

# Lab 2 report

## part 1

1.

a) Can h2 ping h3? Briefly explain why or why not.

Ans: 可以，因為h2和h3都在同一個switch(subnet)之下

```
mininet> h2 ping h3
PING 192.168.1.66 (192.168.1.66) 56(84) bytes of data.
64 bytes from 192.168.1.66: icmp_seq=1 ttl=64 time=0.358 ms
64 bytes from 192.168.1.66: icmp_seq=2 ttl=64 time=0.061 ms
64 bytes from 192.168.1.66: icmp_seq=3 ttl=64 time=0.065 ms
64 bytes from 192.168.1.66: icmp_seq=4 ttl=64 time=0.058 ms
64 bytes from 192.168.1.66: icmp_seq=5 ttl=64 time=0.050 ms
64 bytes from 192.168.1.66: icmp_seq=6 ttl=64 time=0.067 ms
64 bytes from 192.168.1.66: icmp_seq=7 ttl=64 time=0.065 ms
64 bytes from 192.168.1.66: icmp_seq=8 ttl=64 time=0.080 ms
64 bytes from 192.168.1.66: icmp_seq=9 ttl=64 time=0.158 ms
64 bytes from 192.168.1.66: icmp_seq=10 ttl=64 time=0.053 ms
64 bytes from 192.168.1.66: icmp_seq=11 ttl=64 time=0.053 ms
64 bytes from 192.168.1.66: icmp_seq=12 ttl=64 time=0.061 ms
64 bytes from 192.168.1.66: icmp_seq=13 ttl=64 time=0.068 ms
^C
--- 192.168.1.66 ping statistics ---
13 packets transmitted, 13 received, 0% packet loss, time 12310ms
rtt min/avg/max/mdev = 0.050/0.092/0.358/0.081 ms
mininet> █
```

b) Can h2 ping h4? Briefly explain why or why not.

Ans: 不行，h2和h4在不同switch(subnet)之下，要靠router溝通

```
mininet> h2 ping h4
connect: Network is unreachable
mininet> █
```

2. Take screenshot to show that your topology configuration is correct.

```
potatofarm@potatofarm-VirtualBox:~/Downloads$ sudo python topology.py
h1 doesn't have connectivity to 192.168.1.65
h1 doesn't have connectivity to 192.168.1.66
h1 doesn't have connectivity to 192.168.3.1
h1 doesn't have connectivity to 192.168.3.2
WRONG ANSWER
mininet> █
```

## part 2

### 3. Capture DHCP messages and show the IPs and MACs

Ans: Client IP address and Client MAC address

6	4.260870800	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x74218628
7	4.261683996	be:f2:d9:83:56:c7	Broadcast	ARP	42	Who has 192.168.1.2? Tell 192.168.1.1
8	5.274215506	192.168.1.1	192.168.1.2	DHCP	342	DHCP Offer - Transaction ID 0x74218628
9	5.274646135	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transaction ID 0x74218628
10	5.278568716	192.168.1.1	192.168.1.2	DHCP	342	DHCP ACK - Transaction ID 0x74218628

Your (client) IP address: 192.168.1.2

Next server IP address: 192.168.1.1

Relay agent IP address: 0.0.0.0

Client MAC address: ae:11:da:98:6f:c8 (ae:11:da:98:6f:c8)

### 4. Can hosts other than h1 acquire IP addresses from DHCP server? Briefly explain your answer.

Ans:不行，要在同一個subnet之下，只有h1和DHCP在同一個

## part 3

### 5. What does r1 do on the packets from h1 to h5, and h5 to h1, respectively? Capture packets to explain your answers.

