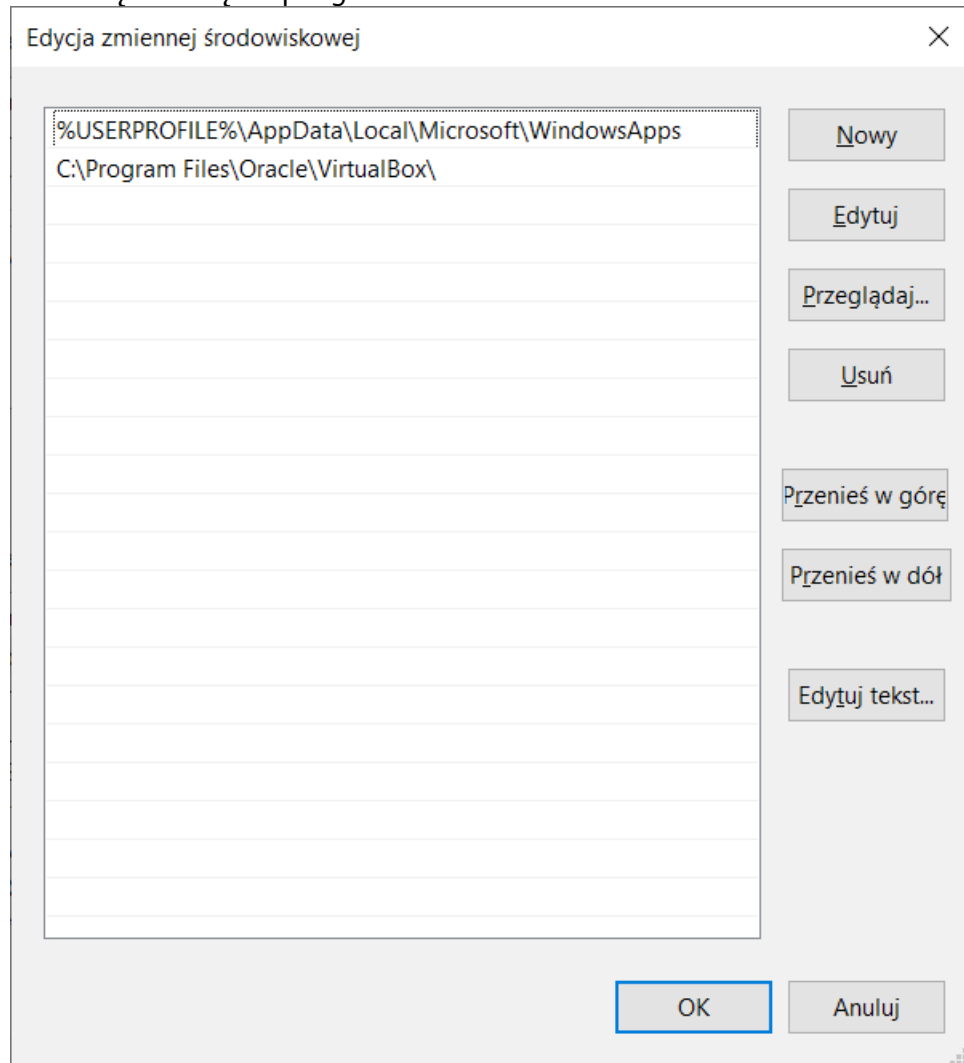


Lab 9. Routing. Konfiguracja kart sieciowych

- Wymagania wstępne
 - praca odbędzie się na programie VirtualBox



```
WybierzAdministrator: Windows PowerShell (x86)
C:\Users\Użytkownik\Desktop\routinglab>vboxmanage modifyvm vm4 --nic1 intnet --macaddress1 525400000043 --cableconnected
1 on --intnet1 "Network3-4"
PS C:\Users\Użytkownik\Desktop\routinglab> .\start-vms.cmd

C:\Users\Użytkownik\Desktop\routinglab>for /L %x in (1 1 4) do (
vboxmanage startvm vm%x
timeout 10
)

C:\Users\Użytkownik\Desktop\routinglab>(
vboxmanage startvm vm1
timeout 10
)
Waiting for VM "vm1" to power on...
VM "vm1" has been successfully started.

Waiting for 0 seconds, press a key to continue ...

