

Network Systems Capstone Homework 7 Report

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Part 1: Create SDN Network

1. When h1 ping h2, what will happen?

```
*** Adding controller
Connecting to remote controller at 127.0.0.1:6653
*** 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=11.0 ms

--- 10.0.0.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 10.977/10.977/10.977/0.000 ms
mininet>

packet in 1 7e:8d:08:94:a7:60 33:33:00:00:00:02 1
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 82:d8:d4:7f:6e:8f 33:33:00:00:00:02 3
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 d6:75:96:b2:12:a7 33:33:00:00:00:02 2
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 ca:e2:31:37:aa:82 33:33:00:00:00:02 4
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 7e:8d:08:94:a7:60 33:33:00:00:00:02 1
EVENT ofp_event->CustomController EventOFPPacketIn
```

```
root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:30:34.515360 IP6 fe80::7c8d:8fff:fe94:a760 > ip6-allrouters: ICMP6, router so
licitation, length 16
15:30:35.535481 IP6 fe80::c05c:6cfff:fe61:333 > ip6-allrouters: ICMP6, router so
licitation, length 16
15:30:39.472635 ARP, Request who-has 10.0.0.2 tell 10.0.0.1, length 28
15:30:39.476012 ARP, Reply 10.0.0.2 is-at d6:75:96:b2:12:a7 (oui Unknown), leng
th 28
15:30:39.479757 IP 10.0.0.1 > 10.0.0.2: ICMP echo request, id 2031, seq 1, leng
th 64
15:30:39.483579 IP 10.0.0.2 > 10.0.0.1: ICMP echo reply, id 2031, seq 1, length
64
15:30:40.662434 IP6 fe80::80d8:d4ff:fe7f:6e8f > ip6-allrouters: ICMP6, router s
olicitation, length 16
15:30:40.665451 IP6 fe80::d475:96fff:feb2:12a7 > ip6-allrouters: ICMP6, router s
olicitation, length 16
15:30:40.749912 IP6 fe80::c05c:6cfff:fe61:333.mdns > ff02::fb.mdns: 0 [2q] PTR (
OH)? _ipps._tcp.local. PTR (OH)? _ipp._tcp.local. (45)
15:30:42.708317 IP6 fe80::c0e2:31fff:fe37:aa82 > ip6-allrouters: ICMP6, router s
olicitation, length 16
15:30:44.697640 ARP, Request who-has 10.0.0.1 tell 10.0.0.2, length 28
15:30:44.697651 ARP, Reply 10.0.0.1 is-at 7e:8d:08:94:a7:60 (oui Unknown), leng
th 28
```

```
root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h2-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:30:34.518630 IP6 fe80::7c8d:8fff:fe94:a760 > ip6-allrouters: ICMP6, router so
licitation, length 16
15:30:36.079312 IP6 fe80::3420:93fff:fe5f:e414 > ip6-allrouters: ICMP6, router so
licitation, length 16
15:30:39.476012 ARP, Request who-has 10.0.0.2 tell 10.0.0.1, length 28
15:30:39.476033 ARP, Reply 10.0.0.2 is-at d6:75:96:b2:12:a7 (oui Unknown), leng
th 28
15:30:39.481390 IP 10.0.0.1 > 10.0.0.2: ICMP echo request, id 2031, seq 1, lengt
h 64
15:30:39.481414 IP 10.0.0.2 > 10.0.0.1: ICMP echo reply, id 2031, seq 1, length
64
15:30:40.662938 IP6 fe80::80d8:d4ff:fe7f:6e8f > ip6-allrouters: ICMP6, router so
licitation, length 16
15:30:40.662993 IP6 fe80::d475:96fff:feb2:12a7 > ip6-allrouters: ICMP6, router so
licitation, length 16
15:30:41.463316 IP6 fe80::3420:93fff:fe5f:e414.mdns > ff02::fb.mdns: 0 [2q] PTR (
OH)? _ipps._tcp.local. PTR (OH)? _ipp._tcp.local. (45)
15:30:42.708327 IP6 fe80::c0e2:31fff:fe37:aa82 > ip6-allrouters: ICMP6, router so
licitation, length 16
15:30:44.694977 ARP, Request who-has 10.0.0.1 tell 10.0.0.2, length 28
15:30:44.699551 ARP, Reply 10.0.0.1 is-at 7e:8d:08:94:a7:60 (oui Unknown), leng
th 28
```

