

# Exploring Software Defined Networking with OpenDaylight Controller



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## Motivation

- 1) Hands on through OpenDaylight Hydrogen Controller and it's working
- 2) Configuring flows using Controller

**NOTE:** In this whole exercise you can start Wireshark and analyze packets flowing in the network.

## Start Controller

```
$cd opendaylight  
$./run.sh
```

it will start opendaylight controller you can view it's GUI using <http://localhost:8080/> and login using Username:admin ,Password: admin

## Start Mininet

Download toponew.py file and put it into ~/mininet/custom

Start mininet by doing this

```
$ sudo mn --custom ~/mininet/custom/toponew.py --topo mytopo --mac --arp --switch ovsk --controller remote
```

Here we are mentioning that our controller will be remote and by default it will point to localhost, the mentioned topology is like below



Figure 1: Sample Topology

## Analyzing Flows using OpenDaylight Controller

Now perform ping between h1 and h2 and vice versa. it will take some time to discover topology by controller.

```
mininet>h1 ping h2 -c 10  
mininet>h2 ping h1 -c 10
```

Now analyze the below things

- 1) Go to opendaylight user interface and check the flows that has been pushed by controller itself automatically , to view those flows go to Troubleshoot and then selects ' flows 'in statistics for any particular switch

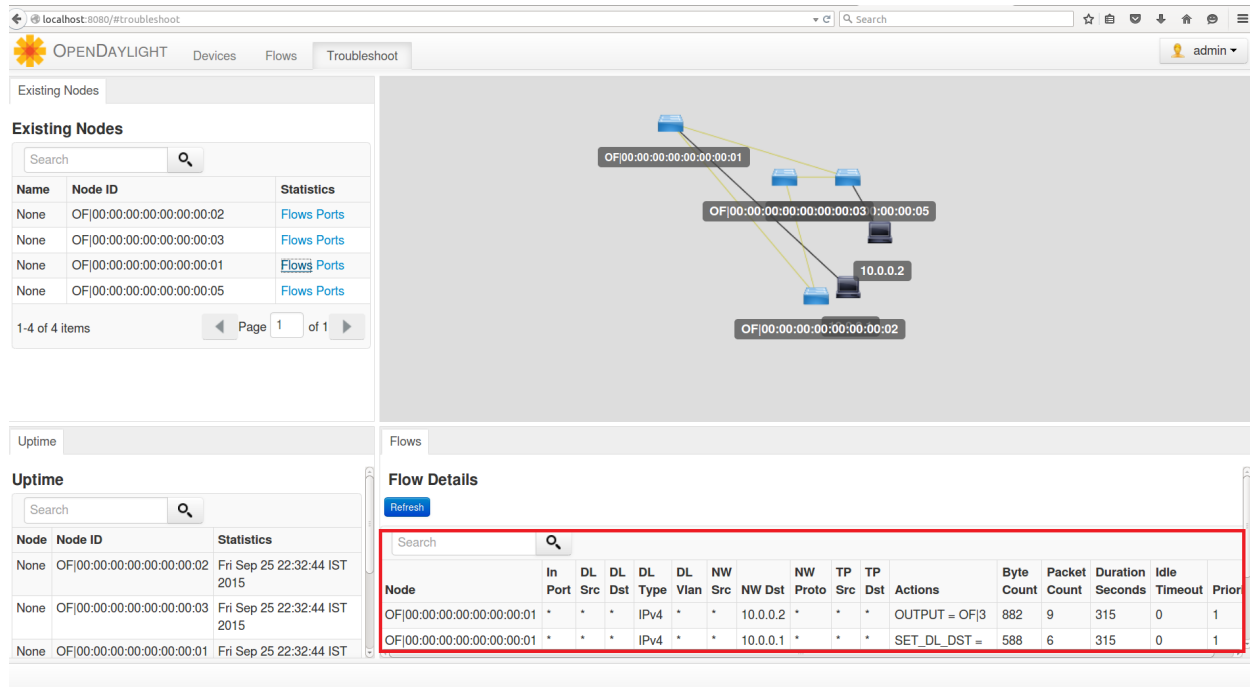


Figure 2: Flow Statistics of Switch 1

2) Default Path used for Ping is h1 -> s5->s1-> h2 because it is shortest path between h1 and h2, and there are no packets routed through path h1->s5->s3->s2 you can verify it by checking flow statistics of switch s2 and switch s3 in that check “*Packet Count*” value, it will be 0. so no packets have passed through that path.

## Analyzing Fault Tolerance

Now make link of s1 to s5 down by issuing following command

```
mininet> link s1 s5 down
```

Now again issue ping command by

```
mininet> h1 ping h2 -c 3
```

After performing ping now check the flow statistics of switch s2 and s3 and check the **packet count** the packet count in s2 and s3 would have been increased because now the path also between s1 and s5 is down so new flow in S1 switch have been inserted.

