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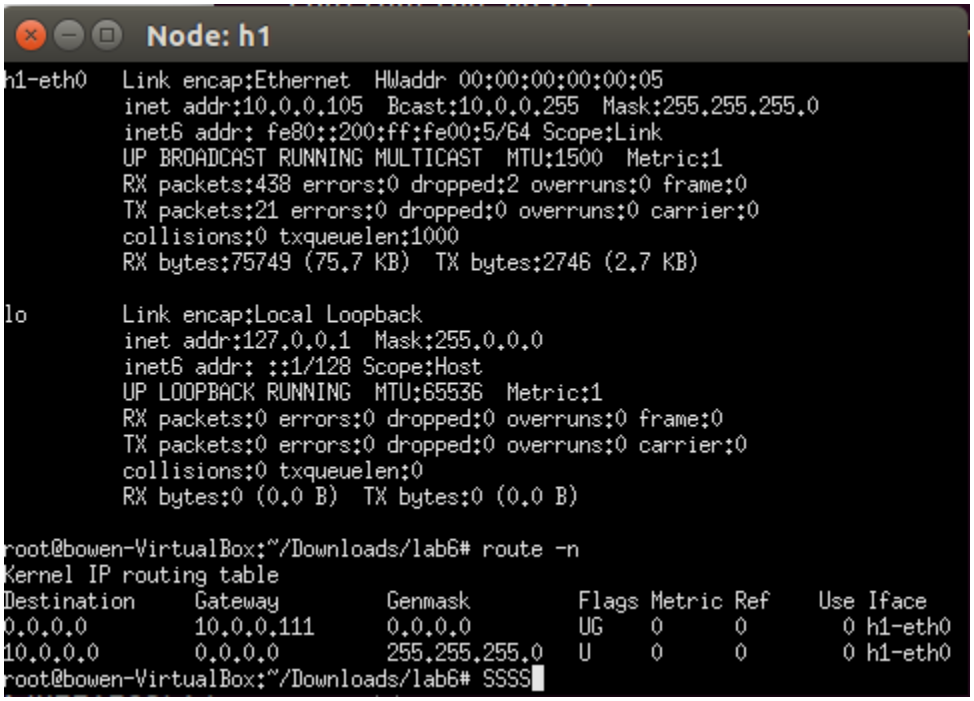
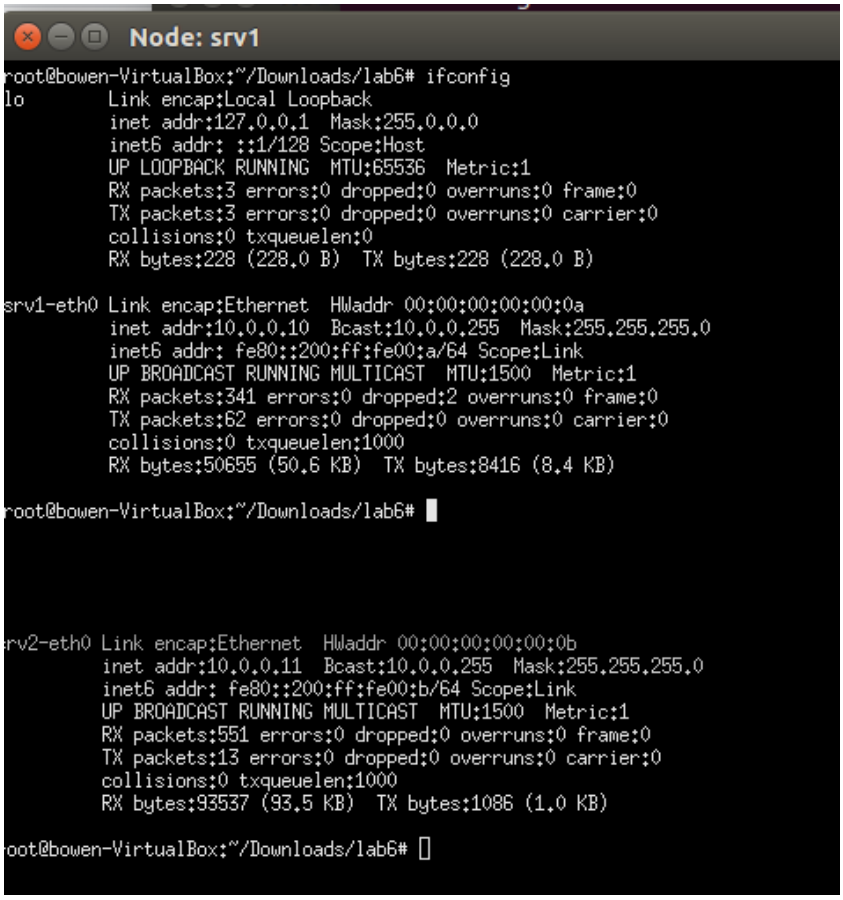
Networks Lab 6

