



The definition of an open metro DWDM network

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Agenda

Pluggable coherent 400G Technology in open Metro Networks

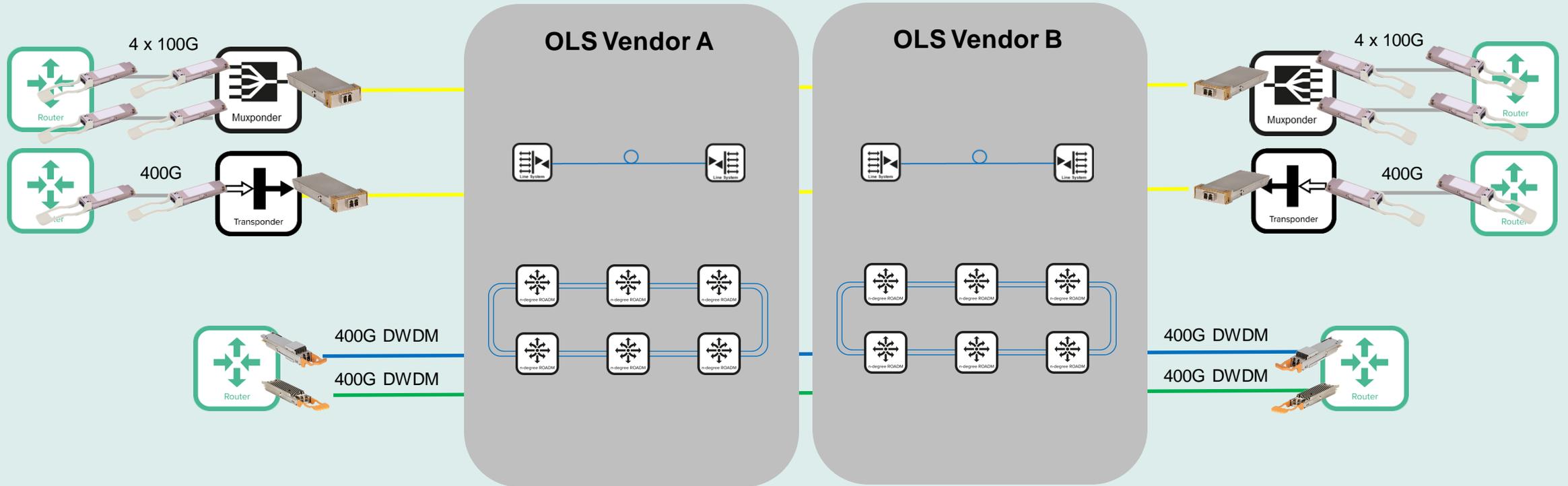
- Use Cases
- 400ZR vs 400ZR+
- Innovation and evolution of pluggable 400G coherent optics

