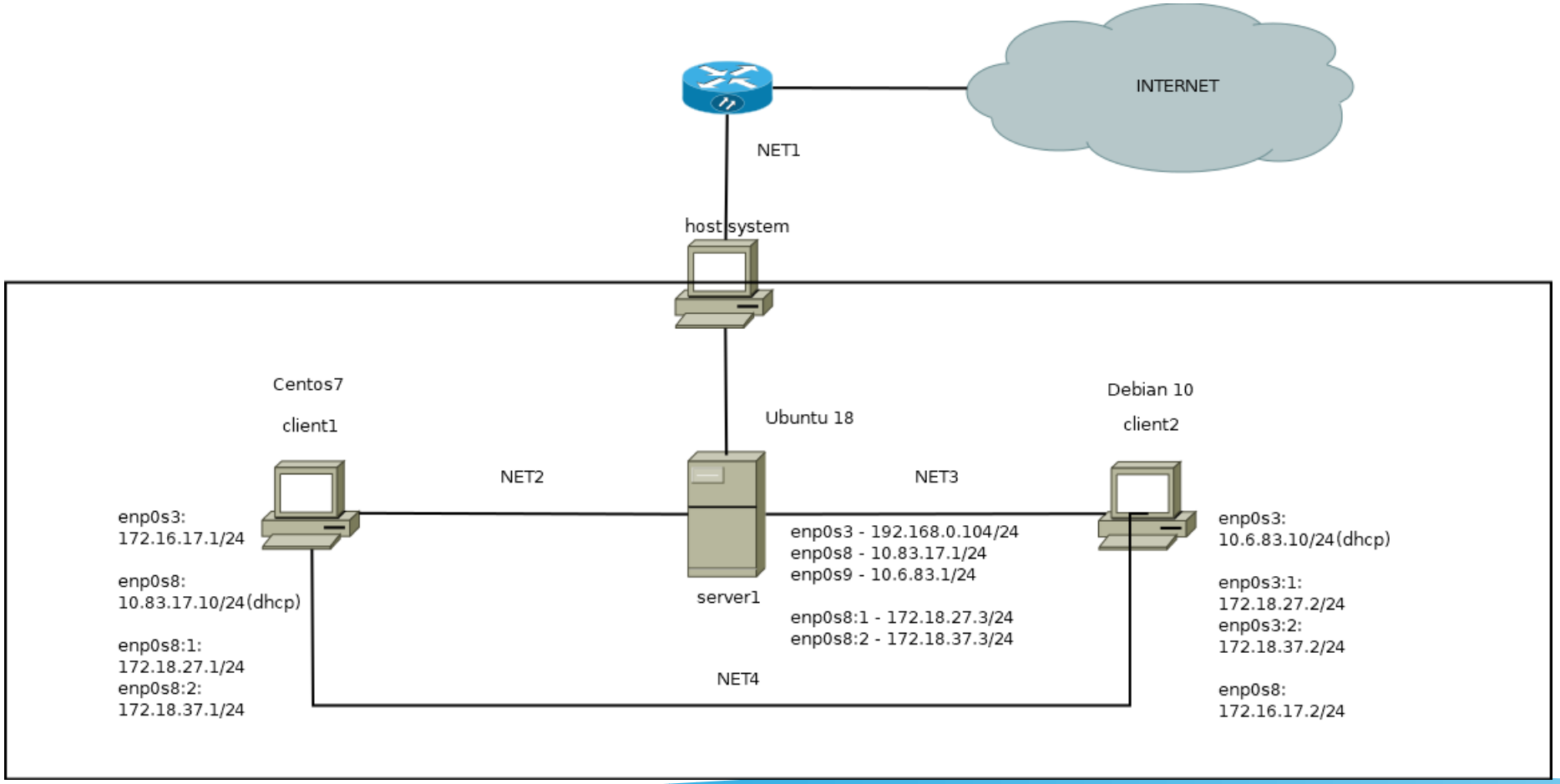
# Linux Network Task


INTERNET
NET1
host system
Centos7
client1
Ubuntu 18
Debian 10
client2
NET2
NET3
enp0s3:
172.16.17.1/24
enp0s8:
10.83.17.10/24(dhcp)
enp0s8:1:
172.18.27.1/24
enp0s8:2:
172.18.37.1/24
server1
enp0s3 - 192.168.0.104/24
enp0s8 - 10.83.17.1/24
enp0s9 - 10.6.83.1/24
enp0s8:1 - 172.18.27.3/24
enp0s8:2 - 172.18.37.3/24
NET4
enp0s3:
10.6.83.10/24(dhcp)
enp0s3:1:
172.18.27.2/24
enp0s3:2:
172.18.37.2/24
enp0s8:
172.16.17.2/24

