



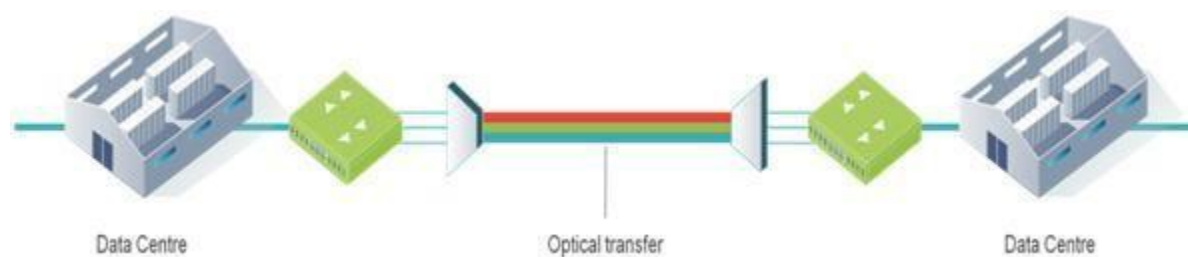
# White Box Aggregated Packet Optical DWDM Switch

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## 1. Introduction

This document describes the project undertaken by PaIC Networks to enhance existing White-box commercial NOS to support the hardware design of open packet transponder along with programming and managing the coherent optical devices.

The packet optical DWDM switch has 100GbE packet switching ports and 100/200GbE coherent optical interfaces. The box was purpose built to enable network operators to easily extend and migrate existing metro and long-haul Dense Wavelength Division Multiplexing (DWDM) networks to add new 200G capacities for data-center interconnect and service provider back-haul use-cases.



### 1.1. Requirement/Scope of the project:

- Integrate TAI (Transponder Abstraction Interface) with NOS to program and manage the Coherent optical devices (ACO/DCO).
- Design and develop driver code to access coherent-modules for different vendors using open-source TAI framework.
- Enhance Chassis-Management-Module to control and manage all the peripheral-devices (Fan, LED, thermal, qsfp28, PSU, coherent-devices [ACO/DCO]).

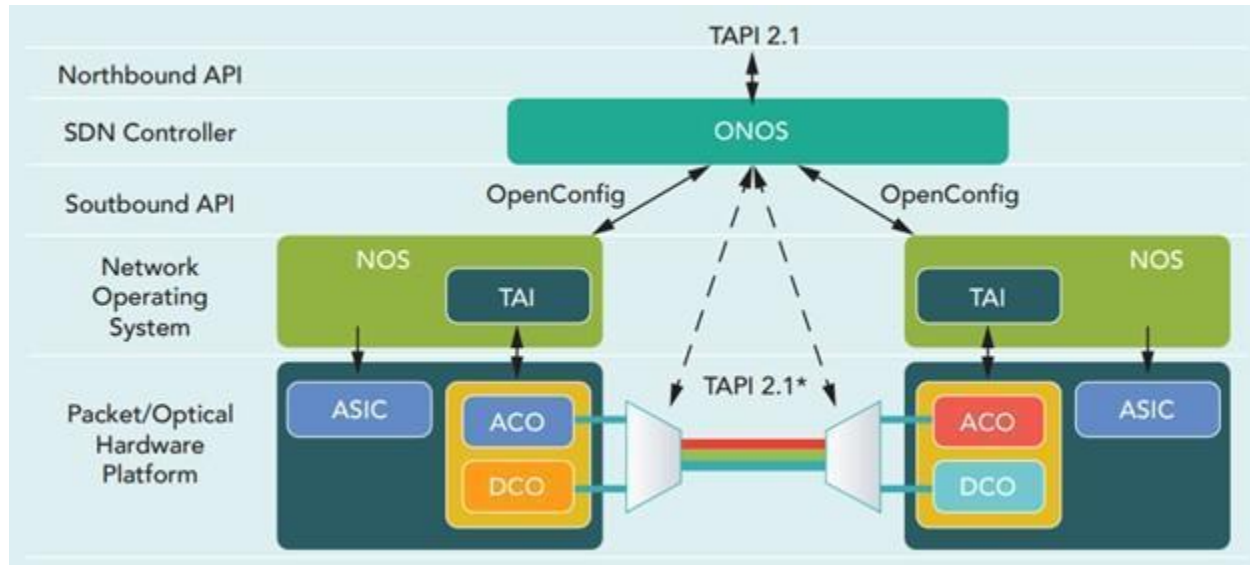
## 2. Hardware Details:

Hardware is a 1.5RU form factor with system throughput of 3.2Tbps based on Broadcom StrataXGS™ Tomahawk™ Plus switch silicon. The design offers sixteen fixed 100 Gigabit Ethernet QSFP28 ports, plus 8 line-card slots to incorporate a flexible mix of additional 200GbE ports or ACO/DCO optical ports based on coherent DSP and optical transceivers from leading optical technology partners.