Open Disaggregated Optical Systems

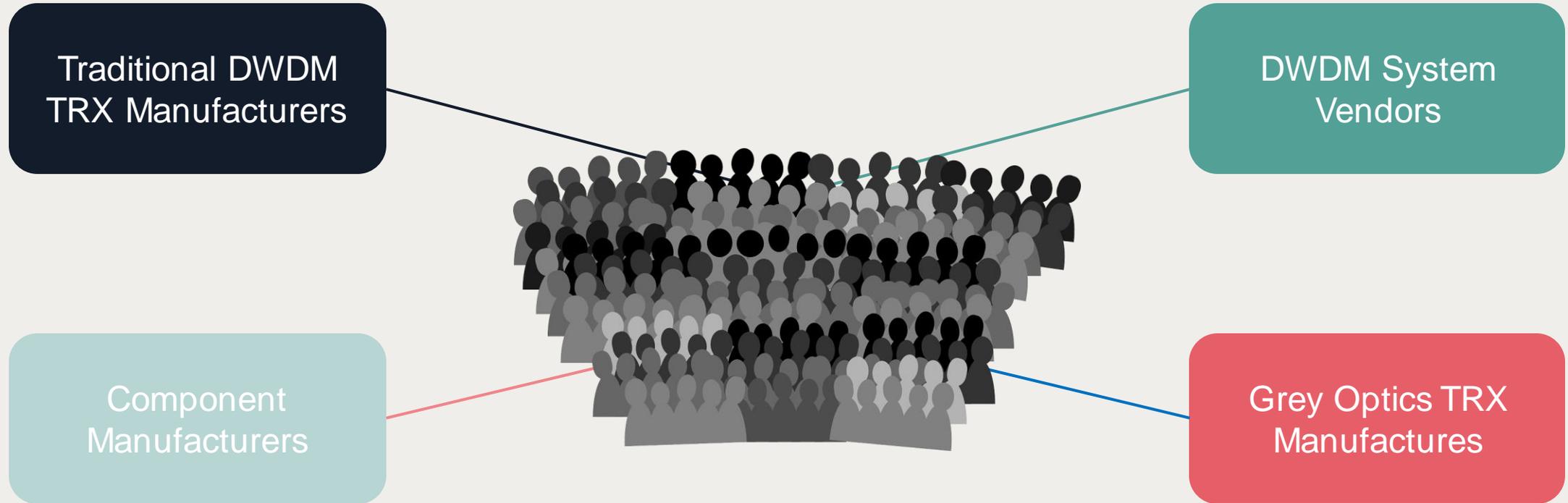
- Disaggregated building concept
- Open Initiatives and management
- Summary



Use cases for pluggable 400G coherent optics



OIF 400ZR & OpenZR+ is now a Crowded Space



Typical Building Blocks for OIF 400ZR & OpenZR+

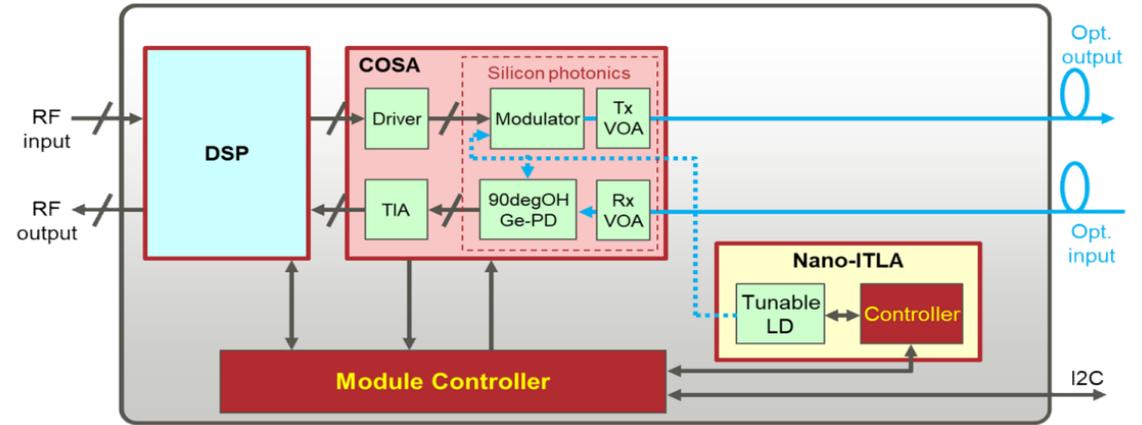
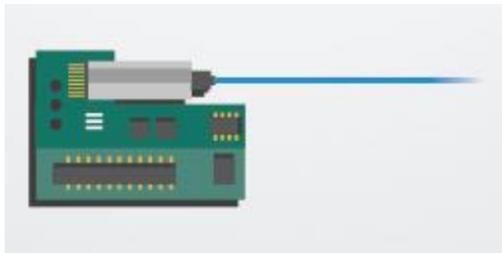
DSP



Silicon COSA



Nano-ITLA



Innovations around 400G Coherent Pluggable Optics

High Tx power 400G QSFP-DD

- In accordance with OpenZR+ but with 0 dBm output power
- Supported is already existing ROADM based networks
- Support for 200G 16QAM to work in 50GHz networks