ARP:

- [t=15:30:39.472635] h1 sent ARP request
- [t=15:30:39.476012] h2 received ARP request from h1
- [t=15:30:39.476033] h2 sent ARP reply
- [t=15:30:39.479757] h1 received ARP reply from h2

ICMP:

- [t=15:30:39.479839] h1 sent ICMP echo request to h2
- [t=15:30:39.481390] h2 received ICMP echo request from h1
- [t=15:30:39.481414] h2 sent ICMP echo reply to h1
- [t=15:30:39.483579] h1 received ICMP echo reply from h2

2. When h1 ping h3, what will happen?

```
nscap2@nscap2: ~/network-systems-capstone-23spring/hw7
mininet> xterm h1 h3
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
mininet>
```

```
root@nscap2: /home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:45:47.017324 ARP, Request who-has 10.0.0.3 tell 10.0.0.1, length 28
15:45:47.022898 ARP, Reply 10.0.0.3 is-at 82:d8:d4:7f:6e:8f (oui Unknown), length 28
15:45:47.022908 IP 10.0.0.1 > 10.0.0.3: ICMP echo request, id 2137, seq 1, length 64
15:45:52.278070 ARP, Request who-has 10.0.0.1 tell 10.0.0.3, length 28
15:45:52.278091 ARP, Reply 10.0.0.1 is-at 7e:8d:08:94:a7:b0 (oui Unknown), length 28
```

```
root@nscap2: /home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h3-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:45:47.020224 ARP, Request who-has 10.0.0.3 tell 10.0.0.1, length 28
15:45:47.020325 ARP, Reply 10.0.0.3 is-at 82:d8:d4:7f:6e:8f (oui Unknown), length 28
15:45:47.025283 IP 10.0.0.1 > 10.0.0.3: ICMP echo request, id 2137, seq 1, length 64
15:45:47.025387 IP 10.0.0.3 > 10.0.0.1: ICMP echo reply, id 2137, seq 1, length 64
15:45:52.271182 ARP, Request who-has 10.0.0.1 tell 10.0.0.3, length 28
15:45:52.280797 ARP, Reply 10.0.0.1 is-at 7e:8d:08:94:a7:b0 (oui Unknown), length 28
```

```
packet in 1 7e:8d:08:94:a7:b0 33:33:00:00:00:02 1
EVENT ofp_event->CustomController EventOFPPacketIn
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 ca:e2:31:37:aa:82 33:33:00:00:00:02 4
packet in 1 d6:75:96:b2:12:a7 33:33:00:00:00:02 2
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 82:d8:d4:7f:6e:8f 33:33:00:00:00:02 3
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 7e:8d:08:94:a7:b0 33:33:00:00:00:02 1
EVENT ofp_event->CustomController EventOFPPacketIn
```

ARP:

- [t=15:45:47.017324] h1 sent ARP request
- [t=15:45:47.020224] h3 received ARP request from h1
- [t=15:45:47.020325] h3 sent ARP reply
- [t=15:45:47.022898] h1 received ARP reply from h3

ICMP:

- [t=15:45:47.022908] h1 sent ICMP echo request to h3
- [t=15:45:47.025283] h3 received ICMP echo request from h1
- [t=15:45:47.025387] h3 sent ICMP echo reply to h1

3. When h3 ping h2, what will happen?

```
nscap2@nscap2: ~/network-systems-capstone-23spring/hw7

mininet> xterm h3 h2
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
mininet>

root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h3-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:14:50.612775 ARP, Request who-has 10.0.0.2 tell 10.0.0.3, length 28
16:14:50.616423 ARP, Reply 10.0.0.2 is-at d6:75:96:b2:12:a7 (oui Unknown), length 28
16:14:50.616494 IP 10.0.0.3 > 10.0.0.2: ICMP echo request, id 2358, seq 1, length 64

root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h2-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:14:50.614452 ARP, Request who-has 10.0.0.2 tell 10.0.0.3, length 28
16:14:50.614470 ARP, Reply 10.0.0.2 is-at d6:75:96:b2:12:a7 (oui Unknown), length 28

packet in 1 7e:8d:08:94:a7:60 82:d8:d4:7f:6e:8f 1
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 ca:e2:31:37:aa:82 33:33:00:00:00:02 4
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 82:d8:d4:7f:6e:8f 33:33:00:00:00:02 3
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 d6:75:96:b2:12:a7 33:33:00:00:00:02 2
EVENT ofp_event->CustomController EventOFPPacketIn
packet in 1 7e:8d:08:94:a7:60 33:33:00:00:00:02 1
EVENT ofp_event->CustomController EventOFPPacketIn
```

