

Sieci komputerowe – Warsztaty 3

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Zadanie dopuszczające do dalszych części (0 pkt.)

Najpierw ustawiamy nazwy interfejsów

```
#V1> ip link set enp0s3 name enp-rem4
#V1> ip link set enp0s8 name enp-rem1

#V2> ip link set enp0s3 name enp-rem1
#V2> ip link set enp0s8 name enp-rem2

#V3> ip link set enp0s3 name enp-rem2
#V3> ip link set enp0s8 name enp-rem3

#V4> ip link set enp0s3 name enp-rem3
#V4> ip link set enp0s8 name enp-rem4
```

Aktywujemy interfejsy

```
V1#> ip link set up dev enp-rem1
V1#> ip addr add 192.168.1.1/24 dev enp-rem1

V2#> ip link set up dev enp-rem1
V2#> ip addr add 192.168.1.2/24 dev enp-rem1
V2#> ip link set up dev enp-rem2
V2#> ip addr add 192.168.2.2/24 dev enp-rem2

V3#> ip link set up dev enp-rem2
V3#> ip addr add 192.168.2.3/24 dev enp-rem2
V3#> ip link set up dev enp-rem3
V3#> ip addr add 192.168.3.3/24 dev enp-rem3

V4#> ip link set up dev enp-rem3
V4#> ip addr add 192.168.3.4/24 dev enp-rem3
```

Ustawiamy bramę domyślną dla *Virbian1* i *Virbian4*

```
V1#> ip route add default via 192.168.1.2
V4#> ip route add default via 192.168.3.3
```

Jak widać pingowanie obu adresów *Virbiana2* z *Virbiana1* działa poprawnie:

```
root@virbian: /home/user
root@virbian:/home/user# ping 192.168.1.2
PING 192.168.1.2 (192.168.1.2) 56(84) bytes of data.
64 bytes from 192.168.1.2: icmp_seq=1 ttl=64 time=0.927 ms
64 bytes from 192.168.1.2: icmp_seq=2 ttl=64 time=0.626 ms
64 bytes from 192.168.1.2: icmp_seq=3 ttl=64 time=0.484 ms
64 bytes from 192.168.1.2: icmp_seq=4 ttl=64 time=0.613 ms
^C
--- 192.168.1.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 8ms
rtt min/avg/max/mdev = 0.484/0.662/0.927/0.164 ms
root@virbian:/home/user# ping 192.168.2.2
PING 192.168.2.2 (192.168.2.2) 56(84) bytes of data.
64 bytes from 192.168.2.2: icmp_seq=1 ttl=64 time=0.554 ms
64 bytes from 192.168.2.2: icmp_seq=2 ttl=64 time=2.15 ms
64 bytes from 192.168.2.2: icmp_seq=3 ttl=64 time=0.668 ms
64 bytes from 192.168.2.2: icmp_seq=4 ttl=64 time=0.590 ms
^C
--- 192.168.2.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 35ms
rtt min/avg/max/mdev = 0.554/0.990/2.150/0.671 ms
root@virbian:/home/user#
```

Tak samo pingowanie *Virbiana3* z *Virbiana2* też działa:

```
root@virbian: /home/user
root@virbian:/home/user# ping 192.168.2.3
PING 192.168.2.3 (192.168.2.3) 56(84) bytes of data.
64 bytes from 192.168.2.3: icmp_seq=1 ttl=64 time=0.623 ms
64 bytes from 192.168.2.3: icmp_seq=2 ttl=64 time=0.682 ms
64 bytes from 192.168.2.3: icmp_seq=3 ttl=64 time=0.592 ms
64 bytes from 192.168.2.3: icmp_seq=4 ttl=64 time=0.521 ms
^C
--- 192.168.2.3 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 63ms
rtt min/avg/max/mdev = 0.521/0.604/0.682/0.063 ms
root@virbian:/home/user#
```

Uruchamiamy Wireshark i pingujemy **192.168.2.3**. Jak widać na załączonym obrazku pakiety dochodzą do celu, ale odpowiedzi nie wracają. Dzieje się to dlatego, że *Virbian3* nie zna trasy do *Virbiana1* aby odesłać pakiet z odpowiedzią.

