

Slices_Demo3

环境要求：

Ubuntu 14.04, 64bit; p4c-bm; bmv2。

实验准备：

请根据实际情况对各个脚本中的路径信息进行修改。

我的实验环境中bmv2的路径：`/home/wasdns/bmv2`

实验步骤：

1.启动mininet：

```
./run_demo.sh
```

此时节点信息：

两台主机：h1(IP: 10.0.0.10/32), h2(IP: 10.0.1.10/32)。

一台交换机：s1。

2.执行pingall, h1与h2无法ping通。

3.打开用于控制交换机的CLI界面，下发命令使h1与h2互ping通。

执行命令如下：

```
table_add send_frame rewrite_mac 1 => 00:aa:bb:00:00:00
table_add send_frame rewrite_mac 2 => 00:aa:bb:00:00:01
table_add forward set_dmac 10.0.0.10 => 00:04:00:00:00:00
table_add forward set_dmac 10.0.1.10 => 00:04:00:00:00:01
table_add ipv4_lpm set_nhop 10.0.0.10/32 => 10.0.0.10 1
table_add ipv4_lpm set_nhop 10.0.1.10/32 => 10.0.1.10 2
```

4.在mininet中执行pingall验证h1与h2能够正常通信。

```
> pingall
```

5.为Match_Table增加一条表项，使计数器实例0开始计数：当经过交换机的包的源IP地址是10.0.0.10时，进行计数。

P4实现：

```
counter Indecounter {
    type : packets;
    static : Match_Table;
    instance_count : 16384;
}

action count_action(index) {
    count(Indecounter, index);
}

table Match_Table {
    reads {
        ipv4.srcAddr : exact;
    }
    actions {
        _noop;
        count_action;
    }
}
```

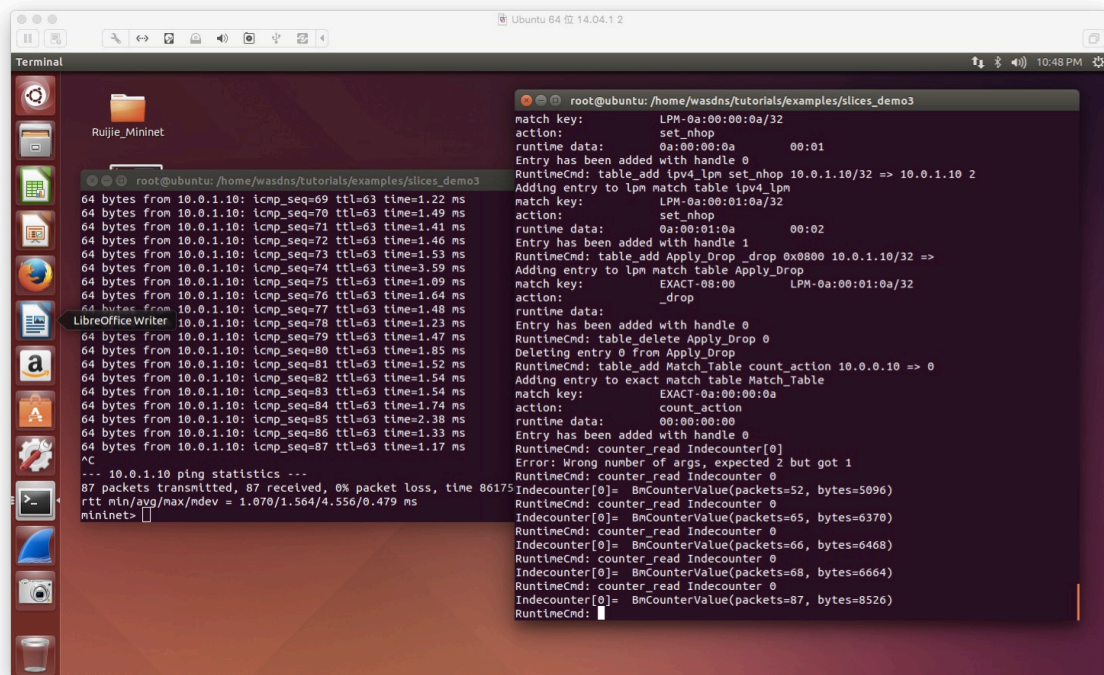
在CLI中下发命令：

```
table_add Match_Table count_action 10.0.0.10 => 0
```

