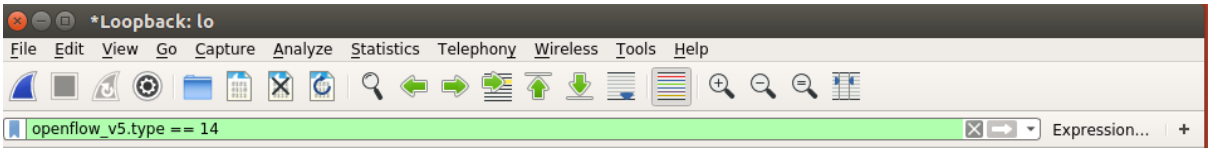
SDN-NFV

0516045 張凱翔

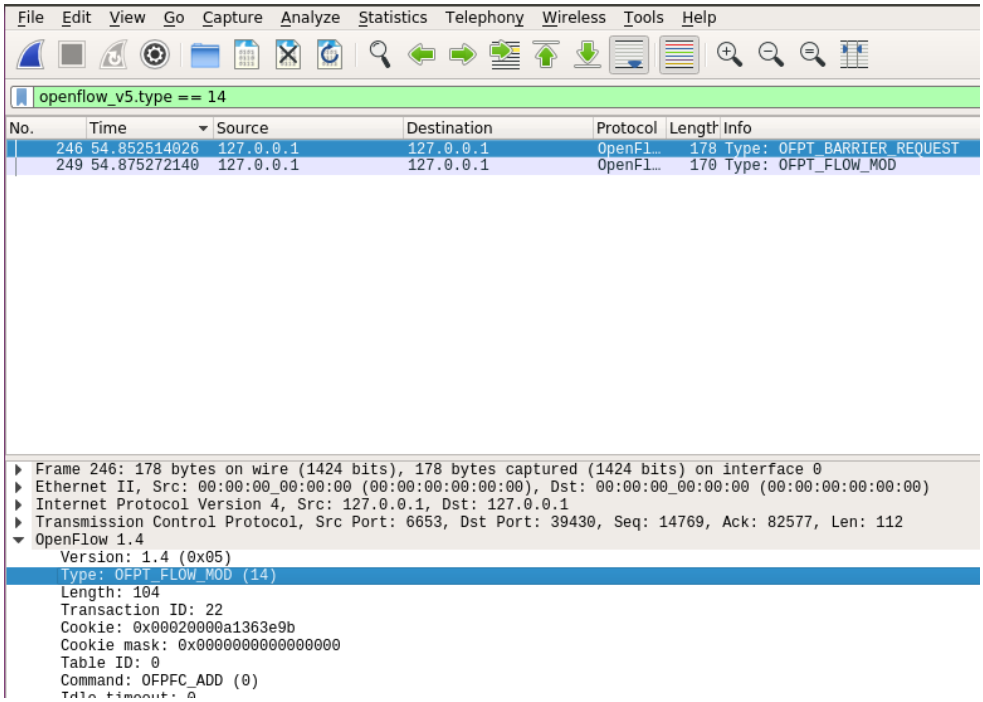
Part1.