## Server1

```
# This is the network config written by 'subiquity'
network:
  ethernets:
    enp0s3:
      dhcp4: no
      addresses:
        - 192.168.0.104/24
      gateway4: 192.168.0.1
      nameservers:
        addresses:
         - 8.8.8.8
    enp0s8:
      dhcp4: no
      addresses:
         - 10.83.17.1/24
    enp0s9:
      dhcp4: no
      addresses:
         - 10.6.83.1/24
  version: 2
~
```

2. На server1 налаштувати DHCP сервіс, який буде конфігурувати адреси Int1 client1 та client2

```
default-lease-time 600;
max-lease-time 7200;
authoritative;

subnet 10.83.17.0 netmask 255.255.255.0
{
range 10.83.17.10 10.83.17.20;
option routers 10.83.17.1;
option domain-name-servers 8.8.8.8;
}

subnet 10.6.83.0 netmask 255.255.255.0
{
range 10.6.83.10 10.6.83.20;
option routers 10.6.83.1;
option domain-name-servers 8.8.8.8;
}
```

# Client1 - enp0s3

```
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=static
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=enp0s3
UUID=8204ce82-80ef-4447-b9d5-e8fed05f0376
DEVICE=enp0s3
ONBOOT=yes
IPADDR=172.16.17.1
PREFIX=24
```

## Client1 - enp0s8

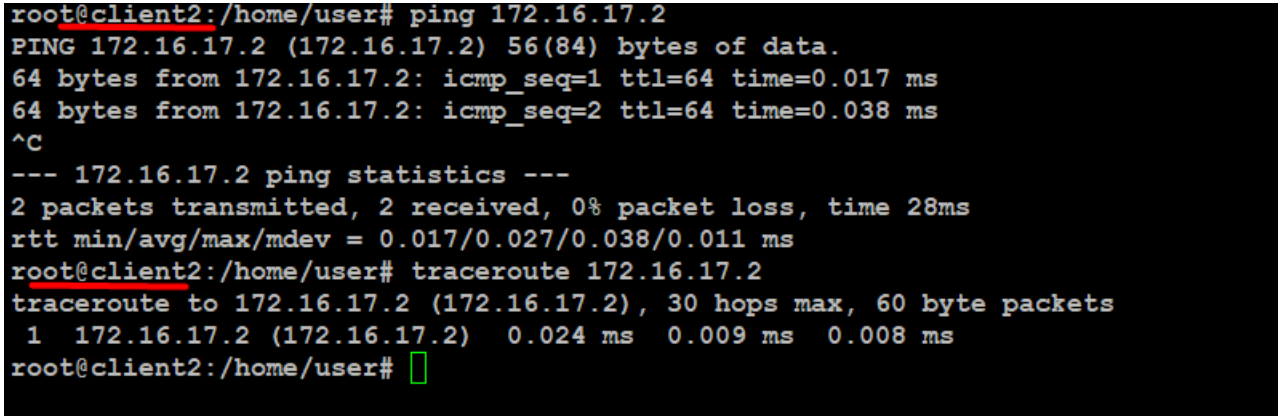
```
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=dhcp
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
IPV6_ADDR_GEN_MODE=stable-privacy
NAME=enp0s8
DEVICE=enp0s8
ONBOOT=yes
```

client2

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

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto enp0s8
iface enp0s8 inet static
address 172.16.17.2/24

