



Abstraction Layer for Implementation of Extensions IN PROGRAMMABLE NETWORKS

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Executive Summary

This document complements deliverable D5.3 "Experimental-driven research" with details about testing scenario steps and all materials like logs, screenshots, packet dumps collected during performing of experimentation tests. We highly encourage to read first D5.3 which contains overview of the experiment, goals to be achieved, experiment environment and also discussion about experiment validation.

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1 Multi-vendor evaluation of HAL in the optical domain

1.1 Testing scenario

In the accompanied deliverable we have briefly described the procedure followed and the goals aiming to achieve with this demonstration. Here we will provide a comprehensive overview of the experiment by providing the steps we have followed.

The steps we have gone through to run this experiment are the following:

- Starting OpenDaylight controller (ODL)
 - OpenDaylight is running in a different Linux machine and is listening for new devices to connect to it.
- Execute WSS OpenFlow datapath with accompanied configuration file, pointing to ADVA ROADMs.
 - Configuration file contains the management interface of the switch, as well as peering information of the managed switch since there is no protocol similar to Link Layer Discovery Protocol (LLDP)
- Execute Fibre switch OpenFlow datapath, with config file pointing to Polatis fibre switch.
 - o Configuration file again contains management interface of the switch and peering information.
- OpenFlow datapaths are sending HELLO messages to the controller and get discovered by ODL.
- ODL controller requests and receives the features of the switch (FEATURES_REQUEST) message.
 - ODL is modified so that is can interpret Circuit extension OpenFlow messages.
- ODL receives FEATURES_REPLY messages from the switches. This is the way ODL registers the switches. Also from the same message ODL parses the peering information and discovers the topology of the optical domain.
- User installs new cross-connection using ODL web interface.
- User tears down existing cross-connection using ODL web interface.

In the next section follows a more detailed description is given by providing the results of these steps backed with the output of the demonstrated software components given as screenshots while performing the experiment.



1.2 Experiment results

Starting with the OpenDaylight controller view we are showing the devices discovered by the SDN controller. Indeed we notice that OpenDaylight is able to discover both the types of optical devices. The process of discovering requires the switch agent to send a HELLO message to the controller and gets a HELLO as a reply. At this point the controller and switch are exchanging the OpenFlow version supported by each entity. The version communicated by the optical agents is 1.0 since there is no official support for optical devices until OpenFlow v1.4. Following the controller sends a FEATURES_REQUEST message to the switch to discover the features of the switch and the latter replies with a FEATURES_REPLY message to the controller. OpenDaylight controller also sends a GETCONF_REQUEST and FLOW_MOD message but these are ignored by the optical switches since they are meant only for packet switches. Finally the agent sends a FEATURES_REQUEST message every 12 seconds and gets an ECHO_REPLY message from the controller to maintain the OpenFlow control channel active.

Controller



Agent



At this point the controller and switch are exchanging the OpenFlow version supported by each entity. The version communicated by the optical agents is 1.0 since there is no official support for optical devices until OpenFlow v1.4. Following the controller sends a FEATURES_REQUEST message to the switch to discover the features of the switch and the latter replies with a FEATURES_REPLY message to the controller. OpenDaylight controller also sends a GETCONF_REQUEST and FLOW_MOD message but these are ignored by the optical switches since they are meant only for packet switches. Finally the agent sends a FEATURES_REQUEST message every 12 seconds and gets an ECHO_REPLY message from the controller to maintain the OpenFlow control channel active.

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The figures below show the discovered topology after FEATURES_REPLY messages have been parsed by the controller. The second view has some more details about the discovered nodes like the type of each switch and number of ports.

🗋 OpenDaylight 🛛 🗙 🔛							_ 0
😋 💿 🔇 🗋 localhost:8080/#							\$
	lows Troublesho	oot					👤 admin -
Flow Entries CFlow Entries							
CElow Entries							
Add CFlow Entry Remove CFlow Entry							
Search				ROADM_n	ode1	ROADM_n	ode2
CElow Name No	ode						
ALIEN FIBRE 03 13	re switch						
ALIEN FIBRE 04 14 fibr	re switch						
1-2 of 2 items Page 1 of 1 ROADM node3 fibre_switch							
Nodes		Flow Detail					
Nodes		CFlow Overview					
Search Q		Remove CFlow Edit CFlow Un	install CFlow				
Node Flo	ows	CFlow Name		Node	Wildcards		HardTimeout
ROADM_node3 0		ALIEN_FIBRE_03_13		fibre_switch	OFPCW_FIBER	PORT	1
ROADM_node2 0		Input Port	Output Port		In Wavelength	Out Wa	velength
ROADM_node1 0 3 13		13		1	1		
fibre_switch 0							
	•						

Figure 1-2 Discovered topology - OpenDaylight controller main view



🗋 Openi	Daylight ×					
00) 🗈 localhost:8080/#					☆ =
						🧕 admin 🗸
Nodes L	Nodes Learned				×	
Nodes						
Searc	Search	0				
Norde Ma	Node Name	Node ID	Tier Name	MAC Address	Ports	
Node Na	fibre_switch	OF 00:00:00:00:00:03:55	Core (Tier-3)	00:00:00:00:03:55	16	
TIDIe_SW	ROADM_node2	OF 00:00:00:00:0b:21:00:0a	Access (Tier-1)	00:00:0b:21:00:0a	9	
ROADM	ROADM_node3	OF 00:00:00:00:0c:21:00:0a	Access (Tier-1)	00:00:0c:21:00:0a	12	
ROADM	ROADM_node1	OF 00:00:00:00:0a:21:00:0a	Access (Tier-1)	00:00:0a:21:00:0a	14	
ROADM	1-4 of 4 items			Page	e 1 of 1 🕨	
1-4 of 4						
Static Ro						
Static F						
Add Static						
Search						
Nan						Ports
						Page 1 of 1

Figure 1-3 Detailed view of discovered switches - OpenDaylight controller

The next figure is taken from OpenDaylight controller's web interface shows the extensions made to install a new crossconnection in the optical switch. First we need to define the node that we want to use and then the input and output port between which we will perform the cross-connection.