C:\Users\Użytkownik\Desktop\routinglab>(
vboxmanage startvm vm2
timeout 10
)
Waiting for VM "vm2" to power on...
VM "vm2" has been successfully started.

Waiting for 0 seconds, press a key to continue ...

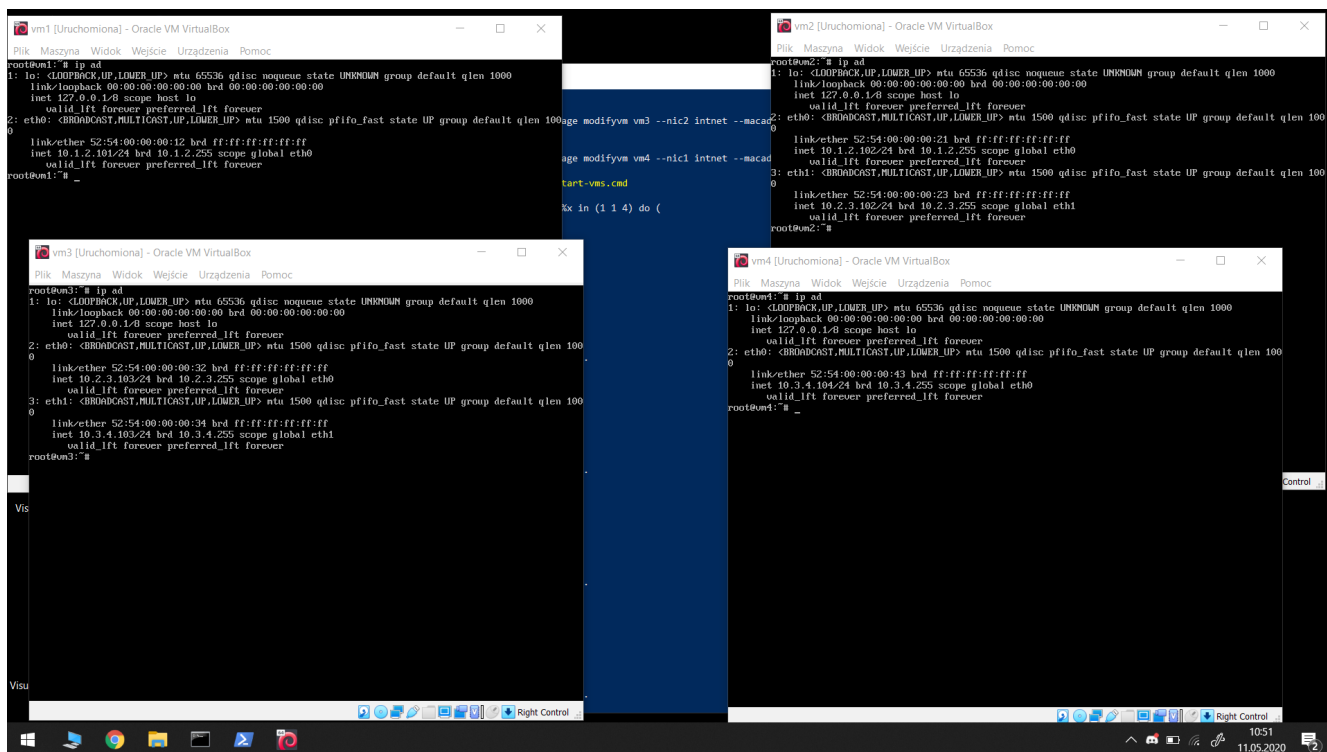
C:\Users\Użytkownik\Desktop\routinglab>(
vboxmanage startvm vm3
timeout 10
)
Waiting for VM "vm3" to power on...
VM "vm3" has been successfully started.

Waiting for 0 seconds, press a key to continue ...

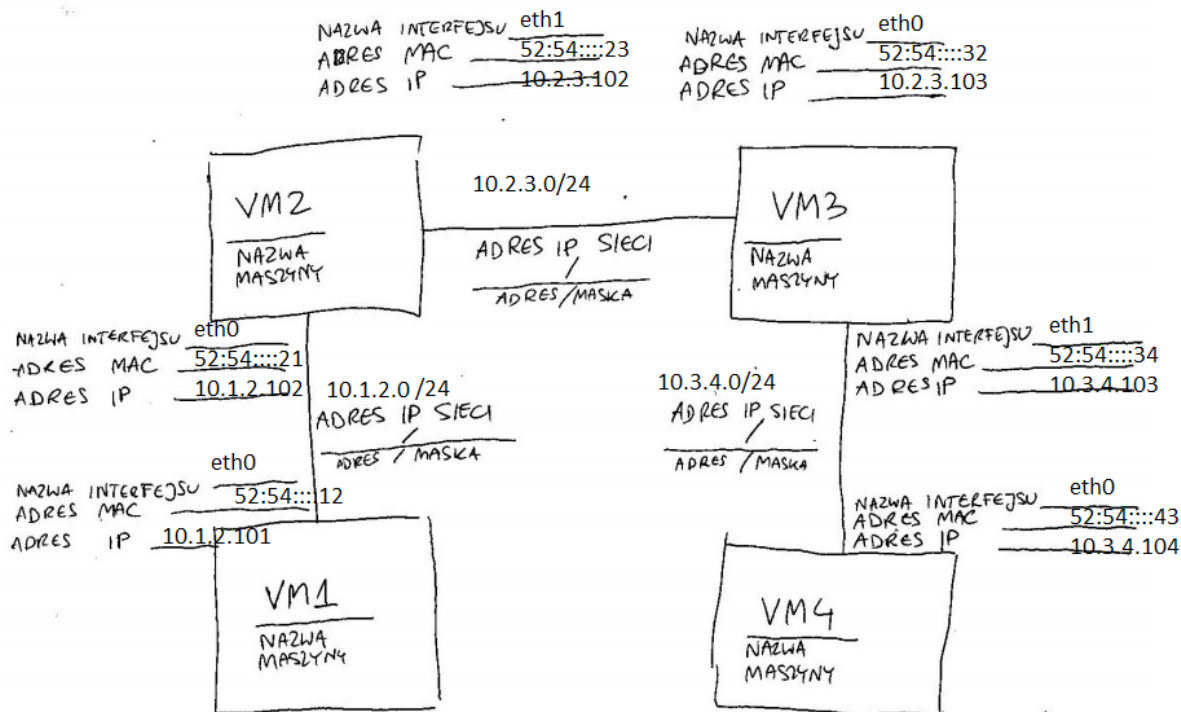
C:\Users\Użytkownik\Desktop\routinglab>(
vboxmanage startvm vm4
timeout 10
)
Waiting for VM "vm4" to power on...
VM "vm4" has been successfully started.

Waiting for 0 seconds, press a key to continue ...
PS C:\Users\Użytkownik\Desktop\routinglab> ■
```