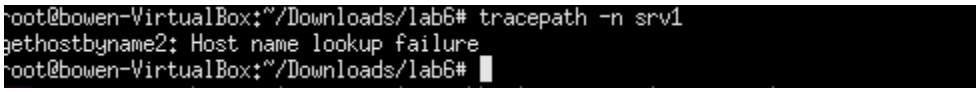
1) The IP subnet chosen for the hosts is 10.0.0.0/24. Since the mask is 255.255.255.0, the subnet mask is 24.



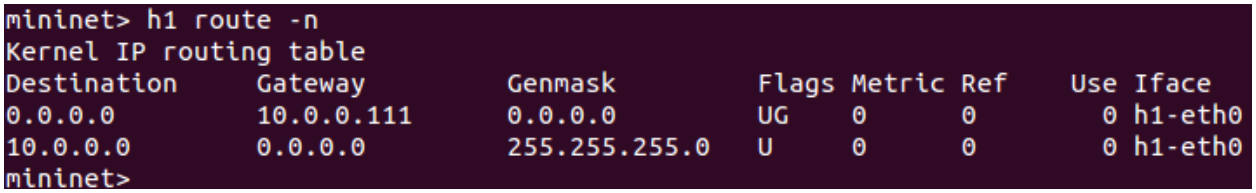
2) Yes, they are in the same subnet.



3) The switch cannot be observed, as the hops shown by traceroute show the path of the IP packet on a routed network (Layer 3). The switch is a Layer 2 device which operates on a broadcast MAC level network and does not operate on Layer 3, a segmented routing over internet protocol (IP) network, thus the Layer 2 traffic passing through the switch would not be observed in the traceroute results. The IP subnet chosen for the hosts is 10.0.0.0/24.



4) 10.0.0.111



5) No, we cannot ping 8.8.8.2 from h1, as the gateway for all the devices is configured to be 10.0.0.111 according to the routing table whereas it should instead be 10.0.0.1 (IP of internal gateway).

```
root@bowen-VirtualBox:~/Downloads/lab6# ping 8.8.8.2
PING 8.8.8.2 (8.8.8.2) 56(84) bytes of data.
From 10.0.0.105 icmp_seq=1 Destination Host Unreachable
From 10.0.0.105 icmp_seq=2 Destination Host Unreachable
From 10.0.0.105 icmp_seq=3 Destination Host Unreachable
From 10.0.0.105 icmp_seq=4 Destination Host Unreachable
From 10.0.0.105 icmp_seq=5 Destination Host Unreachable
From 10.0.0.105 icmp_seq=6 Destination Host Unreachable
From 10.0.0.105 icmp_seq=7 Destination Host Unreachable
From 10.0.0.105 icmp_seq=8 Destination Host Unreachable
From 10.0.0.105 icmp_seq=9 Destination Host Unreachable
From 10.0.0.105 icmp_seq=10 Destination Host Unreachable
From 10.0.0.105 icmp_seq=11 Destination Host Unreachable
```

```
intGW-eth0 Link encap:Ethernet  HWaddr 00:00:00:00:00:09
          inet addr:10.0.0.1  Bcast:10.0.0.255  Mask:255.255.255.0
          inet6 addr: fe80::200:ff:fe00:9/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1214 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:219589 (219.5 KB)  TX bytes:1588 (1.5 KB)
```

```
mininet> h1 route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         10.0.0.111      0.0.0.0         UG    0      0        0 h1-eth0
10.0.0.0        0.0.0.0         255.255.255.0   U     0      0        0 h1-eth0
mininet>
```

