

## Assignment 2

### ข้อ 7.6

```
root@nithiroj-Nitro-AN515-57:/usr/bin# ovs-appctl fdb/show ovs-br1
port  VLAN  MAC          Age
LOCAL 0  36:76:0b:3e:0e:4a  40
      2  0  de:a5:0c:39:a0:f3  1
      1  0  4e:c7:a6:27:14:22  1
      4  0  22:d0:b8:bc:89:79  1
      3  0  ce:7a:cb:bf:96:60  1
```

รูปที่ 1 ก่อนทำ vlan

```
root@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc1 ping 173.16.1.20
PING 173.16.1.20 (173.16.1.20): 56 data bytes
64 bytes from 173.16.1.20: seq=0 ttl=64 time=0.369 ms
64 bytes from 173.16.1.20: seq=1 ttl=64 time=0.054 ms
64 bytes from 173.16.1.20: seq=2 ttl=64 time=0.053 ms
^Croot@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc1 ping 173.16.1.20 -c 5
PING 173.16.1.20 (173.16.1.20): 56 data bytes
64 bytes from 173.16.1.20: seq=0 ttl=64 time=0.024 ms
64 bytes from 173.16.1.20: seq=1 ttl=64 time=0.082 ms
64 bytes from 173.16.1.20: seq=2 ttl=64 time=0.055 ms
64 bytes from 173.16.1.20: seq=3 ttl=64 time=0.055 ms
64 bytes from 173.16.1.20: seq=4 ttl=64 time=0.056 ms

--- 173.16.1.20 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.024/0.054/0.082 ms
root@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc1 ping 173.16.1.30 -c 5
PING 173.16.1.30 (173.16.1.30): 56 data bytes
64 bytes from 173.16.1.30: seq=0 ttl=64 time=0.363 ms
64 bytes from 173.16.1.30: seq=1 ttl=64 time=0.058 ms
64 bytes from 173.16.1.30: seq=2 ttl=64 time=0.050 ms
64 bytes from 173.16.1.30: seq=3 ttl=64 time=0.056 ms
64 bytes from 173.16.1.30: seq=4 ttl=64 time=0.054 ms

--- 173.16.1.30 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.050/0.116/0.363 ms
root@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc1 ping 173.16.1.40 -c 5
PING 173.16.1.40 (173.16.1.40): 56 data bytes
64 bytes from 173.16.1.40: seq=0 ttl=64 time=0.345 ms
64 bytes from 173.16.1.40: seq=1 ttl=64 time=0.057 ms
64 bytes from 173.16.1.40: seq=2 ttl=64 time=0.048 ms
64 bytes from 173.16.1.40: seq=3 ttl=64 time=0.056 ms
64 bytes from 173.16.1.40: seq=4 ttl=64 time=0.075 ms
```

รูปที่ 3 ผลการ Ping ก่อนทำ vlan tag

```
root@nithiroj-Nitro-AN515-57:/usr/bin# ovs-appctl fdb/show ovs-br1
port  VLAN  MAC          Age
LOCAL    0  36:76:0b:3e:0e:4a  17
        4  22:d0:b8:bc:89:79  0
        3  10  ce:7a:cb:bf:96:60  0
        2  10  de:a5:0c:39:a0:f3  0
        1  20  4e:c7:a6:27:14:22  0
root@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc1 ping 173.16.1.20
PING 173.16.1.20 (173.16.1.20): 56 data bytes
^Croot@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc1 ping 173.16.1.10
PING 173.16.1.10 (173.16.1.10): 56 data bytes
64 bytes from 173.16.1.10: seq=0 ttl=64 time=0.038 ms
64 bytes from 173.16.1.10: seq=1 ttl=64 time=0.049 ms
64 bytes from 173.16.1.10: seq=2 ttl=64 time=0.051 ms
^Croot@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc1 ping 173.16.1.30
PING 173.16.1.30 (173.16.1.30): 56 data bytes
^Croot@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc1 ping 173.16.1.40
PING 173.16.1.40 (173.16.1.40): 56 data bytes
64 bytes from 173.16.1.40: seq=0 ttl=64 time=0.056 ms
64 bytes from 173.16.1.40: seq=1 ttl=64 time=0.066 ms
64 bytes from 173.16.1.40: seq=2 ttl=64 time=0.069 ms
^Croot@nithiroj-Nitro-AN515-57:/usr/bin# docker exec pc2 ping 173.16.1.30
PING 173.16.1.30 (173.16.1.30): 56 data bytes
64 bytes from 173.16.1.30: seq=0 ttl=64 time=0.055 ms
64 bytes from 173.16.1.30: seq=1 ttl=64 time=0.065 ms
64 bytes from 173.16.1.30: seq=2 ttl=64 time=0.061 ms
^Croot@nithiroj-Nitro-AN515-57:/usr/bin#
```