- Uruchomienie maszyn wirtualnych i wyświetlenie informacji z ip ad



- Zapoznanie się ze środowiskiem
 - mapa sieci



- Maszyna wirtualna VM2: sprawdzenie ping i traceroute na podane ip

vm2 [Uruchomiona] - Oracle VM VirtualBox

Plik Maszyna Widok Wejście Urządzenia Pomoc

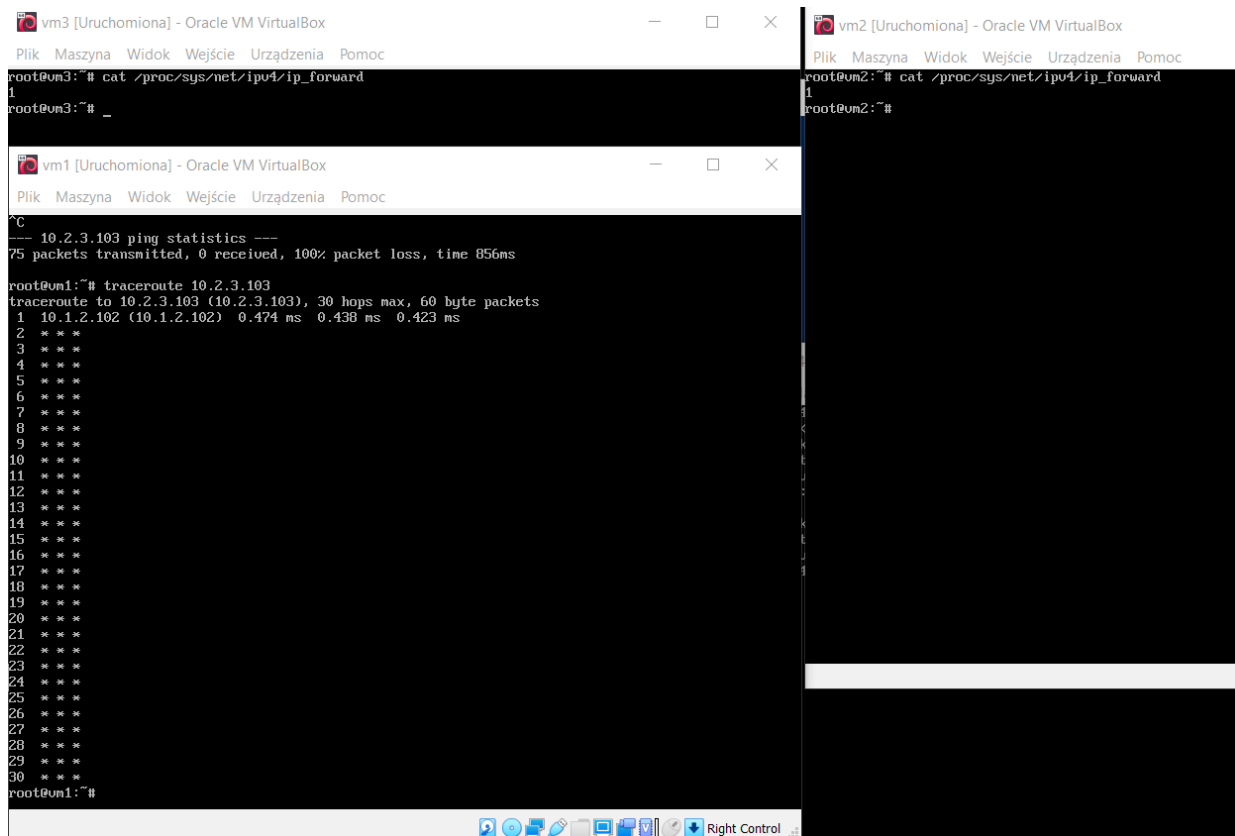
```
root@vm2:~# ip route
10.1.2.0/24 dev eth0 proto kernel scope link src 10.1.2.102
10.2.3.0/24 dev eth1 proto kernel scope link src 10.2.3.102
root@vm2:~# ping 10.1.2.101
PING 10.1.2.101 (10.1.2.101) 56(84) bytes of data.
64 bytes from 10.1.2.101: icmp_seq=1 ttl=64 time=0.554 ms
64 bytes from 10.1.2.101: icmp_seq=2 ttl=64 time=1.11 ms
64 bytes from 10.1.2.101: icmp_seq=3 ttl=64 time=1.15 ms
^C
--- 10.1.2.101 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 5ms
rtt min/avg/max/mdev = 0.554/0.939/1.149/0.272 ms
root@vm2:~# ping 10.2.3.103
PING 10.2.3.103 (10.2.3.103) 56(84) bytes of data.
64 bytes from 10.2.3.103: icmp_seq=1 ttl=64 time=0.534 ms
64 bytes from 10.2.3.103: icmp_seq=2 ttl=64 time=1.13 ms
64 bytes from 10.2.3.103: icmp_seq=3 ttl=64 time=1.22 ms
^C
--- 10.2.3.103 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 37ms
rtt min/avg/max/mdev = 0.534/0.960/1.216/0.304 ms
root@vm2:~# traceroute 10.1.2.101
traceroute to 10.1.2.101 (10.1.2.101), 30 hops max, 60 byte packets
 1  10.1.2.101 (10.1.2.101)  0.400 ms  0.368 ms  0.527 ms
root@vm2:~# traceroute 8.8.8.8
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
connect: Network is unreachable
root@vm2:~# ping 8.8.8.8
connect: Network is unreachable
root@vm2:~# _
```