6) Yes, it is on 10.0.0.10 (srv1)

```
mininet> h1 dhclient -d h1-eth0
Internet Systems Consortium DHCP Client 4.2.4
Copyright 2004-2012 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/

Listening on LPF/h1-eth0/00:00:00:00:00:05
Sending on   LPF/h1-eth0/00:00:00:00:00:05
Sending on   Socket/fallback
DHCPREQUEST of 10.0.0.105 on h1-eth0 to 255.255.255.255 port 67 (xid=0x2868a2a2)
DHCPACK of 10.0.0.105 from 10.0.0.10
RTNETLINK answers: File exists
bound to 10.0.0.105 -- renewal in 18503 seconds.
```

7) On running `intGW ifconfig` we see that the IP of the gateway is 10.0.0.1. So we change the `dhcp-option` line in srv1DHCP.conf to indicate this.

srv1DHCP.conf

```
interface=srv1-eth0
dhcp-range=srv1-eth0,10.0.0.100,10.0.0.200,255.255.255.0,12h
dhcp-option=3,10.0.0.1
dhcp-option=option:dns-server,0.0.0.0,8.8.8.8
dhcp-authoritative
```

8) Yes, we can reach it now.

```
Received IP for h0
Received IP for h1
Received IP for h2
Received IP for h3
Received IP for h4
Starting web servers
*** Starting CLI:
mininet> xterm h1
mininet> h1 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=62 time=5.88 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=62 time=0.308 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=62 time=0.103 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=62 time=0.088 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=62 time=0.075 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=62 time=0.088 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=62 time=0.702 ms
64 bytes from 8.8.8.8: icmp_seq=8 ttl=62 time=0.077 ms
64 bytes from 8.8.8.8: icmp_seq=9 ttl=62 time=0.104 ms
^C
--- 8.8.8.8 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8031ms
rtt min/avg/max/mdev = 0.075/0.825/5.883/1.798 ms
mininet>
```

9) Yes, h1 can reach test.net. Since 8.8.8.8 is the now DNS server, h1 will lookup the IP address of test.net from 8.8.8.8 and because 8.8.8.8 has an authoritative record for test.net, h1 will be able to find it and reach test.net.

```
mininet> h1 ping test.net
PING test.net (8.8.8.2) 56(84) bytes of data.
64 bytes from 8.8.8.2: icmp_seq=1 ttl=62 time=9.64 ms
64 bytes from 8.8.8.2: icmp_seq=2 ttl=62 time=0.263 ms
64 bytes from 8.8.8.2: icmp_seq=3 ttl=62 time=0.096 ms
64 bytes from 8.8.8.2: icmp_seq=4 ttl=62 time=0.286 ms
^C
--- test.net ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3001ms
rtt min/avg/max/mdev = 0.096/2.572/9.643/4.083 ms
```

