



Programmable Optical Transport System

*for Seamless Network Optimization and Smart
Congestion Management*

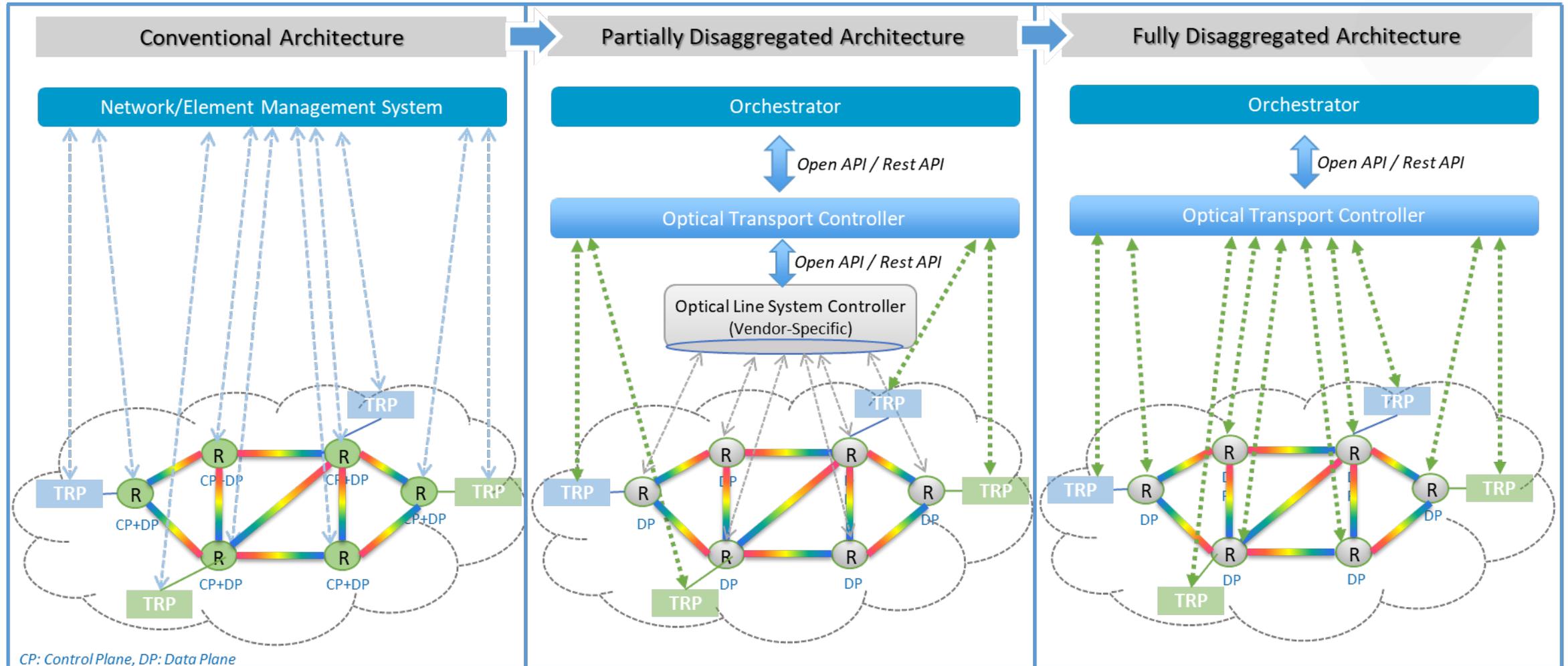
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Need of the hour

From Aggregated to Disaggregated Optical Transport



↔ Management & Config Conn.

⋯ Standard Data Models (OpenConfig / OpenROADM) using standard protocols e.g. NETCONF / gRPC

Industry Challenges of Optical Networking



1

Interoperability between the transponders of different vendors

2

Longer cycle for introduction of new services

3

Tight coupling of Transponder and Optical Line Systems (ROADM, ILA etc....)