- między VM2 a VM1 jest bezpośrednie połączenie
- sieć 8.8.8.8 jest nieosiągalna
- Maszyna wirtualna VM1: sprawdzenie ping i traceroute na podane ip

```
vm1 [Uruchomiona] - Oracle VM VirtualBox
Plik Maszyna Widok Wejście Urządzenia Pomoc
root@um1:~# ip route
default via 10.1.2.102 dev eth0 onlink
10.1.2.0/24 dev eth0 proto kernel scope link src 10.1.2.101
root@um1:~# ping 10.1.2.102
PING 10.1.2.102 (10.1.2.102) 56(84) bytes of data.
64 bytes from 10.1.2.102: icmp_seq=1 ttl=64 time=0.485 ms
64 bytes from 10.1.2.102: icmp_seq=2 ttl=64 time=1.14 ms
64 bytes from 10.1.2.102: icmp_seq=3 ttl=64 time=1.08 ms
^C
--- 10.1.2.102 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 24ms
rtt min/avg/max/mdev = 0.485/0.899/1.136/0.293 ms
root@um1:~# traceroute 10.1.2.102
traceroute to 10.1.2.102 (10.1.2.102), 30 hops max, 60 byte packets
 1 10.1.2.102 (10.1.2.102) 0.467 ms 0.432 ms 0.417 ms
root@um1:~# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
From 10.1.2.102 icmp_seq=1 Destination Net Unreachable
From 10.1.2.102 icmp_seq=2 Destination Net Unreachable
From 10.1.2.102 icmp_seq=3 Destination Net Unreachable
^C
--- 8.8.8.8 ping statistics ---
3 packets transmitted, 0 received, +3 errors, 100% packet loss, time 17ms

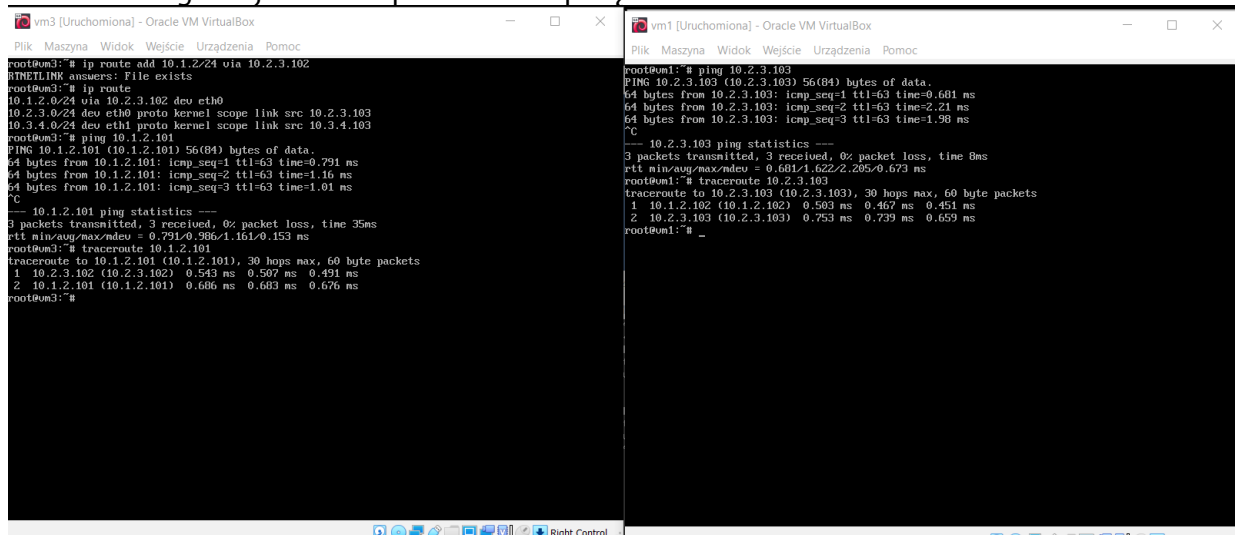
root@um1:~# traceroute 8.8.8.8
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
 1 10.1.2.102 (10.1.2.102) 0.401 ms !N 0.364 ms !N *
root@um1:~# _
```

- VM1 ma bezpośrednie połączenie z VM2
 - wyskakuje komunikat error, nie może połączyć się z siecią
 - informację o nieosiągalności sieci podaje VM2
- Konfiguracja routingu
 - sprawdzenie ip_forward oraz próba połączenia VM1 z pozostałymi



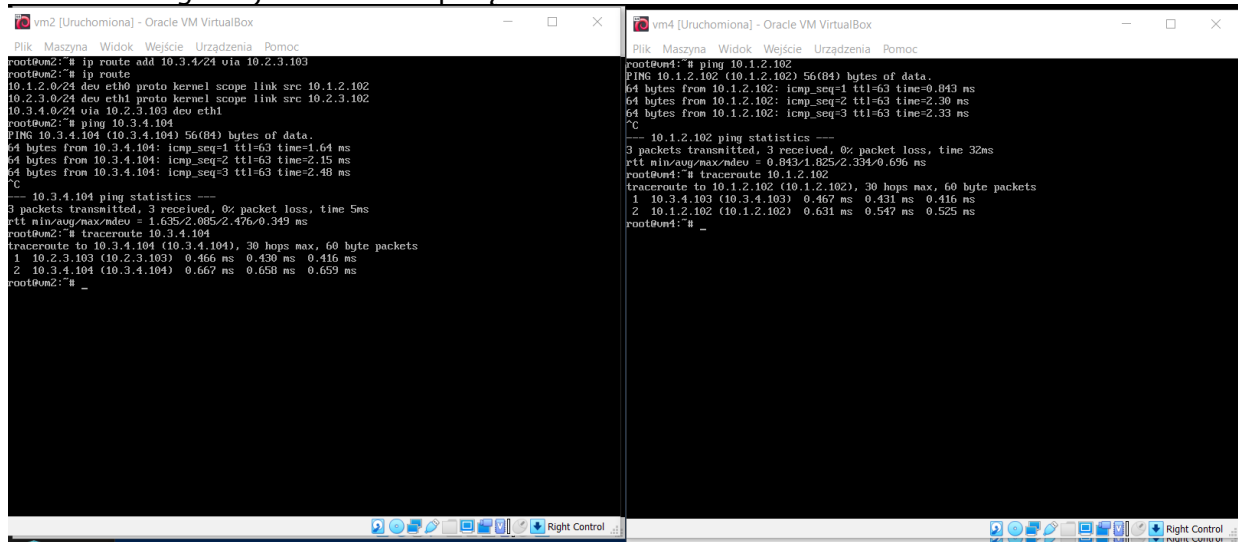
- domyślnie ip_forward był ustawiony na 1
- VM1 ma połączenie z VM2
- VM1 nie ma połączenia z VM3 I VM4
- pakiet z VM1 dotrze najdalej do VM2

