EPAM University Programs DevOps external course

Module – Linux Networking

Практична частина модуля Linux Networking передбачає створення засобами Virtual Box мережі, що показаний на рисунку 1

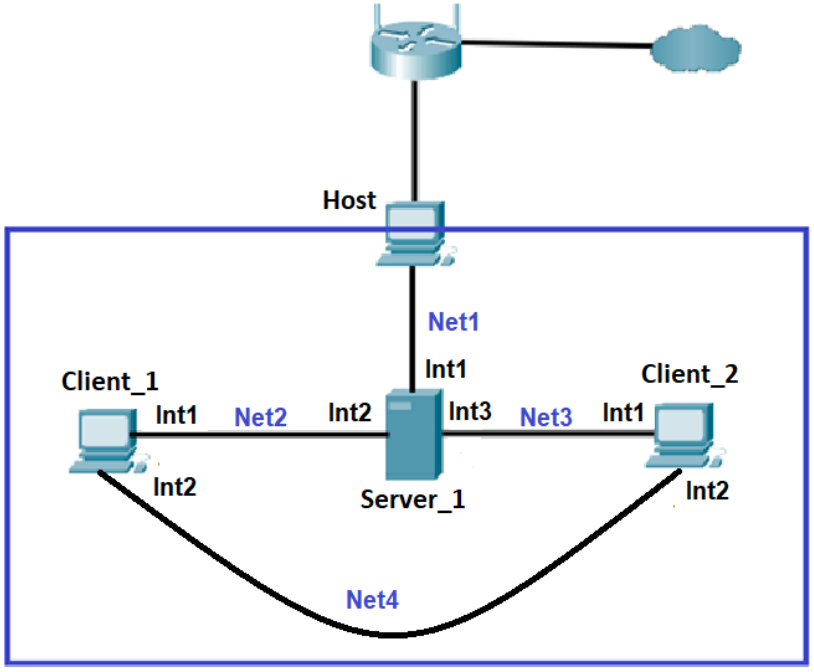
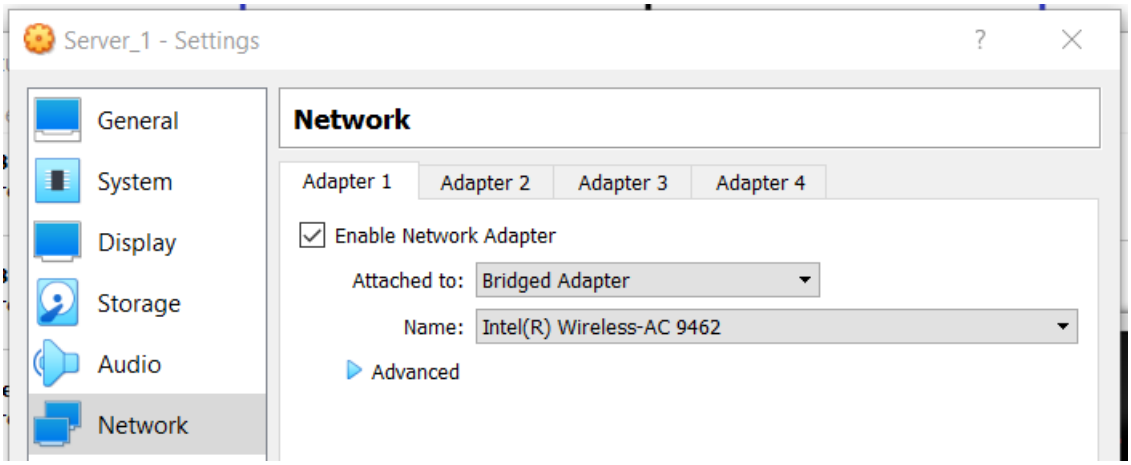
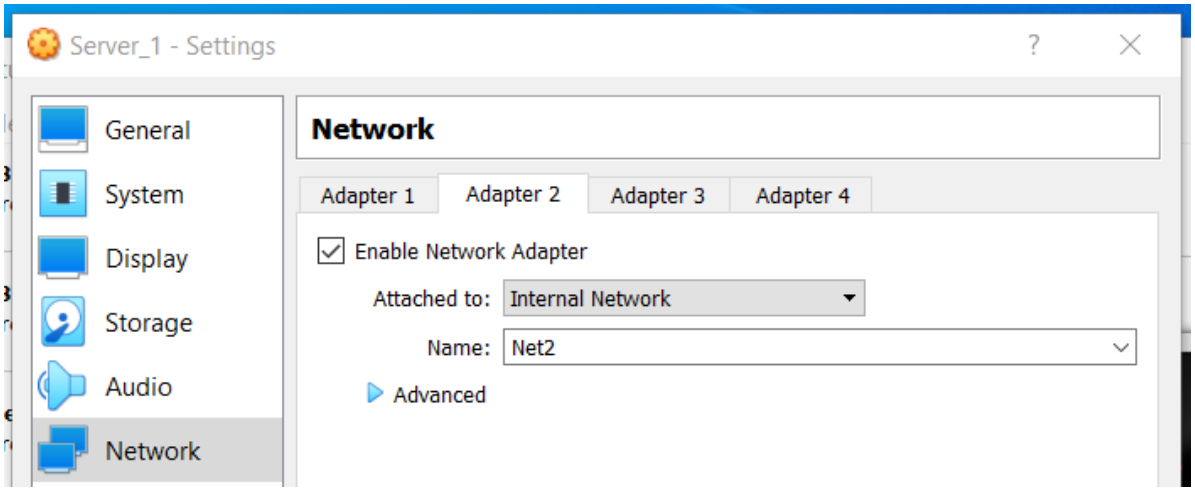


