

# 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**

- 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.

## 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

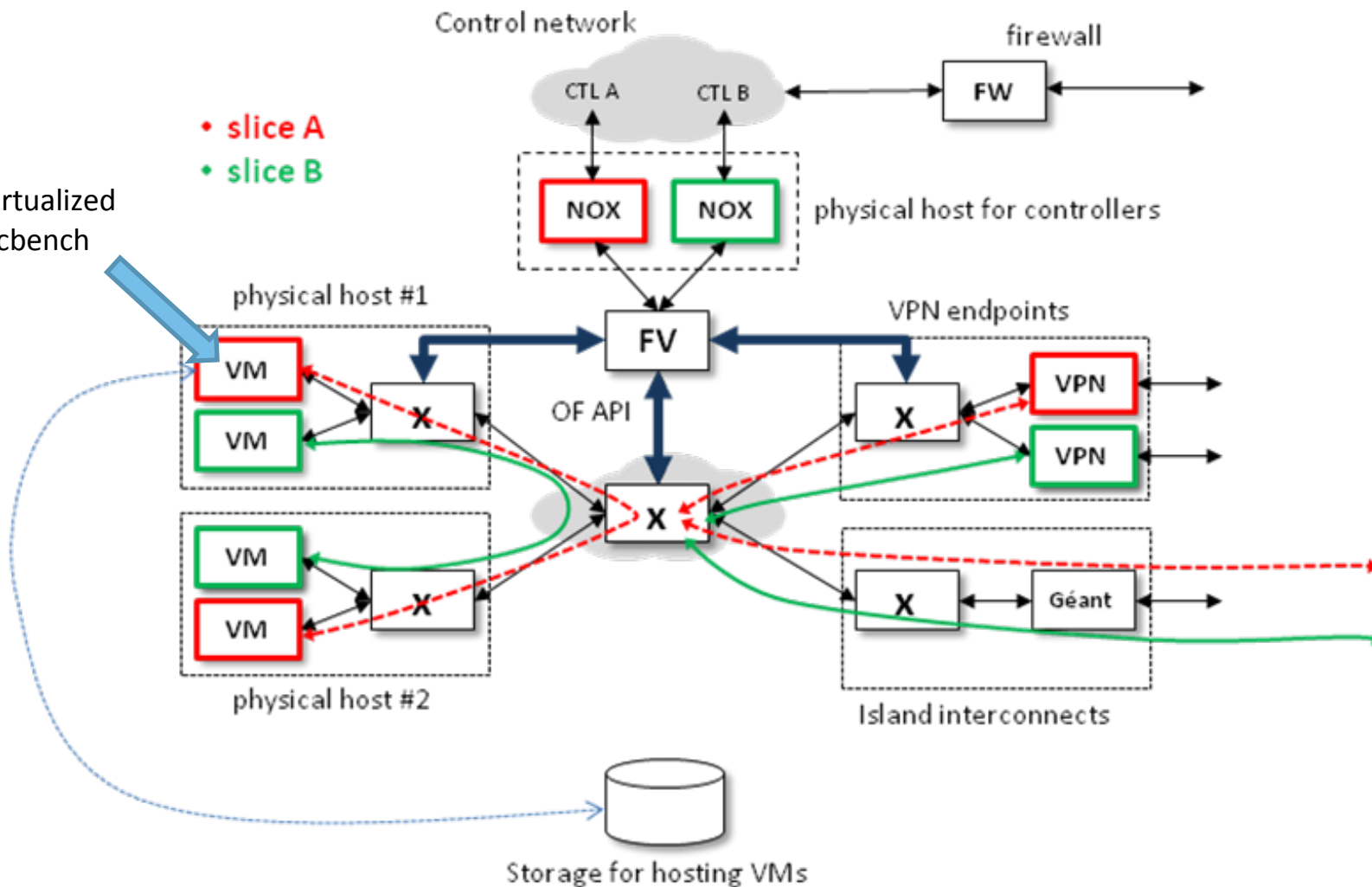
- Number of packet\_in messages processed
  - response time

## FlowVisor related

- Additional penalty introduced for slicing in response time

Bandwidth of the TCP connection between switch and controller

Xen-based  
debian paravirtualized  
iperf, oflops, cbench



- 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.





The screenshot shows the IxNetwork GUI interface. The main window is titled "IxNetwork [default\_User11.ixncfg]". The interface includes a menu bar (File, Home, Automation, Results / Reports, Views) and a toolbar with various icons for adding ports, protocols, traffic, and quick tests. The "Test Configuration" section is active, showing an "Overview" pane on the left with a tree view of "Ports" and "Chassis".

The "Port Selection" dialog box is open, displaying the following data:

Chassis			
Chassis/Card/Port	Type	Owner	
130.149.241.110	ixos 5.70.600.17 ga		
Card 02	4 PORT 10/100/1000 STXS4-256MB		
Port 01	10/100/1000 Base T		<input checked="" type="checkbox"/>
Port 02	10/100/1000 Base T		<input checked="" type="checkbox"/>
Port 03	10/100/1000 Base T		<input type="checkbox"/>
Port 04	10/100/1000 Base T		<input type="checkbox"/>
Card 03	4 PORT 10/100/1000 STXS4-256MB		
Port 01	10/100/1000 Base T		<input type="checkbox"/>
Port 02	10/100/1000 Base T		<input type="checkbox"/>
Port 03	10/100/1000 Base T		<input type="checkbox"/>
Port 04	10/100/1000 Base T		<input type="checkbox"/>

Ports in configuration			
State	Name	Chassis/Card/Port	Type
1	130.149.241.110:02:01-Ethernet	130.149.241.110:02:01	10/100/1000 B
2	130.149.241.110:02:02-Ethernet	130.149.241.110:02:02	10/100/1000 B