auto enp0s3
iface enp0s3 inet dhcp
```

3. За допомогою команд ping та traceroute перевірити зв'язок між віртуальними машнами

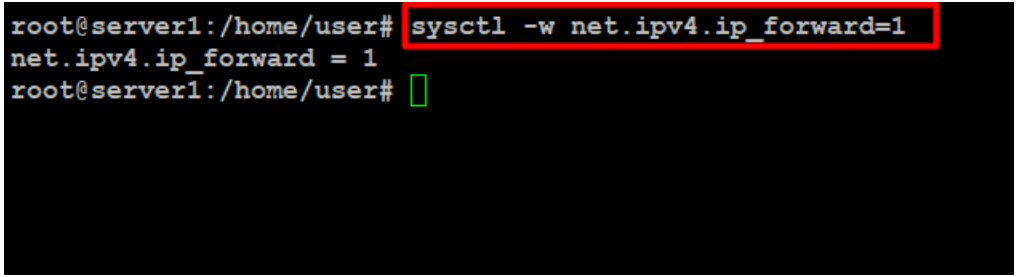
```
[root@client1 ~]# ping 172.16.17.2
PING 172.16.17.2 (172.16.17.2) 56(84) bytes of data.
64 bytes from 172.16.17.2: icmp_seq=1 ttl=64 time=10.1 ms
64 bytes from 172.16.17.2: icmp_seq=2 ttl=64 time=10.2 ms
64 bytes from 172.16.17.2: icmp_seq=3 ttl=64 time=12.3 ms
^C
--- 172.16.17.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2005ms
rtt min/avg/max/mdev = 10.141/10.889/12.316/1.009 ms
[root@client1 ~]#
[root@client1 ~]# traceroute 172.16.17.2
traceroute to 172.16.17.2 (172.16.17.2), 30 hops max, 60 byte packets
 1  172.16.17.2 (172.16.17.2)  58.535 ms  57.730 ms  56.912 ms
[root@client1 ~]#
```




Обидві віртуальні машини підключені одна до одної безпосердньо. Тому є між ними зв’язок.

По-перше на server1 необхідно включити forward пакетів – поправити файл /etc/sysctl.conf

Для застосування налаштування виконуємо команду:



На client1 призначаємо дві віртуальні адреси:

```
[root@client1 ~]# ip  a add 172.18.27.1/24 dev enp0s8:1
```

```
[root@client1 ~]# ip  a add 172.18.37.1/24 dev enp0s8:2
```

На client2 також призначаємо дві віртуальні адреси:

```
root@client2:/home/user# ip add add 172.18.27.2/24 dev enp0s3:1
```

```
root@client2:/home/user# ip add add 172.18.37.2/24 dev enp0s3:2
```

```
root@client2:/home/user# ip r
default via 10.6.83.1 dev enp0s3 onlink
10.6.83.0/24 dev enp0s3 proto kernel scope link src 10.6.83.10
169.254.0.0/16 dev enp0s8 scope link metric 1000
172.16.17.0/24 dev enp0s8 proto kernel scope link src 172.16.17.2
172.18.27.0/24 via 10.6.83.1 dev enp0s3
172.18.37.0/24 dev enp0s3 proto kernel scope link src 172.18.37.2
root@client2:/home/user#
root@client2:/home/user# ping 172.18.27.1
PING 172.18.27.1 (172.18.27.1) 56(84) bytes of data.
64 bytes from 172.18.27.1: icmp_seq=1 ttl=63 time=36.8 ms
64 bytes from 172.18.27.1: icmp_seq=2 ttl=63 time=2.21 ms
^C
--- 172.18.27.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 10ms
rtt min/avg/max/mdev = 2.211/19.487/36.764/17.277 ms
root@client2:/home/user# traceroute 172.18.27.1
traceroute to 172.18.27.1 (172.18.27.1), 30 hops max, 60 byte packets
 1  10.6.83.1 (10.6.83.1)  0.721 ms  38.583 ms  0.776 ms
 2  172.18.27.1 (172.18.27.1)  37.694 ms  38.913 ms  1.975 ms
root@client2:/home/user#
root@client2:/home/user#
root@client2:/home/user# ping 172.18.37.1
PING 172.18.37.1 (172.18.37.1) 56(84) bytes of data.
64 bytes from 172.18.37.1: icmp_seq=1 ttl=64 time=69.1 ms