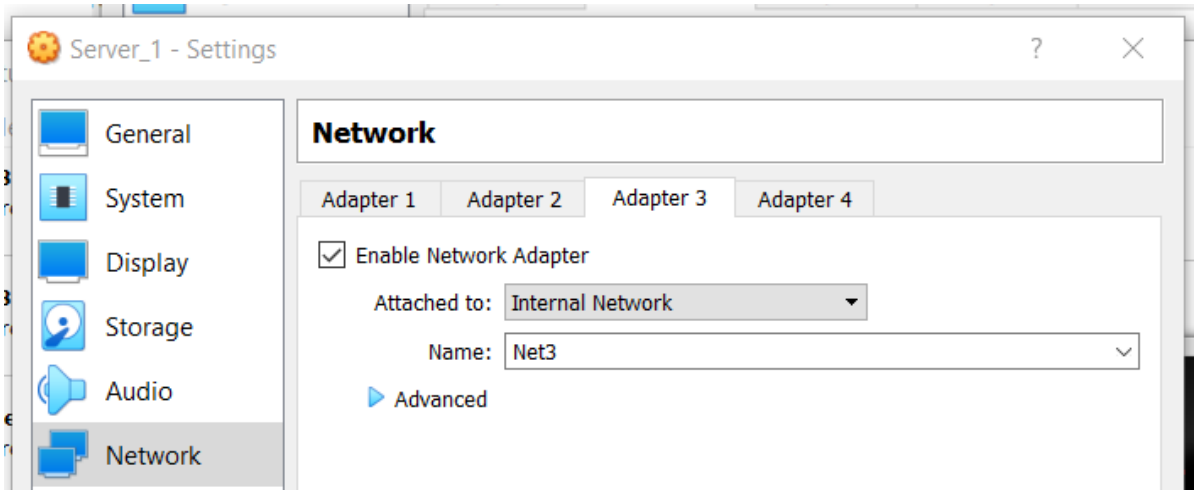
Рисунок 1

Host – це комп’ютер, на якому запущений Virtual Box;

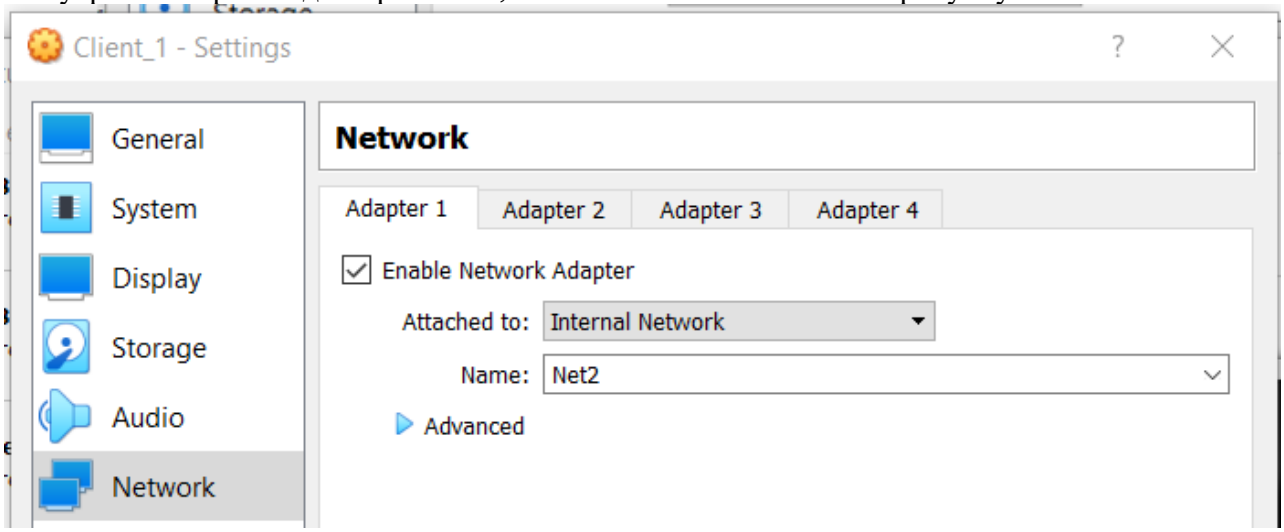
Server_1 – Віртуальна машина, на якій розгорнуто ОС Linux. Int1 цієї машини в режимі «Мережевий міст» підключений до мережі Net1, тобто знаходиться в адресному просторі домашньої мережі. IP-адреса Int1 встановлюється статично відповідно до адресного простору, наприклад 192.168.1.200/24. Інтерфейси Int2 та Int3 відповідно підключено в режимі «Внутрішня мережа» до мереж Net2 та Net3.

