

0716306 lab3 report

Part 1

1. 下圖為 r1 到 r4 還沒 enable BGP 的 routing table

```
demo@SDN-NFV: ~/Desktop/NSC_lab3
File Edit View Search Terminal Help
demo@SDN-NFV:~$ cd Desktop/NSC_lab3
demo@SDN-NFV:~/Desktop/NSC_lab3$ ls
c-ares-1.17.1                                     quagga-1.2.4
example                                             topology.py
'Lab3-Dynamic Routing and Network Address Translation.pdf'
demo@SDN-NFV:~/Desktop/NSC_lab3$ sudo python topology.py
[sudo] password for demo:
mininet> r1 route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
10.0.1.0         0.0.0.0         255.255.255.0    U        0      0      0 r1-eth0
192.168.1.0     0.0.0.0         255.255.255.192 U        0      0      0 r1-eth1
192.168.1.64    0.0.0.0         255.255.255.192 U        0      0      0 r1-eth2
mininet> r2 route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
10.0.0.0         0.0.0.0         255.255.255.0    U        0      0      0 r2-eth0
10.0.1.0         0.0.0.0         255.255.255.0    U        0      0      0 r2-eth1
mininet> r3 route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
10.0.0.0         0.0.0.0         255.255.255.0    U        0      0      0 r3-eth0
10.0.2.0         0.0.0.0         255.255.255.0    U        0      0      0 r3-eth1
mininet> r4 route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
10.0.2.0         0.0.0.0         255.255.255.0    U        0      0      0 r4-eth0
140.114.0.0     0.0.0.0         255.255.255.0    U        0      0      0 r4-eth1
```

下圖是執行 r1 到 r4 的 BGP 後的結果

```
demo@SDN-NFV:~/Desktop/NSC_lab3$ sudo python topology.py
mininet> r1 route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
10.0.1.0         0.0.0.0         255.255.255.0    U        0      0      0 r1-eth0
140.114.0.0     10.0.1.1       255.255.0.0      UG       20     0      0 r1-eth0
192.168.1.0     0.0.0.0         255.255.255.192 U        0      0      0 r1-eth1
192.168.1.64    0.0.0.0         255.255.255.192 U        0      0      0 r1-eth2
mininet> r2 route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
10.0.0.0         0.0.0.0         255.255.255.0    U        0      0      0 r2-eth0
10.0.1.0         0.0.0.0         255.255.255.0    U        0      0      0 r2-eth1
140.113.0.0     10.0.1.2       255.255.0.0      UG       20     0      0 r2-eth1
140.114.0.0     10.0.0.2       255.255.0.0      UG       20     0      0 r2-eth0
mininet> r3 route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
10.0.0.0         0.0.0.0         255.255.255.0    U        0      0      0 r3-eth0
10.0.2.0         0.0.0.0         255.255.255.0    U        0      0      0 r3-eth1
140.113.0.0     10.0.0.1       255.255.0.0      UG       20     0      0 r3-eth0
140.114.0.0     10.0.2.3       255.255.0.0      UG       20     0      0 r3-eth1
mininet> r4 route
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
10.0.2.0         0.0.0.0         255.255.255.0    U        0      0      0 r4-eth0
140.113.0.0     10.0.2.1       255.255.0.0      UG       20     0      0 r4-eth0
140.114.0.0     0.0.0.0         255.255.255.0    U        0      0      0 r4-eth1
mininet>
```

2. R1 的 zebra route

```
edko> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
       0 - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel, N - NHRP,
       > - selected route, * - FIB route

B>* 140.114.0.0/16 [20/0] via 10.0.1.1, r1-eth0, 00:06:39
```

R1 的 bgp route

```

r1> show ip bgp summary
BGP router identifier 10.0.1.2, local AS number 65000
RIB entries 3, using 336 bytes of memory
Peers 1, using 9088 bytes of memory

Neighbor      V      AS MsgRcvd MsgSent   TblVer   InQ OutQ Up/Down  State/PfxRcd
10.0.1.1      4 65001    220    223       0    0    0 00:10:53      1

Total number of neighbors 1
Total num. Established sessions 1
Total num. of routes received 1

