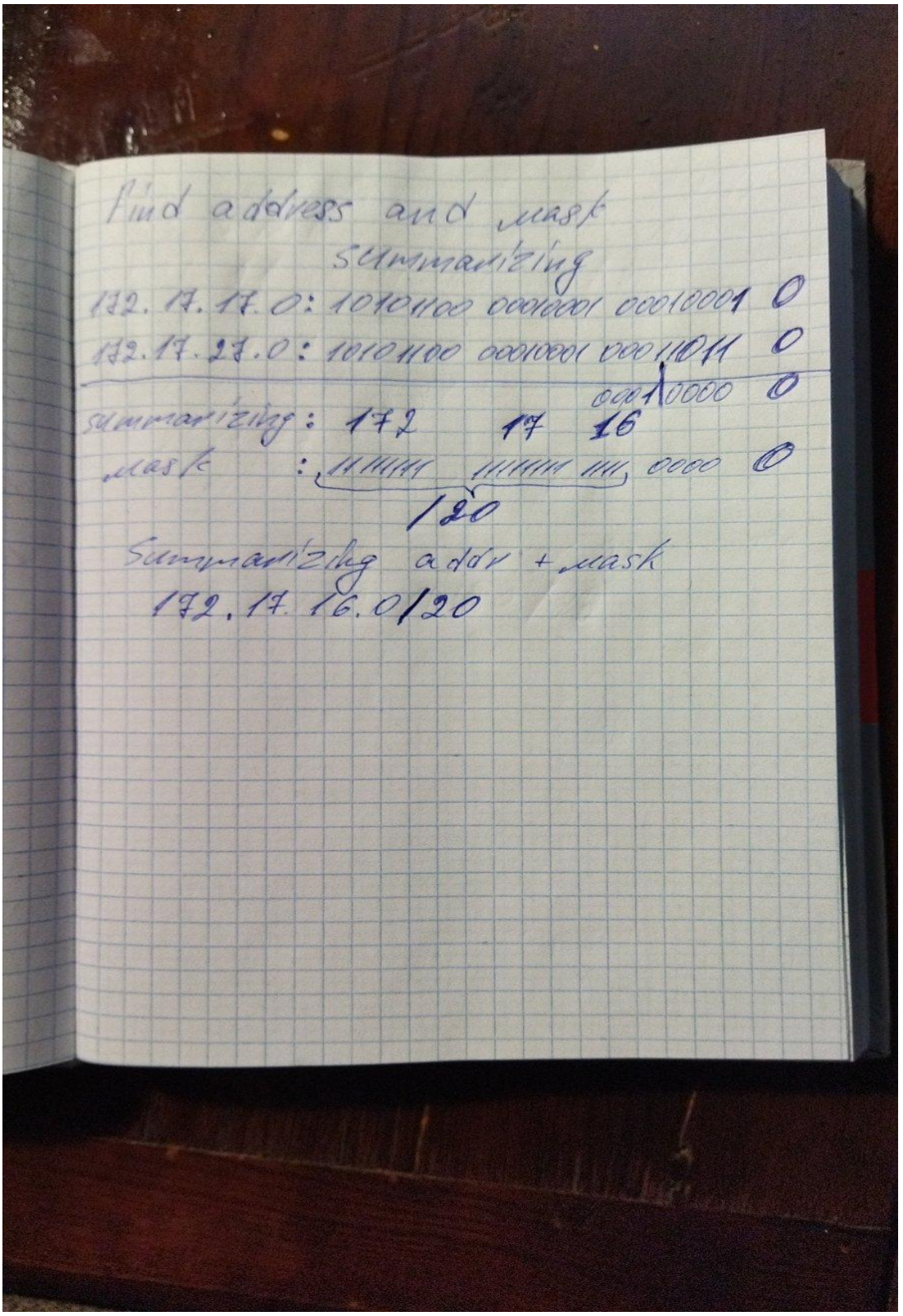
Ip route add 172.17.27.0/24 via 172.16.7.3

172.17.27.0/24 – subnet on client-1 in interface lo

172.16.7.3 – subnet between client-1 and client-2 and interface enp0s9

5. Розрахувати спільну адресу та маску (summarizing) адрес 172.17.D+10.1 та 172.17.D+20.1, при чому префікс має бути максимально можливим. Видалити маршрути, встановлені на попередньому кроці та замінити їх об'єднаним маршрутом, якій має проходити через Server_1.

5.1 Розрахувати спільну адресу та маску (summarizing) адрес 172.17.D+10.1 та 172.17.D+20.1, при чому префікс має бути максимально можливим.