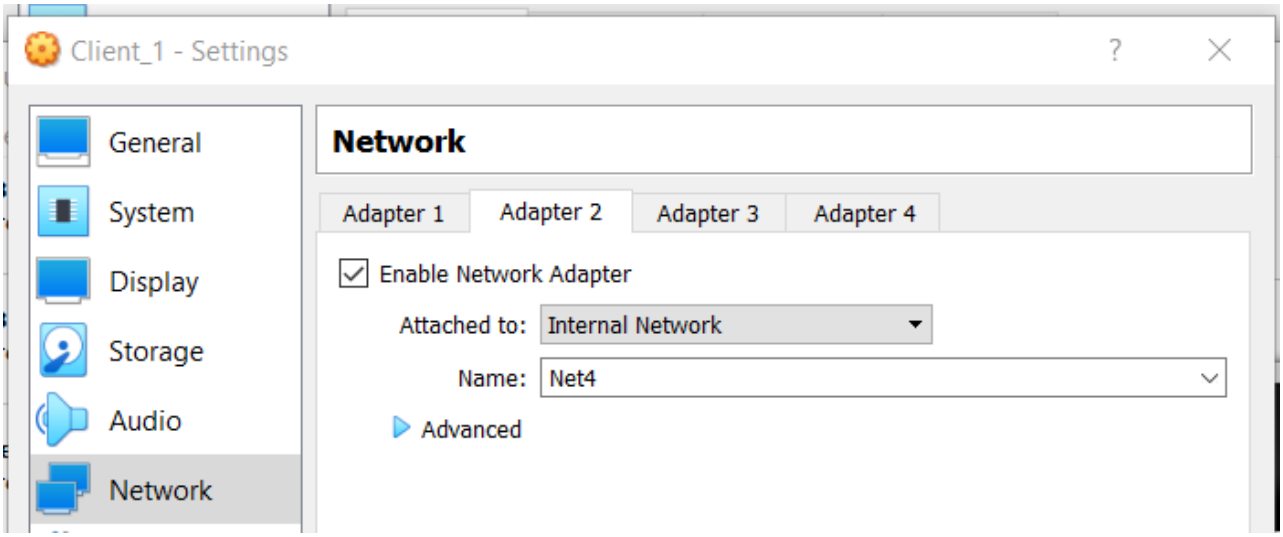


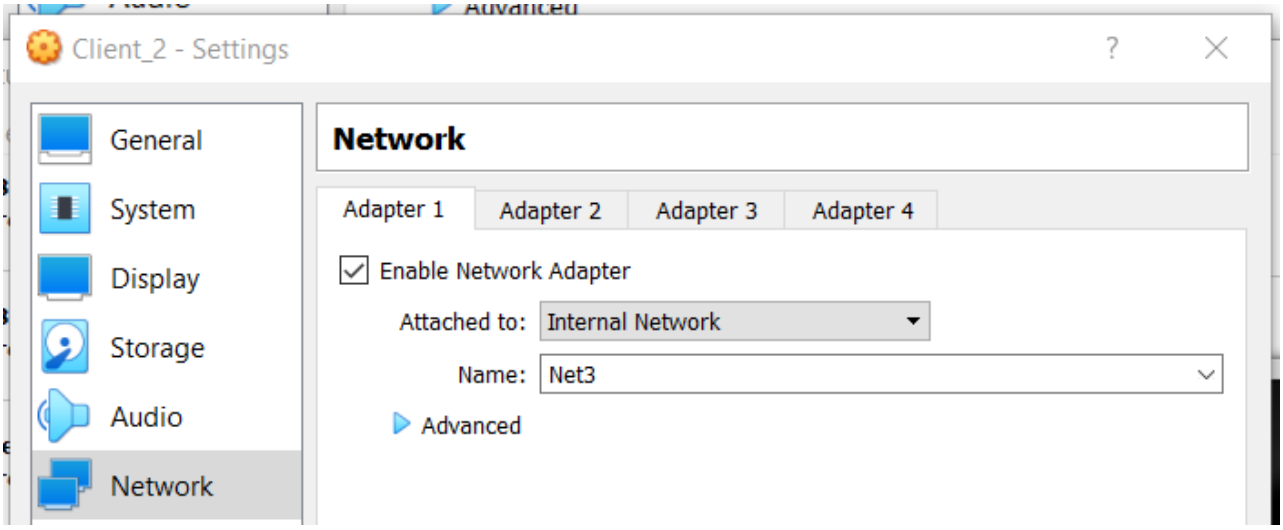


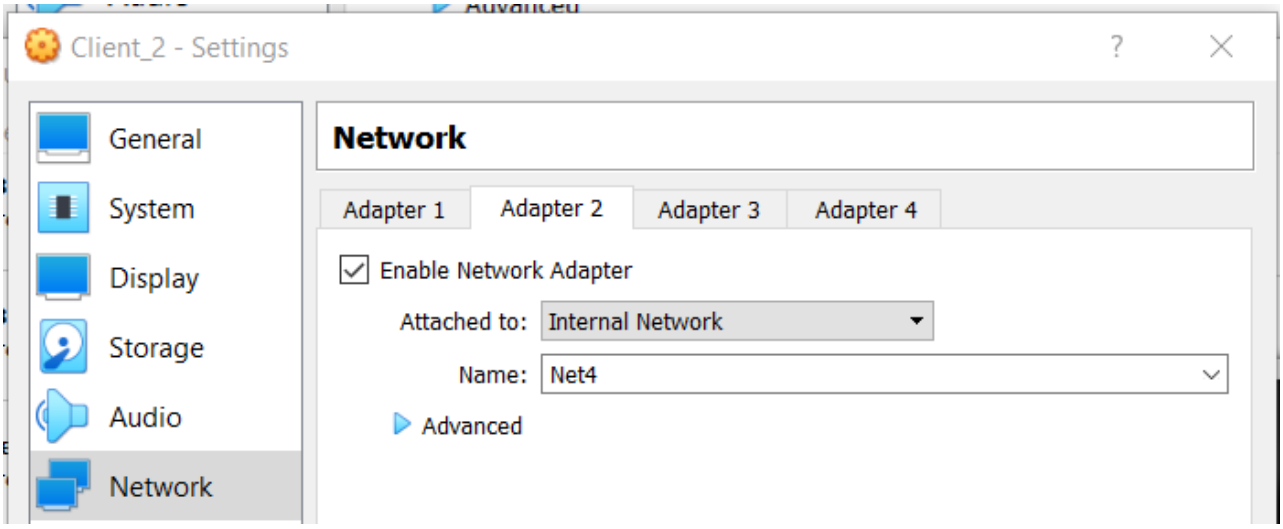


Client_1 та Client_2 – Віртуальні машини, на яких розгорнуто ОС Linux (бажано різні дистрибутиви, наприклад Ubuntu та CentOS). Інтерфейси підключені в режимі «Внутрішня мережа» до мереж Net2, Net3 та Net4 як показано на рисунку 1.









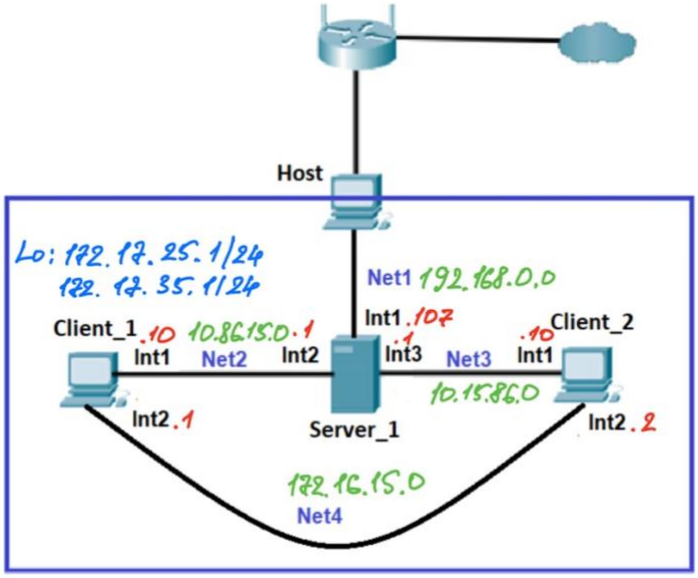
Адреса мережі Net2 – 10.Y.D.0/24, де Y – дві останні цифри з вашого року народження, D – дата народження. 10.86.15.0/24

Адреса мережі Net3 – 10.M.Y.0/24, де M – номер місяця народження. 10.15.86.0/24

Адреса мережі Net4 – 172.16.D.0/24. 172.16.15.0/24

Увага! Якщо, адресний простір Net2, Net3 або Net4 перетинається з адресним простором Net1 – відповідну адресу можна змінити на власний розсуд.

Виходячи з опису вище, у мене ось така схема:



1. На Server_1 налаштувати статичні адреси на всіх інтерфейсах.

```
  GNU nano 2.9.3              01-network-manager-all.yaml

# Let NetworkManager manage all devices on this system
network:
  version: 2
  renderer: NetworkManager
  ethernets:
    enp0s3:
      addresses: [192.168.0.107/24]
      gateway4: 192.168.0.1
      dhcp4: no
      nameservers:
        addresses: [8.8.8.8,8.8.4.4]
    enp0s8:
      addresses: [10.86.15.1/24]
    enp0s9:
      addresses: [10.15.86.1/24]
```

```