6.验证计数器能够进行计数：

在mininet中执行 `h1 ping h2`；

在CLI界面中执行 `counter_read Indecounter 0` 查看计数器实例0的信息。



```
root@ubuntu: /home/wasdns/tutorials/examples/slices_demo3
64 bytes from 10.0.1.10: icmp_seq=69 ttl=63 time=1.22 ms
64 bytes from 10.0.1.10: icmp_seq=70 ttl=63 time=1.49 ms
64 bytes from 10.0.1.10: icmp_seq=71 ttl=63 time=1.41 ms
64 bytes from 10.0.1.10: icmp_seq=72 ttl=63 time=1.46 ms
64 bytes from 10.0.1.10: icmp_seq=73 ttl=63 time=1.53 ms
64 bytes from 10.0.1.10: icmp_seq=74 ttl=63 time=3.59 ms
64 bytes from 10.0.1.10: icmp_seq=75 ttl=63 time=1.09 ms
64 bytes from 10.0.1.10: icmp_seq=76 ttl=63 time=1.64 ms
64 bytes from 10.0.1.10: icmp_seq=77 ttl=63 time=1.48 ms
64 bytes from 10.0.1.10: icmp_seq=78 ttl=63 time=1.23 ms
64 bytes from 10.0.1.10: icmp_seq=79 ttl=63 time=1.47 ms
64 bytes from 10.0.1.10: icmp_seq=80 ttl=63 time=1.85 ms
64 bytes from 10.0.1.10: icmp_seq=81 ttl=63 time=1.52 ms
64 bytes from 10.0.1.10: icmp_seq=82 ttl=63 time=1.54 ms
64 bytes from 10.0.1.10: icmp_seq=83 ttl=63 time=1.54 ms
64 bytes from 10.0.1.10: icmp_seq=84 ttl=63 time=1.74 ms
64 bytes from 10.0.1.10: icmp_seq=85 ttl=63 time=2.38 ms
64 bytes from 10.0.1.10: icmp_seq=86 ttl=63 time=1.33 ms
64 bytes from 10.0.1.10: icmp_seq=87 ttl=63 time=1.17 ms
^C
--- 10.0.1.10 ping statistics ---
87 packets transmitted, 87 received, 0% packet loss, time 86175 ms
rtt min/avg/max/mdev = 1.070/1.564/4.556/0.479 ms
mininet>
```

```
root@ubuntu: /home/wasdns/tutorials/examples/slices_demo3
match key: LPM-0a:00:00:0a/32
action: set_nhop
runtime data: 0a:00:00:0a 00:01
Entry has been added with handle 0
RuntimeCmd: table_add ipv4_lpm set_nhop 10.0.1.10/32 => 10.0.1.10 2
Adding entry to lpm match table ipv4_lpm
match key: LPM-0a:00:01:0a/32
action: set_nhop
runtime data: 0a:00:01:0a 00:02
Entry has been added with handle 1
RuntimeCmd: table_add Apply_Drop_drop 0x0800 10.0.1.10/32 =>
Adding entry to lpm match table Apply_Drop
match key: EXACT-08:00 LPM-0a:00:01:0a/32
action: _drop
runtime data:
Entry has been added with handle 0
RuntimeCmd: table_delete Apply_Drop 0
Deleting entry 0 from Apply_Drop
RuntimeCmd: table_add Match_Table count_action 10.0.0.10 => 0
Adding entry to exact match table Match_Table
match key: EXACT-0a:00:00:0a
action: count_action
runtime data: 00:00:00:00
Entry has been added with handle 0
RuntimeCmd: counter_read Indecounter[0]
Error: Wrong number of args, expected 2 but got 1
RuntimeCmd: counter_read Indecounter 0
Indecounter[0]= BnCounterValue(packets=52, bytes=5096)
RuntimeCmd: counter_read Indecounter 0
Indecounter[0]= BnCounterValue(packets=65, bytes=6370)
RuntimeCmd: counter_read Indecounter 0
Indecounter[0]= BnCounterValue(packets=66, bytes=6468)
RuntimeCmd: counter_read Indecounter 0
Indecounter[0]= BnCounterValue(packets=68, bytes=6664)
RuntimeCmd: counter_read Indecounter 0
Indecounter[0]= BnCounterValue(packets=87, bytes=8526)
RuntimeCmd:
```