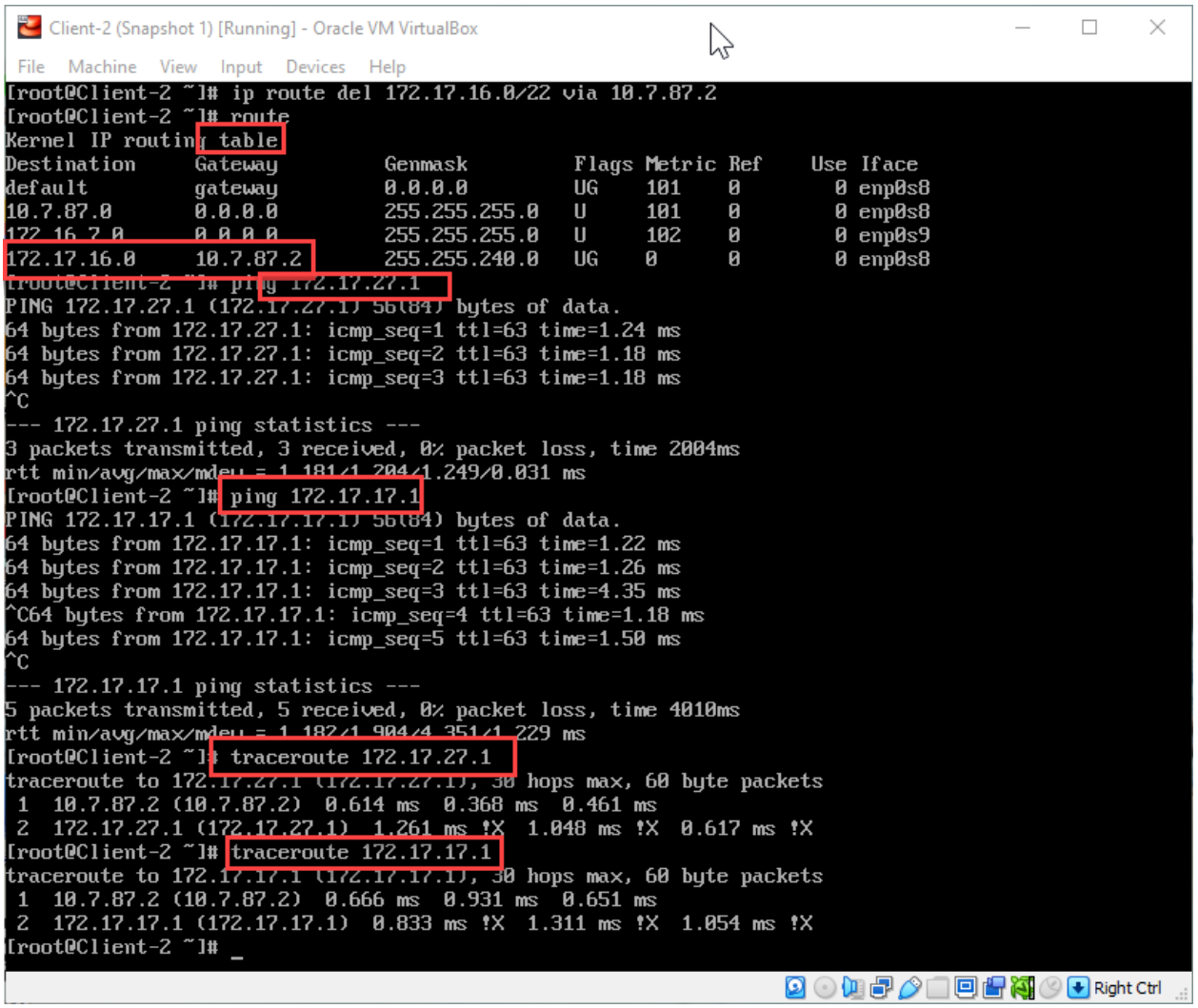
5.2 Видалити маршрути, встановлені на попередньому кроці та замінити їх об’єднаним маршрутом, який має проходити через Server_1.

On client-2:

Ip route add 172.17.16.0/20 via 10.7.87.2

172.17.16.0/20 – summarizing subnet for 172.17.17.0 and 172.17.27.0 on client-1 in interface lo

10.7.87.2 – IP addr of interface on Server for Client-2 subnet



On Server

```
root@Server-1:/home/nik# route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    0      0        0 enp0s3
10.7.87.0       0.0.0.0         255.255.255.0   U     0      0        0 enp0s9
10.87.7.0       0.0.0.0         255.255.255.0   U     0      0        0 enp0s8
172.17.16.0     10.87.7.101     255.255.240.0   UG    0      0        0 enp0s8
192.168.0.0     0.0.0.0         255.255.255.0   U     0      0        0 enp0s3
root@Server-1:/home/nik# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    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: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:05:74:86 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.200/24 brd 192.168.0.255 scope global enp0s3
       valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:bf:50:07 brd ff:ff:ff:ff:ff:ff
    inet 10.87.7.2/24 brd 10.87.7.255 scope global enp0s8
       valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:4e:2f:af brd ff:ff:ff:ff:ff:ff
    inet 10.7.87.2/24 brd 10.7.87.255 scope global enp0s9
       valid_lft forever preferred_lft forever
root@Server-1:/home/nik#
```

ip route add 172.17.16.0/20 via 10.87.7.101

172.17.16.0/20 – summarizing subnet for 172.17.17.0 and 172.17.27.0 on client-1 in interface lo

10.87.7.101– ip interface – enp0s8 in Client-1

On Client-1

```
[root@Client-1 ~]# route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         gateway         0.0.0.0         UG    100    0        0 enp0s3
default         gateway         0.0.0.0         UG    101    0        0 enp0s8
10.7.87.0       10.87.7.2       255.255.255.0   UG    0      0        0 enp0s8
10.87.7.0       0.0.0.0         255.255.255.0   U     101    0        0 enp0s8
172.16.7.0      0.0.0.0         255.255.255.0   U     102    0        0 enp0s9
192.168.0.0     0.0.0.0         255.255.255.0   U     100    0        0 enp0s3
[root@Client-1 ~]#
```