4

Borders between optical domains

5

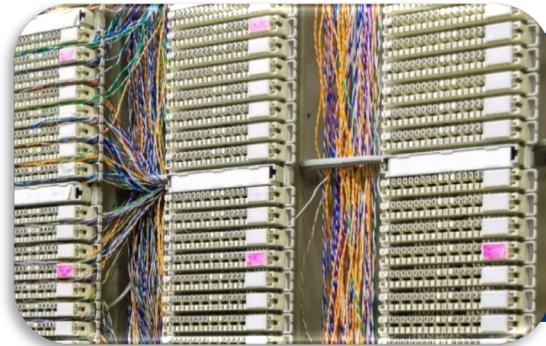
Vendor proprietary network controller

6

Vendor specific data model

Solution : Programmable Networking, Openness & Disaggregation

“STL” facilitates CSP to DSP transformation via PODS



MONOLITHIC SYSTEMS



OPEN SOURCE PROGRAMMABLE WEB-SCALE SYSTEMS

Interfaces	Multiple / Proprietary	Open & Standardized
Hardware	Vendor specific	Programmable white boxes
Services	Static Lambdas	Programmable lambdas
Architecture	Complex and Tightly Coupled	Disaggregated
Switching	Localised Control & Data Plane	Centralised Programmable control plane
Cost	Expensive	Frugal

CSP

DIGITAL RE-INVENTION

DSP

STL Optical Transport PODS - Programmable Open Disaggregated Solution



Programmable

- Multi-vendor & Multi-Layer Control
- Network & Service Automation
- Integrated Telemetry
- Planning & Design