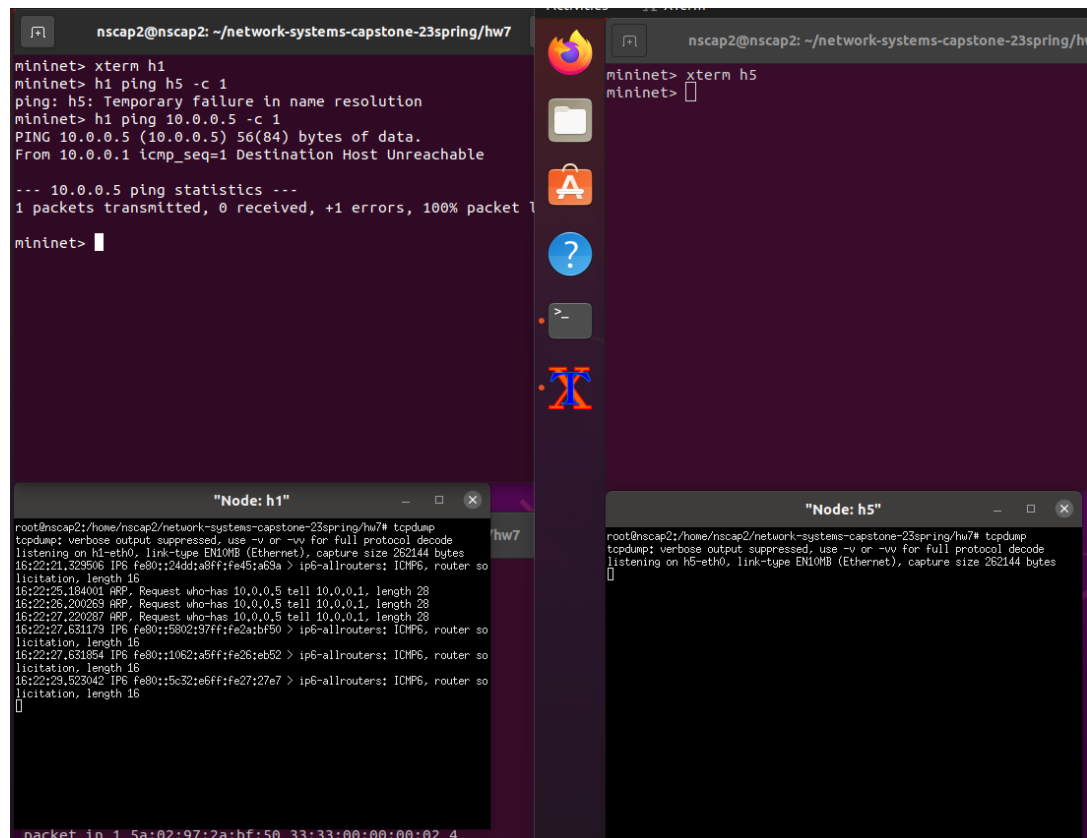
ARP:

- [t=16:14:50.612775] h3 sent ARP request
- [t=16:14:50.614452] h2 received ARP request from h3
- [t=16:14:50.614470] h2 sent ARP reply
- [t=16:14:50.616423] h3 received ARP reply from h2

ICMP:

- [t=16:14:50.616494] h3 sent ICMP echo request to h2

4. When h1 ping h5, what will happen?



The screenshot shows a network simulation environment with two terminal windows and two packet capture windows. The left terminal window, titled 'nscap2@nscap2: ~/network-systems-capstone-23spring/hw7', shows the following commands and output:

```
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
```

The right terminal window, also titled 'nscap2@nscap2: ~/network-systems-capstone-23spring/hw7', shows the following commands and output:

```
mininet> xterm h5
mininet>
```

