Lab 2: IP Assignment and Hop-by-hop Forwarding

0816034 蔡家倫

Part 1

1. After you complete Steps 1-1

a. Can h3 ping h4? Briefly explain why or why not.(5%)

- 可以，h3 和 h4 在同一個 LAN 內

b. Can h3 ping h5? Briefly explain why or why not.(5%)

- 可以，h3 ping h5 會經過的 router 皆有經過設定，使得 h3 和 h5 間是暢通的。

2. Take screenshot to show that your topology configuration is correct. (10%)

```
mininet> net
h1 h1-eth0:s1-eth2
h2 h2-eth0:s1-eth3
h3 h3-eth0:s2-eth2
h4 h4-eth0:s2-eth3
h5 h5-eth0:s3-eth2
h6 h6-eth0:s3-eth3
DHCPServer DHCPServer-eth0:s1-eth4
r1 r1-eth0:r2-eth1 r1-eth1:s1-eth1 r1-eth2:s2-eth1
r2 r2-eth0:r3-eth0 r2-eth1:r1-eth0
r3 r3-eth0:r2-eth0 r3-eth1:r4-eth0
r4 r4-eth0:r3-eth1 r4-eth1:s3-eth1
s1 lo:  s1-eth1:r1-eth1 s1-eth2:h1-eth0 s1-eth3:h2-eth0 s1-eth4:DHCPServer-eth0
s2 lo:  s2-eth1:r1-eth2 s2-eth2:h3-eth0 s2-eth3:h4-eth0
s3 lo:  s3-eth1:r4-eth1 s3-eth2:h5-eth0 s3-eth3:h6-eth0
mininet> 
```

Part 2

3. Run dhcp on h1 and capture DHCP messages. Take screenshot to show the IPs and MACs. (10%)

```
mininet> h1 wireshark &
mininet> h1 dhclient h1-eth0
QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
mininet> h1 ifconfig
h1-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.1  netmask 255.255.255.128  broadcast 192.168.1.127
        inet6 fe80::200:ff:fe00:1  prefixlen 64  scopeid 0x20<link>
        ether 00:00:00:00:00:01  txqueuelen 1000  (Ethernet)
        RX packets 60  bytes 5953 (5.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 14  bytes 1408 (1.4 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 20  bytes 1000 (1000.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 20  bytes 1000 (1000.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

mininet>
```

4. Can hosts other than h1 and h2 acquire IP addresses from DHCP server? Briefly explain your answer. (5%)

- 不行，因為和 DHCP Server 不在同一個 LAN 內

5. Run dhcp on h2 and take screenshot to show IP of h2. (5%)

```
soulr@ubuntu:~/Desktop/lab2$ sudo python topology.py
[+] Run DHCP server
h1 doesn't have connectivity to 192.168.1.129
h1 doesn't have connectivity to 192.168.1.130
h1 doesn't have connectivity to 192.168.3.2
h1 doesn't have connectivity to 192.168.3.3
h2 doesn't have connectivity to 192.168.1.129
h2 doesn't have connectivity to 192.168.1.130
h2 doesn't have connectivity to 192.168.3.2
h2 doesn't have connectivity to 192.168.3.3
WRONG ANSWER
mininet> h1 dhclient h1-eth0
mininet> h2 dhclient h2-eth0
mininet> h2 ifconfig h2-eth0
h2-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.34  netmask 255.255.255.128  broadcast 192.168.1.127
        inet6 fe80::200:ff:fe00:2  prefixlen 64  scopeid 0x20<link>
        ether 00:00:00:00:00:02  txqueuelen 1000  (Ethernet)
        RX packets 42  bytes 4853 (4.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 10  bytes 1128 (1.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

mininet>
```
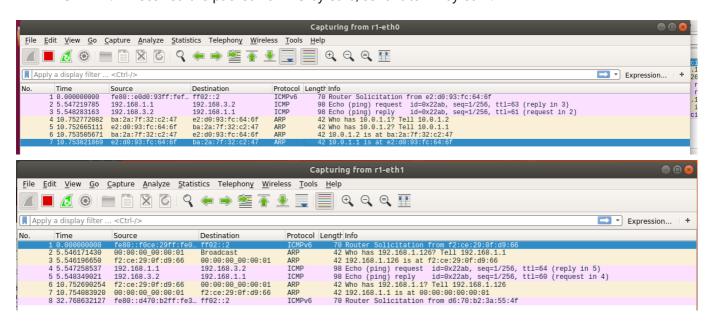
6. Explain how you make dhcp server assigned fixed address to h2. (5%)