รูปที่ 3 หลังทำ vlan tag

การทดสอบ mininet

```
mn --topo tree,2 --mac --arp --switch ovsk
```

```

*** Unknown command: nets
mininet> net
h1 h1-eth0:s2-eth1
h2 h2-eth0:s2-eth2
h3 h3-eth0:s3-eth1
h4 h4-eth0:s3-eth2
s1 lo: s1-eth1:s2-eth3 s1-eth2:s3-eth3
s2 lo: s2-eth1:h1-eth0 s2-eth2:h2-eth0 s2-eth3:s1-eth1
s3 lo: s3-eth1:h3-eth0 s3-eth2:h4-eth0 s3-eth3:s1-eth2
c0
mininet> links
s1-eth1<->s2-eth3 (OK OK)
s1-eth2<->s3-eth3 (OK OK)
s2-eth1<->h1-eth0 (OK OK)
s2-eth2<->h2-eth0 (OK OK)
s3-eth1<->h3-eth0 (OK OK)
s3-eth2<->h4-eth0 (OK OK)
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4
h2 -> h1 h3 h4
h3 -> h1 h2 h4
h4 -> h1 h2 h3
*** Results: 0% dropped (12/12 received)
mininet> pingpair
h1 -> h2
h2 -> h1
*** Results: 0% dropped (2/2 received)
mininet> h1 arp
Address          HWtype  HWaddress          Flags Mask           Iface
10.0.0.2         ether   00:00:00:00:00:02  CM    0             h1-eth0
10.0.0.3         ether   00:00:00:00:00:03  CM    0             h1-eth0
10.0.0.4         ether   00:00:00:00:00:04  CM    0             h1-eth0
mininet> 

```

รูปที่ 4 การทดสอบ mininet ก่อนมี controller

`mn --topo tree, 2 --mac --arp --switch ovsk --controller`

```

root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s1 in_port=1,actions=output:2
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s1 in_port=2,actions=output:1
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=3,actions=output:1
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=3,actions=output:1,2
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s1
cookie=0x0, duration=921.638s, table=0, n_packets=0, n_bytes=0, in_port=3 actions=output:"s1-eth2"
cookie=0x0, duration=324.361s, table=0, n_packets=46, n_bytes=4508, in_port="s1-eth1" actions=output:"s1-eth2"
cookie=0x0, duration=320.254s, table=0, n_packets=43, n_bytes=4214, in_port="s1-eth2" actions=output:"s1-eth1"

```

รูปที่ 5 ตั้งค่า add-flow s1

```

root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s2 in_port=3,actions=output:1,2
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s2 in_port=2,actions=output:1,3
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s2 in_port=1,actions=output:2,3
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s2
cookie=0x0, duration=17.491s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth3" actions=output:"s2-eth1",output:"s2-eth2"
cookie=0x0, duration=8.893s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth2" actions=output:"s2-eth1",output:"s2-eth3"
cookie=0x0, duration=2.219s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth1" actions=output:"s2-eth2",output:"s2-eth3"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s1

```

รูปที่ 6 ตั้งค่า add-flow s2

```

cookie=0x0, duration=554.367s, table=0, n_packets=0, n_bytes=0, in_port=3 actions=output:"s1-eth2"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=1,actions=output:2,3
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=2,actions=output:1,3
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=3,actions=output:1,2
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s3
  cookie=0x0, duration=16.565s, table=0, n_packets=0, n_bytes=0, in_port="s3-eth1" actions=output:"s3-eth2",output:"s3-eth3"
  cookie=0x0, duration=12.114s, table=0, n_packets=0, n_bytes=0, in_port="s3-eth2" actions=output:"s3-eth1",output:"s3-eth3"
  cookie=0x0, duration=7.094s, table=0, n_packets=0, n_bytes=0, in_port="s3-eth3" actions=output:"s3-eth1",output:"s3-eth2"