The following line cards can be as required, providing the network operator with a scalable pay- as-you-grow platform.

- 100GbE Line Card: 2 x 100GbE QSFP28.
- DCO Line Card: 1 x 100G/200G CFP2 with supporting DCO pluggable transceivers;
- ACO Line Card: 1 x 100G/200G CFP2 with supporting ACO transceivers;

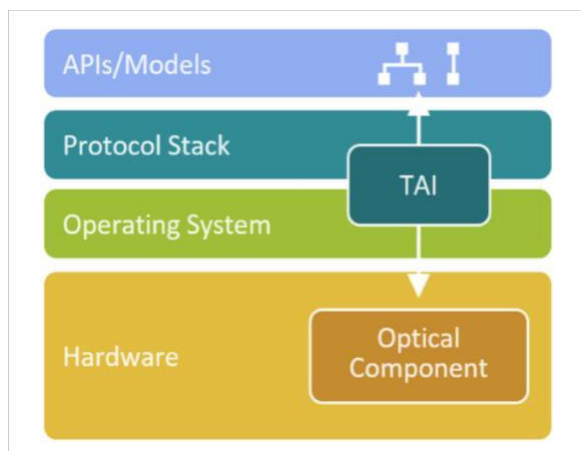
### 3. System Architecture:



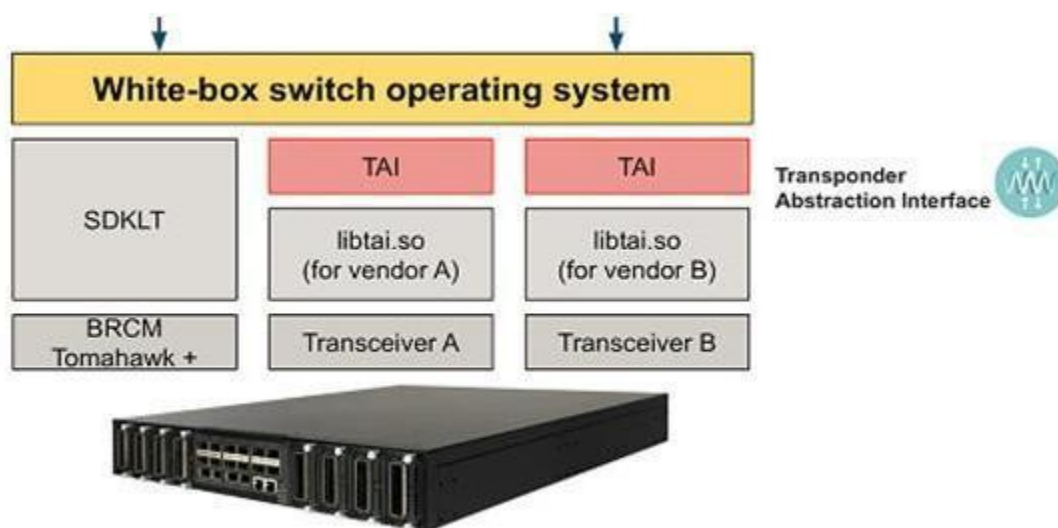
### 4. TAI: Transponder Abstraction Interface

Transponder Abstraction Interface [TAI], defines API's to provide a vendor independent way of programming the transponders from various vendors.

TAI acts as hardware abstraction interface between the system software (NOS) and the coherent optical devices. There by allowing all the TAI complaint transponders to operate with any system software having TAI layer integrated.



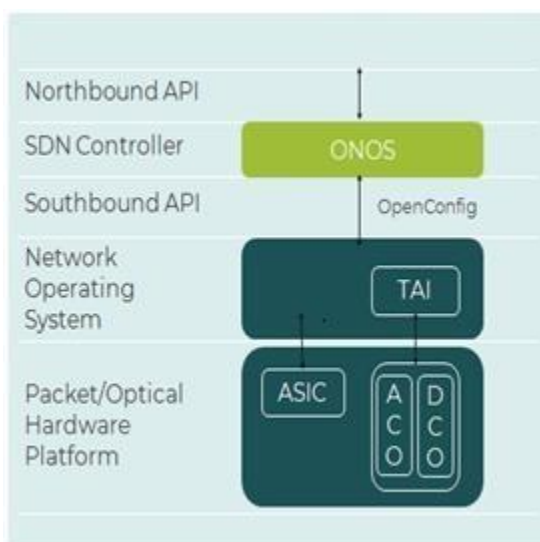
As part of this project, we integrated open-source TAI library in to NOS and developed TAI complaint vendor specific driver modules, the architecture of which is as shown below.