Improved Optical Performance

- Probabilistic shaping
- Sub-carrier technology
- Additional modulation formats



OTN and Encryption support in 400G QSFP-DD

- OpenROADM compliant
- Layer-1 encryption
- In-band management via GCC



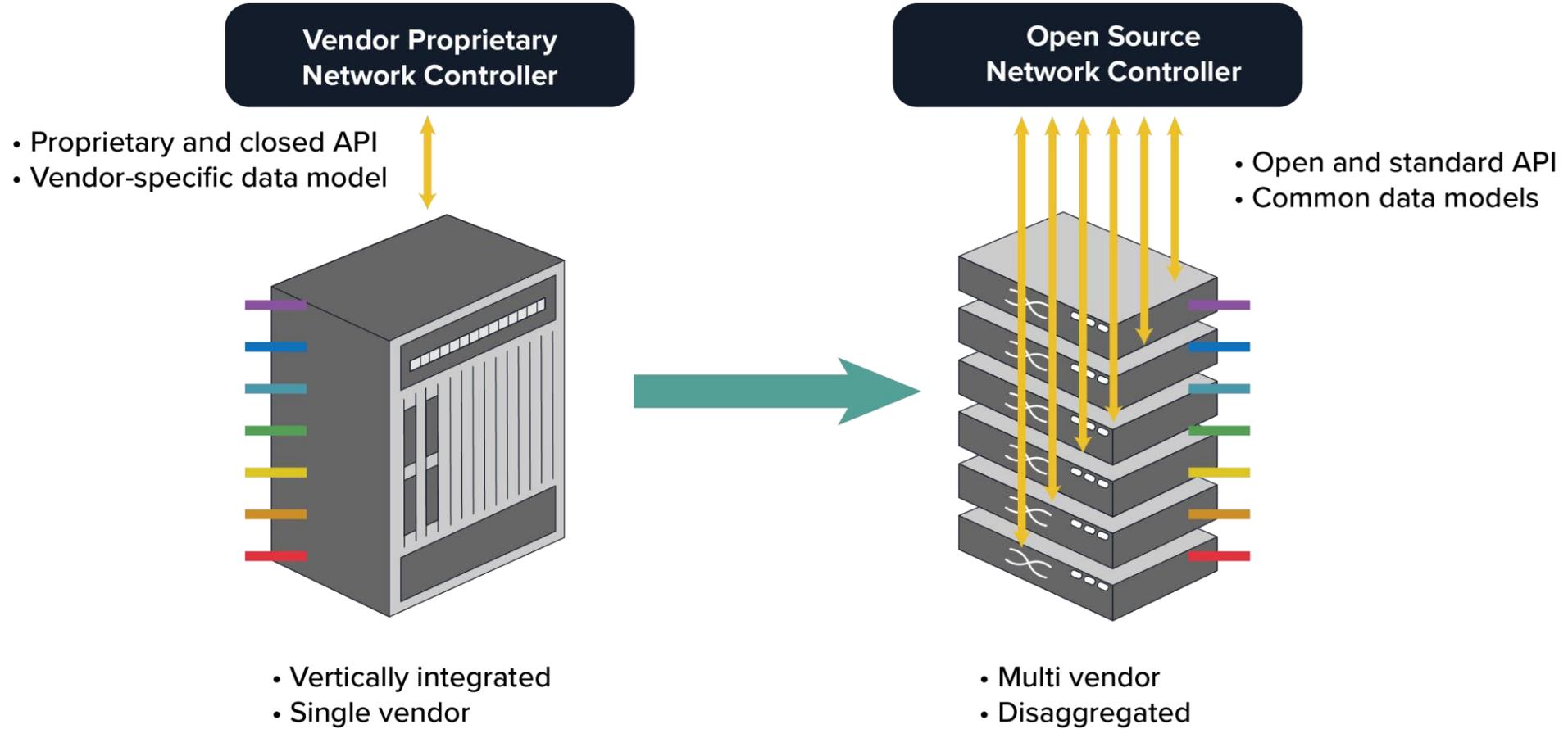
Additional line rates

- 100G QSFP28 coherent DWDM late this year
- 800G pluggable coherent DWDM modules mid next year
- 1,6T during 2025



Open Disaggregated Optical Systems

Disaggregation summary



Why is network disaggregation a strong trend?