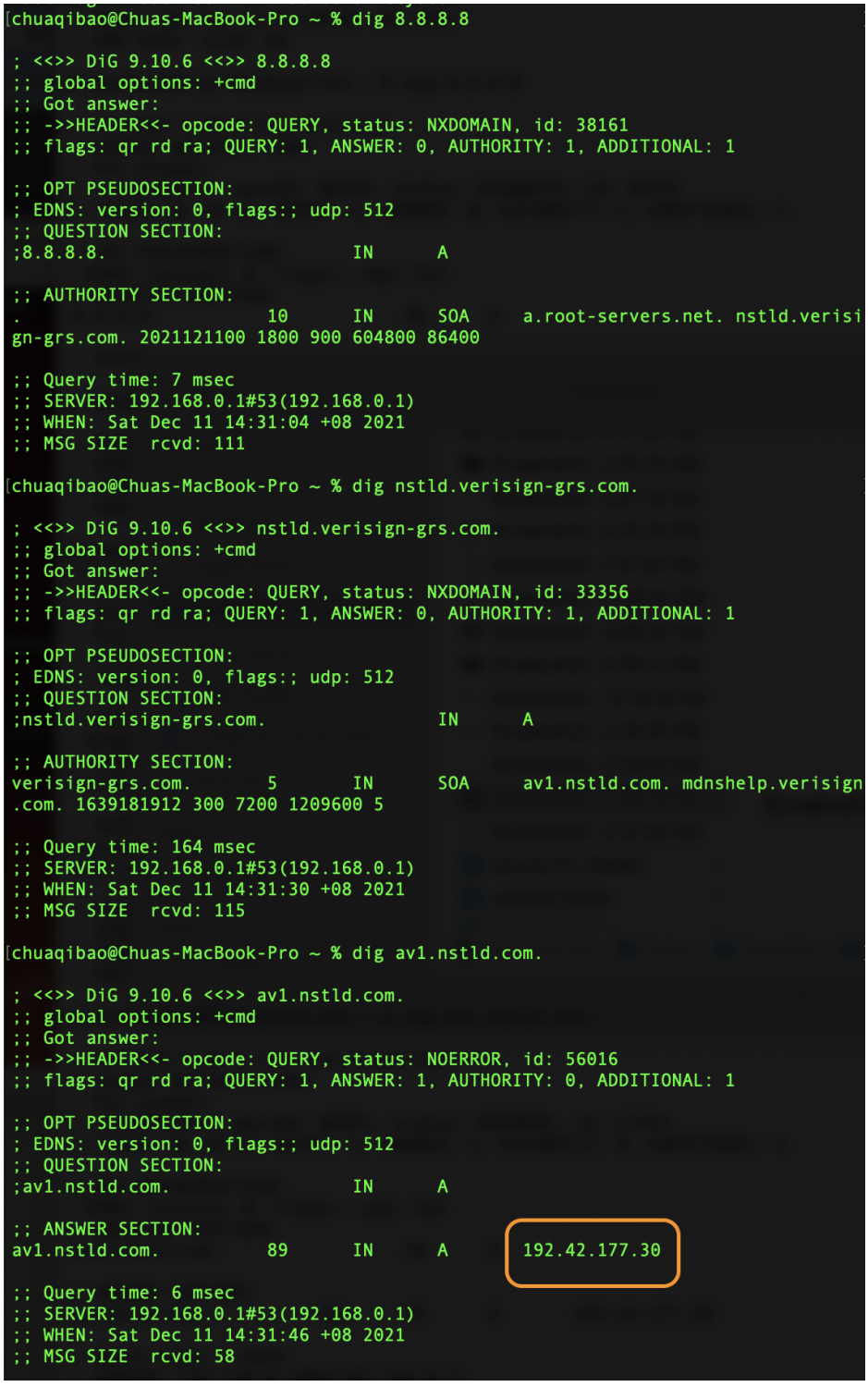
The IP address of test.net is 8.8.8.2.

Using dig to find the authoritative IP address of test.net:

```
chuaqibao@Chuas-MacBook-Pro ~ % dig test.net

; <<>> DiG 9.10.6 <<>> test.net
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 48815
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;test.net.                      IN      A

;; ANSWER SECTION:
test.net.               150     IN      A       85.214.110.167

;; Query time: 344 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Dec 11 14:32:06 +08 2021
;; MSG SIZE  rcvd: 53

chuaqibao@Chuas-MacBook-Pro ~ % dig 85.214.110.167

; <<>> DiG 9.10.6 <<>> 85.214.110.167
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 25128
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;85.214.110.167.                IN      A

;; AUTHORITY SECTION:
.                       10      IN      SOA     a.root-servers.net. nstld.verisi
gn-grs.com. 2021121100 1800 900 604800 86400

;; Query time: 9 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Dec 11 14:32:23 +08 2021
;; MSG SIZE  rcvd: 118
```

```
chuaqibao@Chuas-MacBook-Pro ~ % dig nstld.verisign-grs.com.

; <<>> DiG 9.10.6 <<>> nstld.verisign-grs.com.
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 35371
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;nstld.verisign-grs.com.        IN      A

;; AUTHORITY SECTION:
verisign-grs.com.       5       IN      SOA     av1.nstld.com. mdnshelp.verisign
.com. 1639181912 300 7200 1209600 5

;; Query time: 299 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Dec 11 14:32:30 +08 2021
;; MSG SIZE  rcvd: 115

chuaqibao@Chuas-MacBook-Pro ~ % dig av1.nstld.com.

; <<>> DiG 9.10.6 <<>> av1.nstld.com.
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 61666
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;av1.nstld.com.                 IN      A

;; ANSWER SECTION:
av1.nstld.com.          300     IN      A       192.42.177.30

;; Query time: 73 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Dec 11 14:32:38 +08 2021
;; MSG SIZE  rcvd: 58
```