The TAI layer provides generic API's to switch operating system to manage the optical coherent- devices. The switch operating system uses the TAI abstraction layer to talk to vendor-specific driver code (libtai-dco.so) to program the underlying coherent-device. As part of this integration, we also designed and developed the libtai.so driver for DCO optical CFP2 module.

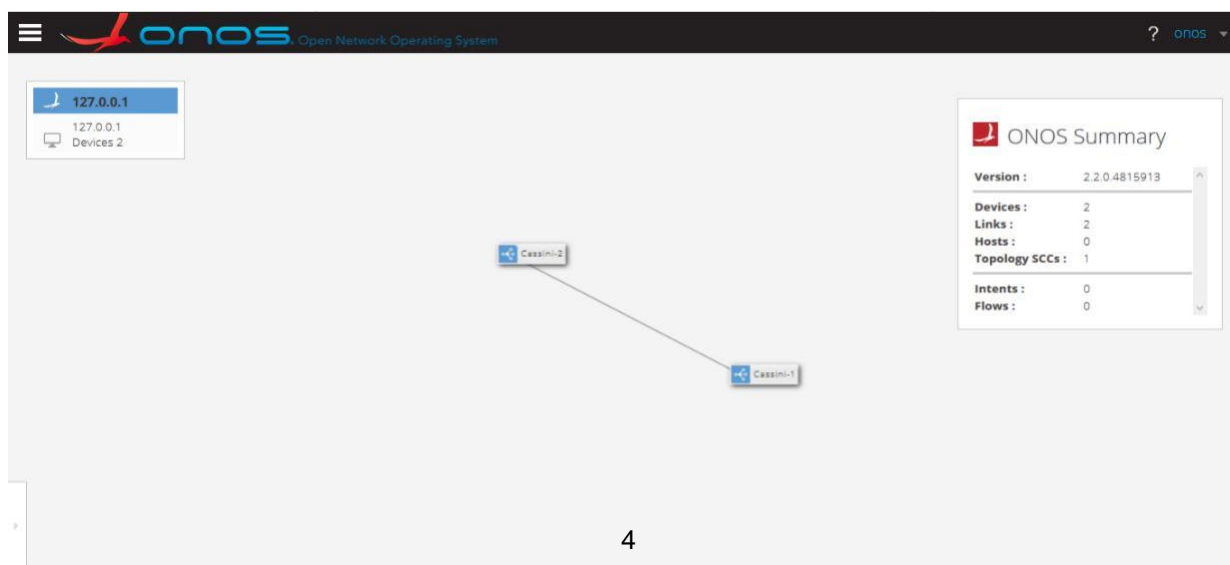
## 5. SDN Controller:

Open and Disaggregated Transport Network (ODTN) project is an operator-led initiative to build data center interconnects using disaggregated optical equipment, open Network OS and common standards.



ODTN enables end-to-end orchestration leveraging the Open Network Operating System SDN controller (ONOS) to provide control, management and provisioning of networks and equipment. The open design enables ONOS to configure the optical modules using ONOS data- models. These OpenConfig specific data-models were developed as part of this project.

ONOS optical port configuration GUI: <http://<onos-ip>:8181/onos/ui>



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Ports for Optical Device netconf:10.128.200.2:830 (8 Total)

PORT ID	REVERSE PORT	NAME	TYPE	ENABLED	MIN FREQ (THz)	MAX FREQ (THz)	GRID (GHz)	CURRENT FREQ (THz)	MODULATION	POWER RANGE (dBm)	CURRENT POWER (dBm)	CURRENT INPUT POWER (dBm)	TARGET POWER (dBm)	HAS TARGET POWER	SERVICE STATE
10108	N/A	port-10108	OCH	true	190.7	195.45	50.0	0		(-30.0,1.0)				true	N/A
10107	N/A	port-10107	OCH	true	190.7	195.45	50.0	0		(-30.0,1.0)				true	N/A
10106	N/A	port-10106	OCH	true	190.7	195.45	50.0	0		(-30.0,1.0)				true	N/A
10105	N/A	port-10105	OCH	true	190.7	195.45	50.0	0		(-30.0,1.0)				true	N/A
10104	N/A	port-10104	OCH	true	190.7	195.45	50.0	0		(-30.0,1.0)				true	N/A
10103	N/A	port-10103	OCH	true	190.7	195.45	50.0	0		(-30.0,1.0)				true	N/A
10102	N/A	port-10102	OCH	true	190.7	195.45	50.0	0		(-30.0,1.0)				true	N/A
10101	N/A	port-10101	OCH	true	190.7	195.45	50.0	0		(-30.0,1.0)	0.48	0.10		true	N/A

## 6. References:

1. <https://telecominfraproject.com/oopt/>
2. <https://www.opennetworking.org/onos/>
3. <https://github.com/Telecominfraproject/oopt-tai>