Ans:

h1到h5: r1透過回應h1讓h1知道要往哪送，並且問r2的位置

h5到h1: 因為已經知道h1的位置，所以將封包送回

Capturing from r1-eth1						
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	192.168.1.5	192.168.3.2	ICMP	98	Echo (ping) request id=0x3792, seq=1/256, t
2	0.000309658	192.168.3.2	192.168.1.5	ICMP	98	Echo (ping) reply id=0x3792, seq=1/256, t
3	5.198324693	8e:19:df:30:25:f0	22:13:db:92:d9:25	ARP	42	Who has 192.168.1.5? Tell 192.168.1.62
4	5.199794383	22:13:db:92:d9:25	8e:19:df:30:25:f0	ARP	42	Who has 192.168.1.62? Tell 192.168.1.5
5	5.199801123	8e:19:df:30:25:f0	22:13:db:92:d9:25	ARP	42	192.168.1.62 is at 8e:19:df:30:25:f0
6	5.199914984	22:13:db:92:d9:25	8e:19:df:30:25:f0	ARP	42	192.168.1.5 is at 22:13:db:92:d9:25

Capturing from r1-eth0						
No.	Time	Source	Destination	Protocol	Length	Info
1	0.0000000000	192.168.1.5	192.168.3.2	ICMP	98	Echo (ping) request id=0x3792, seq=1/256, t
2	0.000276817	192.168.3.2	192.168.1.5	ICMP	98	Echo (ping) reply id=0x3792, seq=1/256, t
3	5.198364668	d2:75:c0:3e:af:0a	6e:6c:94:bf:b1:80	ARP	42	Who has 10.0.1.1? Tell 10.0.1.2
4	5.198324937	6e:6c:94:bf:b1:80	d2:75:c0:3e:af:0a	ARP	42	Who has 10.0.1.2? Tell 10.0.1.1
5	5.199354132	d2:75:c0:3e:af:0a	6e:6c:94:bf:b1:80	ARP	42	10.0.1.2 is at d2:75:c0:3e:af:0a
6	5.199397562	6e:6c:94:bf:b1:80	d2:75:c0:3e:af:0a	ARP	42	10.0.1.1 is at 6e:6c:94:bf:b1:80

## 6. Capture all ICMP messages received by h1 and explain why h1 can only derive only 1st, 2nd, and 5th hops details.

Ans: 因為h1只有接收到來自r1, r2的TTL訊息和h5的port unreachable訊息

13322	192.168.1.62	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
81214	192.168.1.62	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
23706	192.168.1.62	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
62997	10.0.1.1	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
83798	10.0.1.1	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
88240	10.0.1.1	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)

.1	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)
.0	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)
.0	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)
.9	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)
.9	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)
.8	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)

## 7. H1 uses some ICMP messages to derive 1st and 2nd hop details. What are the type(s) and sender(s) of the ICMP messages?

Ans:

.2	192.168.1.62	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
.4	192.168.1.62	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
.6	192.168.1.62	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
.7	10.0.1.1	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
.8	10.0.1.1	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
.9	10.0.1.1	192.168.1.5	ICMP	102 Time-to-live exceeded (Time to live exceeded in transit)
.1	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)
.0	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)
.0	192.168.3.2	192.168.1.5	ICMP	102 Destination unreachable (Port unreachable)

[Header checksum status: Unverified]  
Source: 192.168.1.62  
Destination: 192.168.1.5

Internet Control Message Protocol  
Type: 11 (Time-to-live exceeded)  
Code: 0 (Time to live exceeded in transit)  
Checksum: 0x7a91 [correct]  
[Checksum Status: Good]