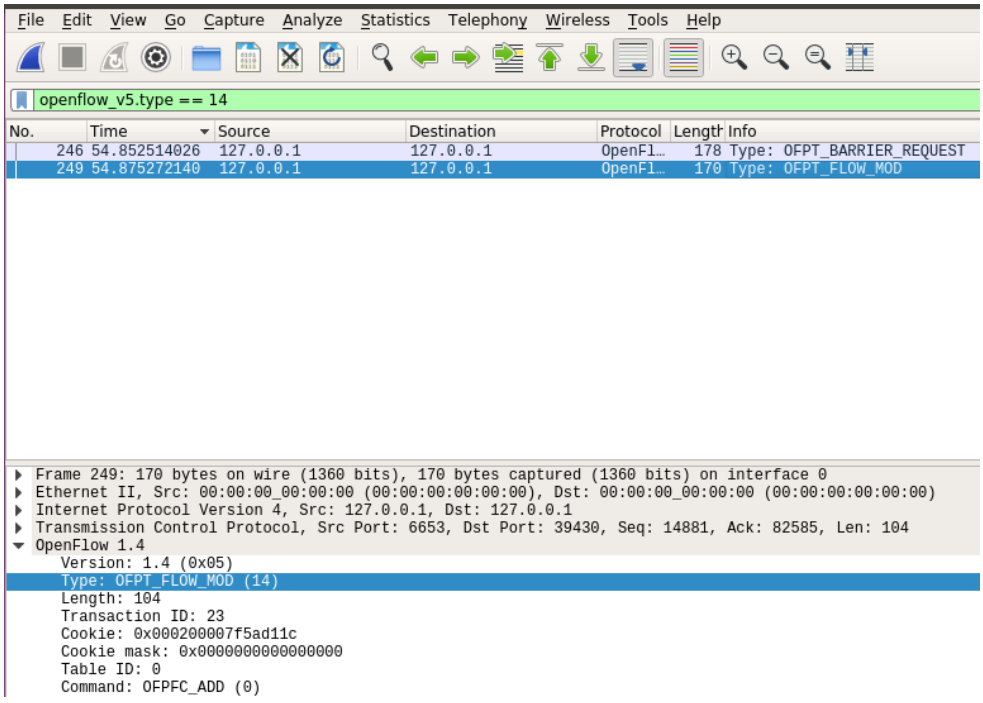
1. 2 個

將 filter 設成 openflow_v5.type == 14(type14 = OFPT_FLOW_MOD)