ubuntu18@server-1:/etc/netplan$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt 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 g
roup default qlen 1000
    link/ether 08:00:27:07:c8:48 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.107/24 brd 192.168.0.255 scope global noprefixroute enp0s3
       valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe07:c848/64 scope link
       valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:c8:e4:92 brd ff:ff:ff:ff:ff:ff
    inet 10.86.15.1/24 brd 10.86.15.255 scope global noprefixroute enp0s8
       valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fec8:e492/64 scope link
       valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:96:75:af brd ff:ff:ff:ff:ff:ff
    inet 10.15.86.1/24 brd 10.15.86.255 scope global noprefixroute enp0s9
       valid_lft forever preferred_lft forever
```

```
ubuntu18@server-1:/etc/netplan$ ping google.com
PING google.com (142.250.203.142) 56(84) bytes of data.
64 bytes from waw07s06-in-f14.1e100.net (142.250.203.142): icmp_seq=1 ttl=120 t
ime=15.4 ms
64 bytes from waw07s06-in-f14.1e100.net (142.250.203.142): icmp_seq=2 ttl=120 t
ime=15.5 ms
64 bytes from waw07s06-in-f14.1e100.net (142.250.203.142): icmp_seq=3 ttl=120 t
ime=15.5 ms
64 bytes from waw07s06-in-f14.1e100.net (142.250.203.142): icmp_seq=4 ttl=120 t
ime=15.4 ms
```