64 bytes from 172.18.37.1: icmp_seq=2 ttl=64 time=0.721 ms
^C
--- 172.18.37.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 20ms
rtt min/avg/max/mdev = 0.721/34.935/69.149/34.214 ms
root@client2:/home/user#
root@client2:/home/user# traceroute 172.18.37.1
traceroute to 172.18.37.1 (172.18.37.1), 30 hops max, 60 byte packets
 1  172.18.37.1 (172.18.37.1)  30.421 ms  30.252 ms  29.041 ms
root@client2:/home/user#
```

Розрахувати спільну адресу та маску (summarizing) адрес 172.18.27.1 та 172.18.37.1 префікс має бути максимально можливим. Видалити маршрути, які вставновлени на попередньому кроці, і прописати сумарний маршрут, для того щоб трафік йшов через server1

Пошук сумарного маршруту для 172.18.27.1 та 172.18.37.1:
10101100 000100010 00 | 011011 00000001
10101100 000100010 00 | 100101 00000001

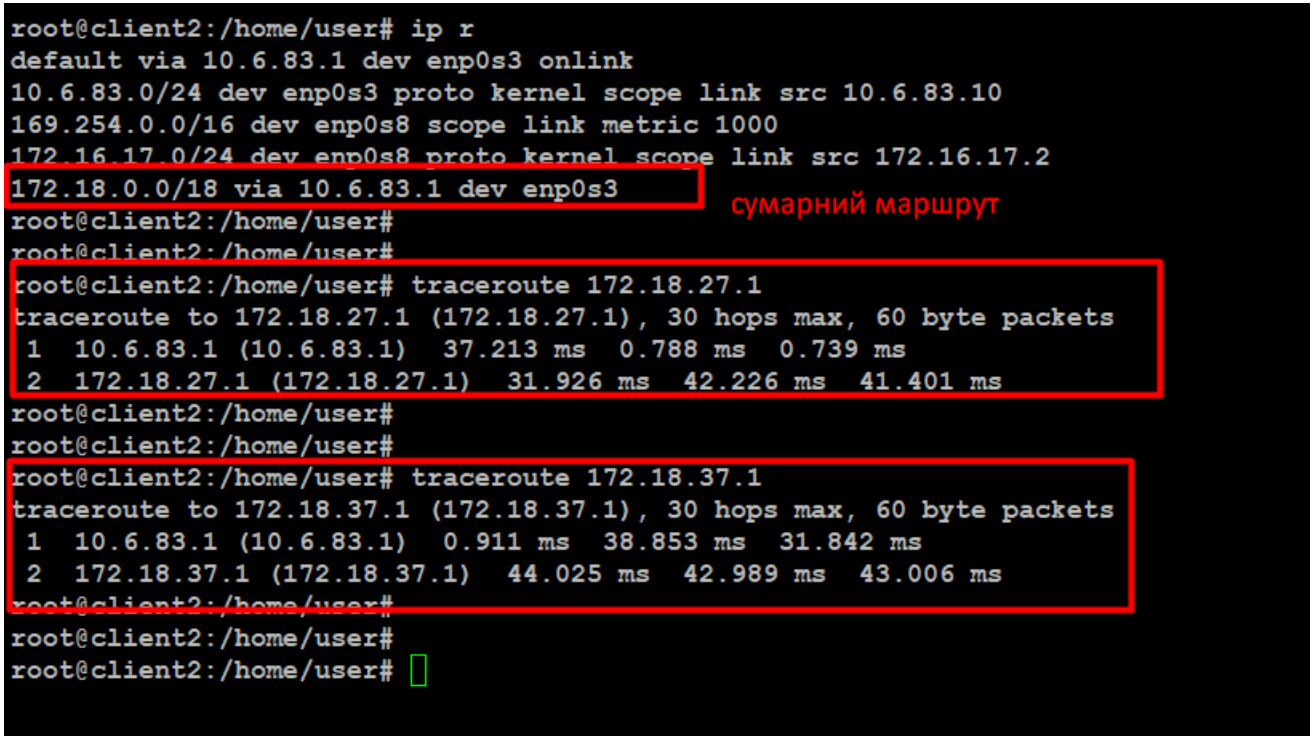
10101100 000100010 00 000000 00000000
11111111 11111111 11 000000 00000000

172.18.0.0
255.255.192.0

172.18.0.0/18

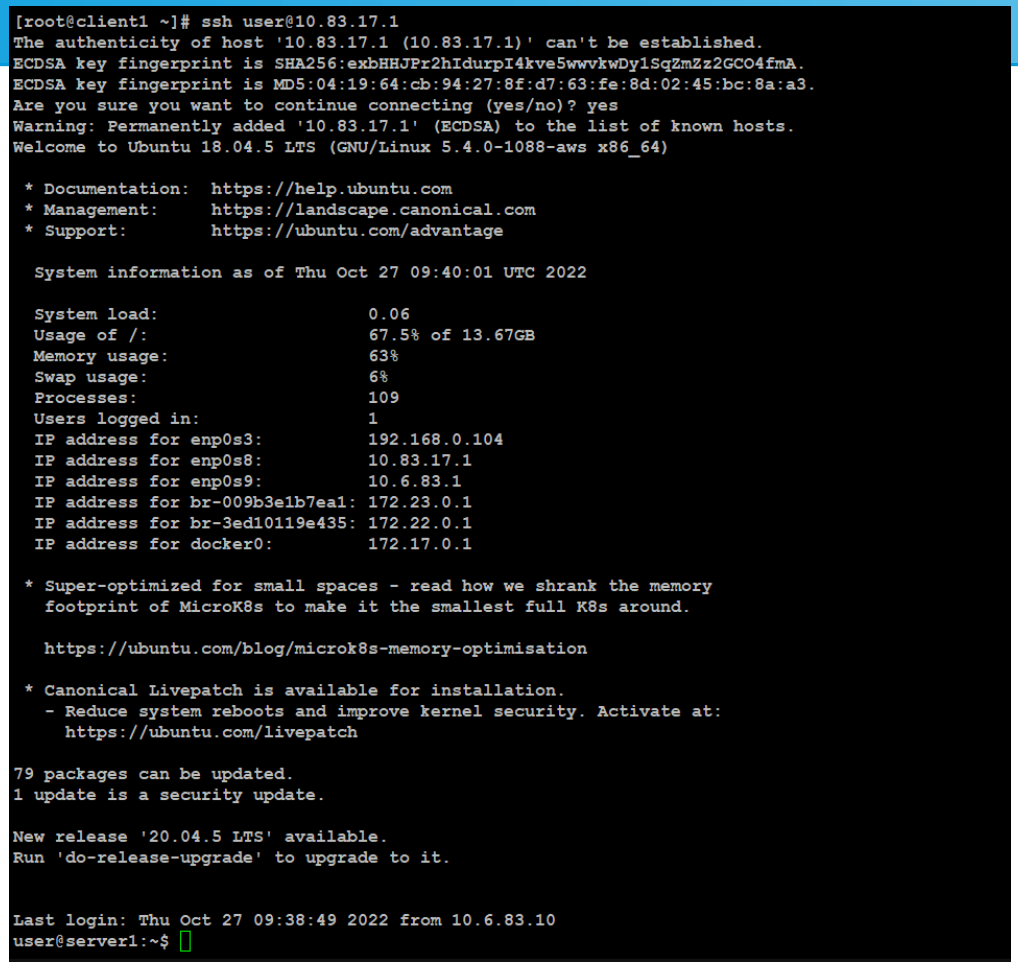
Також щоб маршрутизація працювала через server1, необхідно на сервері server1 додати інтерфейси з даних підмереж:

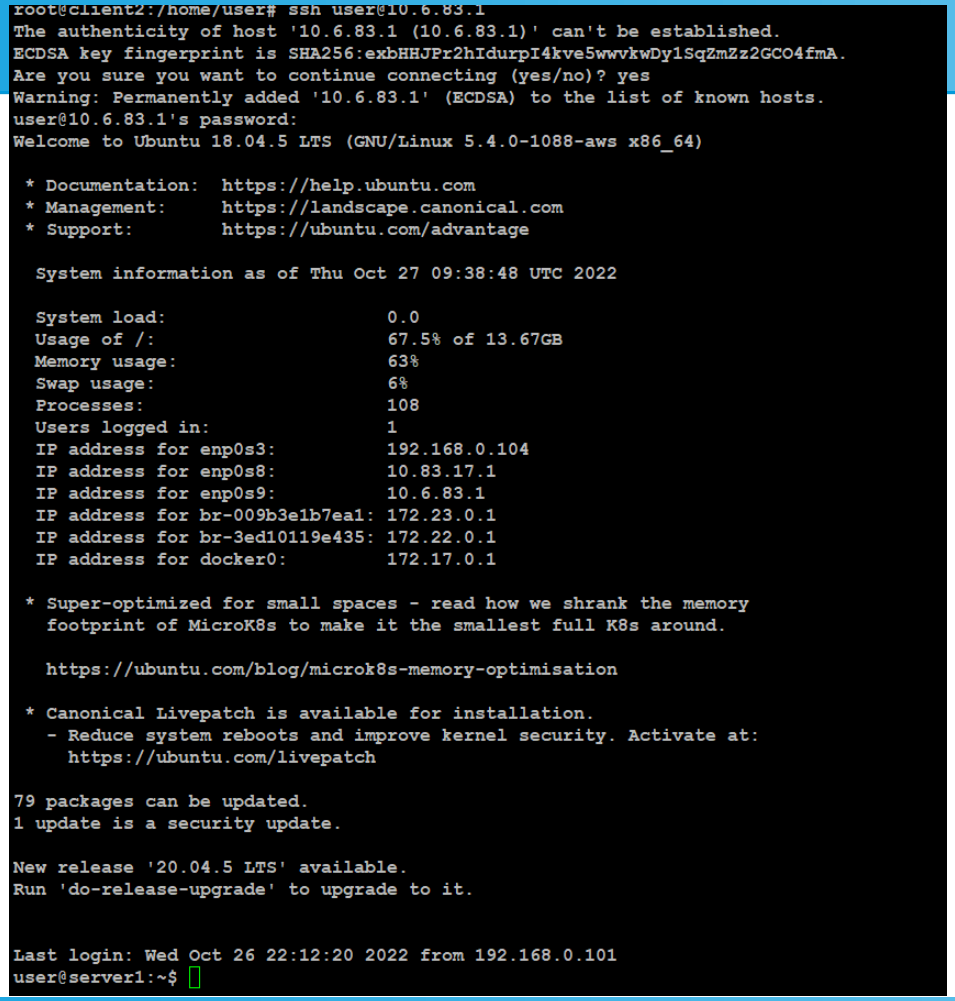
```
enp0s8:1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.18.27.3  netmask 255.255.255.0  broadcast 172.18.27.255
        ether 08:00:27:1f:fa:d8  txqueuelen 1000  (Ethernet)