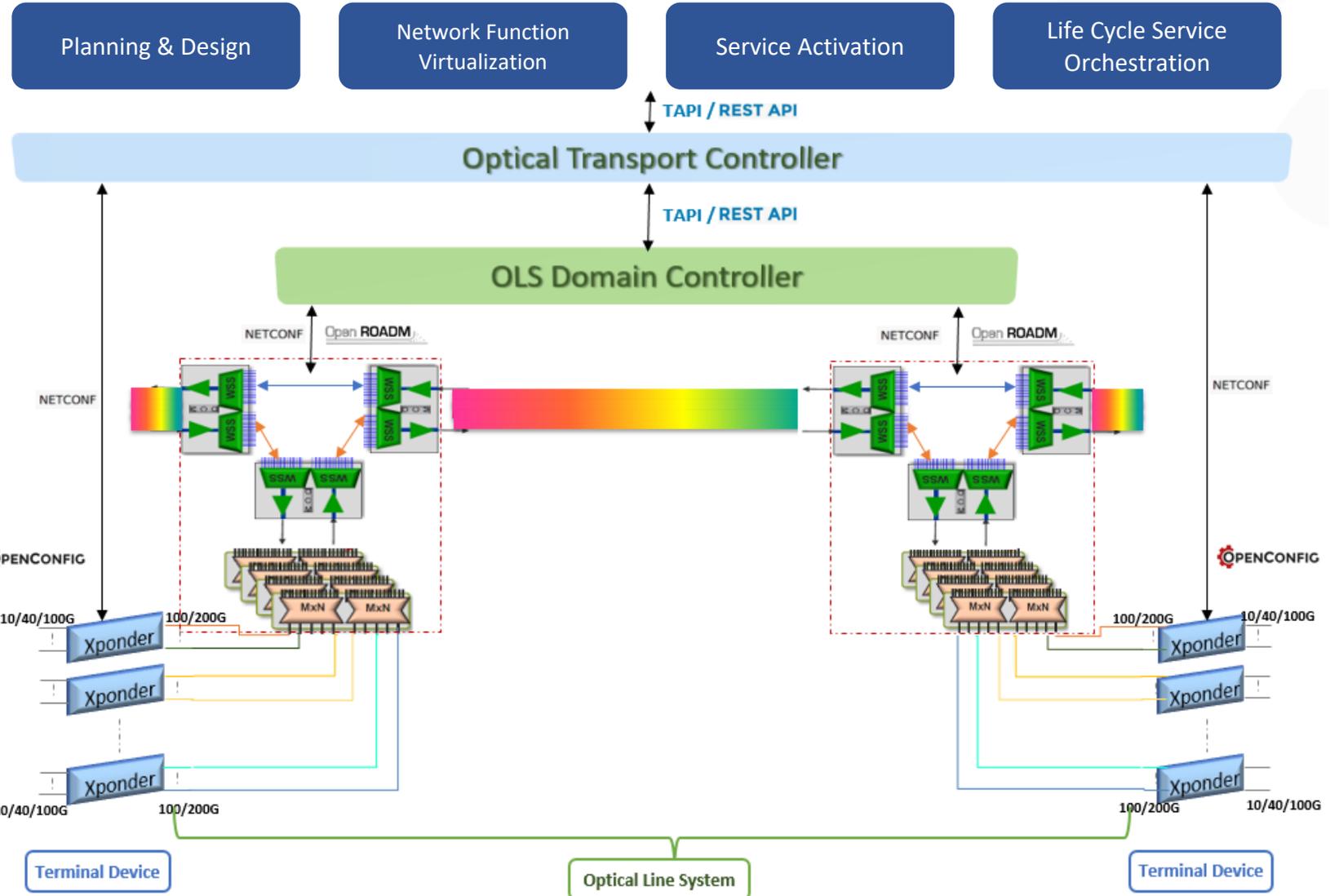
Open

- Preventing Vendor Lock-in
- Supports ecosystem evolution
- Interoperability
- Faster & Flexible

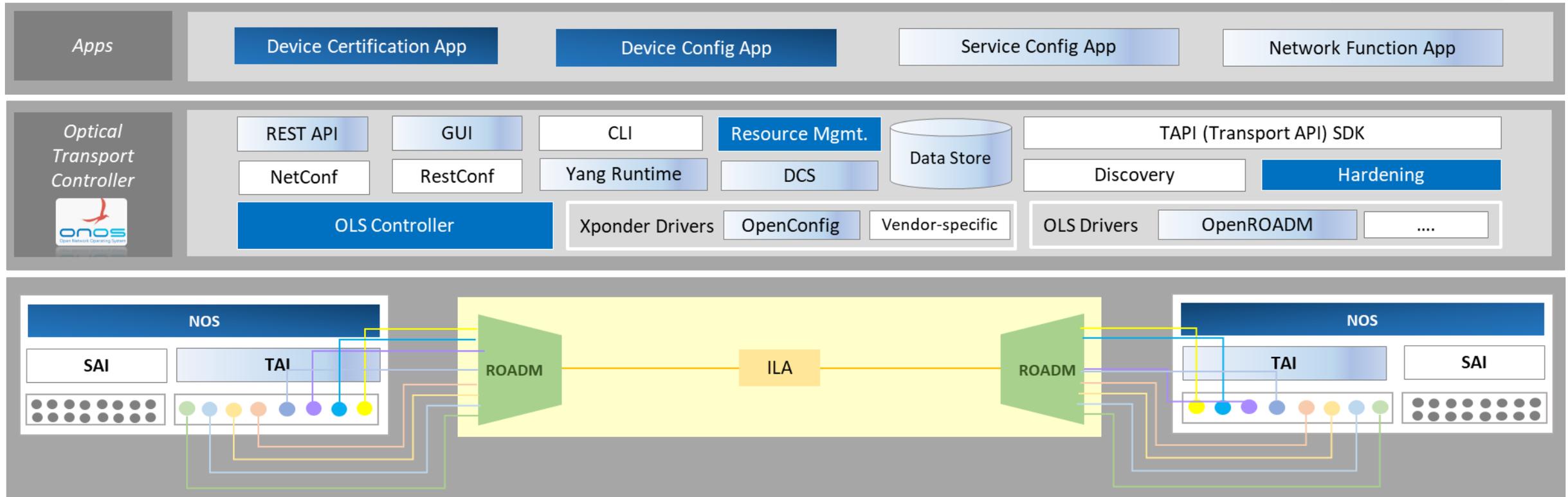


Disaggregated

- Modular & Efficient Scaling
- Open SW, Optics & Architecture
- Pay As You Grow
- Technology Innovation

