

# NSC hw6

## 1. When h1 ping h2, what will happen?

ARP:

h1 sent request

h2 received and replied

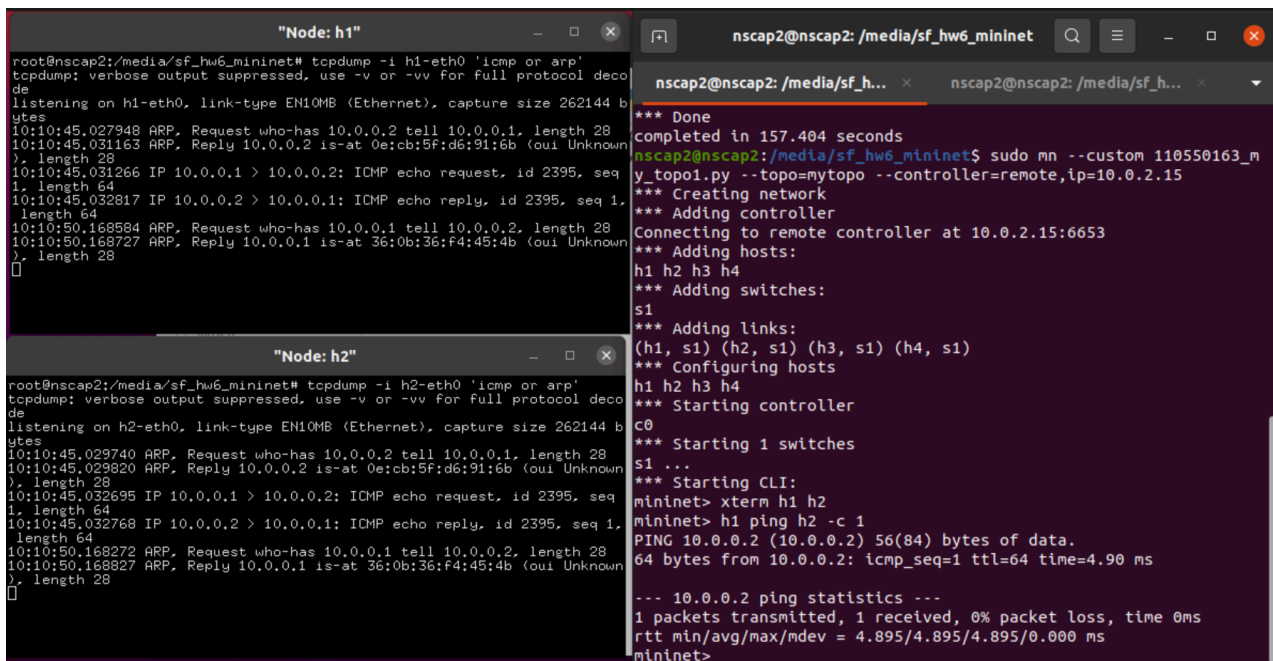
h1 received the reply

ICMP:

h1 sent request

h2 received and replied

h1 received the reply



The screenshot shows three terminal windows in a Mininet environment. The top-left window, titled "Node: h1", shows a tcpdump capture of ARP and ICMP traffic. The top-right window shows the Mininet CLI output, including the command to start the network and the successful completion of the setup. The bottom window shows the results of a ping command from h1 to h2, indicating a successful connection with 0% packet loss and a round-trip time of 4.90 ms.

```
root@nscap2:/media/sf_hw6_mininet# tcpdump -i h1-eth0 'icmp or arp'
tcpdump: verbose output suppressed, use -v or -vv for full protocol deco
de
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 b
ytes
10:10:45.027948 ARP, Request who-has 10.0.0.2 tell 10.0.0.1, length 28
10:10:45.031163 ARP, Reply 10.0.0.2 is-at 0e:cb:5f:d6:91:6b (oui Unknown
), length 28
10:10:45.031266 IP 10.0.0.1 > 10.0.0.2: ICMP echo request, id 2395, seq
1, length 64
10:10:45.032817 IP 10.0.0.2 > 10.0.0.1: ICMP echo reply, id 2395, seq 1,
length 64
10:10:50.168584 ARP, Request who-has 10.0.0.1 tell 10.0.0.2, length 28
10:10:50.168727 ARP, Reply 10.0.0.1 is-at 36:0b:36:f4:45:4b (oui Unknown
), length 28
^

root@nscap2:/media/sf_hw6_mininet# tcpdump -i h2-eth0 'icmp or arp'
tcpdump: verbose output suppressed, use -v or -vv for full protocol deco
de
listening on h2-eth0, link-type EN10MB (Ethernet), capture size 262144 b
ytes
10:10:45.029740 ARP, Request who-has 10.0.0.2 tell 10.0.0.1, length 28
10:10:45.029820 ARP, Reply 10.0.0.2 is-at 0e:cb:5f:d6:91:6b (oui Unknown
), length 28
10:10:45.032695 IP 10.0.0.1 > 10.0.0.2: ICMP echo request, id 2395, seq
1, length 64
10:10:45.032768 IP 10.0.0.2 > 10.0.0.1: ICMP echo reply, id 2395, seq 1,
length 64
10:10:50.168272 ARP, Request who-has 10.0.0.1 tell 10.0.0.2, length 28
10:10:50.168827 ARP, Reply 10.0.0.1 is-at 36:0b:36:f4:45:4b (oui Unknown
), length 28
^

nscap2@nscap2: /media/sf_hw6_mininet
nscap2@nscap2: /media/sf_h...
nscap2@nscap2: /media/sf_h...
*** Done
completed in 157.404 seconds
nscap2@nscap2: /media/sf_hw6_mininet$ sudo mn --custom 110550163_m
y_topo1.py --topo=mytopo --controller=remote,ip=10.0.2.15
*** Creating network
*** Adding controller
Connecting to remote controller at 10.0.2.15:6653
*** Adding hosts:
h1 h2 h3 h4
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1) (h3, s1) (h4, s1)
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
c0
*** Starting 1 switches
s1 ...
*** Starting CLI:
mininet> xterm h1 h2
mininet> h1 ping h2 -c 1
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=4.90 ms

--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 4.895/4.895/4.895/0.000 ms
mininet>
```

## 2. When h1 ping h3, what will happen?

ARP:

h1 sent request

h3 received and replied

h1 received the reply

ICMP:

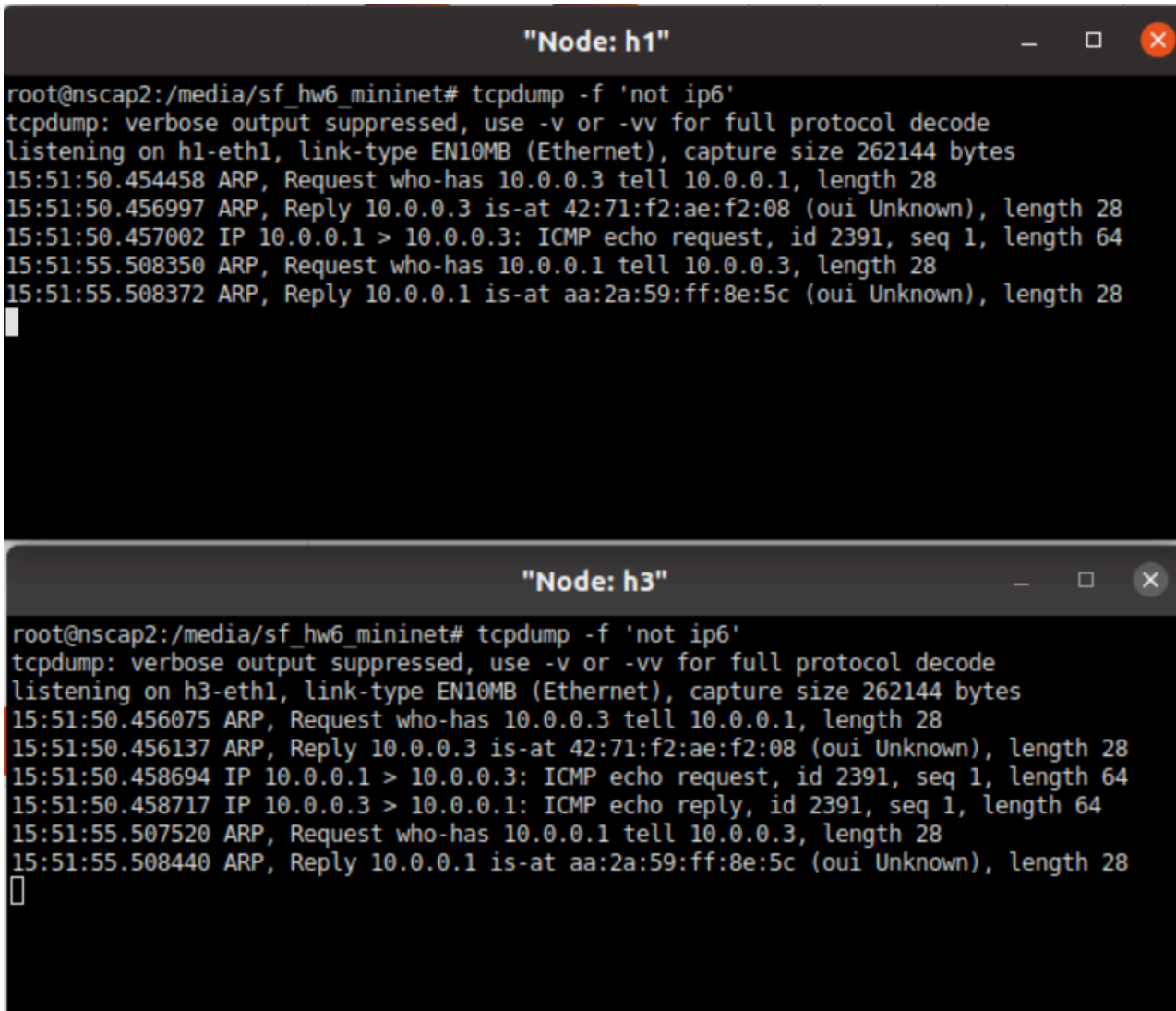
h1 sent request

h3 received and replied

h1 didn't receive the reply since s1 dropped the reply from h3 according to controller's rule.

```
mininet> h1 ping h3 -c 1
PING 10.0.0.3 (10.0.0.3) 56(84) bytes of data.

--- 10.0.0.3 ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
```



```
"Node: h1"
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
15:51:50.454458 ARP, Request who-has 10.0.0.3 tell 10.0.0.1, length 28
15:51:50.456997 ARP, Reply 10.0.0.3 is-at 42:71:f2:ae:f2:08 (oui Unknown), length 28
15:51:50.457002 IP 10.0.0.1 > 10.0.0.3: ICMP echo request, id 2391, seq 1, length 64
15:51:55.508350 ARP, Request who-has 10.0.0.1 tell 10.0.0.3, length 28
15:51:55.508372 ARP, Reply 10.0.0.1 is-at aa:2a:59:ff:8e:5c (oui Unknown), length 28

"Node: h3"
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h3-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
15:51:50.456075 ARP, Request who-has 10.0.0.3 tell 10.0.0.1, length 28
15:51:50.456137 ARP, Reply 10.0.0.3 is-at 42:71:f2:ae:f2:08 (oui Unknown), length 28
15:51:50.458694 IP 10.0.0.1 > 10.0.0.3: ICMP echo request, id 2391, seq 1, length 64
15:51:50.458717 IP 10.0.0.3 > 10.0.0.1: ICMP echo reply, id 2391, seq 1, length 64
15:51:55.507520 ARP, Request who-has 10.0.0.1 tell 10.0.0.3, length 28
15:51:55.508440 ARP, Reply 10.0.0.1 is-at aa:2a:59:ff:8e:5c (oui Unknown), length 28
```