Internet Protocol Version 4, Src: 192.168.1.5, Dst: 192.168.3.2  
0100 .... = Version: 4  
.... 0101 = Header Length: 20 bytes (5)

```

12 192.168.1.62      192.168.1.5    ICMP   102 Time-to-live exceeded (Time to live exceeded in transit)
14 192.168.1.62      192.168.1.5    ICMP   102 Time-to-live exceeded (Time to live exceeded in transit)
16 192.168.1.62      192.168.1.5    ICMP   102 Time-to-live exceeded (Time to live exceeded in transit)
17 10.0.1.1           192.168.1.5    ICMP   102 Time-to-live exceeded (Time to live exceeded in transit)
18 10.0.1.1           192.168.1.5    ICMP   102 Time-to-live exceeded (Time to live exceeded in transit)
19 192.168.3.2        192.168.1.5    ICMP   102 Destination unreachable (Port unreachable)
20 192.168.3.2        192.168.1.5    ICMP   102 Destination unreachable (Port unreachable)
21 192.168.3.2        192.168.1.5    ICMP   102 Destination unreachable (Port unreachable)

Header checksum: 0xcede2 [validation disabled]
[Header checksum status: Unverified]
Source: 10.0.1.1
Destination: 192.168.1.5
- Internet Control Message Protocol
  Type: 11 (Time-to-live exceeded)
  Code: 0 (Time to live exceeded in transit)
  Checksum: 0x7a91 [correct]
  [Checksum Status: Good]
- Internet Protocol Version 4, Src: 192.168.1.5, Dst: 192.168.3.2
  0100 .... = Version: 4

```

type: 11(time to live exceed)

sender:

1st=>r1

2nd=>r2

## 8. H1 uses some ICMP messages to derive 5th hop details. What are the type(s) and sender(s) of the ICMP messages?

Ans:

```

18 10.0.1.1           192.168.1.5    ICMP   102 Time-to-live exceeded (Time to live exceeded in transit)
19 10.0.1.1           192.168.1.5    ICMP   102 Time-to-live exceeded (Time to live exceeded in transit)
20 192.168.3.2        192.168.1.5    ICMP   102 Destination unreachable (Port unreachable)
21 192.168.3.2        192.168.1.5    ICMP   102 Destination unreachable (Port unreachable)
22 192.168.3.2        192.168.1.5    ICMP   102 Destination unreachable (Port unreachable)
23 192.168.3.2        192.168.1.5    ICMP   102 Destination unreachable (Port unreachable)
24 192.168.3.2        192.168.1.5    ICMP   102 Destination unreachable (Port unreachable)

Header checksum: 0x6727 [validation disabled]
[Header checksum status: Unverified]
Source: 192.168.3.2
Destination: 192.168.1.5
- Internet Control Message Protocol
  Type: 3 (Destination unreachable)
  Code: 3 (Port unreachable)
  Checksum: 0x828e [correct]

```

type: 3(Destination unreachable)

sender: h5

**bonus:**

```

mininet> h1 traceroute h5
traceroute to 192.168.3.2 (192.168.3.2), 30 hops max, 60 byte packets
 1 _gateway (192.168.1.62)  0.412 ms  0.359 ms  0.344 ms
 2 10.0.1.1 (10.0.1.1)  0.330 ms  0.305 ms  0.291 ms
 3 10.0.0.2 (10.0.0.2)  0.278 ms  0.248 ms  0.230 ms
 4 10.0.2.3 (10.0.2.3)  0.212 ms  0.187 ms  0.166 ms
 5 192.168.3.2 (192.168.3.2)  0.149 ms  0.120 ms  0.095 ms
mininet>

```

在原本的py檔中加上

```
routers['r1'].cmd('route add -net 10.0.0.0/24 gw 10.0.1.1')
routers['r1'].cmd('route add -net 10.0.2.0/24 gw 10.0.1.1')
routers['r2'].cmd('route add -net 10.0.2.0/24 gw 10.0.0.2')
routers['r3'].cmd('route add -net 10.0.1.0/24 gw 10.0.0.1')
routers['r4'].cmd('route add -net 10.0.0.0/24 gw 10.0.2.1')
routers['r4'].cmd('route add -net 10.0.1.0/24 gw 10.0.2.1')
```

目前還不太確定原因，猜測因為traceroute丟出的封包無法被沒有和gateway相連的router辨別，因此我們要加上一些未相連的router的規則讓它們傳，才能夠走到r3,r4