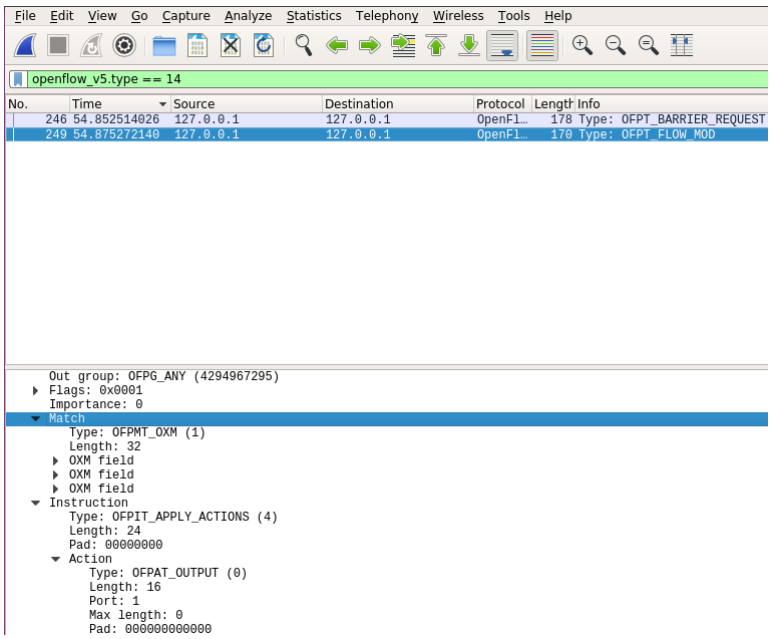
可以看到以下的結果

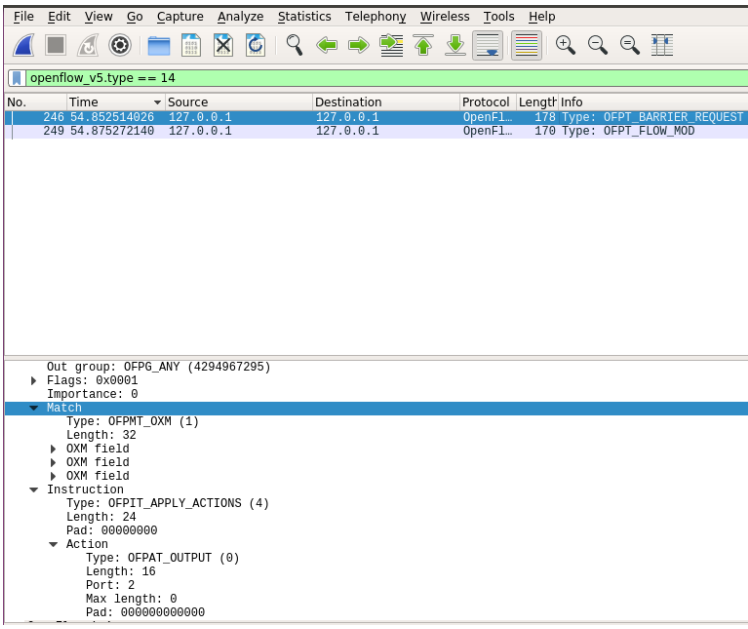




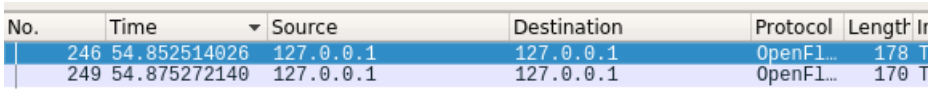
2.

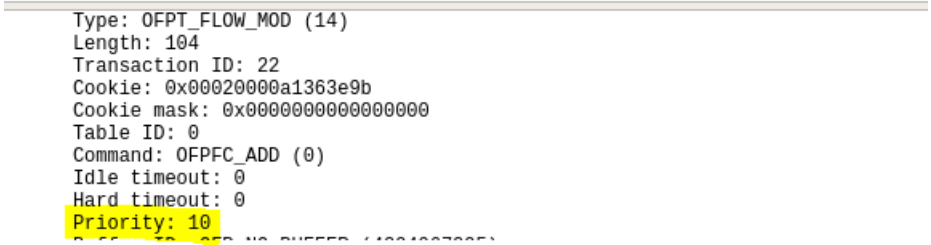
a.


File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
openflow_v5.type == 14
No. Time Source Destination Protocol Length Info
246 54.852514026 127.0.0.1 127.0.0.1 OpenFl… 178 Type: OFPT_BARRIER_REQUEST
249 54.875272140 127.0.0.1 127.0.0.1 OpenFl… 170 Type: OFPT_FLOW_MOD
Out group: OFPG_ANY (4294967295)
Flags: 0x0001
Importance: 0
Match
Type: OFPMT_OXM (1)
Length: 32
OXM field
OXM field
OXM field
Instruction
Type: OFPIT_APPLY_ACTIONS (4)
Length: 24
Pad: 00000000
Action
Type: OFPAT_OUTPUT (0)
Length: 16
Port: 1
Max length: 0
Pad: 000000000000


File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
openflow_v5.type == 14
No. Time Source Destination Protocol Length Info
246 54.852514026 127.0.0.1 127.0.0.1 OpenFl… 178 Type: OFPT_BARRIER_REQUEST
249 54.875272140 127.0.0.1 127.0.0.1 OpenFl… 170 Type: OFPT_FLOW_MOD
Out group: OFPG_ANY (4294967295)
Flags: 0x0001
Importance: 0
Match
Type: OFPMT_OXM (1)
Length: 32
OXM field
OXM field
OXM field
Instruction
Type: OFPIT_APPLY_ACTIONS (4)
Length: 24
Pad: 00000000
Action
Type: OFPAT_OUTPUT (0)
Length: 16
Port: 2
Max length: 0
Pad: 000000000000

b. 10


No. Time Source Destination Protocol Length
246 54.852514026 127.0.0.1 127.0.0.1 OpenFl… 178
249 54.875272140 127.0.0.1 127.0.0.1 OpenFl… 170


Type: OFPT_FLOW_MOD (14)
Length: 104
Transaction ID: 22
Cookie: 0x00020000a1363e9b
Cookie mask: 0x0000000000000000
Table ID: 0
Command: OFPFC_ADD (0)
Idle timeout: 0
Hard timeout: 0
Priority: 10

Part2.