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

```
ubuntu18@server-1:/etc/netplan$ sudo systemctl start isc-dhcp-server
ubuntu18@server-1:/etc/netplan$ sudo systemctl enable isc-dhcp-server
Synchronizing state of isc-dhcp-server.service with SysV service script with /l
ib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable isc-dhcp-server
```

```
  GNU nano 2.9.3                  /etc/dhcp/dhcpd.conf

#  option routers rtr-239-32-1.example.org;
#}

# A slightly different configuration for an internal subnet.
subnet 10.86.15.0 netmask 255.255.255.0 {
  range 10.86.15.10 10.86.15.50;
#  option domain-name-servers 192.168.0.107;
#  option domain-name "example.org";
  option subnet-mask 255.255.255.0;
  option routers 10.86.15.1;
#  option broadcast-address 192.168.0.255;
#  default-lease-time 600;
#  max-lease-time 7200;
}

subnet 10.15.86.0 netmask 255.255.255.0 {
  range 10.15.86.10 10.15.86.50;
#  option domain-name-servers 192.168.0.107;
#  option domain-name "example.org";
  option subnet-mask 255.255.255.0;
  option routers 10.15.86.1;
#  option broadcast-address 192.168.0.255;
}
```

```
ubuntu18@server-1:~$ sudo systemctl restart isc-dhcp-server.service
ubuntu18@server-1:~$ sudo systemctl status isc-dhcp-server.service
● isc-dhcp-server.service - ISC DHCP IPv4 server
   Loaded: loaded (/lib/systemd/system/isc-dhcp-server.service; enabled; vendor
   Active: active (running) since Thu 2023-01-12 10:54:57 EST; 6s ago
     Docs: man:dhcpd(8)
 Main PID: 1659 (dhcpd)
    Tasks: 1 (limit: 2321)
   CGroup: /system.slice/isc-dhcp-server.service
           └─1659 dhcpd -user dhcpd -group dhcpd -f -4 -pf /run/dhcp-server/dhc
```

```
ubuntu18@server-1:~$ dhcp-lease-list
To get manufacturer names please download http://standards.ieee.org/regauth/oui
/oui.txt to /usr/local/etc/oui.txt
Reading leases from /var/lib/dhcp/dhcpd.leases
MAC                IP              hostname       valid until         manufactu
rer
================================================================================
================
08:00:27:07:c8:48  10.15.86.10     client-2       2023-01-12 16:03:03 -NA-

08:00:27:07:c8:49  10.86.15.10     client-1       2023-01-12 16:05:03 -NA-
```

```
ubuntu18@client-1:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt 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 g
roup default qlen 1000
    link/ether 08:00:27:07:c8:49 brd ff:ff:ff:ff:ff:ff
    inet 10.86.15.10/24 brd 10.86.15.255 scope global dynamic noprefixroute enp
0s3
       valid_lft 488sec preferred_lft 488sec
    inet6 fe80::a00:27ff:fe07:c849/64 scope link
       valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:bd:cb:a4 brd ff:ff:ff:ff:ff:ff
    inet6 fe80::ef7e:96b1:e241:76cb/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

```
ubuntu18@client-2:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt 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 g
roup default qlen 1000
    link/ether 08:00:27:07:c8:48 brd ff:ff:ff:ff:ff:ff
    inet 10.15.86.10/24 brd 10.15.86.255 scope global dynamic noprefixroute enp
0s3
       valid_lft 587sec preferred_lft 587sec
    inet6 fe80::a00:27ff:fe07:c848/64 scope link
       valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:6a:c6:d2 brd ff:ff:ff:ff:ff:ff
    inet6 fe80::a63b:70f9:a158:57b1/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

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

Увага! Для того, щоб з Client_1 та Client_2 проходили пакети в мережу Internet (точніше щоб повертались з Internet на Client_1 та Client_2) на Wi-Fi Router необхідно налаштувати статичні маршрути для мереж Net2 та Net3. Якщо такої можливості немає інтерфейс Int1 на Server_1 перевести в режим NAT.

```
ubuntu18@client-1:~$ traceroute 10.15.86.10
traceroute to 10.15.86.10 (10.15.86.10), 30 hops max, 60 byte packets
 1  10.86.15.1 (10.86.15.1)  0.388 ms  0.360 ms  0.352 ms
 2  10.15.86.10 (10.15.86.10)  1.193 ms  1.184 ms  1.174 ms
```

```
ubuntu18@client-1:~$ ping 10.15.86.10
PING 10.15.86.10 (10.15.86.10) 56(84) bytes of data.
64 bytes from 10.15.86.10: icmp_seq=1 ttl=63 time=0.907 ms
64 bytes from 10.15.86.10: icmp_seq=2 ttl=63 time=1.46 ms
64 bytes from 10.15.86.10: icmp_seq=3 ttl=63 time=1.47 ms
^C
--- 10.15.86.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 0.907/1.280/1.473/0.265 ms
```

```
ubuntu18@client-2:~$ traceroute 10.86.15.10
traceroute to 10.86.15.10 (10.86.15.10), 30 hops max, 60 byte packets
 1  10.15.86.1 (10.15.86.1)  0.481 ms  0.448 ms  0.437 ms
 2  10.86.15.10 (10.86.15.10)  1.315 ms  1.304 ms  1.294 ms
ubuntu18@client-2:~$ ping 10.86.15.10
PING 10.86.15.10 (10.86.15.10) 56(84) bytes of data.
64 bytes from 10.86.15.10: icmp_seq=1 ttl=63 time=0.847 ms
64 bytes from 10.86.15.10: icmp_seq=2 ttl=63 time=1.38 ms
64 bytes from 10.86.15.10: icmp_seq=3 ttl=63 time=1.38 ms
^C
--- 10.86.15.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2034ms
rtt min/avg/max/mdev = 0.847/1.207/1.389/0.256 ms
```