```

R2 的 zebra route

```

edko> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel, N - NHRP,
       > - selected route, * - FIB route

B>* 140.113.0.0/16 [20/0] via 10.0.1.2, r2-eth1, 00:12:30
B>* 140.114.0.0/16 [20/0] via 10.0.0.2, r2-eth0, 00:12:29
edko>

```

R2 的 bgp route

```

r2> show ip bgp summary
BGP router identifier 10.0.1.1, local AS number 65001
RIB entries 3, using 336 bytes of memory
Peers 2, using 18 KiB of memory

Neighbor      V      AS MsgRcvd MsgSent   TblVer   InQ OutQ Up/Down  State/PfxRcd
10.0.0.2      4 65002     16     19       0    0    0 00:13:43      1
10.0.1.2      4 65000    278    279       0    0    0 00:13:44      1

Total number of neighbors 2
Total num. Established sessions 2
Total num. of routes received 2

```

R3 的 zebra route

```

edko> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel, N - NHRP,
       > - selected route, * - FIB route

B>* 140.113.0.0/16 [20/0] via 10.0.0.1, r3-eth0, 00:14:44
B>* 140.114.0.0/16 [20/0] via 10.0.2.3, r3-eth1, 00:14:45

```

R3 的 bgp route

```

r3> show ip bgp summary
BGP router identifier 10.0.2.1, local AS number 65002
RIB entries 3, using 336 bytes of memory
Peers 2, using 18 KiB of memory

Neighbor      V      AS MsgRcvd MsgSent   TblVer   InQ OutQ Up/Down  State/PfxRcd
10.0.0.1      4 65001     19     20       0    0    0 00:15:16      1
10.0.2.3      4 65003    307    310       0    0    0 00:15:17      1

Total number of neighbors 2
Total num. Established sessions 2
Total num. of routes received 2

```

R4 的 zebra route

```

edko> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel, N - NHRP,
       > - selected route, * - FIB route

B>* 140.113.0.0/16 [20/0] via 10.0.2.1, r4-eth0, 00:17:06

```

R4 的 bgp route

3.

r2-eth0

r3-eth0

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	Fe80::1464::e8ff::Fed	Ff02::1	ICMPv6	70	Router Solicitation from 46:64:e8:d8:47:c7
2	0.000211921	Fe80::39::27ff::Fe70::	Ff02::2	ICMPv6	70	Router Solicitation from 02:39::27:70:3a:29
3	0.000187201	Fe80::39::27ff::Fe70::	Ff02::2	ICMPv6	70	Router Solicitation from 02:39::27:70:3a:29
4	0.000484837	Fe80::1464::e8ff::Fed	Ff02::1	ICMPv6	70	Router Solicitation from 46:64:e8:d8:47:c7
5	0.000490566	Fe80::39::27ff::Fe70::	Ff02::2	ICMPv6	70	Router Solicitation from 02:39::27:70:3a:29
6	0.110.040710316	46:64:e8:d8:47:c7	Broadcast	ARP	42	Who has 10.0.0.2 tell 10.0.0.1
7	0.110.040715002	MS-NL8-Phys-Serv-3..	46:64:e8:d8:47:c7	ARP	42	10.0.0.0.2 is at 02:39:27:70:3a:29
8	0.110.040715002	MS-NL8-Phys-Serv-3..	46:64:e8:d8:47:c7	ARP	42	47:026 - 179 [SYN] Seq=9 Win=43520 Len=0 MSS=1460 SACK_PERM=1 TSVol=874460228 TSecr=0
9	0.110.040715240	10.0.0.2	10.0.0.1	ICP	64	54/19 - 47026 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
10	0.110.040715240	Fe80::1464::e8ff::Fed	Ff02::1	ICMPv6	70	Router Solicitation from 46:64:e8:d8:47:c7
11	0.110.040778976	10.0.0.1	10.0.0.2	ICP	74	47026 - 179 [SYN] Seq=9 Win=43520 Len=0 MSS=1460 SACK_PERM=1 TSVol=874465237 TSecr=0
12	0.115.001010143	10.0.0.2	10.0.0.1	ICP	64	54/19 - 47026 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
13	0.115.200358824	MS-NL8-Phys-Serv-3..	46:64:e8:d8:47:c7	ARP	42	Who has 10.0.0.17 tell 10.0.0.2
14	0.115.200433580	46:64:e8:d8:47:c7	MS-NL8-Phys-Serv-3..	ARP	42	10.0.0.1 is at 46:64:e8:d8:47:c7
15	0.115.200433580	10.0.0.1	10.0.0.2	ICP	74	47026 - 179 [SYN] Seq=9 Win=43520 Len=0 MSS=1460 SACK_PERM=1 TSVol=874470238 TSecr=0
16	0.120.050375254	10.0.0.2	10.0.0.1	ICP	54	179 - 47026 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
17	0.120.050375254	10.0.0.2	10.0.0.1	ICP	54	179 - 47026 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
18	0.120.050375254	10.0.0.2	10.0.0.1	ICP	54	179 - 47026 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
19	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
20	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
21	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
22	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
23	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
24	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
25	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
26	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
27	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
28	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
29	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
30	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
31	0.127.242849140	10.0.0.1	10.0.0.2	ICP	74	53136 - 179 [ACK] Seq=60 Ack=98 Win=42496 Len=0 MSS=1460 SACK_PERM=1 TSVol=1255982985 TSecr=0
32	0.128.250329699	10.0.0.2	10.0.0.1	ICP	66	179 - 53136 [ACK] Seq=172 Ack=121 Win=43520 Len=0 TSVol=874474834 TSecr=1255983992
33	0.128.250329699	10.0.0.2	10.0.0.1	ICP	66	179 - 53136 [ACK] Seq