有開啟的功能

```
demo@root > apps -a -s                                                    22:22:
*  20 org.onosproject.hostprovider          2.2.0    Host Location Provider
*  21 org.onosproject.lldpprovider          2.2.0    LLDP Link Provider
*  22 org.onosproject.optical-model         2.2.0    Optical Network Model
*  23 org.onosproject.openflow-base         2.2.0    OpenFlow Base Provider
*  24 org.onosproject.openflow              2.2.0    OpenFlow Provider Suite
*  48 org.onosproject.drivers               2.2.0    Default Drivers
* 128 org.onosproject.gui2                  2.2.0    ONOS GUI2
```

Before

Install flow rule 之前 h1 arping h2 和 h1 ping h2 都是 ping 不到的

```
mininet> h1 arping h2
ARPING 10.0.0.2 from 10.0.0.1 h1-eth0
^CSent 3 probes (3 broadcast(s))
Received 0 response(s)
mininet> h1 ping h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
^C
--- 10.0.0.2 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1000ms
```

After

Install 3 個 flow rule 之後 就都可以 ping 到了

```
demo@demo-VirtualBox:~/SDN_project2/part2$ curl -u onos:rocks -X POST -H 'Conten
t-Type: application/json' -d @flows_s1-1_0516045.json 'http://localhost:8181/ono
s/v1/flows/of:0000000000000001'
demo@demo-VirtualBox:~/SDN_project2/part2$ curl -u onos:rocks -X POST -H 'Conten
t-Type: application/json' -d @flows_s1-2_0516045.json 'http://localhost:8181/ono
s/v1/flows/of:0000000000000001'
demo@demo-VirtualBox:~/SDN_project2/part2$ curl -u onos:rocks -X POST -H 'Conten
t-Type: application/json' -d @flows_s1-3_0516045.json 'http://localhost:8181/ono
s/v1/flows/of:0000000000000001'
```

```
mininet> h1 arping h2
ARPING 10.0.0.2 from 10.0.0.1 h1-eth0
Unicast reply from 10.0.0.2 [0E:9E:9A:43:F6:8C]  0.533ms
Unicast reply from 10.0.0.2 [0E:9E:9A:43:F6:8C]  0.607ms
Unicast reply from 10.0.0.2 [0E:9E:9A:43:F6:8C]  0.607ms
^CSent 3 probes (1 broadcast(s))
Received 3 response(s)
mininet> h1 ping h2
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=0.534 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.053 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.061 ms
^C
--- 10.0.0.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2055ms
rtt min/avg/max/mdev = 0.053/0.216/0.534/0.224 ms
```

JSON 檔

For arping

flows_s1-1_0516045.json

```
{
        "priority": 40001,
        "timeout": 0,
        "isPermanent": true,
        "deviceId": "of:0000000000000001",
        "treatment":{
                "instructions": [
                        {
                                "type": "OUTPUT",
                                "port": "1"
                        },
                        {
                                "type": "OUTPUT",
                                "port": "2"
                        }

                ]
        },
        "selector": {
                "criteria": [
                        {
                                "type":"ETH_TYPE",
                                "ethType":"0x0806"
                        }
                ]
        }
}
```

For IPv4

flows_s1-1_0516045.json

```
{
        "priority": 40002,
        "timeout": 0,
        "isPermanent": true,
        "deviceId": "of:0000000000000001",
        "treatment":{
                "instructions": [
                        {
                                "type": "OUTPUT",
                                "port": "1" }
                ]
        },
        "selector": {
                "criteria": [
                        {
                                "type":"ETH_TYPE",
                                "ethType":"0x0800"
                        },
                        {
                                "type":"IN_PORT",
                                "port":"2"
                        }

                ]
        }
}
```

flows_s1-1_0516045.json

```
{
        "priority": 40003,
        "timeout": 0,
        "isPermanent": true,
        "deviceId": "of:0000000000000001",
        "treatment":{
                "instructions": [
                        {
                                "type": "OUTPUT",
                                "port": "2" }
                ]
        },
        "selector": {
                "criteria": [
                        {
                                "type":"ETH_TYPE",
                                "ethType":"0x0800"
                        },
                        {
                                "type":"IN_PORT",
                                "port":"1"
                        }

                ]
        }
}
```