- Faster Innovation – Independent HW & SW design cycles
- Cost saving – Competing vendor -> lower Capex & lower opex
- Best in class functions – Cherry-pick suppliers/technologies
- Flexibility - Limited vendor lock-in
- Simplicity – Control & integration with one SDN system



Examples of Industry Initiatives for disaggregation

OpenRoadm



- Defines interoperability specifications for ROADMs, Transponders & Optics
- Specifications consist of both Optical interoperability as well as YANG data models
- Consortium consist of both vendors and operators

Telecom Infra Project



- Several project groups, Open Optical & Packet Transport group most interesting for optical transport
- Defines open technologies, architectures and interfaces n Optical and IP Networking
- Consortium consist of both vendors and operators

OpenConfig



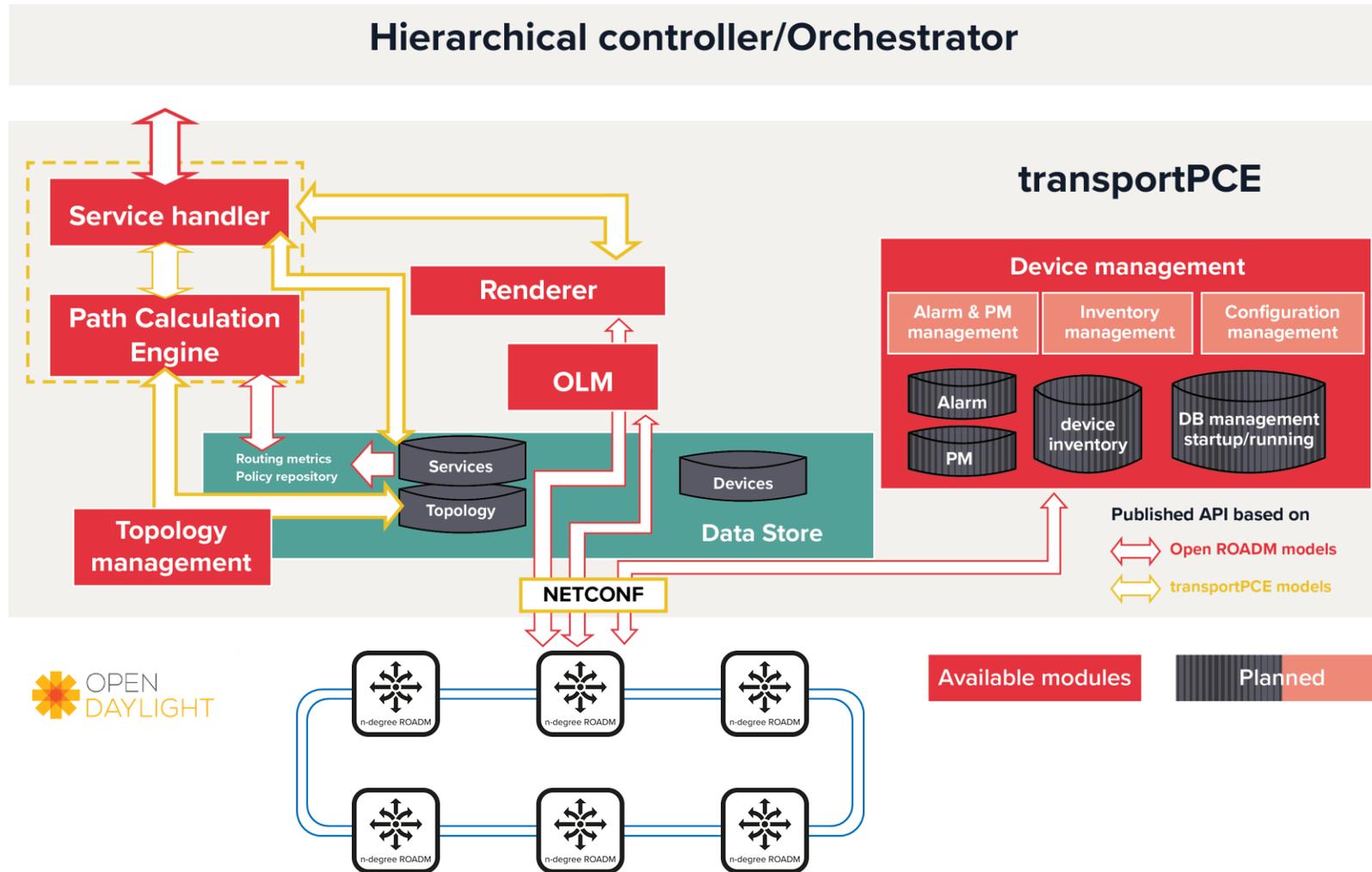
- Initial focus of OpenConfig was to development YANG based vendor-neutral data models
- Subscription based Streaming telemetry is a focus area in which data is streamed from devices continuously
- Consortium only consist of operators