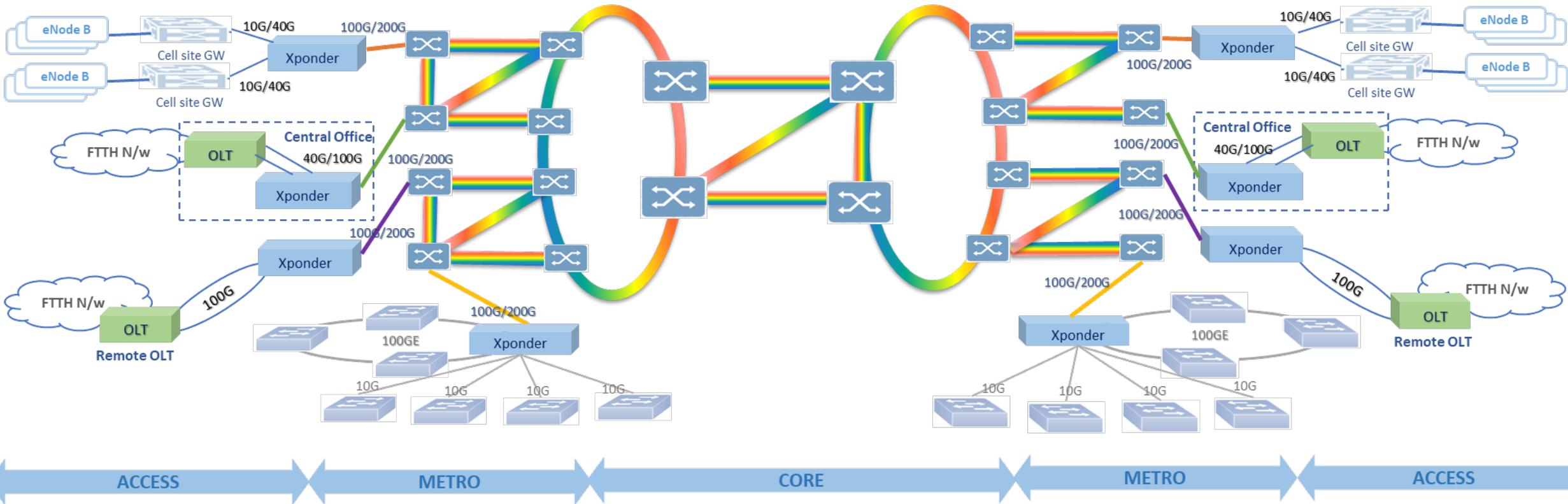


STL pWDM (programmable DWDM) PODS

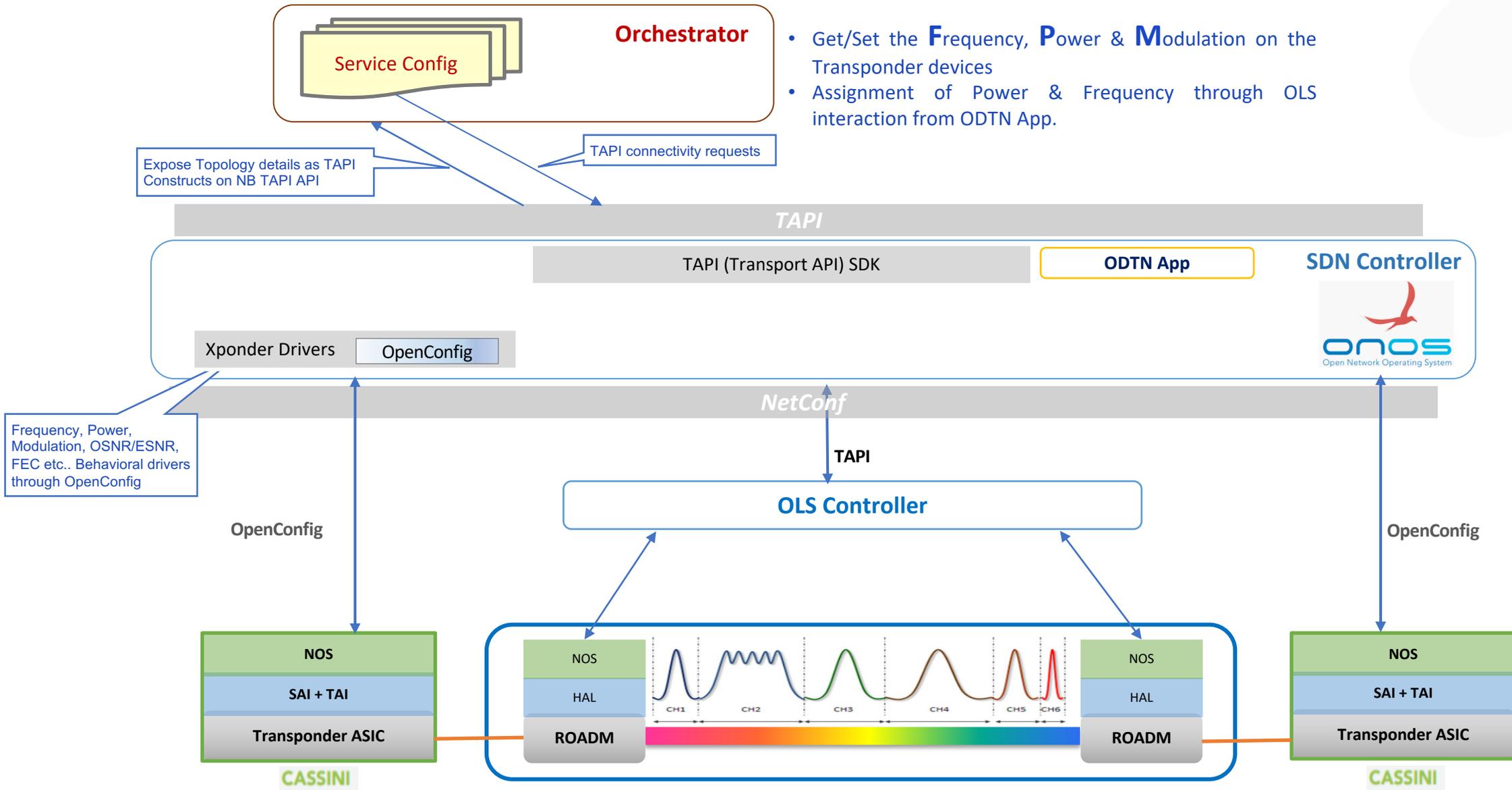


- ONF Developed
- STL – ONF Open Source Curated
- STL IP (Proprietary Development)

STL pWDM PODS – Converged Packet Optical Sol.



STL pWDM - Xponder FPM Configuration over Disaggregated OLS



- Get/Set the **F**requency, **P**ower & **M**odulation on the Transponder devices
- Assignment of Power & Frequency through OLS interaction from ODTN App.

Frequency, Power, Modulation, OSNR/ESNR, FEC etc.. Behavioral drivers through OpenConfig