總共 install 三個 rule，其中比較大的差別是 ethtype，IPv4 是 0x800，ARP 是 0x806。Criteria 為條件，instructions 為行為，只要符合條件，便會執行設定的動作，但要注意的是 priority 較高有優先執行權，所以當設定的時候要比原來預設的要高。

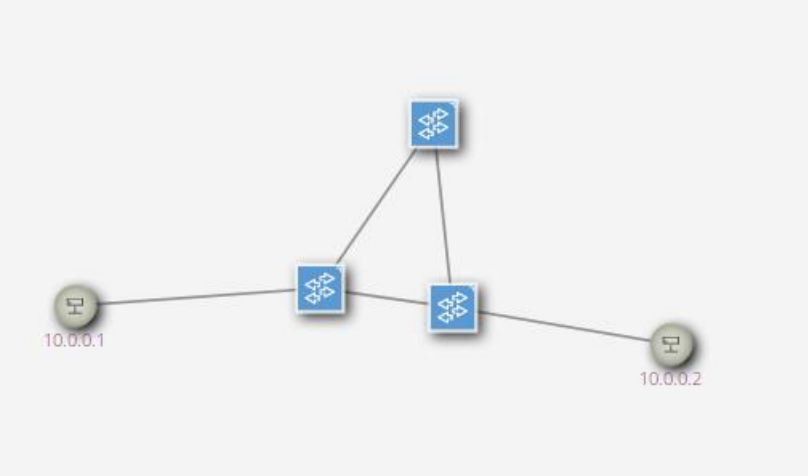
Added	0	1,334	40000	0	ETH_TYPE:bddp	imm[OUTPUT:CONTROLLER], cleared:true	*core
Added	0	1,334	40000	0	ETH_TYPE:lldp	imm[OUTPUT:CONTROLLER], cleared:true	*core
Added	5	1,000	40002	0	IN_PORT:2, ETH_TYPE:ipv4	imm[OUTPUT:1], cleared:false	*rest
Added	5	998	40003	0	IN_PORT:1, ETH_TYPE:ipv4	imm[OUTPUT:2], cleared:false	*rest
Added	6	1,334	40000	0	ETH_TYPE:arp	imm[OUTPUT:CONTROLLER], cleared:true	*core
Added	16	1,002	40001	0	ETH_TYPE:arp	imm[OUTPUT:1, OUTPUT:2], cleared:false	*rest

Part3.

有開啟的功能

```
demo@root > apps -a -s                                                  22:52
*  20 org.onosproject.hostprovider          2.2.0    Host Location Provider
*  21 org.onosproject.lldpprovider          2.2.0    LLDP Link Provider
*  22 org.onosproject.optical-model         2.2.0    Optical Network Model
*  23 org.onosproject.openflow-base         2.2.0    OpenFlow Base Provider
*  24 org.onosproject.openflow              2.2.0    OpenFlow Provider Suite
*  48 org.onosproject.drivers               2.2.0    Default Drivers
* 128 org.onosproject.gui2                  2.2.0    ONOS GUI2
```

建出的拓譜



Flow Rule

```
{
        "priority": 40001,
        "timeout": 0,
        "isPermanent": true,
        "deviceId": "of:0000000000000002",
        "treatment":{
                "instructions": [
                        {
                                "type": "OUTPUT",
                                "port": "1"
                        },
                        {
                                "type": "OUTPUT",
                                "port": "2"
                        },
                        {
                                "type": "OUTPUT",
                                "port": "3"
                        }

                ]
        },
        "selector": {
                "criteria": [
                        {
                                "type":"ETH_TYPE",
                                "ethType":"0x0806"
                        }
                ]
        }
}
```

```
{
        "priority": 40001,
        "timeout": 0,
        "isPermanent": true,
        "deviceId": "of:0000000000000001",
        "treatment":{
                "instructions": [
                        {
                                "type": "OUTPUT",
                                "port": "2"
                        },
                        {
                                "type": "OUTPUT",
                                "port": "3"
                        }

                ]
        },
        "selector": {
                "criteria": [
                        {
                                "type":"ETH_TYPE",
                                "ethType":"0x0806"
                        }
                ]
        }
}
```