The image shows a Wireshark packet capture window and a terminal window. The Wireshark window is titled "Capturing from enp-rem1 (icmp)" and displays a list of ICMP Echo (ping) requests. The terminal window shows the output of ping commands from a host named "virbian".

No.	Time	Source	Destination	Protocol	Length	Info
2	1.017870961	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
3	2.041943900	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
4	3.065894979	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
5	4.090095050	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
6	5.117210702	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
7	6.141248715	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
8	7.161873793	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
9	8.185806375	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
10	9.209880716	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
11	10.233947561	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
12	11.257898640	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
13	12.281922181	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
14	13.305885609	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
15	14.329879972	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
16	15.353949240	192.168.1.1	192.168.2.3	ICMP	98	Echo (ping) request
17	16.378054171	192.168.1.2	192.168.1.1	ICMP	126	Destination unreachable
18	17.402116546	192.168.1.1	192.168.3.3	ICMP	98	Echo (ping) request
19	18.426186546	192.168.1.2	192.168.1.1	ICMP	126	Destination unreachable
20	19.450256546	192.168.1.1	192.168.3.3	ICMP	98	Echo (ping) request
21	20.474326546	192.168.1.2	192.168.1.1	ICMP	126	Destination unreachable
22	21.498396547	192.168.1.1	192.168.3.3	ICMP	98	Echo (ping) request
23	22.512466547	192.168.1.2	192.168.1.1	ICMP	126	Destination unreachable
24	23.536536547	192.168.1.1	192.168.3.3	ICMP	98	Echo (ping) request

```

root@virbian:/home/user# ping 192.168.2.3
PING 192.168.2.3 (192.168.2.3) 56(84) bytes of data.
^C
--- 192.168.2.3 ping statistics ---
15 packets transmitted, 0 received, 100% packet loss, time 344ms

root@virbian:/home/user# ping 192.168.3.3
PING 192.168.3.3 (192.168.3.3) 56(84) bytes of data.
From 192.168.1.2 icmp_seq=1 Destination Net Unreachable
From 192.168.1.2 icmp_seq=2 Destination Net Unreachable
From 192.168.1.2 icmp_seq=3 Destination Net Unreachable
From 192.168.1.2 icmp_seq=4 Destination Net Unreachable
^C
--- 192.168.3.3 ping statistics ---
5 packets transmitted, 0 received, +4 errors, 100% packet loss, time 85ms

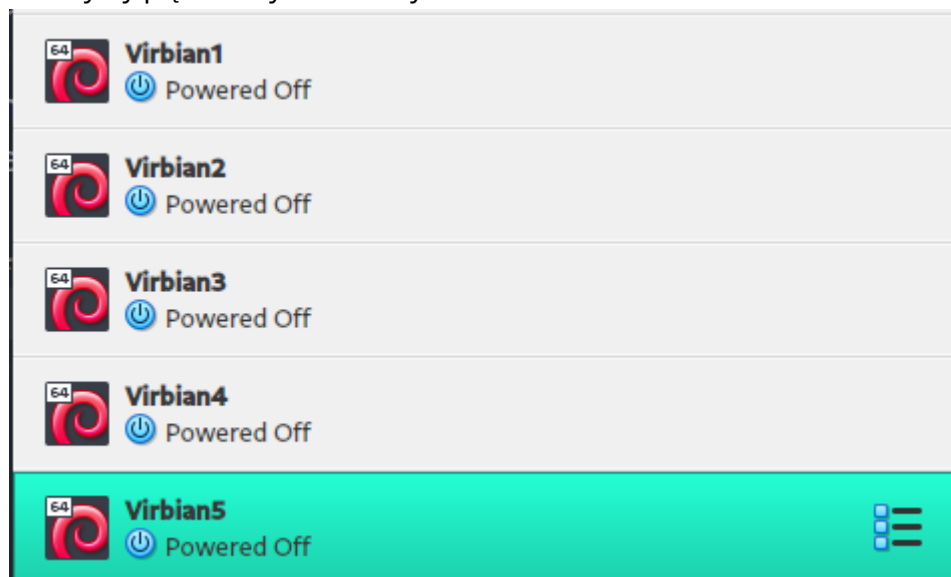
root@virbian:/home/user#