Ip route add 10.7.87.0/24 via 10.87.7.2 dev enp0s8

10.7.87.0/24 – subnet which we want to go

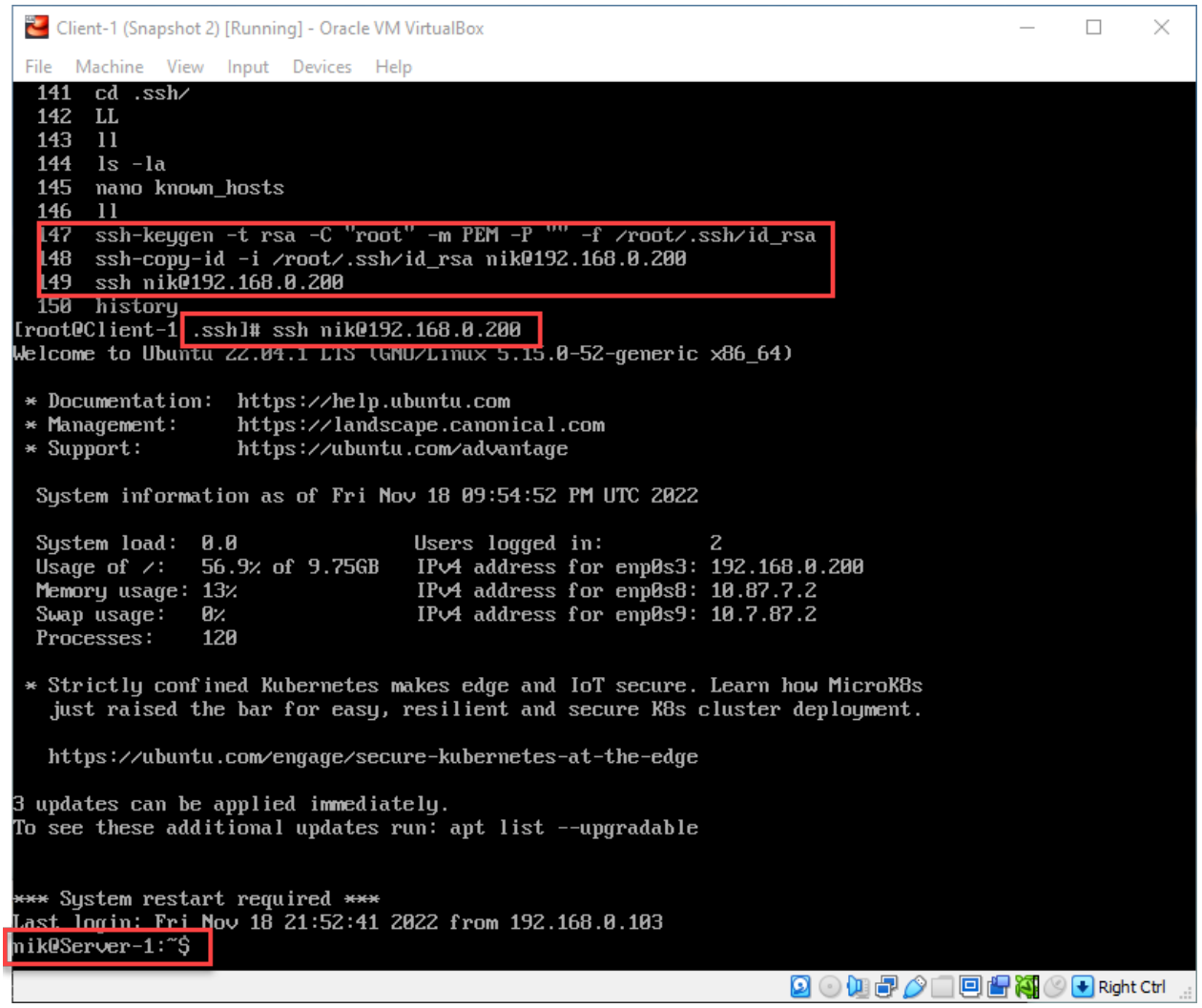
10.87.7.2 – IP addr of interface on Server for Client-1 subnet

6 Налаштувати SSH сервіс таким чином, щоб Client_1 та Client_2 могли підключатись до Server_1 та один до одного.

Ssh connection Client-1 to Server

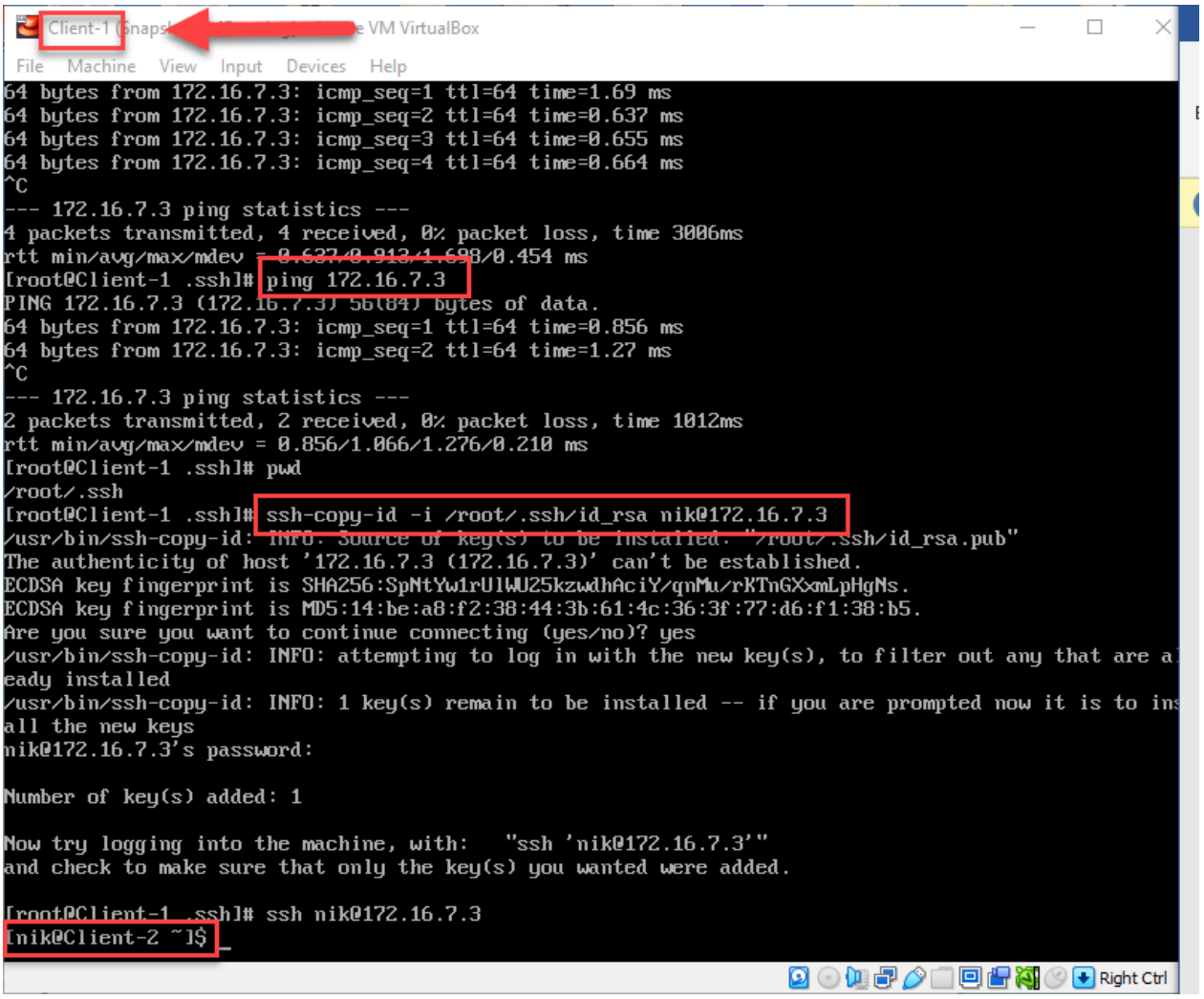
ssh-keygen -t rsa -C "nik" -m PEM -P "" -f /root/.ssh/id_rsa