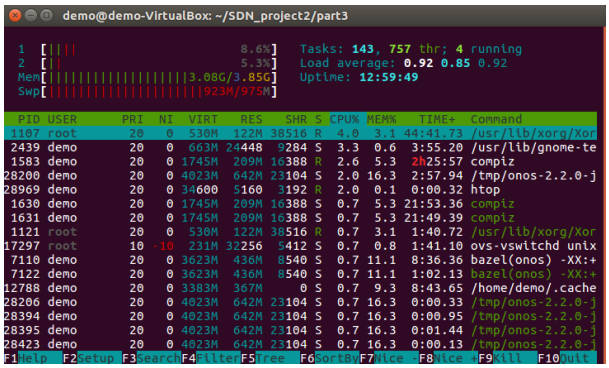
```
{
        "priority": 40001,
        "timeout": 0,
        "isPermanent": true,
        "deviceId": "of:0000000000000003",
        "treatment":{
                "instructions": [
                        {
                                "type": "OUTPUT",
                                "port": "1"
                        },
                        {
                                "type": "OUTPUT",
                                "port": "2"
                        },
                        {
                                "type": "OUTPUT",
                                "port": "3"
                        }

                ]
        },
        "selector": {
                "criteria": [
                        {
                                "type":"ETH_TYPE",
                                "ethType":"0x0806"
                        }
                ]
        }
}
```

```
demo@demo-VirtualBox:~/SDN_project2/part3$ curl -u onos:rocks -X POST -H 'Conten
t-Type: application/json' -d @flows_s1-1_0516045.json 'http://localhost:8181/ono
s/v1/flows/of:0000000000000002'
demo@demo-VirtualBox:~/SDN_project2/part3$ curl -u onos:rocks -X POST -H 'Conten
t-Type: application/json' -d @flows_s2-1_0516045.json 'http://localhost:8181/ono
s/v1/flows/of:0000000000000001'
demo@demo-VirtualBox:~/SDN_project2/part3$ curl -u onos:rocks -X POST -H 'Conten
t-Type: application/json' -d @flows_s3-1_0516045.json 'http://localhost:8181/ono
s/v1/flows/of:0000000000000003'
```

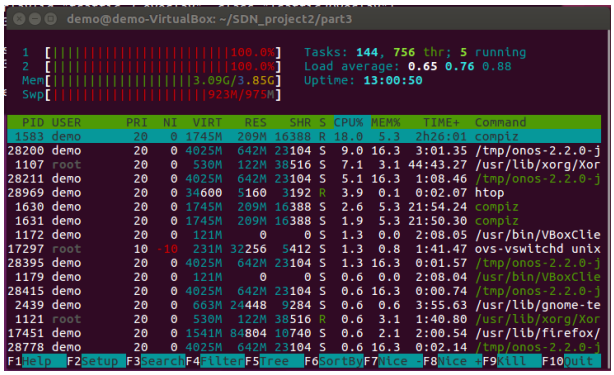
CPU Usage

可以看到當 h1 arping h2 後，CPU 的使用量直接突破天際。

Before



After



我設計了一個有迴圈的 switch 排列，當 broadcast 時會形成一個迴圈導致 broadcast 永無止境的執行。

Bonus.

這次作業花比較多時間的是 part2，花了一點時間才搞懂要怎麼把 rule 加上去，寫 rule 的時候也花了不少時間。之前就有接觸過 wireshark，但沒有深入的去研究，經過這次作業我了解了更多 wireshark 的功能，想必在這學期修的另一堂課也會有所幫助。