```

Jeżeli pingamy adres **192.168.3.3** to otrzymujemy odpowiedź od *Virbiana2*. Dostajemy ją dlatego, że nie zna on trasy do tego adresu (w przeciwieństwie do trasy do **192.168.2.3**) więc pakiet dochodzi do *Virbiana2* a ten nie może go wysłać dalej, więc odpowiada nam, że cel nie jest osiągalny.

Zadanie do zaprezentowania (~~5 pkt.~~ 3,5 pkt.)

Tworzymy pięć maszyn wirtualnych:



Następnie konfigurujemy ich interfejsy sieciowe:

```

V1#> ip link set enp0s3 name enp-loc0
V1#> ip link set up dev enp-loc0
V1#> ip addr add 192.168.0.1/24 dev enp-loc0

```

```
V2#> ip link set enp0s3 name enp-loc0
V2#> ip link set enp0s8 name enp-loc1
V2#> ip link set enp0s9 name enp-loc2
V2#> ip link set up dev enp-loc0
V2#> ip link set up dev enp-loc1
V2#> ip link set up dev enp-loc2
V2#> ip addr add 192.168.0.2/24 dev enp-loc0
V2#> ip addr add 192.168.1.2/24 dev enp-loc1
V2#> ip addr add 192.168.2.2/24 dev enp-loc2
```

```
V3#> ip link set enp0s3 name enp-loc1
V3#> ip link set enp0s8 name enp-loc3
V3#> ip link set up dev enp-loc1
V3#> ip link set up dev enp-loc3
V3#> ip addr add 192.168.1.3/24 dev enp-loc1
V3#> ip addr add 192.168.3.3/24 dev enp-loc3
```

```
V4#> ip link set enp0s3 name enp-loc2
V4#> ip link set enp0s8 name enp-loc3
V4#> ip link set enp0s9 name enp-loc4
V4#> ip link set up dev enp-loc2
V4#> ip link set up dev enp-loc3
V4#> ip link set up dev enp-loc4
V4#> ip addr add 192.168.2.4/24 dev enp-loc2
V4#> ip addr add 192.168.3.4/24 dev enp-loc3
V4#> ip addr add 192.168.4.4/24 dev enp-loc4
```

```
V5#> ip link set enp0s3 name enp-loc4
V5#> ip link set up dev enp-loc4
V5#> ip addr add 192.168.4.5/24 dev enp-loc4
```

Dla *Virbiana1* ustawiamy trasę domyślną przechodzącą przez maszynę *Virbian2*, zaś dla maszyny *Virbian5* trasę domyślną przechodzącą przez maszynę *Virbian4*

```
V1#> ip route add default via 192.168.0.2
V5#> ip route add default via 192.168.4.4
```

```
root@virbian:/home/user# ip route
default via 192.168.0.2 dev enp-loc0
192.168.0.0/24 dev enp-loc0 proto kernel scope link src 192.168.0.1
root@virbian:/home/user#
```

```
root@virbian:/home/user# ip route
default via 192.168.4.4 dev enp-loc4
192.168.4.0/24 dev enp-loc4 proto kernel scope link src 192.168.4.5
root@virbian:/home/user#
```

Następnie na maszynach *Virbian2*, *Virbian3* i *Virbian4* włączamy protokół RIP.

