OFELIA

Metrics and measurement tools needs in Openflow and OFELIA in particular

OpenFlow tests with Ixia T1600 Enterprise Testing Equipment

Hagen Woesner, FI Week Aalborg, EULER workshop on measurements and measurement tools
Agenda

• Core idea of OpenFlow and in a wider sense the new paradigm of SDN is the separation of control, forwarding, and processing of data.

• Performance evaluation of such networks has to look into details of switch internals that were not visible before
  • Bandwidth on the slow path,
  • controller performance, number of FIB entries (e.g., TCAM)

• Requires different tools for measurement.
Typical measurement objectives in OpenFlow

Switch / datapath related
• maximum supported packet_in message generate rate
  – delay between packet arrival and corresponding packet_in
• maximum supported port status messages rate
  – processing delay on the datapath element

Controller related
• Number of packet_in messages processed
  – response time

FlowVisor related
• Additional penalty introduced for slicing in response time

Bandwidth of the TCP connection between switch and controller
Slicing of infrastructure: switches, servers, links

Xen-based debian paravirtualized iperf, oflops, cbench
Tools available in OFELIA

• The VMs have compiled in
  – oflops (datapath element measurements)
  – cbench (controller performance measurements)
  – iperf (throughput on the data path)
• Additionally, there is an IXIA T1600 available at the Berlin (TUB) island
  – Direct access to this can be shown at the OFELIA demo stand tomorrow
    • ask for Elio Salvadori who should be able to explain details.
Expedient Project for an Ixia Test

Select OpenFlow Resources

OpenFlow Aggregate TUB OF Aggregate
Aggregate physical location: Germany, Berlin.

Requested Flowspace

<table>
<thead>
<tr>
<th>Flowspace</th>
<th>Associated OpenFlow Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flowspace 9</td>
<td>OpenFlow Switch: 00:00:00:00:00:04:03 - Port 21</td>
</tr>
<tr>
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<td>OpenFlow Switch: 00:00:00:00:00:04:03 - Port 22</td>
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Granted Flowspace

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Virtualized servers resources

VT Aggregate Manager TUB VM Aggregate
Aggregate physical location: Germany, Berlin.

Server Name | Virt. Tech. | Operating System | CPU | Memory | Disc |
---|---|---|---|---|---|
VMS1 | | GNU/Linux Debian (6.0) | None | None | None |

VM Name | State | OS | Memory | Mgmt IP |
---|---|---|---|---|
VMS1 | | | | |

Create a new virtual machine in server: VMS1

Create VM
IxNetwork GUI via RDP on TUB-Island TerminalServer
VM with OpenFlow Controller

Login into Project VM and starting NOX with switching plug-in

```
marco@thinkpad:~$ ssh marckoerner@10.216.16.30
marckoerner@10.216.16.30's password:
Linux SliceController 2.6.32-5-xen-amd64 #1 SMP Fri Sep 9 22:23:19 UTC 2011 x86_64
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu May 3 13:04:01 2012 from 10.216.16.4
marckoerner@SliceController:~$
marckoerner@SliceController:~$
marckoerner@SliceController:~$
marckoerner@SliceController:~$ su
Password:
root@SliceController:/ofelia/users/marckoerner#
root@SliceController:/ofelia/users/marckoerner# cd /opt/ofelia/software/nox/build/src
root@SliceController:/opt/ofelia/software/nox/build/src#
root@SliceController:/opt/ofelia/software/nox/build/src# ./nox core -v -l ptcp:6633 switch

00041|openflow|DBG:Passive tcp interface bound to port 6633
00042|nox|INFO:nox bootstrap complete
00043|openflow|DBG:Passive tcp interface received connection
00044|openflow|DBG:stream: negotiated OpenFlow version 0x81 (we support versions 0x81 to 0x81 inclusive, peer no last
han version 0x81)
00045|nox|DBG:Success sending in 'sending switch config'
00046|nox|DBG:Success sending in 'receiving features reply'
00047|nox|DBG:Success receiving in 'receiving features reply'
00048|nox|DBG:Success sending in 'receiving ofmp capability reply'
00049|nox|DBG:Success receiving in 'receiving ofmp capability reply'
00050|nox|DBG:Datapath 00000000000403 sent error in response to capability reply, assuming no management support
00051|nox|DBG:No switch auth module registered, auto-approving switch
00052|nox|DBG:Registering switch with DPID = 002
00053|openflow: event|ERR:received OpenFlow error packet from dpid=0000000000403: type=1, code=8, 72 bytes of data
00054|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00055|openflow|DBG:stream: message received, entering CONNECTED
```
Controller shows MAC learning output through Port enabling

```
00041|openflow|DBG:Passive tcp interface bound to port 6633
00042|nox|INFO:nox bootstrap complete
00043|openflow|DBG:Passive tcp interface received connection
00044|openflow|DBG:stream: negotiated OpenFlow version 0x01 (we support versions 0x01 to 0x01 inclusive, peer not handling version 0x01)
00045|nox|DBG:Success sending in 'sending switch config'
00046|nox|DBG:Success sending in 'receiving features reply'
00047|nox|DBG:Success receiving in 'receiving features reply'
00048|nox|DBG:Success sending in 'receiving ofmp capability reply'
00049|nox|DBG:Success receiving in 'receiving ofmp capability reply'
00050|nox|DBG:Datapath 00000000000003 sent error in response to capability reply, assuming no management support
00051|nox|DBG:No switch auth module registered, auto-approving switch
00052|nox|DBG:Registering switch with DPID = 403
00053|openflow-event|ERR:received Openflow error packet from dpid=00000000000403: type=1, code=8, 72 bytes of data
00054|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00055|openflow|DBG:stream: message received, entering CONNECTED
00056|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00057|openflow|DBG:stream: message received, entering CONNECTED
00058|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00059|switch|DBG:learned that 00:00:47:2d:34:c8 is on datapath 000000000403 port 21
00060|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00061|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00062|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00063|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00064|switch|DBG:learned that 00:00:47:2d:34:c9 is on datapath 000000000403 port 22
00065|openFlow-event|DBG:received packet-in event from 000000000403 (len:60)
00066|openFlow-event|DBG:received packet-in event from 000000000403 (len:60)
00067|openFlow-event|DBG:received packet-in event from 000000000403 (len:60)
00068|openFlow-event|DBG:received packet-in event from 000000000403 (len:60)
00069|openFlow-event|DBG:received flow expired event from 000000000403
00070|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00071|openflow|DBG:stream: message received, entering CONNECTED
```
Running Test with Flow statistics
Controller Output during test shows Packet in events
Controller Output after stopped Test

```
00599|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00400|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00401|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00402|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00403|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00404|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00405|openflow-event|DBG:received packet-in event from 000000000403 (len:60)
00406|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00407|openflow|DBG:stream: message received, entering CONNECTED
00408|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00409|openflow|DBG:stream: message received, entering CONNECTED
00410|openflow-event|DBG:received flow expired event from 000000000403
00411|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00412|openflow|DBG:stream: message received, entering CONNECTED
```