### 3. When h3 ping h2, what will happen?

ARP:

h3 sent request

h2 received and replied

h3 received the reply

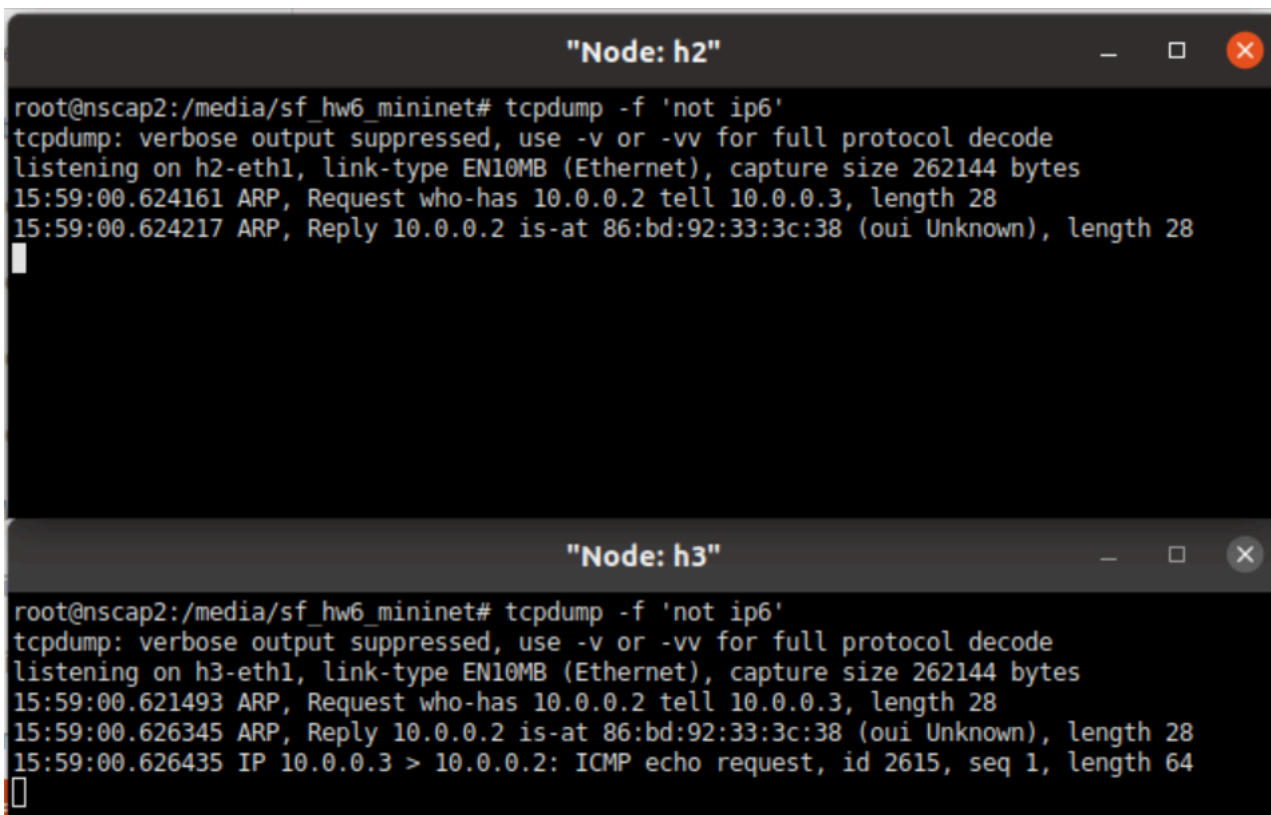
ICMP:

h3 sent request

h2 didn't receive since s1 dropped the request from h3 according to controller's rule

```
mininet> h3 ping h2 -c 1
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.

--- 10.0.0.2 ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
```