```

รูปที่ 7 ตั้งค่า add-flow s3

```

root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s1
  cookie=0x0, duration=921.638s, table=0, n_packets=0, n_bytes=0, in_port=3 actions=output:"s1-eth2"
  cookie=0x0, duration=324.361s, table=0, n_packets=46, n_bytes=4508, in_port="s1-eth1" actions=output:"s1-eth2"
  cookie=0x0, duration=320.254s, table=0, n_packets=43, n_bytes=4214, in_port="s1-eth2" actions=output:"s1-eth1"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s2
  cookie=0x0, duration=394.674s, table=0, n_packets=44, n_bytes=4284, in_port="s2-eth3" actions=output:"s2-eth1",output:"s2-eth2"
  cookie=0x0, duration=386.076s, table=0, n_packets=19, n_bytes=1862, in_port="s2-eth2" actions=output:"s2-eth1",output:"s2-eth3"
  cookie=0x0, duration=379.402s, table=0, n_packets=27, n_bytes=2646, in_port="s2-eth1" actions=output:"s2-eth2",output:"s2-eth3"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s3
  cookie=0x0, duration=358.970s, table=0, n_packets=22, n_bytes=2156, in_port="s3-eth1" actions=output:"s3-eth2",output:"s3-eth3"
  cookie=0x0, duration=354.519s, table=0, n_packets=21, n_bytes=2058, in_port="s3-eth2" actions=output:"s3-eth1",output:"s3-eth3"
  cookie=0x0, duration=257.176s, table=0, n_packets=24, n_bytes=2352, in_port="s3-eth3" actions=output:"s3-eth1",output:"s3-eth2"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# 

```

รูปที่ 8 dump-flows s1, s2, s3

```

root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s2
  cookie=0x0, duration=128.022s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth3" actions=output:"s2-eth1",output:"s2-eth2"
  cookie=0x0, duration=51.483s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth1" actions=output:"s2-eth2"
  cookie=0x0, duration=46.394s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth2" actions=output:"s2-eth1"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s2 in_port=3,actions=output:1,2
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s2 in_port=2,actions=output:1,3
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s2 in_port=1,actions=output:2,3
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s2
  cookie=0x0, duration=17.491s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth3" actions=output:"s2-eth1",output:"s2-eth2"
  cookie=0x0, duration=8.893s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth2" actions=output:"s2-eth1",output:"s2-eth3"
  cookie=0x0, duration=2.219s, table=0, n_packets=0, n_bytes=0, in_port="s2-eth1" actions=output:"s2-eth2",output:"s2-eth3"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s1
  cookie=0x0, duration=651.454s, table=0, n_packets=20, n_bytes=1913, in_port="s1-eth1" actions=output:"s1-eth2"
  cookie=0x0, duration=559.713s, table=0, n_packets=5, n_bytes=471, in_port="s1-eth2" actions=output:3
  cookie=0x0, duration=554.367s, table=0, n_packets=0, n_bytes=0, in_port=3 actions=output:"s1-eth2"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=1,actions=output:2,3
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=2,actions=output:1,3
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=3,actions=output:1,2
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl dump-flows s3
  cookie=0x0, duration=16.565s, table=0, n_packets=0, n_bytes=0, in_port="s3-eth1" actions=output:"s3-eth2",output:"s3-eth3"
  cookie=0x0, duration=12.114s, table=0, n_packets=0, n_bytes=0, in_port="s3-eth2" actions=output:"s3-eth1",output:"s3-eth3"
  cookie=0x0, duration=7.094s, table=0, n_packets=0, n_bytes=0, in_port="s3-eth3" actions=output:"s3-eth1",output:"s3-eth2"
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s1 in_port=1,actions=output:2
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s1 in_port=2,actions=output:1
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=3,actions=output:1
root@nithiroj-Nitro-AN515-57:/home/nithiroj# ovs-ofctl add-flow s3 in_port=3,actions=output:1,2
root@nithiroj-Nitro-AN515-57:/home/nithiroj# 

```

รูปที่ 10 add-flow s1, s2, s3

```

mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4
h2 -> h1 h3 h4
h3 -> h1 h2 h4
h4 -> h1 h2 h3
*** Results: 0% dropped (12/12 received)
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4
h2 -> h1 h3 h4
h3 -> h1 h2 h4
h4 -> h1 h2 h3
*** Results: 0% dropped (12/12 received)
mininet> 

```

รูปที่ 10 pingall เพื่อทดสอบว่าทุกเครื่องไปหากันได้