ssh-copy-id -i /root/.ssh/id_rsa root@192.168.0.200



Ssh connection Client-1 to Client-2

ssh-copy-id -i /root/.ssh/id_rsa root@172.16.7.3



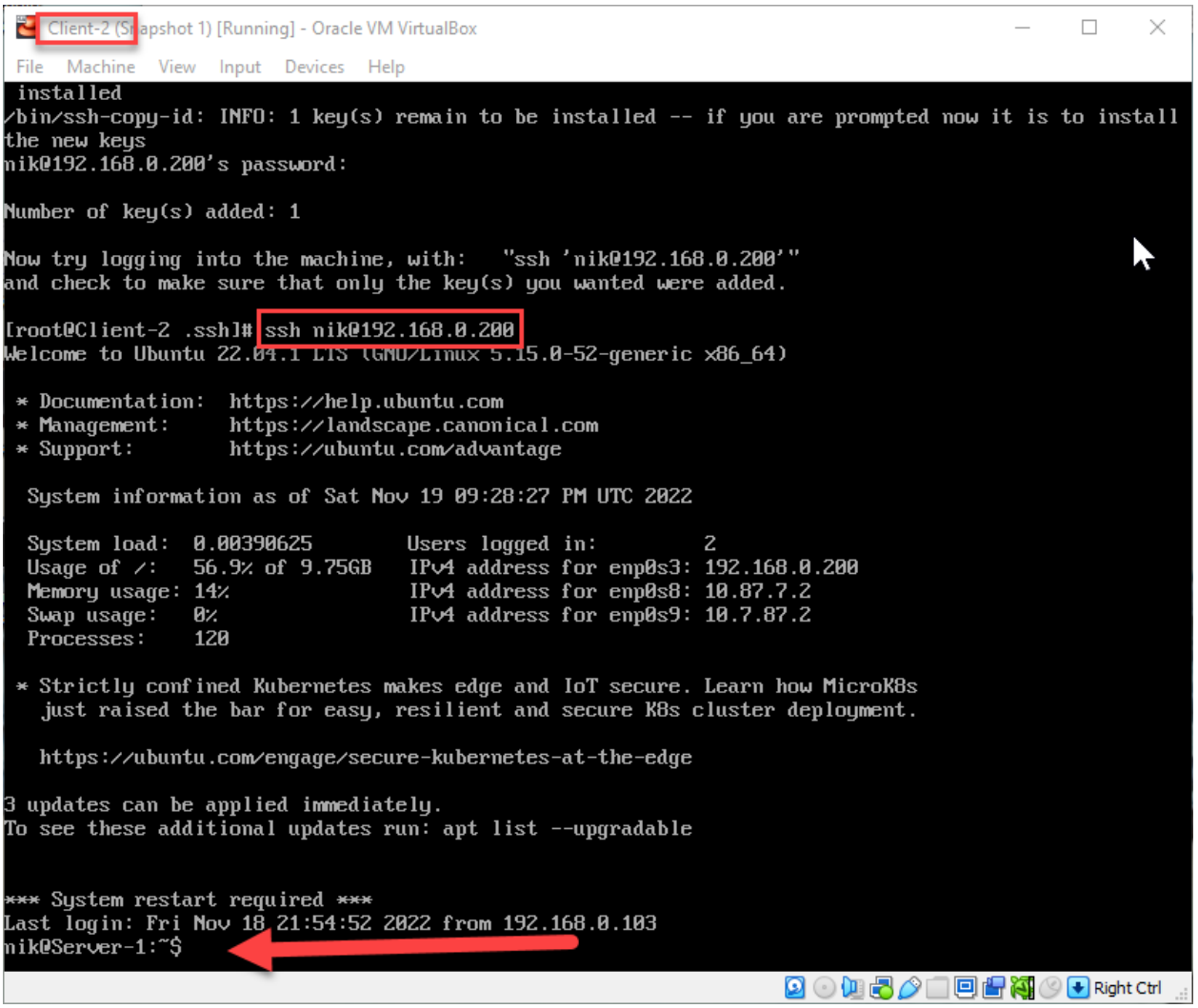
Ssh connection Client-2 to Server

Ip route add 192.168.0.0/24 via 10.7.87.102

Route from subnet of Server to interface IP of Client-2

ssh-keygen -t rsa -C "nik" -m PEM -P "" -f /root/.ssh/id_rsa

ssh-copy-id -i /root/.ssh/id_rsa root@192.168.0.200



7 Налаштуйте на Server_1 iptables

Iptables -L

 # table of input trafic

Chain INPUT (policy ACCEPT)

target prot opt source destination

 # table of passing trafic

Chain FORWARD (policy ACCEPT)

target prot opt source destination

 # frafic that create uor Server

Chain OUTPUT (policy ACCEPT)

target prot opt source destination

ACCEPT – allow

DROP – refuse

ADD RULES. RULES ADD in chain order !!!!

 # Allow all connections that were before

iptables -A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT

 # Allow ssh access to 22 port

Iptables -A INPUT -p tcp –dport ssh -j ACCEPT

 # Refuse ALL traffic

Iptables -A INPUT -j DROP

 # If we forget to add some rule! Add icmp in chain before ssh rule!

Iptables -I INPUT 2 -p icmp -j ACCEPT

 # Delete or Drop rules

Iptables -D INPUT 2

Iptables -D INPUT -p icmp -j ACCEPT

7.1 Дозволено підключатись через SSH з Client_1 та заборонено з Client_2

```
root@Server-1:/home/nik# iptables -I INPUT 2 -p tcp --dport 22 -s 10.87.7.0/24 -j ACCEPT
root@Server-1:/home/nik# iptables -L
Chain INPUT (policy ACCEPT)
target     prot opt source               destination
ACCEPT     all  --  anywhere             anywhere             state RELATED,ESTABLISHED
ACCEPT     tcp  --  10.87.7.0/24         anywhere             tcp dpt:ssh
DROP       all  --  anywhere             anywhere

Chain FORWARD (policy ACCEPT)
target     prot opt source               destination

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination
root@Server-1:/home/nik#
```