3.2 在 mininet 中執行 r4 ip link r4-eth0 down 後，結果如下圖

```
mininet> r4 ip link set r4-eth0 down
mininet> r1 rout
bash: rout: command not found
mininet> r1 route
Kernel IP routing table
Destination        Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.1.0           0.0.0.0         255.255.255.0   U        0      0      0 r1-eth0
192.168.1.0        0.0.0.0         255.255.255.192 U        0      0      0 r1-eth1
192.168.1.64       0.0.0.0         255.255.255.192 U        0      0      0 r1-eth2
mininet> r2 route
Kernel IP routing table
Destination        Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.0.0           0.0.0.0         255.255.255.0   U        0      0      0 r2-eth0
10.0.1.0           0.0.0.0         255.255.255.0   U        0      0      0 r2-eth1
140.113.0.0        10.0.1.2        255.255.0.0     UG       20     0      0 r2-eth1
mininet> r3 route
Kernel IP routing table
Destination        Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.0.0           0.0.0.0         255.255.255.0   U        0      0      0 r3-eth0
10.0.2.0           0.0.0.0         255.255.255.0   U        0      0      0 r3-eth1
140.113.0.0        10.0.0.1        255.255.0.0     UG       20     0      0 r3-eth0
mininet> r4 route
Kernel IP routing table
Destination        Gateway         Genmask         Flags Metric Ref    Use Iface
140.114.0.0        0.0.0.0         255.255.255.0   U        0      0      0 r4-eth1
mininet>
```

從 r1 到 r4 的 route 可知，因為把 r4-eth0 關閉後，140.114.0.0/16 無法藉由 r4-eth0 傳出，因此其他 router 不能藉由 bgp 新增到 140.114.0.0/16 的 route

3.3 透過 ping 這個指令，可以發現 r3 到 r4 或是 r4 到 r3 的 ping 皆無法抵達目的地，如下圖

```
mininet> r3 ping r4
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
PING 10.0.2.3 (10.0.2.3) 56(84) bytes of data:
From 10.0.2.1 icmp_seq=1 Destination Host Unreachable
From 10.0.2.1 icmp_seq=2 Destination Host Unreachable
From 10.0.2.1 icmp_seq=3 Destination Host Unreachable
From 10.0.2.1 icmp_seq=4 Destination Host Unreachable
From 10.0.2.1 icmp_seq=5 Destination Host Unreachable
From 10.0.2.1 icmp_seq=6 Destination Host Unreachable
From 10.0.2.1 icmp_seq=7 Destination Host Unreachable
^C
--- 10.0.2.3 ping statistics ---
8 packets transmitted, 0 received, +7 errors, 100% packet loss, time 7126ms
pipe 4
mininet> r4 ping r3
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
connect: Network is unreachable
mininet>
```