7.计数达到100个包之后执行丢包。

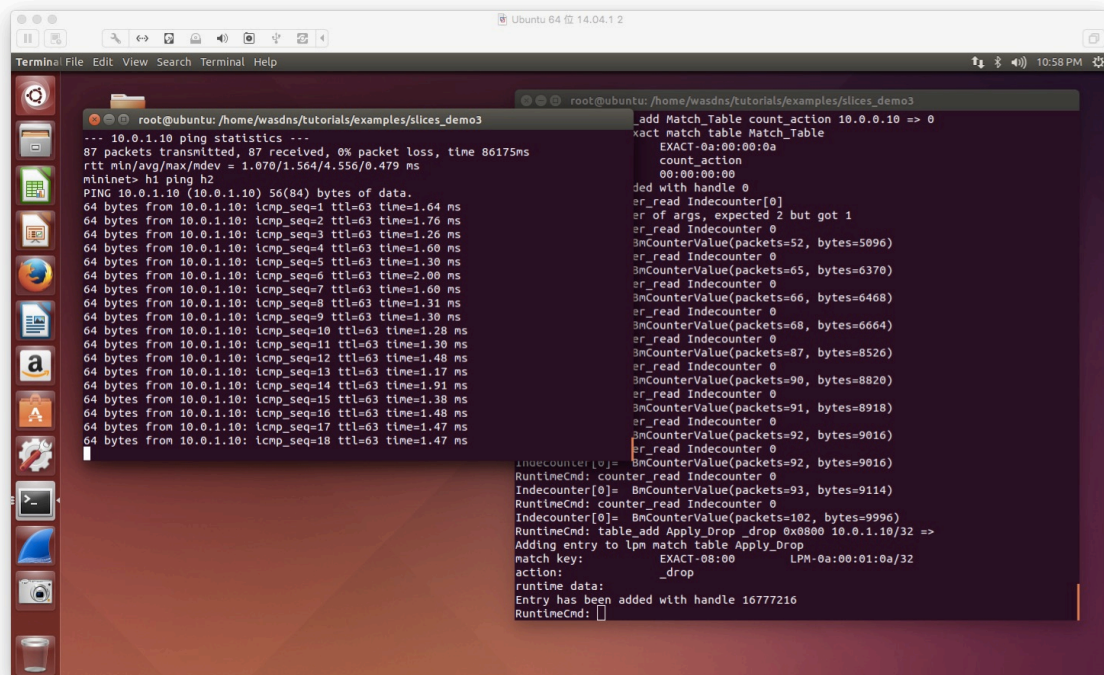
在CLI中通过命令：

```
counter_read Indecounter 0
```

查看计数器实例0的信息，发现超过100个包时，下发命令：

```
table_add Apply Drop 10.0.0.10/32 0x0800 =>
```