Below the terminal windows are two packet capture windows. The left window, titled '"Node: h1"', shows a list of captured packets:

```
root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:22:21.323906 IP6 fe80::24dd:a8ff:fe45:a69a > ip6-allrouters: ICMP6, router solicitation, length 16
16:22:25.184001 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
16:22:26.200269 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
16:22:27.220287 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
16:22:27.631179 IP6 fe80::5802:97ff:fe2a:bf50 > ip6-allrouters: ICMP6, router solicitation, length 16
16:22:27.631894 IP6 fe80::1062:a5ff:fe26:eb52 > ip6-allrouters: ICMP6, router solicitation, length 16
16:22:29.629042 IP6 fe80::5c32:ef5ff:fe27:27e7 > ip6-allrouters: ICMP6, router solicitation, length 16
```

The right window, titled '"Node: h5"', shows the following output:

```
root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h5-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
```

ARP:

- [t=16:22:25.184001] h1 sent ARP request
- [t=16:22:26.200269] h1 sent ARP request (retry)
- [t=16:22:27.220287] h1 sent ARP request (retry)

Part 2. Create GRE Tunnel

5. When h1 ping h5, what will happen?

```
nscap2@nscap2: ~/network-systems-capstone-23spring/hw7
mininet> xterm h1
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=22.8 ms

--- 10.0.0.5 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 22.779/22.779/22.779/0.000 ms
mininet>

"Node: h1"
root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:42:35.141288 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
16:42:35.153808 ARP, Reply 10.0.0.5 is-at 52:99:2d:1d:25:44 (oui Unknown), length 28
16:42:35.153817 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 5516, seq 1, length 64
16:42:35.164039 IP 10.0.0.5 > 10.0.0.1: ICMP echo reply, id 5516, seq 1, length 64

"Node: h5"
root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h5-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:42:35.080776 ARP, Request who-has 10.0.0.5 tell 10.0.0.1, length 28
16:42:35.081008 ARP, Reply 10.0.0.5 is-at 52:99:2d:1d:25:44 (oui Unknown), length 28
16:42:35.090652 IP 10.0.0.1 > 10.0.0.5: ICMP echo request, id 5516, seq 1, length 64
16:42:35.090746 IP 10.0.0.5 > 10.0.0.1: ICMP echo reply, id 5516, seq 1, length 64
```

ARP:

- [t=16:42:35.141288 (vm1)] h1 sent ARP request
- [t=16:42:35.080776 (vm2)] h5 received ARP request from h1
- [t=16:42:35.081008 (vm2)] h5 sent ARP reply
- [t=16:42:35.153808 (vm1)] h1 received ARP reply from h5

ICMP:

- [t=16:42:35.153817 (vm1)] h1 sent ICMP echo request to h5
- [t=16:42:35.090652 (vm2)] h5 received ICMP echo request from h1
- [t=16:42:35.090746 (vm2)] h5 sent ICMP echo reply to h1
- [t=16:42:35.164039 (vm1)] h1 received ICMP echo reply from h5

6. When h1 ping h7, what will happen?

```

nscap2@nscap2: ~/network-systems-capstone-23spring/hw7
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 0
mininet>

"Node: h1"
root@nscap2: ~/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:52:53.508314 ARP, Request who-has 10.0.0.7 tell 10.0.0.1, length 28
16:52:53.522568 ARP, Reply 10.0.0.7 is-at 82:e8:46:b5:1e:7e (oui Unknown), length 28
16:52:53.522579 IP 10.0.0.1 > 10.0.0.7: ICMP echo request, id 5906, seq 1, length 64
16:52:58.667613 ARP, Request who-has 10.0.0.1 tell 10.0.0.7, length 28
16:52:58.667636 ARP, Reply 10.0.0.1 is-at 0e:1d:5d:58:1b:17 (oui Unknown), length 28

"Node: h7"
root@nscap2: ~/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h7-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:52:53.459216 ARP, Request who-has 10.0.0.7 tell 10.0.0.1, length 28
16:52:53.459341 ARP, Reply 10.0.0.7 is-at 82:e8:46:b5:1e:7e (oui Unknown), length 28
16:52:53.472848 IP 10.0.0.1 > 10.0.0.7: ICMP echo request, id 5906, seq 1, length 64
16:52:53.473002 IP 10.0.0.7 > 10.0.0.1: ICMP echo reply, id 5906, seq 1, length 64
16:52:58.614132 ARP, Request who-has 10.0.0.1 tell 10.0.0.7, length 28
16:52:58.621376 ARP, Reply 10.0.0.1 is-at 0e:1d:5d:58:1b:17 (oui Unknown), length 28