3.4 而 r2 到 r4 的關係也是用相同方法測試

```
mininet> r2 ping r4
connect: Network is unreachable
mininet> r4 ping r2
connect: Network is unreachable
```

Part 2 question

1. 下圖為 h4 curl 140.113.0.40:80 的結果

```
mininet> h4 curl 140.113.0.40:80
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 3.2 Final//EN"><html>
<title>Directory listing for /</title>
<body>
<h2>Directory listing for /</h2>
<hr>
<ul>
<li><a href="c-ares-1.17.1/">c-ares-1.17.1/</a>
<li><a href="configs/">configs/</a>
<li><a href="Lab3-Dynamic%20Routing%20and%20Network%20Address%20Translation.pdf">Lab3-Dynamic Routing and Network Address Translation
.pdf</a>
<li><a href="quagga-1.2.4/">quagga-1.2.4/</a>
<li><a href="topology.py">topology.py</a>
</ul>
</body>
</html>
```

2. 下圖中包含 h1 ping h4 -c 1、h2 ping h4 -c 1 以及 h3 ping h4 -c 1 的結果

```
mininet> h1 ping h4 -c 1
PING 140.114.0.1 (140.114.0.1) 56(84) bytes of data.
64 bytes from 140.114.0.1: icmp_seq=1 ttl=60 time=0.215 ms

--- 140.114.0.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.215/0.215/0.215/0.000 ms
mininet> h2 ping h4 -c 1
PING 140.114.0.1 (140.114.0.1) 56(84) bytes of data.
64 bytes from 140.114.0.1: icmp_seq=1 ttl=60 time=0.987 ms

--- 140.114.0.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.987/0.987/0.987/0.000 ms
mininet> h3 ping h4 -c 1
PING 140.114.0.1 (140.114.0.1) 56(84) bytes of data.
64 bytes from 140.114.0.1: icmp_seq=1 ttl=60 time=0.483 ms

--- 140.114.0.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.483/0.483/0.483/0.000 ms
mininet>
```

3. 在下圖的 r1-eth0 結圖中可看到，編號 38、39 的封包是由 140.113.0.30 和 h4 互相傳送封包，因此可知這兩個封包由 h1 的網域發出；而編號 58、59 的封包由 140.113.0.40 發出，可知是由 h2 的網域發出，同時也符合兩個 ping 指令之間的先後順序

No.	Time	Source	Destination	Protocol	Length	Info
31	21.918676492	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=153 Ack=153 Win=83 Len=0 TSval=2849226442 TSecr=2684489391
32	24.021369412	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
33	24.021451156	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
34	24.021461305	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=172 Ack=172 Win=83 Len=0 TSval=2849229444 TSecr=2684412393
35	27.024635408	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
36	27.024786098	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
37	27.024888895	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=191 Ack=191 Win=83 Len=0 TSval=2849232448 TSecr=2684415397
38	28.283125031	140.113.0.30	140.114.0.1	ICMP	98	Echo (ping) request id=0x6aea, seq=1/256, ttl=63 (reply in 39)
39	28.283156201	140.114.0.1	140.113.0.30	ICMP	98	Echo (ping) reply id=0x6aea, seq=1/256, ttl=61 (request in 38)
40	30.028148514	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
41	30.028250620	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
42	30.028268442	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=219 Ack=219 Win=83 Len=0 TSval=2849235451 TSecr=2684418409
43	33.030707621	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
44	33.030805522	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
45	33.030888690	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=229 Ack=229 Win=83 Len=0 TSval=2849238454 TSecr=2684421403
46	36.032789985	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
47	36.032814449	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=229 Ack=248 Win=83 Len=0 TSval=2849241456 TSecr=2684424405
48	36.033895079	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
49	36.076850722	10.0.1.2	10.0.1.1	TCP	66	179 → 56282 [ACK] Seq=248 Ack=248 Win=85 Len=0 TSval=2849244449 TSecr=2849241456
50	39.037508772	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
51	39.037537311	10.0.1.2	10.0.1.1	TCP	66	179 → 56282 [ACK] Seq=248 Ack=267 Win=85 Len=0 TSval=2849247410 TSecr=2849244461
52	39.037817795	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
53	39.037828053	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=267 Ack=267 Win=83 Len=0 TSval=2849244461 TSecr=2849247410
54	42.038849920	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
55	42.038862618	10.0.1.2	10.0.1.1	TCP	66	179 → 56282 [ACK] Seq=267 Ack=286 Win=85 Len=0 TSval=28492430411 TSecr=2849247462
56	42.038974740	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
57	42.038974740	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=286 Ack=286 Win=83 Len=0 TSval=2849247462 TSecr=2684430411
58	44.244488893	140.113.0.40	140.114.0.1	ICMP	98	Echo (ping) request id=0x6aed, seq=1/256, ttl=63 (reply in 59)
59	44.244535040	140.114.0.1	140.113.0.40	ICMP	98	Echo (ping) reply id=0x6aed, seq=1/256, ttl=61 (request in 58)
60	45.042795143	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
61	45.042803068	10.0.1.2	10.0.1.1	TCP	66	179 → 56282 [ACK] Seq=286 Ack=305 Win=85 Len=0 TSval=2849250466 TSecr=2849250466
62	45.042877433	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
63	45.042890297	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=305 Ack=305 Win=83 Len=0 TSval=2849250466 TSecr=2684433415
64	48.045414365	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message
65	48.045496809	10.0.1.2	10.0.1.1	BGP	85	KEEPALIVE Message
66	48.045508365	10.0.1.1	10.0.1.2	TCP	66	56282 → 179 [ACK] Seq=324 Ack=324 Win=83 Len=0 TSval=2849253469 TSecr=2684436418
67	51.046668173	10.0.1.1	10.0.1.2	BGP	85	KEEPALIVE Message