STL Contribution & Alignment with ODTN



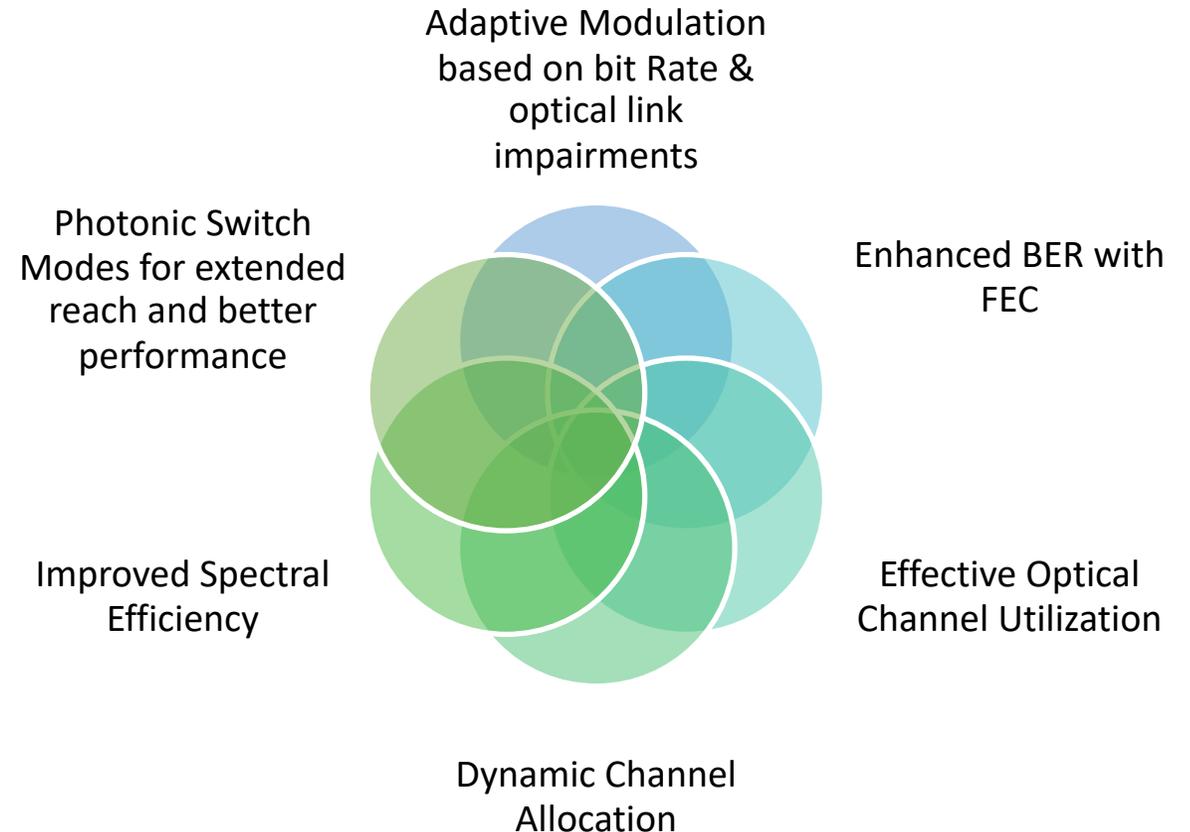
- STL contributed the workflows and device behaviors of **Channel Modulation** and **OSNR/ESNR** through OpenConfig data models
- Defined the **openconfig-terminal-device** Yang Model for the additional mandatory Photonic feature set for Transponder Configuration. It's been shared across the ODTN group for further inputs and feedback.
- E2E QA testing of Cassini Transponder devices through ONOS Controller on **STL Performance workbench lab setup** (WIP)
 - ✓ Stability – Bring up sessions and verify data transmission
 - ✓ Performance – Determine throughput, latency, frame loss/Errors

SMART FPM – To Optimize, Control and Automate the Packet Optical Networks

Requirements

- Offer flexible Packet & Optical layer grooming to maximize Network Efficiency
- Effective Network Resource (Optical Channel and Spectrum) utilization
- Adaptive Network Solution
- Automated e2e optical service provisioning as per available optical resources to efficiently carry the user traffic demands

Features



Enabler of SMART FPM Config

For Seamless Network Optimization & Smart Congestion Management



- **SW Configurable Client Packet to OCh Line Mapping**

- ✓ Any Client to Any Line port
- ✓ Multiple Clients to One Line Port
- ✓ Line Port Metering

- **SW Configurable Modulation / Bit Rate**

- ✓ Variable Baud Rate : 32GBaud to 56GBaud
- ✓ Adaptive Modulation: QPSK, 8QAM, 16QAM
- ✓ BER vs OSNR at various receive optical power...

- **Real time interaction with OLS Controller to compute & validate Transponder parameters (Frequency & Power)**

- ✓ Wavelength Assignment wrt required channel bandwidth
- ✓ Channel Power wrt to given OSNR/ESNR, BER, CD & PMD tolerance values
 - Optical Path calculation & Provisioning
 - Linear optical Impairments verification (Power Loss, OSNR, CD & PMD)
 - Non-Linear optical Impairments verification (SPM, XPM, FWM)

STL SMART FPM Features

For Seamless Network Optimization and Smart Congestion Management



- **Effective Channel Utilization**

- ✓ Flexible client ports to line Ports mapping through network traffic-policing policies

- **Open Interfaces Support for Xponder & OLS real time interactions**

- ✓ Real-time validation from Optical Line System (OLS) through TAPI or OpenROADM Interfaces