3. 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. 172.17.25.1/24 172.17.35.1/24 Налаштувати маршрутизацію таким чином, щоб трафік з Client_2 до 172.17.D+10.1 172.17.25.1/24 проходив через Server_1, а до 172.17.D+20.1 172.17.35.1/24 через Net4. Для перевірки використати traceroute.

```
ubuntu18@client-1:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt 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
    inet 172.17.25.1/24 scope global lo
       valid_lft forever preferred_lft forever
    inet 172.17.35.1/24 scope global lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
```

```
ubuntu18@client-2:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    20100  0        0 enp0s3
10.15.86.0      0.0.0.0         255.255.255.0   U     100    0        0 enp0s3
link-local      0.0.0.0         255.255.0.0     U     1000   0        0 enp0s8
172.16.15.0     0.0.0.0         255.255.255.0   U     101    0        0 enp0s8
_gateway        0.0.0.0         255.255.255.255 UH    20100  0        0 enp0s3
```

```
ubuntu18@client-2:~$ sudo ip route add 172.17.35.0/24 via 172.16.15.1
[sudo] password for ubuntu18:
```

```
ubuntu18@client-2:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         _gateway        0.0.0.0         UG    20100  0        0 enp0s3
10.15.86.0      0.0.0.0         255.255.255.0   U     100    0        0 enp0s3
link-local      0.0.0.0         255.255.0.0     U     1000   0        0 enp0s8
172.16.15.0     0.0.0.0         255.255.255.0   U     101    0        0 enp0s8
172.17.35.0     172.16.15.1     255.255.255.0   UG    0      0        0 enp0s8
_gateway        0.0.0.0         255.255.255.255 UH    20100  0        0 enp0s3
```

```
ubuntu18@client-2:~$ traceroute 172.17.35.1
traceroute to 172.17.35.1 (172.17.35.1), 30 hops max, 60 byte packets
 1  172.17.35.1 (172.17.35.1)  0.423 ms  0.388 ms  0.378 ms
```

```
ubuntu18@server-1:~$ sudo ip route add 172.17.25.0/24 via 10.86.15.10
[sudo] password for ubuntu18:
```

```
ubuntu18@client-2:~$ traceroute 172.17.25.1
traceroute to 172.17.25.1 (172.17.25.1), 30 hops max, 60 byte packets
 1  10.15.86.1 (10.15.86.1)  0.459 ms  0.426 ms  0.419 ms
 2  172.17.25.1 (172.17.25.1)  1.203 ms  1.192 ms  1.181 ms
```

4. Розрахувати спільну адресу та маску (summarizing) адрес 172.17.D+10.1 172.17.25.1 та 172.17.D+20.1 172.17.35.1, 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.

Supernet Address: 172.17.0.0/18

Details of Supernet Address	
Supernet Address	172.17.0.0/18
Supernet Range	172.17.0.0 - 172.17.63.255
Total IPs	16 384
Subnet/Network Mask	255.255.192.0
Wildcard/Host Mask	0.0.63.255

Binary Information	
Matching Network Bits	18
Supernet IP: **172.17.0.0**	10101100 00010001 00000000 00000000
Supernet Subnet Mask: **255.255.192.0**	11111111 11111111 11000000 00000000
Supernet Host Mask: **0.0.63.255**	00000000 00000000 00111111 11111111

```
ubuntu18@client-2:~$ sudo ip route del 172.17.35.0/24 via 172.16.15.1
[sudo] password for ubuntu18:
```

```
ubuntu18@server-1:~$ sudo ip route del 172.17.25.0/24 via 10.86.15.10
[sudo] password for ubuntu18:
```

```
ubuntu18@server-1:~$ sudo ip route add 172.17.0.0/18 via 10.86.15.10
```

```
ubuntu18@client-2:~$ ping 172.17.25.1
PING 172.17.25.1 (172.17.25.1) 56(84) bytes of data.
64 bytes from 172.17.25.1: icmp_seq=1 ttl=63 time=0.585 ms
64 bytes from 172.17.25.1: icmp_seq=2 ttl=63 time=1.23 ms
64 bytes from 172.17.25.1: icmp_seq=3 ttl=63 time=1.34 ms
^C
--- 172.17.25.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2028ms
rtt min/avg/max/mdev = 0.585/1.052/1.342/0.334 ms
ubuntu18@client-2:~$ ping 172.17.35.1
PING 172.17.35.1 (172.17.35.1) 56(84) bytes of data.
64 bytes from 172.17.35.1: icmp_seq=1 ttl=63 time=0.863 ms
64 bytes from 172.17.35.1: icmp_seq=2 ttl=63 time=1.30 ms
64 bytes from 172.17.35.1: icmp_seq=3 ttl=63 time=1.53 ms
^C
--- 172.17.35.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2034ms
rtt min/avg/max/mdev = 0.863/1.232/1.533/0.279 ms
```

```
ubuntu18@client-2:~$ traceroute 172.17.35.1
traceroute to 172.17.35.1 (172.17.35.1), 30 hops max, 60 byte packets
 1  10.15.86.1 (10.15.86.1)  0.658 ms  0.624 ms  0.613 ms
 2  172.17.35.1 (172.17.35.1)  1.465 ms  1.365 ms  1.323 ms
```