Na każdej z tych trzech maszyn tworzymy pliki konfiguracyjne i uruchamiamy usługę **ripd**.

```
root@virbian:/home/user# touch /etc/quagga/ripd.conf
root@virbian:/home/user# touch /etc/quagga/zebra.conf
root@virbian:/home/user# touch /etc/quagga/vtysh.conf
root@virbian:/home/user# systemctl start ripd
root@virbian:/home/user#
root@virbian:/home/user# vtysh
```

Virbian2:

```
virbian# configure terminal
virbian(config)# router rip
virbian(config-router)# version 2
virbian(config-router)# network 192.168.0.0/24
virbian(config-router)# network 192.168.1.0/24
virbian(config-router)# network 192.168.2.0/24
virbian(config-router)# end
```

Virbian3:

```
virbian# configure terminal
virbian(config)# router rip
virbian(config-router)# version 2
virbian(config-router)# network 192.168.1.0/24
virbian(config-router)# network 192.168.3.0/24
virbian(config-router)# end
```

Virbian4:

```
virbian# configure terminal
virbian(config)# router rip
virbian(config-router)# version 2
virbian(config-router)# network 192.168.2.0/24
virbian(config-router)# network 192.168.3.0/24
virbian(config-router)# network 192.168.4.0/24
virbian(config-router)# end
```

Otrzymaliśmy w wyniku tego następujące tablice routingu:

Virbian2:

```
virbian# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
    (n) - normal, (s) - static, (d) - default, (r) - redistribute,
    (i) - interface
```

	Network	Next Hop	Metric	From	Tag	Time
C(i)	192.168.0.0/24	0.0.0.0	1	self	0	
C(i)	192.168.1.0/24	0.0.0.0	1	self	0	
C(i)	192.168.2.0/24	0.0.0.0	1	self	0	
R(n)	192.168.3.0/24	192.168.1.3	2	192.168.1.3	0	02:35
R(n)	192.168.4.0/24	192.168.2.4	2	192.168.2.4	0	02:33

```
virbian#
```


Virbian3:

```
virbian# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
    (n) - normal, (s) - static, (d) - default, (r) - redistribute,
    (i) - interface

Network          Next Hop          Metric From          Tag Time
R(n) 192.168.0.0/24 192.168.1.2        2 192.168.1.2        0 03:00
C(i) 192.168.1.0/24 0.0.0.0            1 self               0
R(n) 192.168.2.0/24 192.168.1.2        2 192.168.1.2        0 03:00
C(i) 192.168.3.0/24 0.0.0.0            1 self               0
R(n) 192.168.4.0/24 192.168.3.4        2 192.168.3.4        0 02:40
virbian#
```

Virbian4:

```
virbian# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
    (n) - normal, (s) - static, (d) - default, (r) - redistribute,
    (i) - interface

Network          Next Hop          Metric From          Tag Time
R(n) 192.168.0.0/24 192.168.2.2        2 192.168.2.2        0 02:48
R(n) 192.168.1.0/24 192.168.2.2        2 192.168.2.2        0 02:48
C(i) 192.168.2.0/24 0.0.0.0            1 self               0
C(i) 192.168.3.0/24 0.0.0.0            1 self               0
C(i) 192.168.4.0/24 0.0.0.0            1 self               0
virbian#
```

Sprawdźmy teraz osiągalność maszyn za pomocą ping:

- Virbian1 i Virbian3:

Virbian1 [Running] - Oracle VM VirtualBox	Virbian3 [Running] - Oracle VM VirtualBox
<pre>root@virbian: /home/user root@virbian:/home/user# ping 192.168.1.3 PING 192.168.1.3 (192.168.1.3) 56(84) bytes of data. 64 bytes from 192.168.1.3: icmp_seq=1 ttl=63 time=1.21 ms 64 bytes from 192.168.1.3: icmp_seq=2 ttl=63 time=1.12 ms 64 bytes from 192.168.1.3: icmp_seq=3 ttl=63 time=0.664 ms 64 bytes from 192.168.1.3: icmp_seq=4 ttl=63 time=1.19 ms 64 bytes from 192.168.1.3: icmp_seq=5 ttl=63 time=1.48 ms 64 bytes from 192.168.1.3: icmp_seq=6 ttl=63 time=0.946 ms ^C --- 192.168.1.3 ping statistics --- 6 packets transmitted, 6 received, 0% packet loss, time 32ms rtt min/avg/max/mdev = 0.664/1.101/1.475/0.250 ms root@virbian:/home/user#</pre>	<pre>root@virbian: /home/user root@virbian:/home/user# ping 192.168.0.1 PING 192.168.0.1 (192.168.0.1) 56(84) bytes of data. 64 bytes from 192.168.0.1: icmp_seq=1 ttl=63 time=0.494 ms 64 bytes from 192.168.0.1: icmp_seq=2 ttl=63 time=1.47 ms 64 bytes from 192.168.0.1: icmp_seq=3 ttl=63 time=1.01 ms 64 bytes from 192.168.0.1: icmp_seq=4 ttl=63 time=1.41 ms 64 bytes from 192.168.0.1: icmp_seq=5 ttl=63 time=0.885 ms ^C --- 192.168.0.1 ping statistics --- 5 packets transmitted, 5 received, 0% packet loss, time 14ms rtt min/avg/max/mdev = 0.494/1.051/1.467/0.359 ms root@virbian:/home/user#</pre>