7.2 З Client_2 на 172.17.D+10.1 ping проходив, а на 172.17.D+20.1 не проходив

```
Server-1 (Snapshot 4) [Running] - Oracle VM VirtualBox
File  Machine  View  Input  Devices  Help
DROP       all  --  anywhere             anywhere

Chain FORWARD (policy ACCEPT)
target     prot opt source               destination
ACCEPT     all  --  anywhere             anywhere             state RELATED,ESTABLISHED
ACCEPT     tcp  --  anywhere             anywhere             tcp dpt:ssh
ACCEPT     icmp --  172.17.17.0/24       anywhere
ACCEPT     icmp --  10.87.7.0/24         anywhere
ACCEPT     icmp --  10.7.87.0/24         anywhere
DROP       icmp --  172.17.27.1          anywhere
DROP       all  --  anywhere             anywhere

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination
DROP       all  --  anywhere             anywhere
root@Server-1:~# nano /etc/netplan//00-installer-config.yaml ^C
root@Server-1:~# ^C
root@Server-1:~# ^C
root@Server-1:~# route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         192.168.0.1     0.0.0.0         UG    0      0        0 enp0s3
10.7.87.0       0.0.0.0         255.255.255.0   U     0      0        0 enp0s9
10.87.7.0       0.0.0.0         255.255.255.0   U     0      0        0 enp0s8
172.17.17.0     10.87.7.101     255.255.255.0   UG    0      0        0 enp0s8
172.17.27.0     10.87.7.101     255.255.255.0   UG    0      0        0 enp0s8
192.168.0.0     0.0.0.0         255.255.255.0   U     0      0        0 enp0s3
root@Server-1:~# ip route del 172.17.27.0/24 via 10.87.7.101
root@Server-1:~# route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         192.168.0.1     0.0.0.0         UG    0      0        0 enp0s3
10.7.87.0       0.0.0.0         255.255.255.0   U     0      0        0 enp0s9
10.87.7.0       0.0.0.0         255.255.255.0   U     0      0        0 enp0s8
172.17.17.0     10.87.7.101     255.255.255.0   UG    0      0        0 enp0s8
192.168.0.0     0.0.0.0         255.255.255.0   U     0      0        0 enp0s3
root@Server-1:~#
Right Ctrl
```

Any rules in iptables can’t halp!

Only separate routes on two subnets:

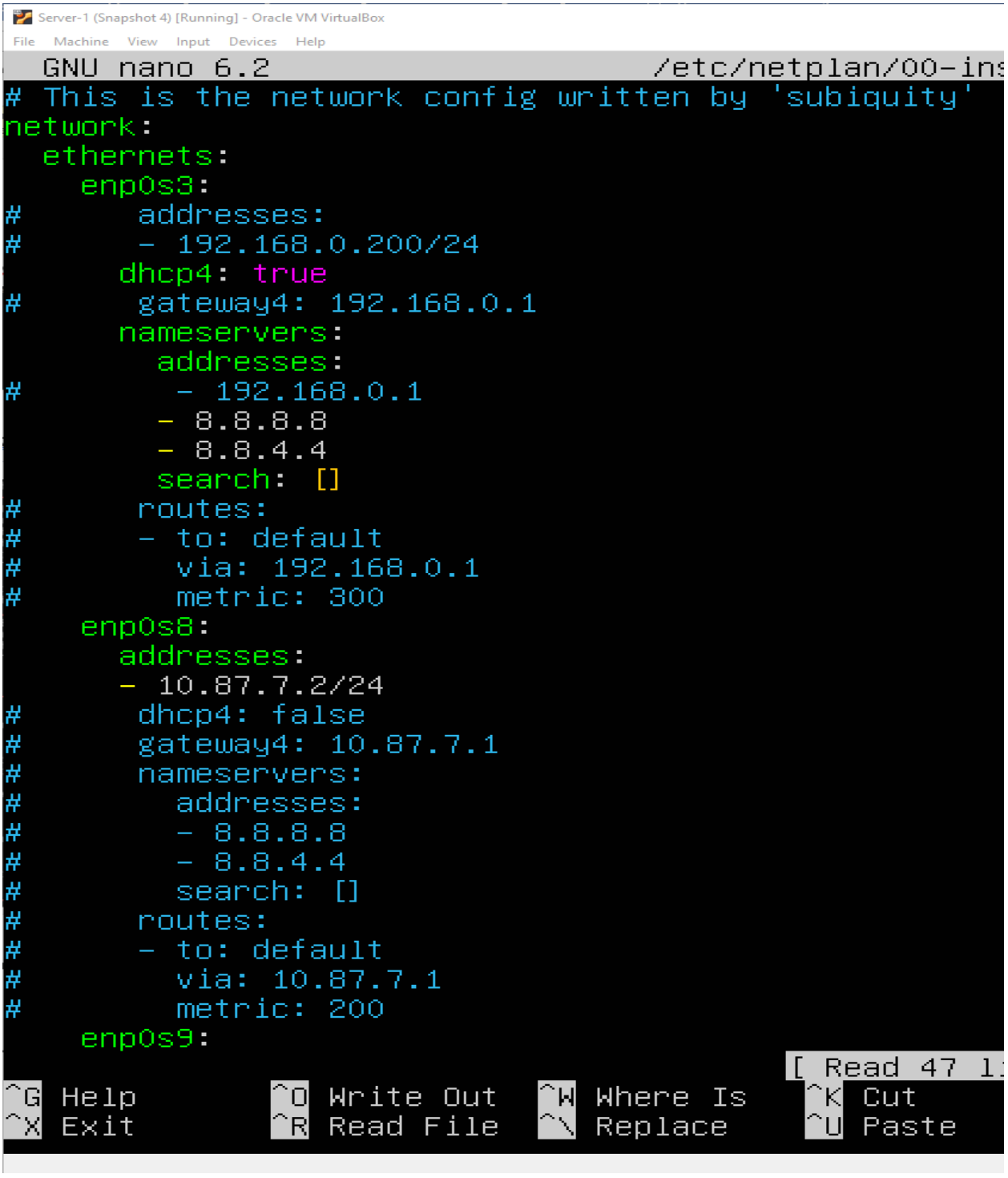
172.17.17.0/24

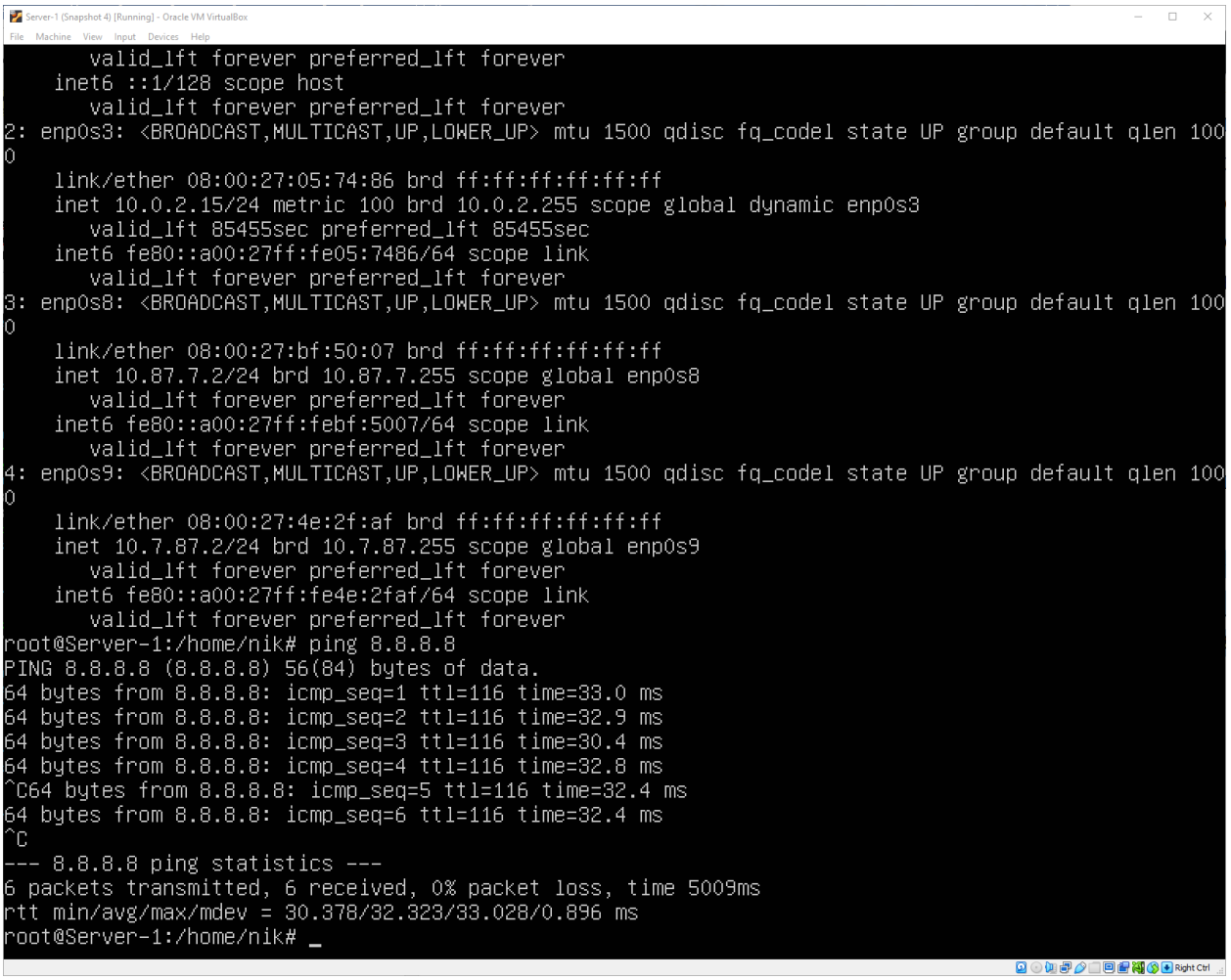
172.17.27.0/24

And then delete forward route to second one!

NAT

8 Якщо в п.3 була налаштована маршрутизація для доступу Client_1 та Client_2 до мережі Інтернет – видалити відповідні записи. На Server_1 налаштувати NAT сервіс таким чином, щоб з Client_1 та Client_2 проходив ping в мережу Інтернет





Iptables -t nat -L

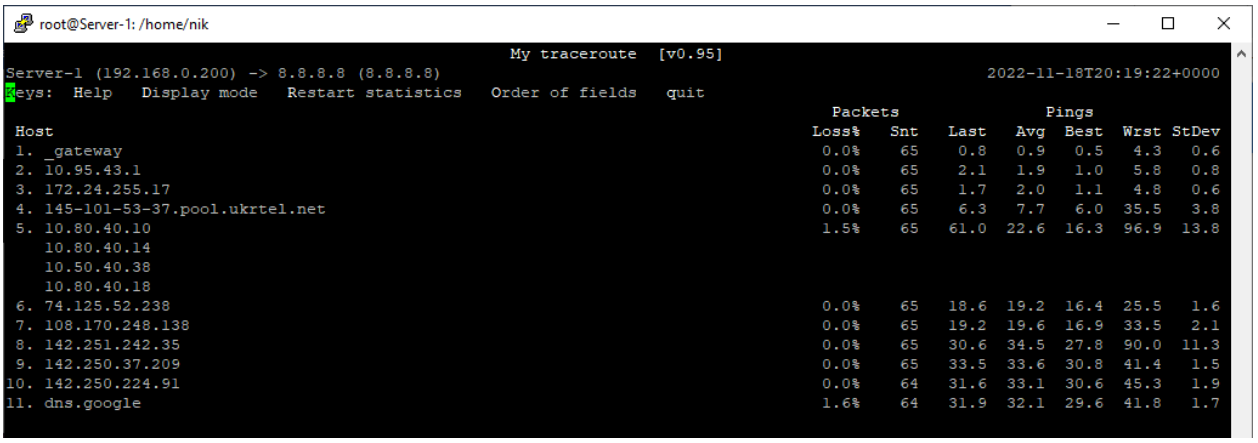
Iptables -t nat -A POSTROUTING -s 10.0.0.0/16 -j SNAT –to-source 10.0.2.15

To add a permanent route in Ubuntu use Netplan.