Buttons at the bottom of the dialog: OK, Cancel, Help.



```
marc@thinkpad:~$
marc@thinkpad:~$
marc@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 10.216.126.4
marckoerner@SliceController:~$
marckoerner@SliceController:~$
marckoerner@SliceController:~$
marckoerner@SliceController:~$ su
Password:
root@SliceController:/ofelia/users/marckoerner#
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#
root@SliceController:/opt/ofelia/software/nox/build/src# ./nox core -v -i ptcp:6633 switch
```

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

```
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 no later than 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 000000000403 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=000000000403: 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
```

The screenshot shows the IxNetwork software interface. The main window is titled 'IxNetwork [default\_User11.ixncfg]'. The 'Configuration' tab is active, showing 'Protocol Interfaces'. The 'Connected Interfaces' section is expanded, displaying a table of interface configurations. Below this, the 'Global Protocol Statistics' section is visible, showing a table of statistics for two interfaces.

Port Description	Port Link	Interface Description	Enable	IPv4 Address (10.0.x.x - Reserved IP)	IPv4 Mask Width	Gateway	IPv6 Address	IPv6 Mask Width
130.149.241.110:02:01-Ethernet - 10/100/1000 Base T		Connected - Protocolint	<input checked="" type="checkbox"/>	192.168.0.1	24	192.168.0.2		
130.149.241.110:02:02-Ethernet - 10/100/1000 Base T		Connected - Protocolint	<input checked="" type="checkbox"/>	192.168.0.2	24	192.168.0.1		

Stat Name	Control Packet Tx.	Control Packet Rx.	Ping Reply Tx.	Ping Request Tx.	Ping Reply Rx.	Ping Request Rx.	Arp Reply Tx.	Arp Request Tx.	Arp Request Rx.	Arp Reply Rx.	Neighbor Solic
130.149.241.110/Card02/Port02	23	8	0	0	0	0	8	15	8	0	
130.149.241.110/Card02/Port02	15	16	0	0	0	0	0	15	8	8	

```
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 no la
han 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 00000000403 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=00000000403: 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 00000000403 (len:60)
00059|switch|DBG:learned that 00:00:47:2d:34:c8 is on datapath 00000000403 port 21
00060|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00061|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00062|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00063|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00064|switch|DBG:learned that 00:00:47:2d:34:c9 is on datapath 00000000403 port 22
00065|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00066|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00067|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00068|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00069|openflow-event|DBG:received flow expired event from 00000000403
00070|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00071|openflow|DBG:stream: message received, entering CONNECTED
```

**ixN Advanced Traffic Wizard**

**Endpoints**

Packet / QoS  
Flow Group Setup  
Frame Setup  
Rate Setup  
Flow Tracking  
Dynamic Fields  
Preview  
Validate

**Endpoints**

**Traffic Item**  
Traffic Name: Traffic Item 1  
Type of Traffic: IPv4

**Source / Destination Endpoints**  
Traffic Group ID Filters: None selected

**Traffic Mesh**  
Source/Dest.: One - One  
Routes/Hosts: One - One  
 Bi-Directional  
 Allow Self-Destined

Number of hosts per Route: 1

Merge Destination Ranges  
Uncheck this option to test overlapping VPN addresses

**Source**  
All Ports  
130.149.241.110:02:01-Ethernet  
130.149.241.110:02:02-Ethernet

**Destination**  
All Ports  
130.149.241.110:02:01-Ethernet  
130.149.241.110:02:02-Ethernet

**Endpoint Sets**

	Encapsulation	Source Endpo...	Destination Endp...	Traffic Gro...
▼ Name: EndpointSet-1				
1	Ethernet II, IPv4	1 Endpoints	1 Endpoints	None selected
▼ Name: EndpointSet-2				
2	<New>	<New>	<New>	None selected

Prev Next Finish Cancel Help

The screenshot shows the IxNetwork software interface. The top menu bar includes File, Home, Automation, Results / Reports, Views, and Configuration. The main window is titled 'IxNetwork [default\_User11.ixncfg]'. The left sidebar shows a tree view with categories like Overview, Ports, Protocol Configuration, Traffic Configuration, QuickTests, and Captures. The 'Traffic Configuration' section is expanded to show 'L2-3 Traffic Items'. The main area displays a table with columns: Transmit State, Traffic Item Name, Enabled, Flow Groups, Tx Ports, Rx Ports, and Endpoint/Encapsulation Sets. Below this, there are tabs for Summary, Settings, Tracking and Latency, and All. The 'Traffic Item Statistics' tab is active, showing a detailed table of statistics for 'Traffic Item 1'.

Traffic Item	Tx Frames	Rx Frames	Frames Delta	Loss %	Tx Frame Rate	Rx Frame Rate	Rx Bytes	Tx Rate (Bps)	Rx Rate (Bps)	Tx Rate (bps)	Rx Rate (bps)	Tx Rate (Kbps)	Rx Rate (Kbps)	Tx Rate (M)
1 Traffic Item 1	3,141,273	3,128,308	12,965	0.413	148,809.603	148,809.103	200,211,712	9,523,814....	9,523,782....	76,190,516...	76,190,260...	76,190.517	76,190.261	76

At the bottom of the interface, it indicates 'Traffic Running for 00:00:22' and provides options for Logs and Messages.



```
00399|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00400|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00401|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00402|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00403|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00404|openflow-event|DBG:received packet-in event from 00000000403 (len:60)
00405|openflow-event|DBG:received packet-in event from 00000000403 (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 00000000403
00411|openflow|DBG:stream: idle 15 seconds, sending inactivity probe
00412|openflow|DBG:stream: message received, entering CONNECTED
```