```

ARP:

- [t=16:52:53.508314 (vm1)] h1 sent ARP request
- [t=16:52:53.459216 (vm2)] h7 received ARP request from h1
- [t=16:52:53.459341 (vm2)] h7 sent ARP reply
- [t=16:52:53.522568 (vm1)] h1 received ARP reply from h7

ICMP:

- [t=16:52:53.522579 (vm1)] h1 sent ICMP echo request to h7
- [t=16:52:53.472848 (vm2)] h7 received ICMP echo request from h1
- [t=16:52:53.473002 (vm2)] h7 sent ICMP echo reply to h1

7. When h7 ping h1, what will happen?

```

nscap2@nscap2: ~/network-systems-capstone-23spring/hw7
mininet> xterm h1
mininet>

nscap2@nscap2: ~/network-systems-capstone-23spring/hw7
mininet> xterm h7
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
mininet>

"Node: h1"
root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h1-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:58:40.659663 ARP, Request who-has 10.0.0.1 tell 10.0.0.7, length 28
16:58:40.659676 ARP, Reply 10.0.0.1 is-at 4e16b2a610e1c810d (oui Unknown), length 28
16:58:46.520357 IP 6 fe80::b83c:a7ff:fe49:f73a > ip6-allrouters: ICMP6, router solicitation, length 16
16:58:46.572933 IP 6 fe80::12be142ff:fe15:56b3 > ip6-allrouters: ICMP6, router solicitation, length 16
16:58:48.673223 IP 6 fe80::ac2dceff:fe93:64a0 > ip6-allrouters: ICMP6, router solicitation, length 16

"Node: h7"
root@nscap2:/home/nscap2/network-systems-capstone-23spring/hw7# tcpdump
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on h7-eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
16:58:40.654326 ARP, Request who-has 10.0.0.1 tell 10.0.0.7, length 28
16:58:40.654241 ARP, Reply 10.0.0.1 is-at 4e16b2a610e1c810d (oui Unknown), length 28
16:58:40.654251 IP 10.0.0.7 > 10.0.0.1: ICMP echo request, id 3937, seq 1, length 84
16:58:46.509931 IP 6 fe80::b83c:a7ff:fe49:f73a > ip6-allrouters: ICMP6, router solicitation, length 16
16:58:48.654089 IP 6 fe80::14cc:95ff:febe:1333 > ip6-allrouters: ICMP6, router solicitation, length 16
16:58:48.659924 IP 6 fe80::12be142ff:fe15:56b3 > ip6-allrouters: ICMP6, router solicitation, length 16
16:58:48.651101 IP 6 fe80::ac2dceff:fe93:64a0 > ip6-allrouters: ICMP6, router solicitation, length 16

```

ARP:

- [t=16:58:40.645356 (vm2)] h7 sent ARP request
- [t=16:58:40.659663 (vm1)] h1 received ARP request from h7
- [t=16:58:40.659676 (vm1)] h1 sent ARP reply
- [t=16:58:40.654241 (vm2)] h7 received ARP reply from h1

ICMP:

- [t=16:58:40.654251 (vm2)] h7 sent ICMP echo request to h1

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

No, they are not the same. According to the screenshot provided in the answer to question 4, even the ARP request cannot be sent to the target host, i.e. h5. But in the screenshots provided in the answers to questions 6 and 7, we can see that the ARP request/reply are propagated properly. We can infer that the reason for the drop in question 4 is due to connectivity, and, on the other hand, the drop in questions 6 and 7 is because of the filter rules we set on the controller.

(See the screenshots provided in previous questions for more details)

9. Change filter_table2 rule

From: packets coming from port_3 or port_4 will be dropped, while other packets will be allowed to pass.

To: 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 screenshot) explain why or why not.

The outcome of questions 5 and 6 are different from the original version, while the one of question 7 remains the same.

In the modified version, the outcomes of question 5 and 6 become similar to that of question 7. This means that the ARP request/reply packets would be transmitted successfully, but the ICMP request packets would not reach its intended destination (h5/h7) correctly.

The reason for this is that we are utilizing a GRE tunnel for transmitting these packets between h1 and h5 or h1 and h7. As a result, the 'in_port' value of these packets transmitted through the tunnel becomes 5 (in my case), which is not in the allowed list when we are constructing the filtering rules. Consequently, the ICMP request packets are dropped.