Using dig to find the authoritative IP address of test.net from 8.8.8.8:



```
chuaqibao@Chuas-MacBook-Pro ~ % dig 8.8.8.8

; <<>> DiG 9.10.6 <<>> 8.8.8.8
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 38161
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;8.8.8.8.                       IN      A

;; AUTHORITY SECTION:
.                       10      IN      SOA     a.root-servers.net. nstld.verisi
gn-grs.com. 2021121100 1800 900 604800 86400

;; Query time: 7 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Dec 11 14:31:04 +08 2021
;; MSG SIZE  rcvd: 111

chuaqibao@Chuas-MacBook-Pro ~ % dig nstld.verisign-grs.com.

; <<>> DiG 9.10.6 <<>> nstld.verisign-grs.com.
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 33356
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;nstld.verisign-grs.com.                IN      A

;; AUTHORITY SECTION:
verisign-grs.com.       5       IN      SOA     av1.nstld.com. mdnshelp.verisign
.com. 1639181912 300 7200 1209600 5

;; Query time: 164 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Dec 11 14:31:30 +08 2021
;; MSG SIZE  rcvd: 115

chuaqibao@Chuas-MacBook-Pro ~ % dig av1.nstld.com.

; <<>> DiG 9.10.6 <<>> av1.nstld.com.
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 56016
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;av1.nstld.com.                 IN      A

;; ANSWER SECTION:
av1.nstld.com.          89      IN      A       192.42.177.30

;; Query time: 6 msec
;; SERVER: 192.168.0.1#53(192.168.0.1)
;; WHEN: Sat Dec 11 14:31:46 +08 2021
;; MSG SIZE  rcvd: 58
```

10) intGw

11) Rules added:

```
iptables -I INPUT -s 10.0.0.11 -j DROP
iptables -I FORWARD -s 10.0.0.11 -j DROP
```

```
root@test:~/lab6# iptables -I FORWARD -s 10.0.0.11 -j DROP
root@test:~/lab6# sudo iptables -L -v
Chain INPUT (policy ACCEPT 2 packets, 124 bytes)
 pkts bytes target     prot opt in     out     source               destination
    0     0 DROP       all  --  any    any     10.0.0.11            anywhere

Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source               destination
    0     0 DROP       all  --  any    any     10.0.0.11            anywhere
    9   671 ACCEPT     all  --  intGW-eth0 intGW-eth1  10.0.0.0/24          anywhere
  ctstate NEW
   67  5564 ACCEPT     all  --  any    any     anywhere             anywhere             ctstat
e RELATED,ESTABLISHED

Chain OUTPUT (policy ACCEPT 2 packets, 108 bytes)
 pkts bytes target     prot opt in     out     source               destination
```

No longer able to ping 8.8.8.8 from srv2 after adding rules

Before adding rules:

```
mininet> srv2 ping -c 10 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=62 time=2.42 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=62 time=2.57 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=62 time=0.928 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=62 time=0.115 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=62 time=0.084 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=62 time=0.179 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=62 time=0.396 ms
64 bytes from 8.8.8.8: icmp_seq=8 ttl=62 time=0.136 ms
64 bytes from 8.8.8.8: icmp_seq=9 ttl=62 time=0.136 ms
64 bytes from 8.8.8.8: icmp_seq=10 ttl=62 time=0.163 ms

--- 8.8.8.8 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9000ms
rtt min/avg/max/mdev = 0.084/0.714/2.575/0.925 ms
```

After adding rules:

```
mininet> srv2 ping -c 10 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.

--- 8.8.8.8 ping statistics ---
10 packets transmitted, 0 received, 100% packet loss, time 8999ms
```