enp0s8:2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.18.37.3  netmask 255.255.255.0  broadcast 172.18.37.255
        ether 08:00:27:1f:fa:d8  txqueuelen 1000  (Ethernet)
```


root@client2:/home/user# ip r
default via 10.6.83.1 dev enp0s3 onlink
10.6.83.0/24 dev enp0s3 proto kernel scope link src 10.6.83.10
169.254.0.0/16 dev enp0s8 scope link metric 1000
172.16.17.0/24 dev enp0s8 proto kernel scope link src 172.16.17.2
172.18.0.0/18 via 10.6.83.1 dev enp0s3
сумарний маршрут
root@client2:/home/user#
root@client2:/home/user#
root@client2:/home/user# traceroute 172.18.27.1
traceroute to 172.18.27.1 (172.18.27.1), 30 hops max, 60 byte packets
1 10.6.83.1 (10.6.83.1) 37.213 ms 0.788 ms 0.739 ms
2 172.18.27.1 (172.18.27.1) 31.926 ms 42.226 ms 41.401 ms
root@client2:/home/user#
root@client2:/home/user#
root@client2:/home/user# traceroute 172.18.37.1
traceroute to 172.18.37.1 (172.18.37.1), 30 hops max, 60 byte packets
1 10.6.83.1 (10.6.83.1) 0.911 ms 38.853 ms 31.842 ms
2 172.18.37.1 (172.18.37.1) 44.025 ms 42.989 ms 43.006 ms
root@client2:/home/user#
root@client2:/home/user#
root@client2:/home/user#

На всих трьох віртуальних машинах необхідно підняти ssh сервер, з налаштуваннями за замовчуванням можна підключатися по стандартним портам:

```
[root@client1 ~]# ssh user@172.16.17.2
The authenticity of host '172.16.17.2 (172.16.17.2)' can't be established.
ECDSA key fingerprint is SHA256:W1TfN5qOIqBDXiCknEFniqss1sJ4mrM7MGLzWJN4+ek.
ECDSA key fingerprint is MD5:8a:d2:9d:fb:72:cc:93:25:68:fe:4d:8a:5d:5b:cb:4d.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '172.16.17.2' (ECDSA) to the list of known hosts.
user@172.16.17.2's password:
Linux client2 4.19.0-16-686 #1 SMP Debian 4.19.181-1 (2021-03-19) i686

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Oct 27 09:37:41 2022 from 10.6.83.1
user@client2:~$
```


[root@client1 ~]# ssh user@10.83.17.1
The authenticity of host '10.83.17.1 (10.83.17.1)' can't be established.
ECDSA key fingerprint is SHA256:exbHHJPr2hIdurpI4kve5wwvkwDy1SqZmZz2GCO4fmA.
ECDSA key fingerprint is MD5:04:19:64:cb:94:27:8f:d7:63:fe:8d:02:45:bc:8a:a3.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '10.83.17.1' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 18.04.5 LTS (GNU/Linux 5.4.0-1088-aws x86_64)
* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/advantage
System information as of Thu Oct 27 09:40:01 UTC 2022
System load: 0.06
Usage of /: 67.5% of 13.67GB
Memory usage: 63%
Swap usage: 6%
Processes: 109
Users logged in: 1
IP address for enp0s3: 192.168.0.104
IP address for enp0s8: 10.83.17.1
IP address for enp0s9: 10.6.83.1
IP address for br-009b3e1b7ea1: 172.23.0.1
IP address for br-3ed10119e435: 172.22.0.1
IP address for docker0: 172.17.0.1
* Super-optimized for small spaces - read how we shrank the memory
footprint of MicroK8s to make it the smallest full K8s around.
https://ubuntu.com/blog/microk8s-memory-optimisation
* Canonical Livepatch is available for installation.
- Reduce system reboots and improve kernel security. Activate at:
https://ubuntu.com/livepatch
79 packages can be updated.
1 update is a security update.
New release '20.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.
Last login: Thu Oct 27 09:38:49 2022 from 10.6.83.10
user@server1:~$


root@client2:/home/user# ssh user@10.6.83.1
The authenticity of host '10.6.83.1 (10.6.83.1)' can't be established.
ECDSA key fingerprint is SHA256:exbHHJPr2hIdurpI4kve5wwvkwDy1SqZmZz2GCO4fmA.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '10.6.83.1' (ECDSA) to the list of known hosts.
user@10.6.83.1's password:
Welcome to Ubuntu 18.04.5 LTS (GNU/Linux 5.4.0-1088-aws x86_64)
* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/advantage
System information as of Thu Oct 27 09:38:48 UTC 2022
System load: 0.0
Usage of /: 67.5% of 13.67GB
Memory usage: 63%
Swap usage: 6%
Processes: 108
Users logged in: 1
IP address for enp0s3: 192.168.0.104
IP address for enp0s8: 10.83.17.1
IP address for enp0s9: 10.6.83.1
IP address for br-009b3e1b7ea1: 172.23.0.1
IP address for br-3ed10119e435: 172.22.0.1
IP address for docker0: 172.17.0.1
* Super-optimized for small spaces - read how we shrank the memory
footprint of MicroK8s to make it the smallest full K8s around.
https://ubuntu.com/blog/microk8s-memory-optimisation
* Canonical Livepatch is available for installation.
- Reduce system reboots and improve kernel security. Activate at:
https://ubuntu.com/livepatch
79 packages can be updated.
1 update is a security update.
New release '20.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.
Last login: Wed Oct 26 22:12:20 2022 from 192.168.0.101
user@server1:~$

```
root@client2:/home/user# ssh root@172.16.17.1
The authenticity of host '172.16.17.1 (172.16.17.1)' can't be established.
ECDSA key fingerprint is SHA256:dD6WVATuJBqIL++TL28BDR1TQBRk6z3hiqMLmrPuUeg.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '172.16.17.1' (ECDSA) to the list of known hosts.
root@172.16.17.1's password:
Last login: Wed Oct 26 18:15:07 2022 from gateway
[root@client1 ~]#
```

Налаштуйте на Server_1 firewall таким чином:

- Дозволено підключатись через SSH з client1 та заборонено з client2
- З client2 на 172.18.27.1 ping проходив, а на 172.18.37.1 не проходив

Для вирішення цієї задачі необхідно зробити налаштування iptables на server1:

```
root@server1:/home/user# iptables -A INPUT -s 10.6.83.10 -p tcp --dport 22 -j REJECT
```

```
root@server1:/home/user# iptables -L -nv
Chain INPUT (policy ACCEPT 55 packets, 4588 bytes)
 pkts bytes target     prot opt in     out     source               destination
    0     0 REJECT     tcp  --  *      *       10.6.83.10           0.0.0.0/0            tcp dpt:22 reject-with icmp-port-unreachable

Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source               destination

Chain OUTPUT (policy ACCEPT 28 packets, 3968 bytes)
 pkts bytes target     prot opt in     out     source               destination
```

```
[root@client1 ~]# ssh user@10.83.17.1
Welcome to Ubuntu 18.04.5 LTS (GNU/Linux 5.4.0-1088-aws x86_64)

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

  System information as of Thu Oct 27 09:45:16 UTC 2022

  System load:                    0.0
  Usage of /:                     67.5% of 13.67GB
  Memory usage:                   63%
  Swap usage:                     6%
  Processes:                      109
  Users logged in:                1
  IP address for enp0s3:          192.168.0.104
  IP address for enp0s8:          10.83.17.1
  IP address for enp0s9:          10.6.83.1
  IP address for br-009b3e1b7ea1: 172.23.0.1
  IP address for br-3ed10119e435: 172.22.0.1
  IP address for docker0:         172.17.0.1

 * Super-optimized for small spaces - read how we shrank the memory
   footprint of MicroK8s to make it the smallest full K8s around.

   https://ubuntu.com/blog/microk8s-memory-optimisation

 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch

79 packages can be updated.
1 update is a security update.