Optical Internetworking Forum



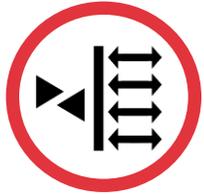
- Focused on electrical, optical and control interoperability, to enable more efficient and reliable network
- 400ZR and pluggable coherent standards
- Consists of 130+ network operators, system vendors, component vendors and test equipment vendors

TransportPCE – OpenROADM controller implementation



- **Service Handler**
handles request coming from a higher level controller through the northbound API
- **Path Calculation Engine**
calculates shortest path (hop count or delay) and assigns wavelength
- **Topology Management**
builds the topology based on LLDP discovery and external data
- **Renderer**
configures the optical devices in the path
- **OLM**
sets up power levels and continuously adjusts settings

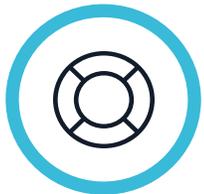
Smartoptics definition on a true Open Line System



No licenses or hidden fees



Compliant with IP over DWDM



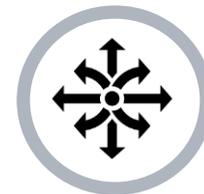
Open and standardized APIs



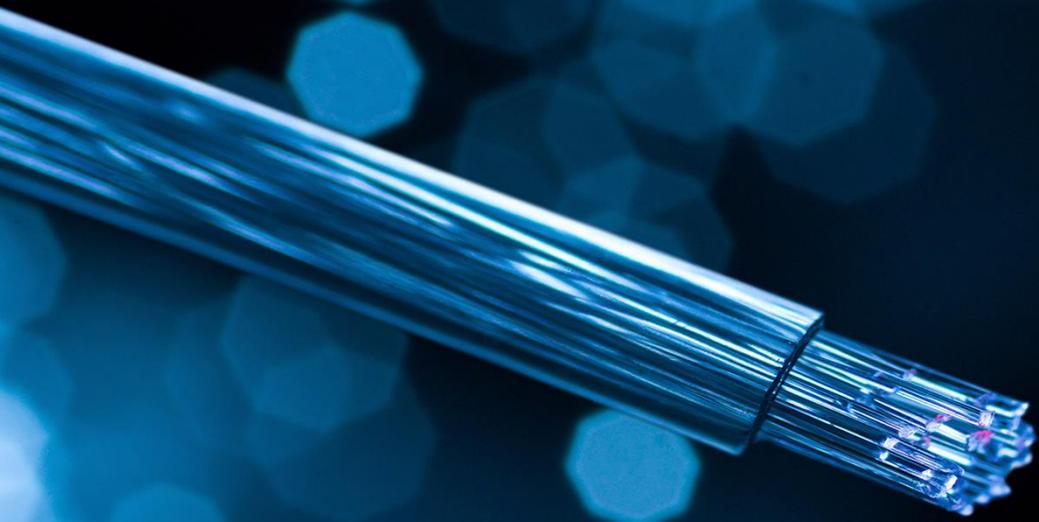
Full monitoring capability of all wavelengths



Standard data models (YANG)



Full provisioning capability of all wavelengths



Thank You