使交换机执行丢包，此时h1无法ping通h2。



```
root@ubuntu: /home/wasdns/tutorials/examples/slices_demo3
--- 10.0.1.10 ping statistics ---
87 packets transmitted, 87 received, 0% packet loss, time 86175ms
rtt min/avg/max/mdev = 1.070/1.564/4.556/0.479 ms
mininet> h1 ping h2
PING 10.0.1.10 (10.0.1.10) 56(84) bytes of data:
64 bytes from 10.0.1.10: icmp_seq=1 ttl=63 time=1.64 ms
64 bytes from 10.0.1.10: icmp_seq=2 ttl=63 time=1.76 ms
64 bytes from 10.0.1.10: icmp_seq=3 ttl=63 time=1.26 ms
64 bytes from 10.0.1.10: icmp_seq=4 ttl=63 time=1.60 ms
64 bytes from 10.0.1.10: icmp_seq=5 ttl=63 time=1.30 ms
64 bytes from 10.0.1.10: icmp_seq=6 ttl=63 time=2.00 ms
64 bytes from 10.0.1.10: icmp_seq=7 ttl=63 time=1.60 ms
64 bytes from 10.0.1.10: icmp_seq=8 ttl=63 time=1.31 ms
64 bytes from 10.0.1.10: icmp_seq=9 ttl=63 time=1.30 ms
64 bytes from 10.0.1.10: icmp_seq=10 ttl=63 time=1.28 ms
64 bytes from 10.0.1.10: icmp_seq=11 ttl=63 time=1.30 ms
64 bytes from 10.0.1.10: icmp_seq=12 ttl=63 time=1.48 ms
64 bytes from 10.0.1.10: icmp_seq=13 ttl=63 time=1.17 ms
64 bytes from 10.0.1.10: icmp_seq=14 ttl=63 time=1.91 ms
64 bytes from 10.0.1.10: icmp_seq=15 ttl=63 time=1.38 ms
64 bytes from 10.0.1.10: icmp_seq=16 ttl=63 time=1.48 ms
64 bytes from 10.0.1.10: icmp_seq=17 ttl=63 time=1.47 ms
64 bytes from 10.0.1.10: icmp_seq=18 ttl=63 time=1.47 ms
mininet>

Add Match_Table count_action 10.0.0.10 => 0
Exact Match Table Match_Table
EXACT-0a:00:00:0a
count_action
00:00:00:00
ded with handle 0
er_read Indecounter[0]
er of args, expected 2 but got 1
er_read Indecounter 0
BnCounterValue(packets=52, bytes=5096)
er_read Indecounter 0
BnCounterValue(packets=65, bytes=6370)
er_read Indecounter 0
BnCounterValue(packets=66, bytes=6468)
er_read Indecounter 0
BnCounterValue(packets=68, bytes=6664)
er_read Indecounter 0
BnCounterValue(packets=87, bytes=8526)
er_read Indecounter 0
BnCounterValue(packets=90, bytes=8820)
er_read Indecounter 0
BnCounterValue(packets=91, bytes=8918)
er_read Indecounter 0
BnCounterValue(packets=92, bytes=9016)
er_read Indecounter 0
BnCounterValue(packets=92, bytes=9016)
Indecounter[0]= BnCounterValue(packets=92, bytes=9016)
RuntimeCmd: counter_read Indecounter 0
Indecounter[0]= BnCounterValue(packets=93, bytes=9114)
RuntimeCmd: counter_read Indecounter 0
Indecounter[0]= BnCounterValue(packets=102, bytes=9996)
RuntimeCmd: table add Apply_Drop_drop 0x0000 10.0.1.10/32 =>
Adding entry to lpm match table Apply_Drop
match key: EXACT-00:00 LPM-0a:00:01:0a/32
action: _drop
runtime data:
Entry has been added with handle 16777216
RuntimeCmd: [
```

```
--- 10.0.1.10 ping statistics ---
144 packets transmitted, 18 received, 87% packet loss, time 143057ms
rtt min/avg/max/mdev = 1.173/1.488/2.001/0.224 ms
mininet>
```

实验结论

通过作为控制平面的CLI，我们可以实时查看交换机中的计数器信息，并且可以通过CLI下发指令主机之间的正常通信。

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