- I bind the specific IP with the MAC address of h2 in `dhcpd.conf`.

```
host fixed-ip {
      hardware ethernet 00:00:00:00:00:02;
      fixed-address 192.168.1.34;
}
```
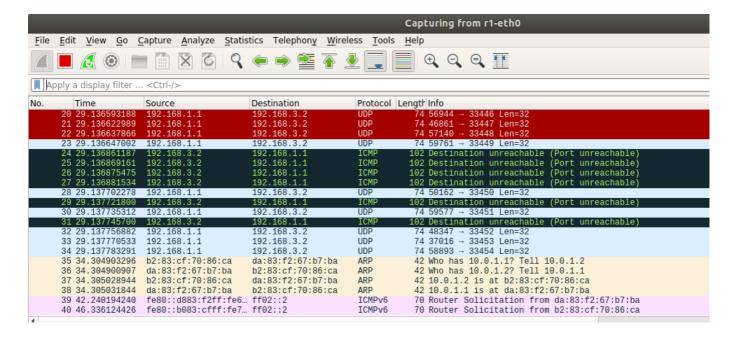
Part 3

7. What does r1 do on the packets from h1 to h5, and h5 to h1, respectively? Capture packets and show screenshot to explain your answers. (5%)

- h1 -> h5: r1 received the packet from h1 by eth1, send it to h5 by eth0.
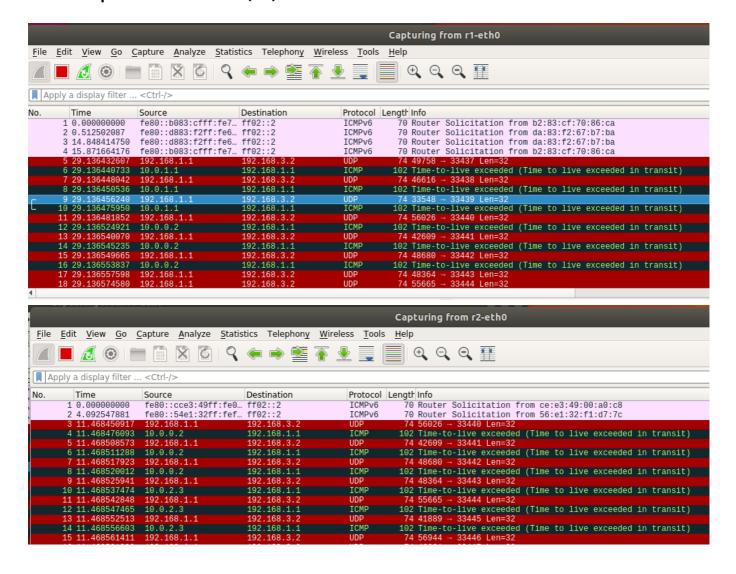- h5 -> h1: r1 received the packet from h5 by eth0, send it to h1 by eth1.

8. Capture packets and take screenshot to answer the following two questions

a. Show the first six ICMP Unreachable messages. Ultimately, h1 will send traceroute packets to h5 successfully. (5%)
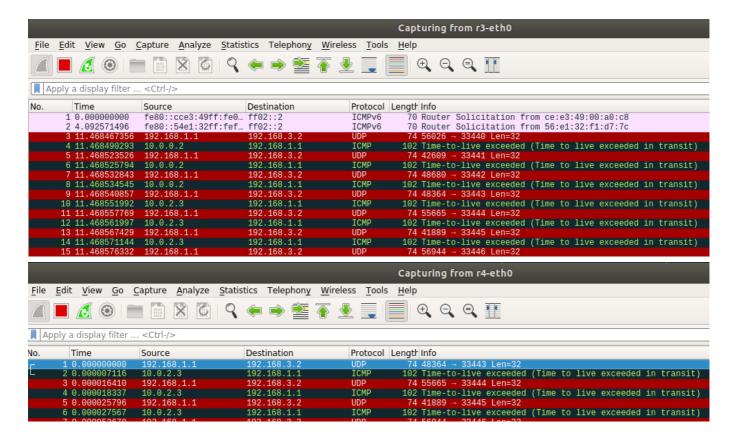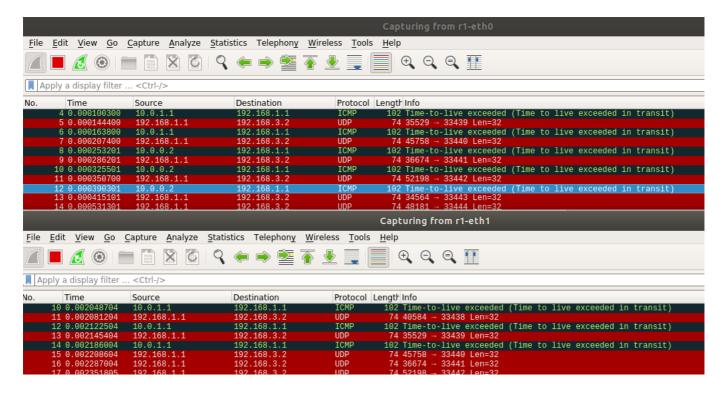
b. Show the ICMP packets forwarded by each router, which constitute the first successful delivery of a traceroute packet from h1 to h5. (5%)

9. Briefly explain why sometimes we may have hop details with "***." Take Wireshark screenshots to justify your answer. (5%)

- router 會擋由外網送到內網地址的封包，以 r1 為例，它不會轉傳從 r3 來的封包。

- 根據上圖所示，r1-eth0 可以收到 r3 (10.0.0.2) 傳來的封包，但 r1 不會轉傳給 h1 (r1-eth1)。