

0716306 NSC lab4 report

Question 1

```
mininet> h1 ping Gwr
PING 10.0.0.3 (10.0.0.3) 56(84) bytes of data.
64 bytes from 10.0.0.3: icmp_seq=1 ttl=64 time=0.121 ms
64 bytes from 10.0.0.3: icmp_seq=2 ttl=64 time=0.102 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.145 ms
^C
--- 10.0.0.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2037ms
rtt min/avg/max/mdev = 0.102/0.122/0.145/0.021 ms
mininet> h2 ping Gwr
PING 10.0.0.3 (10.0.0.3) 56(84) bytes of data.
64 bytes from 10.0.0.3: icmp_seq=1 ttl=64 time=0.115 ms
64 bytes from 10.0.0.3: icmp_seq=2 ttl=64 time=0.083 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=0.082 ms
^C
--- 10.0.0.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2052ms
rtt min/avg/max/mdev = 0.082/0.093/0.115/0.017 ms
mininet>
```

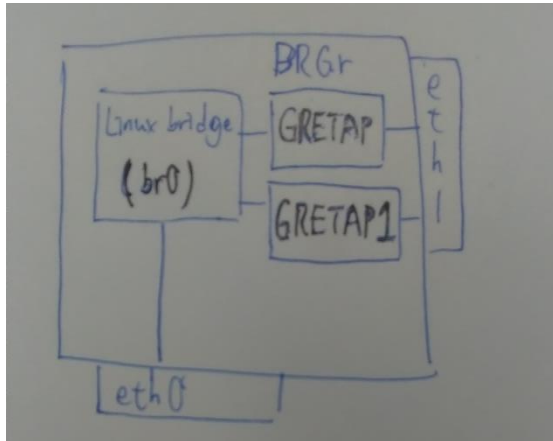
Question 2

下圖中的編號 7 和 9 分別是對 h1 和 h2 的 GRE tunnel

```
demo@SDN-NFV: ~/Desktop/NSC_lab4
File Edit View Search Terminal Help
qlen 1000
    link/gre 0.0.0.0 brd 0.0.0.0
3: gretap0@NONE: <BROADCAST,MULTICAST> mtu 1462 qdisc noop state DOWN mode DEFAU
LT group default qlen 1000
    link/ether 00:00:00:00:00:00 brd ff:ff:ff:ff:ff:ff
4: erspan0@NONE: <BROADCAST,MULTICAST> mtu 1450 qdisc noop state DOWN mode DEFAU
LT group default qlen 1000
    link/ether 00:00:00:00:00:00 brd ff:ff:ff:ff:ff:ff
5: BRGr-eth0@if5: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue maste
r br0 state UP mode DEFAULT group default qlen 1000
    link/ether 96:e9:9c:02:15:37 brd ff:ff:ff:ff:ff:ff link-netnsid 0
6: BRGr-eth1@if5: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state
UP mode DEFAULT group default qlen 1000
    link/ether 36:8c:6d:15:4c:77 brd ff:ff:ff:ff:ff:ff link-netnsid 1
7: GREtAP0@NONE: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1462 qdisc fq_codel master
br0 state UNKNOWN mode DEFAULT group default qlen 1000
    link/ether 02:21:10:79:8f:05 brd ff:ff:ff:ff:ff:ff
8: br0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1462 qdisc noqueue state UP mode D
EFAULT group default qlen 1000
    link/ether 02:21:10:79:8f:05 brd ff:ff:ff:ff:ff:ff
9: GREtAP1@NONE: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1462 qdisc fq_codel maste
r br0 state UNKNOWN mode DEFAULT group default qlen 1000
    link/ether e2:53:5b:5f:0a:aa brd ff:ff:ff:ff:ff:ff
mininet>
```

Question 3

下圖中的 br0 為一開始建立的 bridge，GRETAP 是 GWr 對 h1 的 tunnel，GRETAP1 是對 h2 的 tunnel。建立 bridge 和 GRE TAP 的步驟和 spec 相同，而建立 GRE TAP 時只需要建立 GRE TAP1 後將其 bring up，再用 ip link addif 將 GRE TAP1 與 br0 連接即可