- Virbian1 i Virbian5:

Virbian1 [Running] - Oracle VM VirtualBox	Virbian5 [Running] - Oracle VM VirtualBox
<pre>root@virbian: /home/user root@virbian:/home/user# ping 192.168.4.5 PING 192.168.4.5 (192.168.4.5) 56(84) bytes of data. 64 bytes from 192.168.4.5: icmp_seq=1 ttl=62 time=1.47 ms 64 bytes from 192.168.4.5: icmp_seq=2 ttl=62 time=1.79 ms 64 bytes from 192.168.4.5: icmp_seq=3 ttl=62 time=0.869 ms 64 bytes from 192.168.4.5: icmp_seq=4 ttl=62 time=1.76 ms 64 bytes from 192.168.4.5: icmp_seq=5 ttl=62 time=0.888 ms 64 bytes from 192.168.4.5: icmp_seq=6 ttl=62 time=2.38 ms ^C --- 192.168.4.5 ping statistics --- 6 packets transmitted, 6 received, 0% packet loss, time 53ms rtt min/avg/max/mdev = 0.869/1.527/2.382/0.533 ms root@virbian:/home/user#</pre>	<pre>root@virbian: /home/user root@virbian:/home/user# ping 192.168.0.1 PING 192.168.0.1 (192.168.0.1) 56(84) bytes of data. 64 bytes from 192.168.0.1: icmp_seq=1 ttl=62 time=2.06 ms 64 bytes from 192.168.0.1: icmp_seq=2 ttl=62 time=1.36 ms 64 bytes from 192.168.0.1: icmp_seq=3 ttl=62 time=0.854 ms 64 bytes from 192.168.0.1: icmp_seq=4 ttl=62 time=1.92 ms 64 bytes from 192.168.0.1: icmp_seq=5 ttl=62 time=1.32 ms 64 bytes from 192.168.0.1: icmp_seq=6 ttl=62 time=1.80 ms ^C --- 192.168.0.1 ping statistics --- 6 packets transmitted, 6 received, 0% packet loss, time 19ms rtt min/avg/max/mdev = 0.854/1.555/2.060/0.415 ms root@virbian:/home/user#</pre>

- *Virbian3 i Virbian5:*

The image shows two terminal windows from Oracle VM VirtualBox. The left window is titled 'Virbian3 [Running] - Oracle VM VirtualBox' and shows a root user at 'root@virbian:/home/user' performing a ping to 192.168.4.5. The output shows 13 successful pings with varying times, followed by a summary: '13 packets transmitted, 13 received, 0% packet loss, time 38ms rtt min/avg/max/mdev = 0.525/1.185/1.627/0.290 ms'. The right window is titled 'Virbian5 [Running] - Oracle VM VirtualBox' and shows a root user at 'root@virbian:/home/user' performing a ping to 192.168.3.3. The output shows 7 successful pings, followed by a summary: '7 packets transmitted, 7 received, 0% packet loss, time 42ms rtt min/avg/max/mdev = 0.736/1.278/2.288/0.465 ms'.

Jak widać wszystkie maszyny są wzajemnie osiągalne.