• Frame 1: 85 bytes on wire (680 bits). 85 bytes captured (680 bits) on interface 0

• Ethernet II, Src: 56:0e:09:66:02:6b (56:0e:09:66:02:6b), Dst: 96:35:c2:d7:0d:c1 (96:35:c2:d7:0d:c1)

• Internet Protocol Version 4, Src: 10.0.1.2, Dst: 10.0.1.1

• Transmission Control Protocol, Src Port: 179, Dst Port: 56282, Seq: 1, Ack: 1, Len: 10

• Border Gateway Protocol - KEEPALIVE Message

r1-eth1 截圖，可看見由 h1 傳出以及由 h4 傳入的封包是在編號 1、2 的封包

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	192.168.1.12	140.114.0.1	ICMP	98	Echo (ping) request id=0x0aaa, seq=1/256, ttl=64 (reply in 2)
2	0.000052138	140.114.0.1	192.168.1.12	ICMP	98	Echo (ping) reply id=0x0aaa, seq=1/256, ttl=60 (request in 1)
3	5.140537294	46:42:85:90:90:80	b6:c9:47:81:a9:1e	ARP	42	Who has 192.168.1.12? Tell 192.168.1.62
4	5.140575236	b6:c9:47:81:a9:1e	46:42:85:90:90:80	ARP	42	Who has 192.168.1.62? Tell 192.168.1.12
5	5.140599024	46:42:85:90:90:80	b6:c9:47:81:a9:1e	ARP	42	192.168.1.62 is at 46:42:85:90:90:80
6	5.140673359	b6:c9:47:81:a9:1e	46:42:85:90:90:80	ARP	42	192.168.1.12 is at b6:c9:47:81:a9:1e
7	35.61369111	fe80::4c1c:3bff:fe4...	ff02::2	ICMPv6	70	Router Solicitation from 46:42:85:90:90:80
8	35.639267442	fe80::4442:85ff:fe9...	ff02::2	ICMPv6	70	Router Solicitation from 46:42:85:90:90:80

▶ Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
 ▶ Ethernet II, Src: b6:c9:47:81:a9:1e (b6:c9:47:81:a9:1e), Dst: 46:42:85:90:90:80 (46:42:85:90:90:80)
 ▶ Internet Protocol Version 4, Src: 192.168.1.12, Dst: 140.114.0.1
 ▶ Internet Control Message Protocol

r1-eth2 截圖，可看見由 h2 傳出以及由 h4 傳入的封包是在編號 1、2 的封包