The image shows two terminal windows. The top window is titled '"Node: h2"' and shows the output of a tcpdump command: 'tcpdump -f 'not ip6''. It lists two ARP packets: a request from 10.0.0.3 to 10.0.0.2 at 15:59:00.624161, and a reply from 10.0.0.2 to 10.0.0.3 at 15:59:00.624217. The bottom window is titled '"Node: h3"' and shows the output of a tcpdump command: 'tcpdump -f 'not ip6''. It lists three packets: an ARP request from 10.0.0.3 to 10.0.0.2 at 15:59:00.621493, an ARP reply from 10.0.0.2 to 10.0.0.3 at 15:59:00.626345, and an ICMP echo request from 10.0.0.3 to 10.0.0.2 at 15:59:00.626435.

```
"Node: h2"
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h2-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
15:59:00.624161 ARP, Request who-has 10.0.0.2 tell 10.0.0.3, length 28
15:59:00.624217 ARP, Reply 10.0.0.2 is-at 86:bd:92:33:3c:38 (oui Unknown), length 28

"Node: h3"
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h3-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
15:59:00.621493 ARP, Request who-has 10.0.0.2 tell 10.0.0.3, length 28
15:59:00.626345 ARP, Reply 10.0.0.2 is-at 86:bd:92:33:3c:38 (oui Unknown), length 28
15:59:00.626435 IP 10.0.0.3 > 10.0.0.2: ICMP echo request, id 2615, seq 1, length 64
```

## 4. When h1 ping h5, what will happen?

ARP:

h1 sent request

h1 sent request

h1 sent request

h5 didn't receive the request since s1 cannot find h5

ICMP:

No icmp packet

```
mininet> xterm h1
mininet> h1 ping h5 -c 1
ping: h5: Temporary failure in name resolution
mininet> h1 ping 10.0.0.5 -c 1
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
From 10.0.0.1 icmp_seq=1 Destination Host Unreachable

--- 10.0.0.5 ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms
```

## "Node: h1"

```
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
16:04:41.056358 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
16:04:42.068462 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
16:04:43.093287 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
```

## "Node: h5"

```
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h5-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
```

## 5. When h1 ping h5, what will happen?

ARP:

h1 sent request

h5 received and replied

h1 received the reply

ICMP:

h1 sent request

h5 received and replied

h1 received the reply

```
mininet> h1 ping 10.0.0.5 -c 1
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=21.3 ms

--- 10.0.0.5 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 21.339/21.339/21.339/0.000 ms
```

```
"Node: h1"
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol de
code
listening on h1-eth1, link-type EN10MB (Ethernet), capture size 262144
bytes
13:00:53.921437 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
13:00:53.936069 ARP, Reply 10.0.0.5 is-at 76:68:77:7b:64:0e (oui Unkno
wn), length 28
13:00:53.936127 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 3077, se
q 1, length 64
13:00:53.942747 IP 10.0.0.5 > 10.0.0.1: ICMP echo reply, id 3077, seq
1, length 64
13:00:58.944503 ARP, Request who-has 10.0.0.1 tell 10.0.0.5, length 28
13:00:58.944557 ARP, Reply 10.0.0.1 is-at 3a:ab:4f:e3:95:2e (oui Unkno
wn), length 28
```

```
"Node: h5"
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol de
code
listening on h5-eth1, link-type EN10MB (Ethernet), capture size 262144
bytes
13:00:53.922155 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
13:00:53.922222 ARP, Reply 10.0.0.5 is-at 76:68:77:7b:64:0e (oui Unkno
wn), length 28
13:00:53.937301 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 3077, se
q 1, length 64
13:00:53.937392 IP 10.0.0.5 > 10.0.0.1: ICMP echo reply, id 3077, seq
1, length 64
13:00:58.939716 ARP, Request who-has 10.0.0.1 tell 10.0.0.5, length 28
13:00:58.941528 ARP, Reply 10.0.0.1 is-at 3a:ab:4f:e3:95:2e (oui Unkno
wn), length 28
```

## 6. When h1 ping h7, what will happen?

ARP:

h1 sent ARP request

h7 received and replied

h1 received the reply

ICMP:

h1 sent request

h7 received and replied

h1 didn't received since s2 dropped the reply from h7 according to controller's rule



```
mininet> h1 ping 10.0.0.7 -c 1
PING 10.0.0.7 (10.0.0.7) 56(84) bytes of data.

--- 10.0.0.7 ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
```

```
"Node: h1"
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
13:05:08.289803 ARP, Request who-has 10.0.0.7 tell 10.0.0.1, length 28
13:05:08.298052 ARP, Reply 10.0.0.7 is-at da:ee:c2:fa:70:35 (oui Unknown), length 28
13:05:08.298105 IP 10.0.0.1 > 10.0.0.7: ICMP echo request, id 3126, seq 1, length 64
13:05:13.395316 ARP, Request who-has 10.0.0.1 tell 10.0.0.7, length 28
13:05:13.395350 ARP, Reply 10.0.0.1 is-at 3a:ab:4f:e3:95:2e (oui Unknown), length 28
```

```
"Node: h7"
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h7-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
13:05:08.305794 ARP, Request who-has 10.0.0.7 tell 10.0.0.1, length 28
13:05:08.305808 ARP, Reply 10.0.0.7 is-at da:ee:c2:fa:70:35 (oui Unknown), length 28
13:05:08.316807 IP 10.0.0.1 > 10.0.0.7: ICMP echo request, id 3126, seq 1, length 64
13:05:08.316831 IP 10.0.0.7 > 10.0.0.1: ICMP echo reply, id 3126, seq 1, length 64
13:05:13.404261 ARP, Request who-has 10.0.0.1 tell 10.0.0.7, length 28
13:05:13.408606 ARP, Reply 10.0.0.1 is-at 3a:ab:4f:e3:95:2e (oui Unknown), length 28
```

## 7. When h7 ping h1, what will happen?

ARP:

h7 sent request

h1 received and replied

h7 received the reply

ICMP:

h7 sent request

h1 didn't receive since s2 dropped the request from h7 according to controller's rule

```
mininet> h7 ping 10.0.0.1 -c 1
PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data.

--- 10.0.0.1 ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
```

### "Node: h1"

```
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
13:10:59.770028 ARP, Request who-has 10.0.0.1 tell 10.0.0.7, length 28
13:10:59.770157 ARP, Reply 10.0.0.1 is-at 3a:ab:4f:e3:95:2e (oui Unknown), length 28
```

### "Node: h7"

```
root@nscap2:/media/sf_hw6_mininet# tcpdump -f 'not ip6'
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h7-eth1, link-type EN10MB (Ethernet), capture size 262144 bytes
13:10:54.748177 IP 10.0.0.7 > 10.0.0.1: ICMP echo request, id 2565, seq 1, length 64
13:10:59.771514 ARP, Request who-has 10.0.0.1 tell 10.0.0.7, length 28
13:10:59.774987 ARP, Reply 10.0.0.1 is-at 3a:ab:4f:e3:95:2e (oui Unknown), length 28
```

8. If the packet in Question 6 or 7 is dropped in some part of the network, are the outcome and explanation the same as that of Question 4? (use screenshots to prove your answers)

原因不同，因為在Q4 時還沒有建立 GRE tunnel，所以連 ARP 封包都收不到，因此判斷為 unreachable。而 Q6、Q7 中 h1 和 h7是有連通的，因此收得到 ARP封包，但因為從 h7 傳出的 ICMP 會被 drop，因此判斷為 packet loss。

```
mininet> xterm h1
mininet> h1 ping h5 -c 1
ping: h5: Temporary failure in name resolution
mininet> h1 ping 10.0.0.5 -c 1
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data.
From 10.0.0.1 icmp_seq=1 Destination Host Unreachable

--- 10.0.0.5 ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms
```

```
mininet> h1 ping 10.0.0.7 -c 1
PING 10.0.0.7 (10.0.0.7) 56(84) bytes of data.

--- 10.0.0.7 ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
```

```
mininet> h7 ping 10.0.0.1 -c 1
PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data.

--- 10.0.0.1 ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms
```

## 9. Change filter\_table2 rule

---

From the original rule: packets coming from port\_3 or port\_4 will be dropped, while other packets will be allowed to pass.

To the new rule: packets coming from port\_1 or port\_2 will be allowed to pass, while other packets will be dropped.

Will the outcome of Questions 5, 6, and 7 differ? (no need to print screenshots)

Explain your answers.

Q5、Q6、Q7 都會 packet loss。

因為 GRE tunnel 對 switch 來說是 port 5，因此這個情境下的 ICMP 會被 drop 掉。