◦ konfiguracja VM3 I sprawdzenie połączenia



- połączenie między VM1 a VM3 działa

- konfiguracja VM2 I test połączenia z VM4



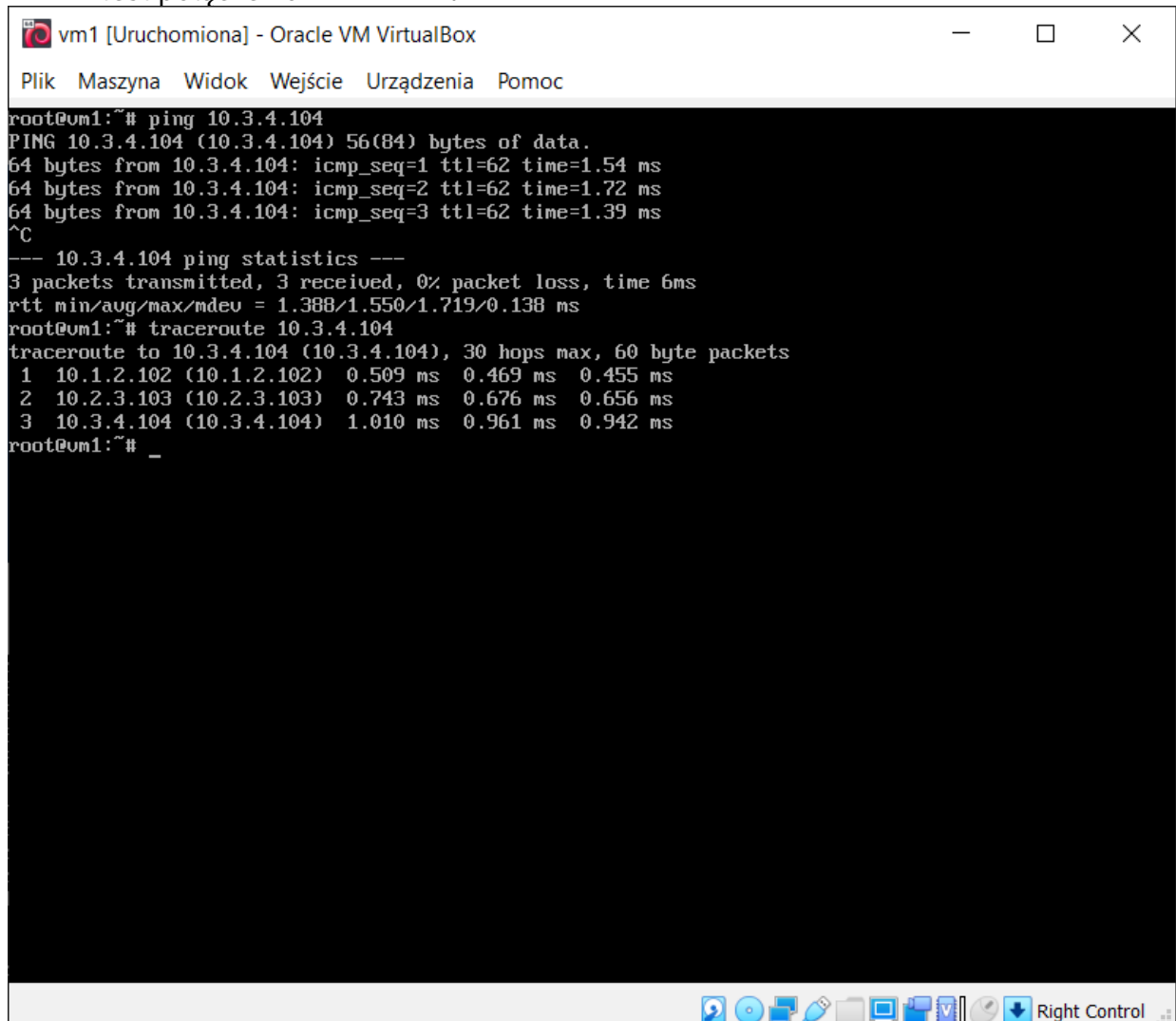
The screenshot shows two side-by-side Oracle VM VirtualBox windows. The left window, titled 'vm2 [Uruchomiona] - Oracle VM VirtualBox', shows the terminal output for VM2. The user has added a route to 10.3.4.24 via 10.2.3.103, viewed the routing table, and performed a ping test to 10.3.4.104. The ping statistics show 3 packets transmitted, 3 received, 0% packet loss, and a time of 5ms. The right window, titled 'vm4 [Uruchomiona] - Oracle VM VirtualBox', shows the terminal output for VM4. The user has pinged 10.1.2.102, viewed the ping statistics (3 packets transmitted, 3 received, 0% packet loss, time 32ms), and performed a traceroute to 10.1.2.102. The traceroute shows 3 hops: 10.3.4.103 (0.467 ms), 10.1.2.102 (0.631 ms), and 10.1.2.102 (0.547 ms).

```
root@vm2:~# ip route add 10.3.4.24 via 10.2.3.103
root@vm2:~# ip route
10.1.2.0/24 dev eth0 proto kernel scope link src 10.1.2.102
10.2.3.0/24 dev eth1 proto kernel scope link src 10.2.3.102
10.3.4.0/24 via 10.2.3.103 dev eth1
root@vm2:~# ping 10.3.4.104
PING 10.3.4.104 (10.3.4.104) 56(84) bytes of data:
64 bytes from 10.3.4.104: icmp_seq=1 ttl=63 time=1.64 ms
64 bytes from 10.3.4.104: icmp_seq=2 ttl=63 time=2.45 ms
64 bytes from 10.3.4.104: icmp_seq=3 ttl=63 time=2.48 ms
^C
--- 10.3.4.104 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 5ms
rtt min/avg/max/mdev = 1.635/2.085/2.476/0.349 ms
root@vm2:~# traceroute 10.3.4.104
traceroute to 10.3.4.104 (10.3.4.104), 30 hops max, 60 byte packets
 1 10.2.3.103 (10.2.3.103) 0.466 ms 0.430 ms 0.416 ms
 2 10.3.4.104 (10.3.4.104) 0.667 ms 0.658 ms 0.659 ms
root@vm2:~#
```

```
root@vm4:~# ping 10.1.2.102
PING 10.1.2.102 (10.1.2.102) 56(84) bytes of data:
64 bytes from 10.1.2.102: icmp_seq=1 ttl=63 time=0.043 ms
64 bytes from 10.1.2.102: icmp_seq=2 ttl=63 time=2.30 ms
64 bytes from 10.1.2.102: icmp_seq=3 ttl=63 time=2.33 ms
^C
--- 10.1.2.102 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 32ms
rtt min/avg/max/mdev = 0.043/1.825/2.334/0.636 ms
root@vm4:~# traceroute 10.1.2.102
traceroute to 10.1.2.102 (10.1.2.102), 30 hops max, 60 byte packets
 1 10.3.4.103 (10.3.4.103) 0.467 ms 0.431 ms 0.416 ms
 2 10.1.2.102 (10.1.2.102) 0.631 ms 0.547 ms 0.525 ms
root@vm4:~#
```