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

```
ubuntu18@client-1:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ubuntu18/.ssh/id_rsa): key1
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in key1.
Your public key has been saved in key1.pub.
The key fingerprint is:
SHA256:WIHskVfRQjpFdNQymOzpF6y4F3E4pMUjutZMlQZEluI ubuntu18@client-1
The key's randomart image is:
+---[RSA 2048]----+
|      . =*XBBo.   |
|       *.++&.+ .  |
|      o =+O * o   |
|       Eoo.* +    |
|       .=So = .   |
|       o + + .    |
|      .    . o    |
|         . .      |
|          .       |
+----[SHA256]-----+
```

```
ubuntu18@client-1:~$ ssh-copy-id -i ~/key1.pub ubuntu18@10.86.15.1
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/ubuntu18/k
ey1.pub"
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter
 out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are promp
ted now it is to install the new keys
ubuntu18@10.86.15.1's password:

Number of key(s) added: 1

Now try logging into the machine, with:   "ssh 'ubuntu18@10.86.15.1'"
and check to make sure that only the key(s) you wanted were added.
```

```
ubuntu18@client-1:~$ ssh -i ~/key1 ubuntu18@10.86.15.1
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-136-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

32 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

New release '20.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
ubuntu18@server-1:~$
```

```
ubuntu18@client-2:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ubuntu18/.ssh/id_rsa):
Created directory '/home/ubuntu18/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ubuntu18/.ssh/id_rsa.
Your public key has been saved in /home/ubuntu18/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:+LC/kK+XjYGs/n3BUWWlIQYyCkGqEuKeEknUWjJFtG8 ubuntu18@client-2
The key's randomart image is:
+---[RSA 2048]----+
| .==+.  o ..o.+..|
|.o +.. . o ..o o |
|o.*.  .    .  .  |
|+=  .  .  .      |
|=.   Eo.S. .     |
|o.. . o=. o      |
|.o   .+ .= .     |
|.    .  =+ o     |
|   ...oo=o       |
+----[SHA256]-----+
```

```
ubuntu18@client-2:~/.ssh$ ssh-copy-id -i ~/.ssh/id_rsa.pub ubuntu18@10.15.86.1
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/ubuntu18/.
ssh/id_rsa.pub"
The authenticity of host '10.15.86.1 (10.15.86.1)' can't be established.
ECDSA key fingerprint is SHA256:k00Y4KJusDkJCsnux/K1Kyw5x4LEtkyrHbSndAlrPFU.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter
 out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are promp
ted now it is to install the new keys
ubuntu18@10.15.86.1's password:

Number of key(s) added: 1

Now try logging into the machine, with:   "ssh 'ubuntu18@10.15.86.1'"
and check to make sure that only the key(s) you wanted were added.
```

```
ubuntu18@client-2:~/.ssh$ ssh -i ~/.ssh/id_rsa.pub ubuntu18@10.15.86.1
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-136-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

32 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

New release '20.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Tue Jan 17 12:03:42 2023 from 10.86.15.10
ubuntu18@server-1:~$
```

```
ubuntu18@client-1:~/.ssh$ ssh-copy-id -i ~/.ssh/id_rsa.pub ubuntu18@10.15.86.10
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/ubuntu18/.
ssh/id_rsa.pub"
The authenticity of host '10.15.86.10 (10.15.86.10)' can't be established.
ECDSA key fingerprint is SHA256:uQXRwwdgit0c8l5zcXyddtNwKYulMSQ0AxwKGJW9sU8.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter
 out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are promp
ted now it is to install the new keys
ubuntu18@10.15.86.10's password:

Number of key(s) added: 1

Now try logging into the machine, with:   "ssh 'ubuntu18@10.15.86.10'"
and check to make sure that only the key(s) you wanted were added.
```

```
ubuntu18@client-1:~/.ssh$ ssh -i ~/.ssh/id_rsa.pub ubuntu18@10.15.86.10
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-135-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

30 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your
 Internet connection or proxy settings

Your Hardware Enablement Stack (HWE) is supported until April 2023.
ubuntu18@client-2:~$
```

```
ubuntu18@client-2:~/.ssh$ ssh-copy-id -i ~/.ssh/id_rsa2.pub ubuntu18@10.86.15.1
0
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/ubuntu18/.
ssh/id_rsa2.pub"
The authenticity of host '10.86.15.10 (10.86.15.10)' can't be established.
ECDSA key fingerprint is SHA256:kvWAqgzsxnZ3xexsbU+lVZH/KhDypYDl/Seax6pck/s.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter
 out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are promp
ted now it is to install the new keys
ubuntu18@10.86.15.10's password:

Number of key(s) added: 1

Now try logging into the machine, with:   "ssh 'ubuntu18@10.86.15.10'"
and check to make sure that only the key(s) you wanted were added.
```

```
ubuntu18@client-2:~/.ssh$ ssh -i ~/.ssh/id_rsa2.pub ubuntu18@10.86.15.10
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-135-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

30 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Your Hardware Enablement Stack (HWE) is supported until April 2023.
ubuntu18@client-1:~$
```