Question 4

在 h1 和 h2 發送封包給 GWr 後，BRGr 會在 MAC table 中記錄 h1 和 h2 的封包分別從哪個 gretap 進入(如 question 3 的截圖中，GRETAP 的 MAC 是 02:21:10:79:8f:05，GRETAP1 的 MAC 是 e2:53:5b:5f:0a:aa)，因此在 GWr 要將封包發送出去時，Linux kernel 可以透過 GRE packet 最外層(outer ethernet header)得知要轉送到 h1 或 h2 的封包應該由哪個 gretap 出去

Question 5

原本在一開始，pcap 的 filter rule 是"ip proto gre"，在我的做法中，每次新的 tunnel 建立時，我會在 rule 後方加上"and not host " + host_ip，使得這個 host 到 GWr 或 GWr 到這個 host 的 GRE packet 會不被接收。下圖的時間點是在 h1 和 h2 都被 rule 禁止後，此時 h1 和 GWr 之間的封包以及 h2 和 GWr 之間的封包都不會被 BRGr 的 packet filter 接收，如下圖(一)所示，因此執行了 tcpdump 後也不會在 xterm 上出現，見圖(二)

圖(一)

```
rule changed to : ip proto gre and not host 140.114.0.1 and not host 140.115.0.1
```

圖(二)

```
00 ff 2f 0f 8b 8c 71 00 01 8c 72 00 01 00 00 65 58 33 33 00 00 00 02 1e 8f be 90
c3 9f 98 dd 60 00 00 00 10 3a ff fe 80 00 00 00 00 00 1c 8f be ff fe 90 c
3 9f ff 02 00 00 00 00 00 00 00 00 00 00 00 02 85 00 3d af 00 00 00 01
01 1e 8f be 90 c3 9f
Outer Source MAC: 33:33:00:00:00:02
Outer Destination MAC: 8e:0d:17:6f:76:de
Ethernet type: 56710
Src IP 140.113.0.1
Dst IP 140.114.0.1
Inner Source MAC: 1e:8f:be:90:c3:9f
Inner Destination MAC: 33:33:00:00:00:02
Next Layer protocol : 6558

check if tunnel for the two IPs already exists
tunnel not created yet, create tunnel for new host
creating tunnel with source ip : 140.113.0.1 and destination ip : 140.114.0.1
===== command to cmd : ip link add GRETP0 type gretap remote 140.114.0.1 loc
al 140.113.0.1
RTNETLINK answers: File exists
===== command to cmd : ip link set GRETP0 up
Cannot find device "GRETP0"
===== command to cmd : brctl addif br0 GRETP0
interface GRETP0 does not exist!
tunnel for the two host created, break loop to add rule
Tunnel finish

capture packet error
new tunnel created, ready to change BPF rule
rule changed to : ip proto gre and not host 140.114.0.1
compile the filter
installing filter
capture packet
Packet number [1]
packet content : 35 8c 6d 15 4c 77 96 d5 17 6f 76 de 08 00 45 00 00 5e c2 83 40
09 fd 2f 0f 8b 8c 71 00 01 8c 72 00 01 00 00 65 58 33 33 00 00 00 02 3a f0 bc ad
c2 cb 88 dd 60 00 00 00 10 3a ff fe 80 00 00 00 00 00 39 f0 bc ff fe a8 c
2 cb ff 02 00 00 00 00 00 00 00 00 00 00 00 02 85 00 0a 85 00 00 00 01
01 3a f0 bc ad c2 cb
Outer Source MAC: 8e:0d:17:6f:76:de
Outer Destination MAC: 33:33:00:00:00:02
Ethernet type: 56710
Src IP 140.113.0.1
Dst IP 140.114.0.1
Inner Source MAC: 3a:f0:bc:ad:c2:cb
Inner Destination MAC: 33:33:00:00:00:02
Next Layer protocol : 6558

check if tunnel for the two IPs already exists
tunnel not created yet, create tunnel for new host
creating tunnel with source ip : 140.113.0.1 and destination ip : 140.113.0.1
===== command to cmd : ip link add GRETP1 type gretap remote 140.113.0.1 loc
al 140.113.0.1
===== command to cmd : ip link set GRETP1 up
===== command to cmd : brctl addif br0 GRETP1
tunnel for the two host created, break loop to add rule
Tunnel finish

capture packet error
new tunnel created, ready to change BPF rule
rule changed to : ip proto gre and not host 140.114.0.1 and not host 140.113.0.1
compile the filter
installing filter
capture packet
compile the filter
installing filter
capture packet
```