- połączenie między VM2 I VM4 działa

- test połączenia VM1 z VM4



The screenshot shows a single Oracle VM VirtualBox window titled 'vm1 [Uruchomiona] - Oracle VM VirtualBox'. The terminal output shows the user performing a ping test to 10.3.4.104 and a traceroute to 10.3.4.104. The ping statistics show 3 packets transmitted, 3 received, 0% packet loss, and a time of 6ms. The traceroute shows 3 hops: 10.1.2.102 (0.509 ms), 10.2.3.103 (0.743 ms), and 10.3.4.104 (1.010 ms).

```
root@vm1:~# ping 10.3.4.104
PING 10.3.4.104 (10.3.4.104) 56(84) bytes of data:
64 bytes from 10.3.4.104: icmp_seq=1 ttl=62 time=1.54 ms
64 bytes from 10.3.4.104: icmp_seq=2 ttl=62 time=1.72 ms
64 bytes from 10.3.4.104: icmp_seq=3 ttl=62 time=1.39 ms
^C
--- 10.3.4.104 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 6ms
rtt min/avg/max/mdev = 1.388/1.550/1.719/0.138 ms
root@vm1:~# traceroute 10.3.4.104
traceroute to 10.3.4.104 (10.3.4.104), 30 hops max, 60 byte packets
 1 10.1.2.102 (10.1.2.102) 0.509 ms 0.469 ms 0.455 ms
 2 10.2.3.103 (10.2.3.103) 0.743 ms 0.676 ms 0.656 ms
 3 10.3.4.104 (10.3.4.104) 1.010 ms 0.961 ms 0.942 ms
root@vm1:~#
```

- Konfiguracja interfejsów sieciowych
 - zmiana została wykonana w aplikacji nano z 10.1.2.101/24 na 10.1.2.105/24
 - ponowne połączenia VM1 i VM4

```

root@vm4:~# ping 10.1.2.105
PING 10.1.2.105 (10.1.2.105) 56(84) bytes of data:
64 bytes from 10.1.2.105: icmp_seq=1 ttl=62 time=1.47 ms
64 bytes from 10.1.2.105: icmp_seq=2 ttl=62 time=2.97 ms
64 bytes from 10.1.2.105: icmp_seq=3 ttl=62 time=3.27 ms
^C
--- 10.1.2.105 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 5ms
rtt min/avg/max/mdev = 1.470/2.570/3.273/0.790 ms
root@vm4:~#

root@vm1:~# traceroute 10.1.2.102
traceroute to 10.1.2.102 (10.1.2.102), 30 hops max, 60 byte packets
 1 10.1.2.102 (10.1.2.102) 0.555 ms 0.501 ms 0.896 ms
root@vm1:~# traceroute 10.2.3.103
traceroute to 10.2.3.103 (10.2.3.103), 30 hops max, 60 byte packets
 1 10.1.2.102 (10.1.2.102) 0.476 ms 0.437 ms 0.424 ms
 2 10.2.3.103 (10.2.3.103) 0.750 ms 0.736 ms 0.721 ms
root@vm1:~# traceroute 10.2.4.104
traceroute to 10.2.4.104 (10.2.4.104), 30 hops max, 60 byte packets
 1 10.1.2.102 (10.1.2.102) 0.405 ms 0.434 ms 0.434 ms
root@vm1:~# traceroute 10.3.4.104
traceroute to 10.3.4.104 (10.3.4.104), 30 hops max, 60 byte packets
 1 10.1.2.102 (10.1.2.102) 0.435 ms 0.396 ms 0.380 ms
 2 10.2.3.103 (10.2.3.103) 0.714 ms 0.702 ms 0.609 ms
 3 10.3.4.104 (10.3.4.104) 0.904 ms 0.963 ms 0.950 ms
root@vm1:~#