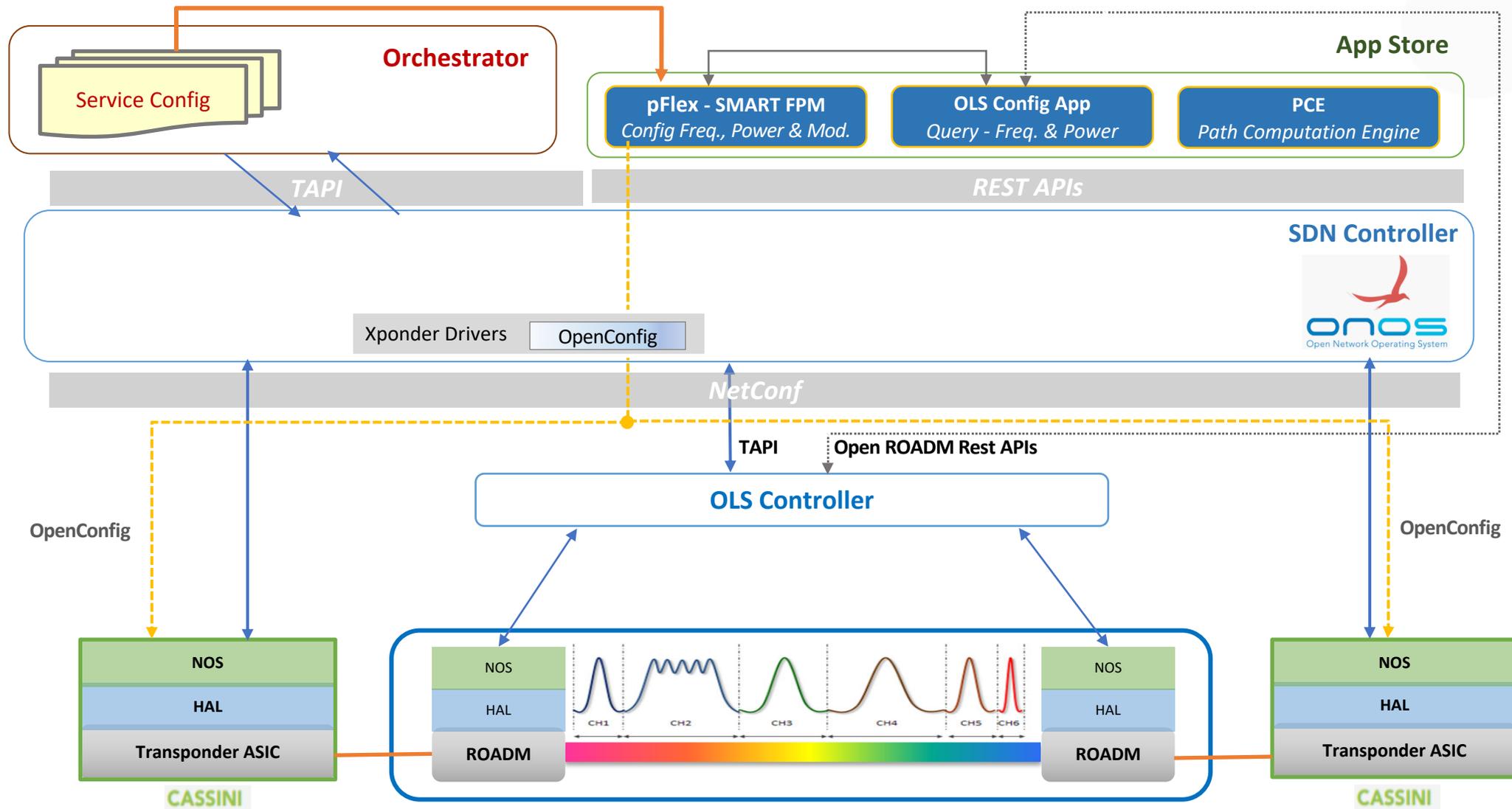
- **Adaptive Modulation**

- ✓ Modulation / Baud Rate configuration based on the required bit rate

- **Photonic Switch Modes**

- ✓ Photonic Switch Modes to maximize channel capacity, extended reach and better performance

STL pFlex™ - SMART FPM Config over Disaggregated OLS





beyond tomorrow