Now, make s1-s5 link up

```
mininet> link s1 s5 up
```

## Configuring Flows in Switch using Controller GUI interface

We will now configure flow such that any packet that is coming from Host 2 and if it is of TCP type packet then it should follow path like s5->s3->s2-> s1 ->h1

Now click on the links to analyze port connection of switches and host

Mininet> links

h1-eth0<->s1-eth1 (OK OK)

s1-eth2<->s2-eth1 (OK OK)

s1-eth3<->s5-eth2 (OK OK)

s2-eth2<->s3-eth1 (OK OK)

s3-eth2<->s5-eth1 (OK OK)

s5-eth3<->h2-eth0 (OK OK)

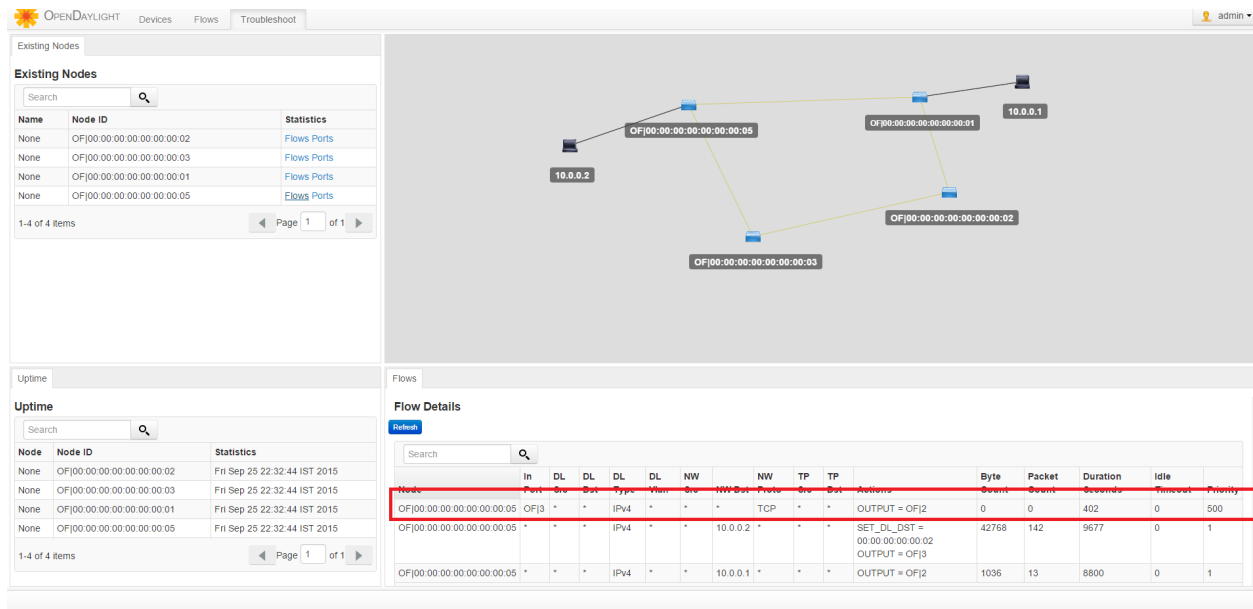
It will describe the port relationship of various switches and hosts  
(E.g. here port eth2 of s1 is connected with port eth1 with s2)

Now, go to.opendaylight controller GUI and then go to 'Flows' Tab and then click on 'add flow entry' , then configure flow as below

- 1) Flow Name: TCP
- 2) Select node as switch 5 with mac address ending on: 05
- 3) Select input port as s5-eth3 [Because port eth3 of s5 is connected with h2-eth0]
- 4) Then go to 'protocol' and set it as 'tcp'.
- 5) then click on configure action and select action as 'Add Output Port' and select output port as 's5-eth1' and then click on 'Add Action' and then click on 'install flow'

Above steps will install a new flow on switch s5.

You can easily view your installed flow in switch 5 by clicking into troubleshooting-> and then selecting switch s5's flow statistics



Here as of now Packet Count Value is '0'.

We will first host the http server on host1 by issuing following command

```
mininet>xterm h1
mininet>xterm h2
```

Node h1:

```
#> nc -lk 10.0.0.1 80
```

Now let's try to send tcp flows from host 2 to host 1 issue following command

Node h2:

```
#> echo "hello" |nc 10.0.0.1 80
```

Then again check the switch s5's flow statistics you can see from that flow that flow of s5 has applied and also check the value of Packet Count it will be increased by few packets.

## Exercises

- 1) Try to Send Multiple flows from h2 to h1 such that one flow is TCP and other flow can be (UDP or ICMP) and analyze flow statistics using Opendaylight controller.
- 2) Try to configure flow in Switch 1 such that all the TCP Packets coming from only host h2 should drop
- 3) Try to add one more host into topology (you are required to modify toponew.py file) at switch2 let's say this host as 'h3' and then configure http server on host h3(like we did on h1) and then configure flow such that flow from h2 -> h1 should follow path of h2-s5->s1->h1 and flow from h2->h3 should follow path h2->s5->s3->s2->h3  
Verify it by sending packets from h2 to h1 and h2 to h3 and also verify flow statistics on.opendaylight controller GUI.
- 4) You can also Query Flows or Insert flows using REST APIs, Please see below link to check it <http://www.frank-durr.de/?p=68>

## Extra Reading

<https://www.opendaylight.org/sites/opendaylight/files/bk-user-guide.pdf>

<http://learn.extremenetworks.com/rs/extreme/images/ODP-Technical-Study.pdf>

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