```

- VM1 ma kontakt z maszynami VM2, VM3 i VM4
- VM4 widzi nowe ip VM1
- dodanie ustawień w 40-network-cfg

```

GNU nano 3.2 /etc/network/interfaces.d/40-network-cfg Modified

# Network configuration
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet static
    address 10.2.3.103/24

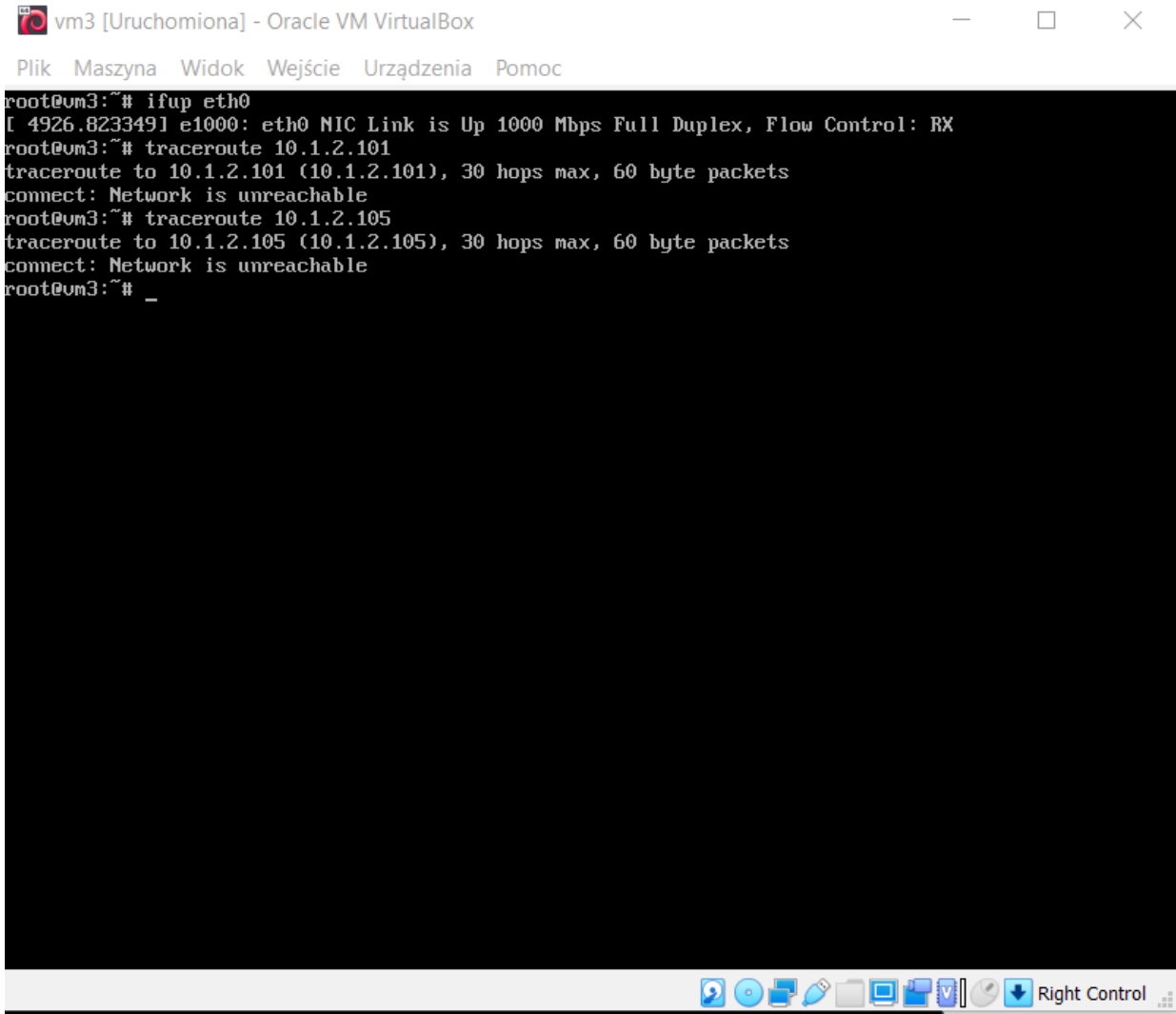
auto eth1
iface eth1 inet static
    address 10.3.4.103/24

up route add -net 10.1.2.101 netmask 255.255.255.0 gw 10.2.3.102
down route del -net 10.1.2.101 network 255.255.255.0 gw 10.2.3.102_

```

◦ .