7. Налаштуйте на Server_1 firewall таким чином:

- Дозволено підключатись через SSH з Client_1 та заборонено з Client_2

```
ubuntu18@server-1:/$ sudo iptables -A INPUT -m state --state NEW,ESTABLISHED,RE
LATED --source 10.86.15.10 -p tcp --dport 22 -j ACCEPT
[sudo] password for ubuntu18:
ubuntu18@server-1:/$ sudo iptables -A INPUT -m state --state NEW,ESTABLISHED,RE
LATED -p tcp --dport 22 -j DROP
```

```
ubuntu18@server-1:/$ sudo iptables -L
Chain INPUT (policy ACCEPT)
target     prot opt source               destination
ACCEPT     tcp  --  10.86.15.10          anywhere             state NEW,RELATED
,ESTABLISHED tcp dpt:ssh
DROP       tcp  --  anywhere             anywhere             state NEW,RELATED
,ESTABLISHED tcp dpt:ssh

Chain FORWARD (policy ACCEPT)
target     prot opt source               destination

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination
```

```
ubuntu18@client-1:~$ ssh -i ~/key1 ubuntu18@10.86.15.1
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-136-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

32 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

New release '20.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Tue Jan 17 13:48:07 2023 from 10.15.86.10
ubuntu18@server-1:~$
```

```
ubuntu18@client-2:~/.ssh$ ssh -i ~/.ssh/id_rsa.pub ubuntu18@10.15.86.1

^C
ubuntu18@client-2:~/.ssh$
```

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

```
ubuntu18@server-1:/$ sudo iptables -A FORWARD -s 172.17.25.1 -p ICMP --icmp-typ
e 8 -j ACCEPT
ubuntu18@server-1:/$ sudo iptables -A FORWARD -p ICMP --icmp-type 8 -j DROP
```

```
ubuntu18@server-1:/$ ping 172.17.25.1
PING 172.17.25.1 (172.17.25.1) 56(84) bytes of data.
64 bytes from 172.17.25.1: icmp_seq=1 ttl=64 time=0.527 ms
64 bytes from 172.17.25.1: icmp_seq=2 ttl=64 time=0.533 ms
64 bytes from 172.17.25.1: icmp_seq=3 ttl=64 time=0.563 ms
64 bytes from 172.17.25.1: icmp_seq=4 ttl=64 time=0.552 ms
^C
--- 172.17.25.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3070ms
rtt min/avg/max/mdev = 0.527/0.543/0.563/0.032 ms
```

```
ubuntu18@client-2:~/.ssh$ ping 172.17.35.1
PING 172.17.35.1 (172.17.35.1) 56(84) bytes of data.
^C
--- 172.17.35.1 ping statistics ---
6 packets transmitted, 0 received, 100% packet loss, time 5090ms
```

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

```
ubuntu18@server-1:~$ sudo iptables -t nat -A POSTROUTING -s 10.86.15.0/24 -j SN
AT --to-source 192.168.0.107
[sudo] password for ubuntu18:
ubuntu18@server-1:~$ sudo iptables -t nat -A POSTROUTING -s 10.15.86.0/24 -j SN
AT --to-source 192.168.0.107
```

```
ubuntu18@client-1:~/.ssh$ ping google.com
PING google.com (142.250.201.206) 56(84) bytes of data.
64 bytes from bud02s35-in-f14.1e100.net (142.250.201.206): icmp_seq=1 ttl=118 t
ime=22.4 ms
64 bytes from bud02s35-in-f14.1e100.net (142.250.201.206): icmp_seq=2 ttl=118 t
ime=23.1 ms
64 bytes from bud02s35-in-f14.1e100.net (142.250.201.206): icmp_seq=3 ttl=118 t
ime=23.0 ms
64 bytes from bud02s35-in-f14.1e100.net (142.250.201.206): icmp_seq=4 ttl=118 t
ime=22.8 ms
^C
--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
rtt min/avg/max/mdev = 22.457/22.892/23.169/0.292 ms
```

```
ubuntu18@client-2:~/.ssh$ ping google.com
PING google.com (142.250.201.206) 56(84) bytes of data.
64 bytes from bud02s35-in-f14.1e100.net (142.250.201.206): icmp_seq=1 ttl=118 t
ime=22.4 ms
64 bytes from bud02s35-in-f14.1e100.net (142.250.201.206): icmp_seq=2 ttl=118 t
ime=23.2 ms
64 bytes from bud02s35-in-f14.1e100.net (142.250.201.206): icmp_seq=3 ttl=118 t
ime=22.4 ms
^C
--- google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 22.421/22.711/23.215/0.397 ms
```