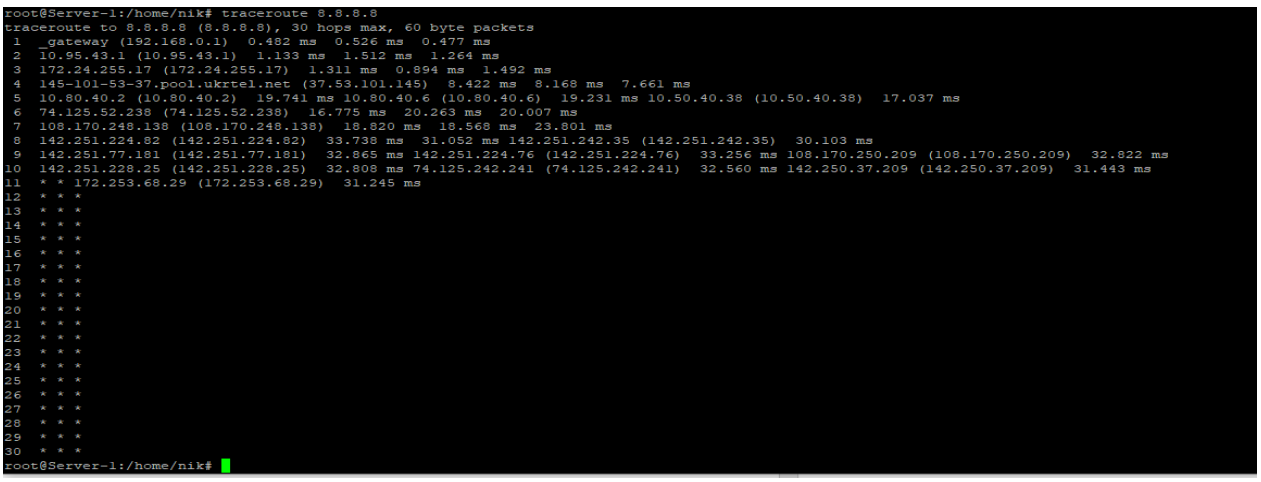
```
network:
  version: 2
  renderer: NetworkManager
  ethernets:
    enp0s3:
#     addresses: [10.0.4.2/24]
      dhcp4: true
#     routes:
#       - to: 10.0.3.0/24
#         via: 10.0.5.2
#         metric: 50
    enp0s8:
      addresses: [10.0.5.1/24]
      routes:
        - to: 10.0.3.0/24
          via: 10.0.5.2
          metric: 50
```

Troubleshooting or find out of problems

Apt install -y mtr



Traceroute



- **Не разрешает себя проверять сеть или подсеть (не возвращает некрологи)**

Ping – Network layer

```
root@Server-1:/home/nik# 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=117 time=33.0 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=117 time=32.7 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=117 time=32.9 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=117 time=33.4 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=117 time=32.7 ms
^C
--- 8.8.8.8 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4007ms
rtt min/avg/max/mdev = 32.671/32.942/33.402/0.267 ms
root@Server-1:/home/nik#
```

Netstat -at -n show tcp

```
root@Server-1:/home/nik# netstat -at -n
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 127.0.0.53:53           0.0.0.0:*               LISTEN
tcp        0      0 0.0.0.0:22              0.0.0.0:*               LISTEN
tcp        0      0 192.168.0.200:22        192.168.0.105:65408     ESTABLISHED
tcp        0     64 192.168.0.200:22        192.168.0.105:65409     ESTABLISHED
tcp6       0      0 :::22                   :::*                    LISTEN
root@Server-1:/home/nik#
```

Port 22 – SSH

Port 53 – DNS

Netstat -au -n show udp

```
root@Server-1:/home/nik# netstat -au -n
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
udp        0      0 127.0.0.53:53           0.0.0.0:*
udp        0      0 0.0.0.0:67              0.0.0.0:*
root@Server-1:/home/nik#
```

Port 67 - DHCP

Nslookup

```
root@Server-1:/home/nik# nslookup 8.8.8.8
8.8.8.8.in-addr.arpa    name = dns.google.

Authoritative answers can be found from:

root@Server-1:/home/nik# nslookup google.com
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
Name:   google.com
Address: 142.250.186.206
Name:   google.com
Address: 2a00:1450:401b:800::200e

root@Server-1:/home/nik#
```

Dig

```
root@Server-1:/home/nik# dig google.com

; <<>> DiG 9.18.1-1ubuntu1.2-Ubuntu <<>> google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 62413
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;google.com.                    IN      A

;; ANSWER SECTION:
google.com.             151     IN      A       142.250.186.206

;; Query time: 0 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Fri Nov 18 20:52:55 UTC 2022
;; MSG SIZE  rcvd: 55

root@Server-1:/home/nik#
```

Arp

Для внутренних сетей. Просмотреть соответствие между IP и MAC адресами!

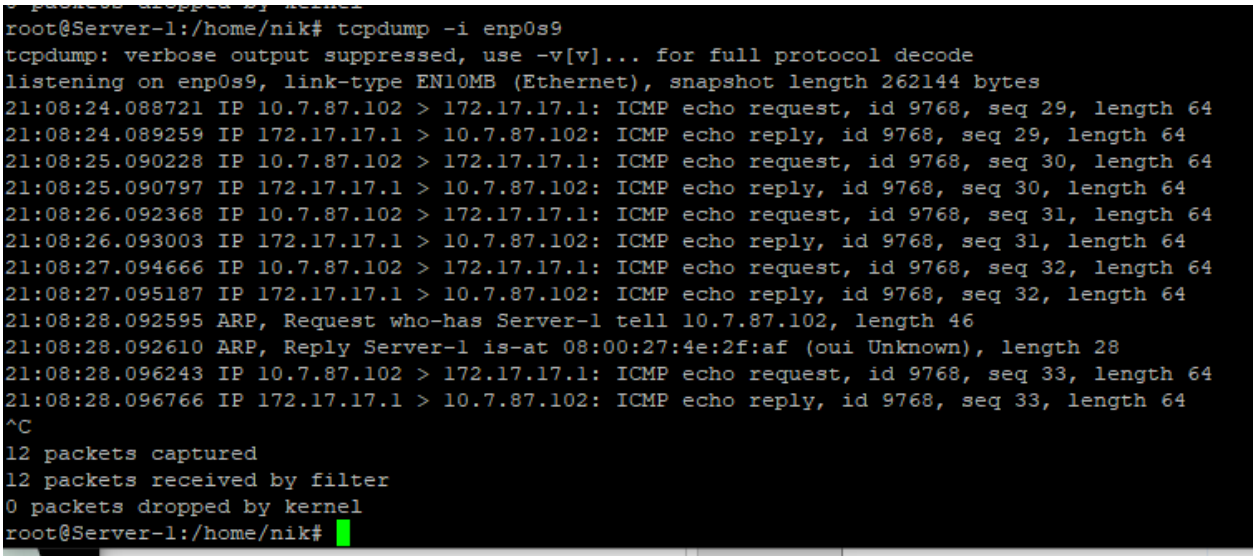
```
root@Server-1:/home/nik# arp -a
? (172.17.17.1) at 08:00:27:da:65:7b [ether] on enp0s8
? (10.7.87.102) at 08:00:27:f5:9b:5c [ether] on enp0s9
? (192.168.0.105) at d4:5d:64:b2:b8:f5 [ether] on enp0s3
? (192.168.0.104) at b0:be:76:bf:c2:85 [ether] on enp0s3
? (10.87.7.1) at <incomplete> on enp0s8
? (10.87.7.101) at 08:00:27:da:65:7b [ether] on enp0s8
_gateway (192.168.0.1) at b0:be:76:bf:c2:84 [ether] on enp0s3
root@Server-1:/home/nik#
```