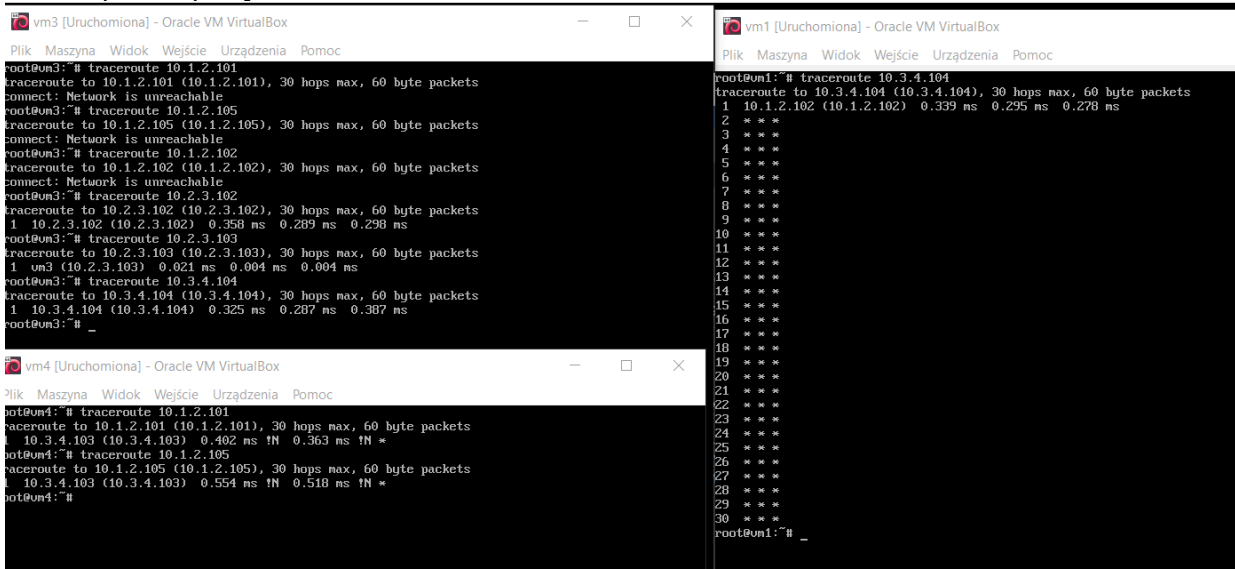
- próba połączenia się VM3 z VM1 po restarcie VM3



```
vm3 [Uruchomiona] - Oracle VM VirtualBox
Plik Maszyna Widok Wejście Urządzenia Pomoc
root@vm3:~# ifup eth0
[ 4926.823349] e1000: eth0 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: RX
root@vm3:~# traceroute 10.1.2.101
traceroute to 10.1.2.101 (10.1.2.101), 30 hops max, 60 byte packets
connect: Network is unreachable
root@vm3:~# traceroute 10.1.2.105
traceroute to 10.1.2.105 (10.1.2.105), 30 hops max, 60 byte packets
connect: Network is unreachable
root@vm3:~# _
```

- VM3 nie może nawiązać połączenia z VM1 zarówno poprzez ip 101 | 105

- próba połączenia VM1 z VM4



```
vm3 [Uruchomiona] - Oracle VM VirtualBox
Plik Maszyna Widok Wejście Urządzenia Pomoc
root@vm3:~# traceroute 10.1.2.101
traceroute to 10.1.2.101 (10.1.2.101), 30 hops max, 60 byte packets
connect: Network is unreachable
root@vm3:~# traceroute 10.1.2.105
traceroute to 10.1.2.105 (10.1.2.105), 30 hops max, 60 byte packets
connect: Network is unreachable
root@vm3:~# traceroute 10.1.2.102
traceroute to 10.1.2.102 (10.1.2.102), 30 hops max, 60 byte packets
connect: Network is unreachable
root@vm3:~# traceroute 10.2.3.102
traceroute to 10.2.3.102 (10.2.3.102), 30 hops max, 60 byte packets
1 10.2.3.102 (10.2.3.102) 0.358 ms 0.358 ms 0.298 ms
root@vm3:~# traceroute 10.2.3.103
traceroute to 10.2.3.103 (10.2.3.103), 30 hops max, 60 byte packets
1 10.2.3.103 (10.2.3.103) 0.021 ms 0.004 ms 0.004 ms
root@vm3:~# traceroute 10.3.4.104
traceroute to 10.3.4.104 (10.3.4.104), 30 hops max, 60 byte packets
1 10.3.4.104 (10.3.4.104) 0.325 ms 0.287 ms 0.387 ms
root@vm3:~# _

vm1 [Uruchomiona] - Oracle VM VirtualBox
Plik Maszyna Widok Wejście Urządzenia Pomoc
root@vm1:~# traceroute 10.3.4.104
traceroute to 10.3.4.104 (10.3.4.104), 30 hops max, 60 byte packets
1 10.1.2.102 (10.1.2.102) 0.339 ms 0.295 ms 0.278 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 ***
root@vm1:~# _

vm4 [Uruchomiona] - Oracle VM VirtualBox
Plik Maszyna Widok Wejście Urządzenia Pomoc
root@vm4:~# traceroute 10.1.2.101
traceroute to 10.1.2.101 (10.1.2.101), 30 hops max, 60 byte packets
1 10.3.4.103 (10.3.4.103) 0.402 ms !N 0.363 ms !N *
root@vm4:~# traceroute 10.1.2.105
traceroute to 10.1.2.105 (10.1.2.105), 30 hops max, 60 byte packets
1 10.3.4.103 (10.3.4.103) 0.554 ms !N 0.518 ms !N *
```

- VM1 nie ma połączenia z VM4
- VM3 uniemożliwia połączenia się VM4 z VM2 i VM1
- VM3 także uniemożliwia połączenia się VM1 i VM2 z VM4