Trasy pomiędzy maszynami wyznaczone przez **tracert**:

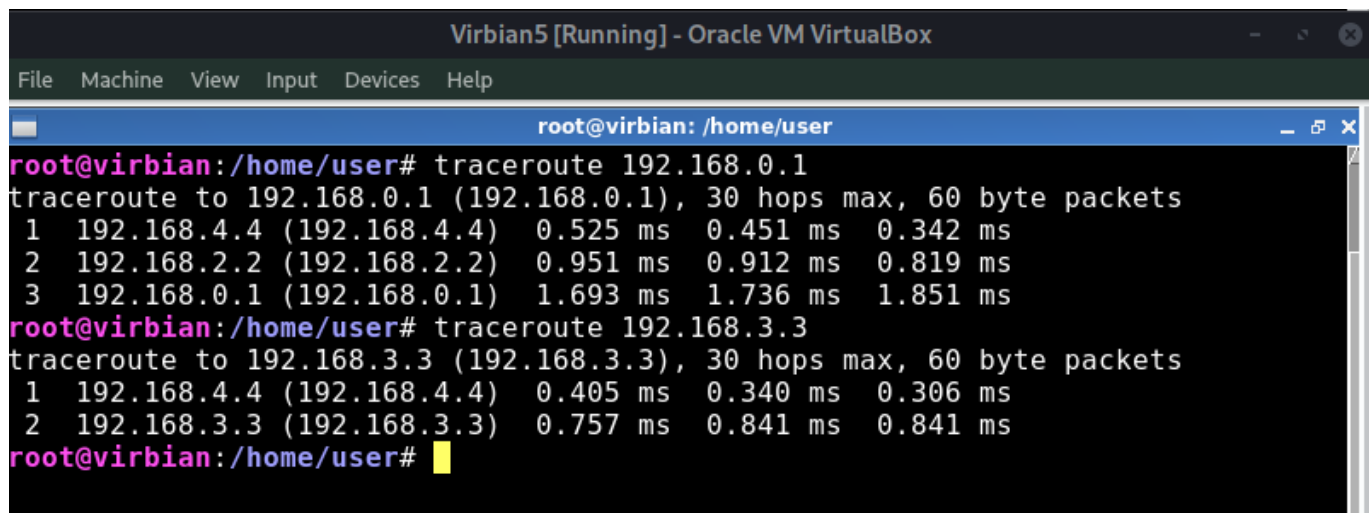
z *Virbian1*:

The image shows a terminal window titled 'Virbian1 [Running] - Oracle VM VirtualBox'. The root user at 'root@virbian:/home/user' runs 'tracert 192.168.3.3'. The output shows a path of 2 hops: 192.168.0.2 to 192.168.3.3. Then, the user runs 'tracert 192.168.4.5'. The output shows a path of 3 hops: 192.168.0.2 to 192.168.2.4 to 192.168.4.5.

z *Virbian3*:

The image shows a terminal window titled 'Virbian3 [Running] - Oracle VM VirtualBox'. The root user at 'root@virbian:/home/user' runs 'tracert 192.168.0.1'. The output shows a path of 2 hops: 192.168.1.2 to 192.168.0.1. Then, the user runs 'tracert 192.168.4.5'. The output shows a path of 2 hops: 192.168.3.4 to 192.168.4.5.

z Virbian5:



```
Virbian5 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
root@virbian: /home/user
root@virbian:/home/user# traceroute 192.168.0.1
traceroute to 192.168.0.1 (192.168.0.1), 30 hops max, 60 byte packets
 1  192.168.4.4 (192.168.4.4)  0.525 ms  0.451 ms  0.342 ms
 2  192.168.2.2 (192.168.2.2)  0.951 ms  0.912 ms  0.819 ms
 3  192.168.0.1 (192.168.0.1)  1.693 ms  1.736 ms  1.851 ms
root@virbian:/home/user# traceroute 192.168.3.3
traceroute to 192.168.3.3 (192.168.3.3), 30 hops max, 60 byte packets
 1  192.168.4.4 (192.168.4.4)  0.405 ms  0.340 ms  0.306 ms
 2  192.168.3.3 (192.168.3.3)  0.757 ms  0.841 ms  0.841 ms
root@virbian:/home/user#
```