Nmap

```
root@Server-1:/home/nik# nmap 8.8.8.8
Starting Nmap 7.80 ( https://nmap.org ) at 2022-11-18 21:03 UTC
Nmap scan report for dns.google (8.8.8.8)
Host is up (0.031s latency).
Not shown: 998 filtered ports
PORT    STATE SERVICE
53/tcp  open  domain
443/tcp open  https

Nmap done: 1 IP address (1 host up) scanned in 4.21 seconds
root@Server-1:/home/nik#
```

Tcpdump – менеджер пакетов внутренней сети



net.ipv4.ip_forward=1

cd /etc/sysconfig/network-scripts

systemctl restart network

lshw -class network

sudo nano /etc/dhcp/dhcpd.conf

sudo systemctl restart NetworkManager.service

sudo systemctl status NetworkManager.service

nano /etc/netplan/00-installer-config.yaml

netplan apply

sudo netplan --debug apply

systemctl restart isc-dhcp-server

systemctl status isc-dhcp-server

--- route

ip route show

root@Server-1:/home/nik# route

Kernel IP routing table

Destination Gateway Genmask Flags Metric Ref Use Iface

default _gateway 0.0.0.0 UG 0 0 0 enp0s3

10.7.87.0 0.0.0.0 255.255.255.0 U 0 0 0 enp0s9

10.87.7.0 0.0.0.0 255.255.255.0 U 0 0 0 enp0s8

192.168.0.0 0.0.0.0 255.255.255.0 U 0 0 0 enp0s3

--- transit route on server MUST BE ENABLED !!!!!!!!!!!!

nano /proc/sys/net/ipv4/ip_forward

1

Work immediately

nano /etc/sysctl.conf

net.ipv4.ip_forward=1

net.ipv6.conf.all.forwarding=1

work after reboot

traceroute 8.8.8.8

tcpdump -i enp0s8

iptables -L

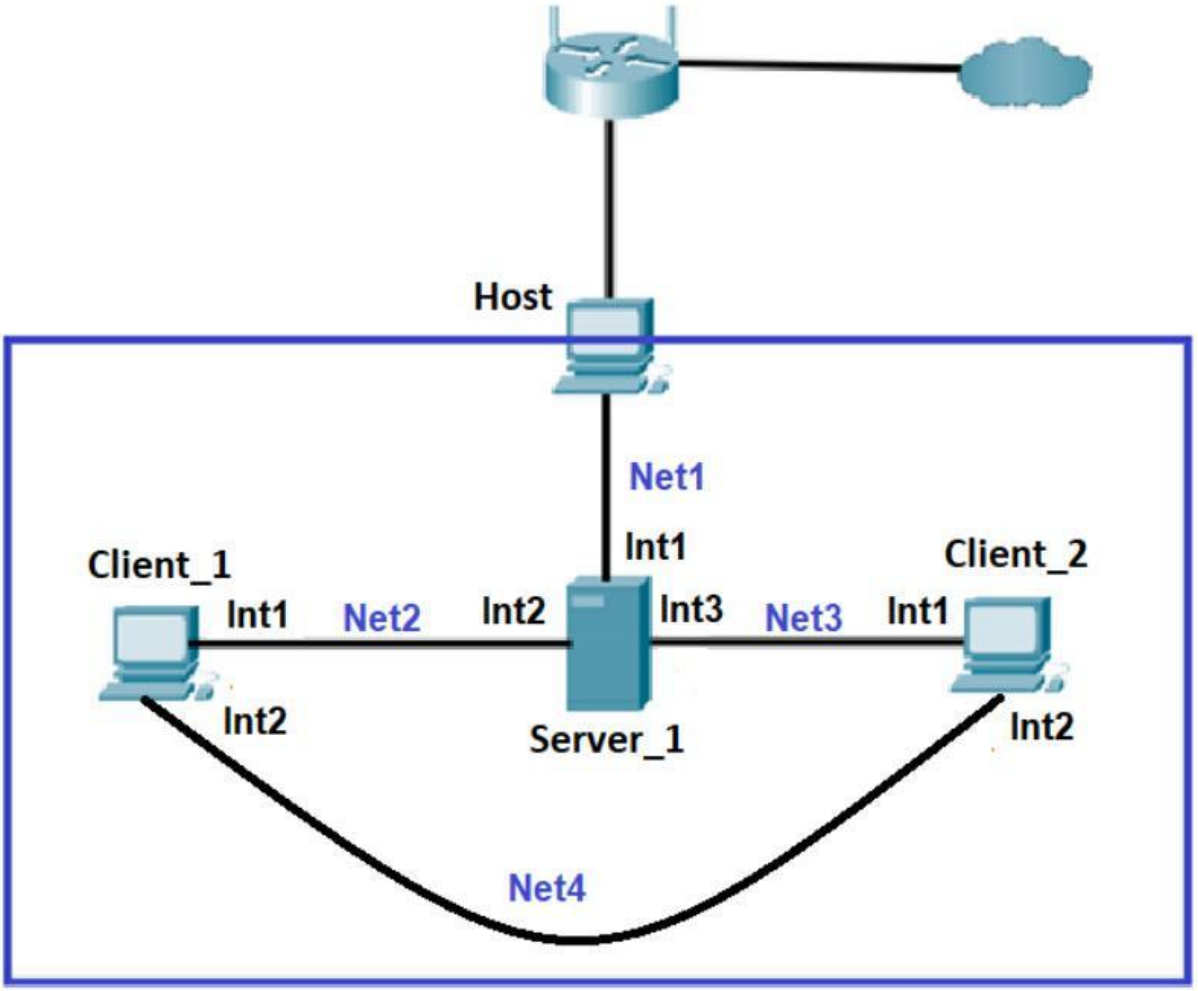


Рисунок 1