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


Last login: Thu Oct 27 09:40:03 2022 from 10.83.17.10
user@server1:~$
```

3 clien1 - дозволено

3 client2 - заборонен

```
root@client2:/home/user# ssh user@10.6.83.1
ssh: connect to host 10.6.83.1 port 22: Connection refused
root@client2:/home/user#
```

3 clien2 на 172.18.37.1 – ping заборонено, на 172.18.27.1 - дозволено

```
root@client2:/home/user# ping 172.18.37.1
PING 172.18.37.1 (172.18.37.1) 56(84) bytes of data.
^C
--- 172.18.37.1 ping statistics ---
4 packets transmitted, 0 received, 100% packet loss, time 141ms

root@client2:/home/user# ping 172.18.27.1
PING 172.18.27.1 (172.18.27.1) 56(84) bytes of data.
64 bytes from 172.18.27.1: icmp_seq=1 ttl=63 time=41.7 ms
64 bytes from 172.18.27.1: icmp_seq=2 ttl=63 time=35.6 ms
64 bytes from 172.18.27.1: icmp_seq=3 ttl=63 time=36.6 ms
^C
--- 172.18.27.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 28ms
rtt min/avg/max/mdev = 35.569/37.962/41.680/2.674 ms
root@client2:/home/user# traceroute 172.18.27.1
traceroute to 172.18.27.1 (172.18.27.1), 30 hops max, 60 byte packets
 1  10.6.83.1 (10.6.83.1)  92.824 ms  0.747 ms  0.733 ms
 2  172.18.27.1 (172.18.27.1)  37.957 ms  37.126 ms  36.018 ms
```

Видаляємо статичні маршрути, які були встановлені на початку роботи:

Static Route

| | Destination IP Address | Subnet Mask | Gateway | Status | Edit |
|---|---|---|---|---|---|
| ☐ | 10.83.17.0 | 255.255.255.0 | 192.168.0.104 | Enable | Edit |
| ☐ | 10.6.83.0 | 255.255.255.0 | 192.168.0.104 | Enable | Edit |

Доступ в мережу інтернет відсутній на client1

```
[root@client1 ~]# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
^C
--- 8.8.8.8 ping statistics ---
8 packets transmitted, 0 received, 100% packet loss, time 7019ms

[root@client1 ~]#
```

Доступ в мережу інтернет відсутній на client2

```
root@client2:/home/user# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
^C
--- 8.8.8.8 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 73ms
```

Додаємо правила nat на server1:

```
root@server1:/home/user# iptables -t nat -A POSTROUTING -s 10.6.83.0/24 -o enp0s3  -j MASQUERADE
```

```
root@server1:/home/user# iptables -t nat -A POSTROUTING -s 10.83.17.0/24 -o enp0s3  -j MASQUERADE
```

```
root@server1:/home/user# iptables -t nat -L -nv
Chain PREROUTING (policy ACCEPT 3 packets, 406 bytes)
 pkts bytes target     prot opt in     out     source               destination
   82 23280 DOCKER     all  --  *      *       0.0.0.0/0            0.0.0.0/0           ADDRTYPE match dst-type LOCAL

Chain INPUT (policy ACCEPT 2 packets, 322 bytes)
 pkts bytes target     prot opt in     out     source               destination

Chain OUTPUT (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source               destination
    0     0 DOCKER     all  --  *      *       0.0.0.0/0           !127.0.0.0/8         ADDRTYPE match dst-type LOCAL

Chain POSTROUTING (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source               destination
    2   168 MASQUERADE  all  --  *      enp0s3  10.6.83.0/24          0.0.0.0/0
    1    84 MASQUERADE  all  --  *      enp0s3  10.83.17.0/24         0.0.0.0/0
```

Доступ в мережу інтернет з’явився на client1 та client2:

```
[root@client1 ~]# 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=115 time=28.2 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=115 time=27.8 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=115 time=28.0 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=115 time=27.7 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=115 time=28.2 ms
^C
--- 8.8.8.8 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4016ms
rtt min/avg/max/mdev = 27.722/28.024/28.231/0.199 ms
[root@client1 ~]#
```

```
root@client2:/home/user# 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=115 time=33.3 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=115 time=31.5 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=115 time=84.0 ms
^C
--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 45ms
rtt min/avg/max/mdev = 31.482/49.584/84.019/24.360 ms
```