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🗅 OpenDaylight	×		
😋 💿 🔇 🗋 localho	st:8080/#		☆】 =
OPENDAYLIGHT			🧕 admin 🗸
Flow Entries CFlow En			
CFlow Entries		Add CFlow Entry ×	
Add CFlow Entry Remove CF	low Entry	ALIEN_FIBRE_03_13	
Search	0	Node	
CFlow Name	Node	fibre_switch	
ALIEN_FIBRE_04_1		Hard Timeout	
1-1 of 1 item		1	
<u> </u>		Wildcards	
		OFPCW FIBER ports	
		In Port	
		POL3(3)	fibre_switch
		In Wavelength	
-		1	
Nodes		Out Port	
Nodes		POL13(13)	
Search	0		
Node	Flows	Install CFlow Save CFlow Close	
ROADM_node3			
ROADM_node2			
ROADM_node1			
fibre_switch			

Figure 1-4 Create new cross-connection using OpenDaylight controller

The message is received by the OpenFlow agent and parsed to discover the attributes of the CFLOW_MOD message. The switch needs to perform a cross connection between fibre ports 3 and 13. The agent sends the appropriate TL1 commands to the switch and we see that the cross-connection was successful.

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🔽 Terminal - root@gblallen-VirtualBox: /home/gblallen/ALIEN/rofl-polatis/examples/polatisswitch _ 🗉
File Edit View Terminal Tabs Help
ROFL [handle_message]:OpenFlow (1) message received: 3 (bytes 2048) ROFL [handle_revent]:#### csocket(0xa062c70)::handle_revent()
ROFL [handle_message]:OpenFlow (1) message received: 9 (bytes 3072)
ROFL [handle_message]:SET_CONFIG message received! ROFL [handle_revent]:#### csocket(0xa062c70)::handle_revent()
ROFL [handle_message]:OpenFlow (1) message received: 7 (bytes 2048)
ROFL [handle_message]:GET_CONF_REQUEST message received! ROFL [handle_revent]:#### csocket(0xa062c70)::handle_revent()
ROFL [handle_message]:OpenFlow (1) message received: 22 (bytes 13312)
ROFL [handle_message]:CFLOW_MOD message received. Parse frame to construct a new cflow_mod message. AGENT: Received CFLOW_MOD message with type 22 AGENT: length:52
AGENT: cross-connect: 3<==>13 [0] AGENT: perform cross connection between ports: 3<==>13 [00:0][03:3][0d:13]sending XC command: ENT-PATCH::3,13:123:; Client:Message rcv:
(nil) 12-03-13 23:21:18 M 123 COMPLD ;
XC success AGENT: success! AGENT: end.
ROFL [handle_revent]:#### csocket(0xa062c70)::handle_revent()
ROFL [handle_message]:OpenFlow (1) message received: 18 (bytes 2048)
ROFL [handle_message]:BARRIER REQUEST received. AGENT: Handle Barrier request message from polatissw. ####

Figure 1-5 Handle CFLOW_MOD –Install new cross-connection

Here is the proprietary web-interface of the Polatis switch that shows the cross-connection between ports 3 and 13 was successful.

Connections:	
1 9 3 4 5 6 7 8 7 15 16	×

Figure 1-6 Polatis web interface -cross-connection table after installing flow

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Finally we are removing the flow we had installed before in the switch by selecting the flow and pressing the "Remove CFlow" red button in OpenDaylight controller as shown in figure 28. Then a CFLOW_MOD message will by send to the OpenFlow agent as shown in the following screenshot.

🔽 Terminal - root@gblallen-VirtualBox: /home/gblallen/ALIEN/rofl-polatis/examples/polatisswitch _ =	,
File Edit View Terminal Tabs Help	
ROFL [handle_message]:GET_CONF_REQUEST message received! ROFL [handle_revent]:#### csocket(0x92bdc70)::handle_revent()	
ROFL [handle_message]:OpenFlow (1) message received: 22 (bytes 13312)	
ROFL [handle_message]:CFLOW_MOD message received. Parse frame to construct a new cflow_mod message. AGENT: Received CFLOW_MOD message with type 22 AGENT: length:52	
AGENT: cross-connect: 4<==>14 [1] AGENT: perform tear-down of lightpath 4%<==>d [03:3][04:4][0e:14]sending XC command: DLT-PATCH::4&14:123:; Client:Message rcv:	
<pre>(nil) 12-03-15 19:19:17 A 3330 REPT EVT EQPT "SYSTEM:MISC:\"Switch complete\"" ;</pre>	
XC success AGENT: success! AGENT: end. ROFL [handle_revent]:#### csocket(0x92bdc70)::handle_revent()	
ROFL [handle_message]:OpenFlow (1) message received: 18 (bytes 2048)	
ROFL [handle_message]:BARRIER REQUEST received. AGENT: Handle Barrier request message from polatissw. ####	

Figure 1-7 Handle CFLOW_MOD – Remove existing cross-connection