
cisco Live!
TURN
IT
UP
#CiscoLive

The bridge to possible

Managing Your Optical Network

Using Open APIs and Cisco NSO

Michael Maddern
Technical Marketing Engineer

BRKOPT-2007

Agenda

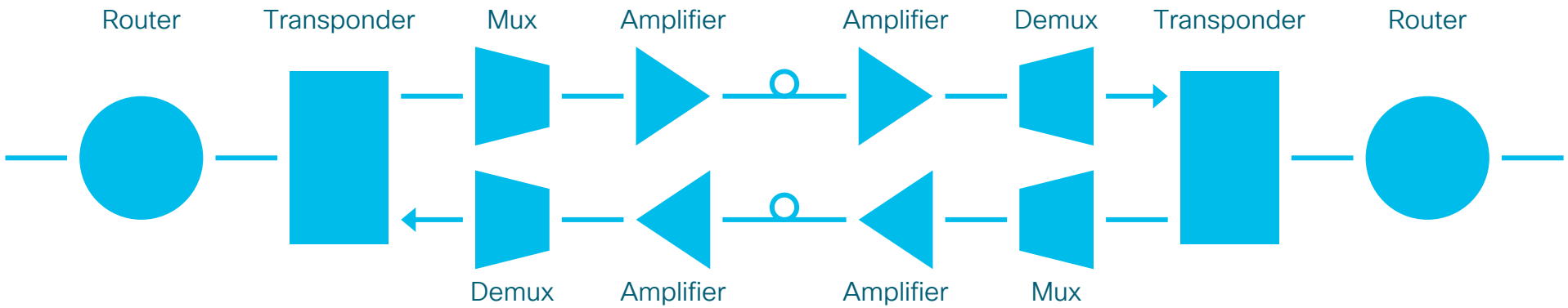
- Network Disaggregation
- OIF Transport SDN Interop
- Cisco NSO
- OpenConfig
- ONF Transport-API
- End-to-End Demo
- Conclusions

Network Disaggregation

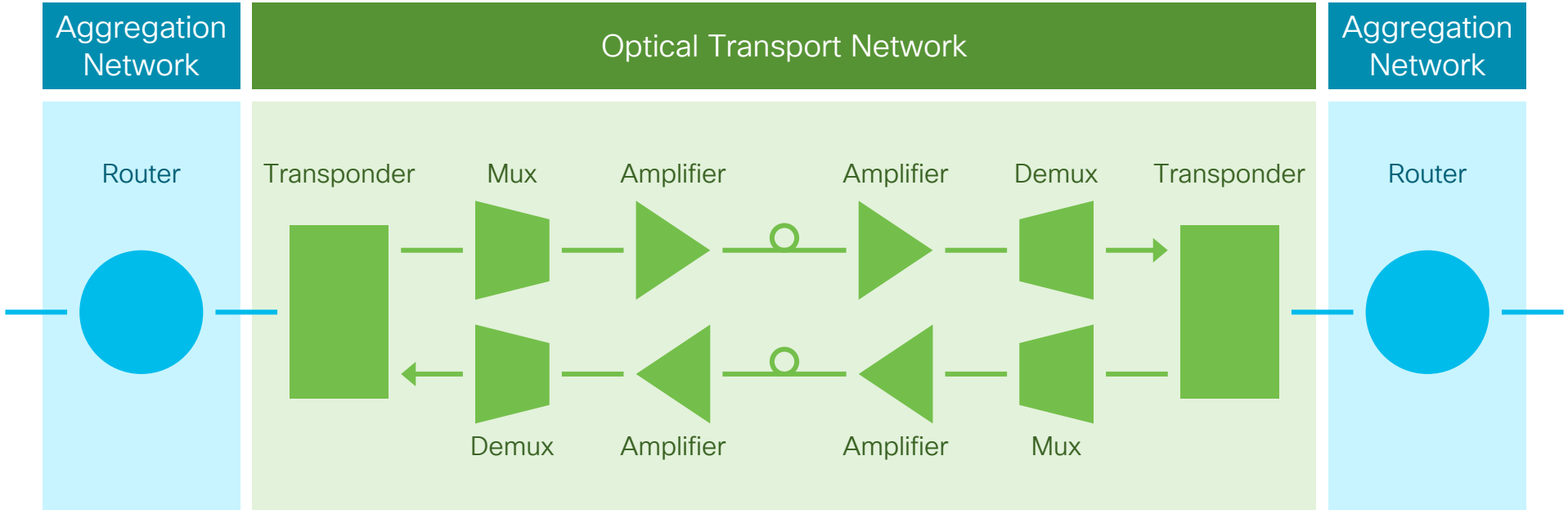
Network Disaggregation

- Flexible and modular architecture
- Reduced vendor lock-in
- Separation of the control plane from the data plane
- Partial versus full disaggregation

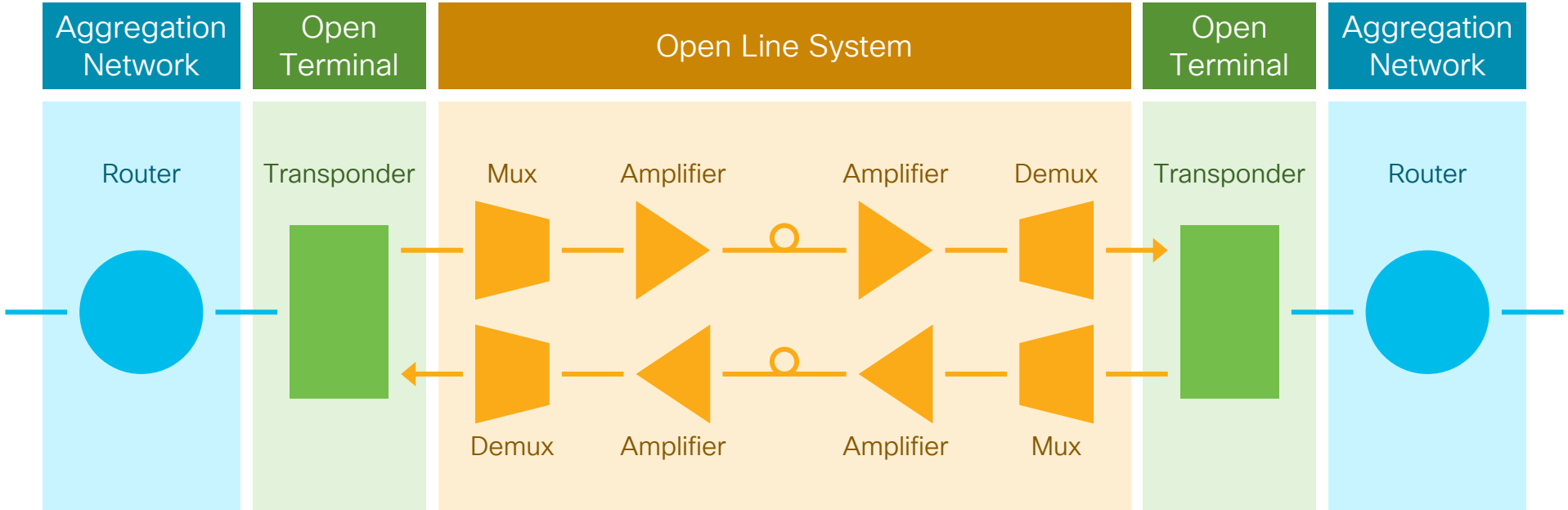
Network Disaggregation



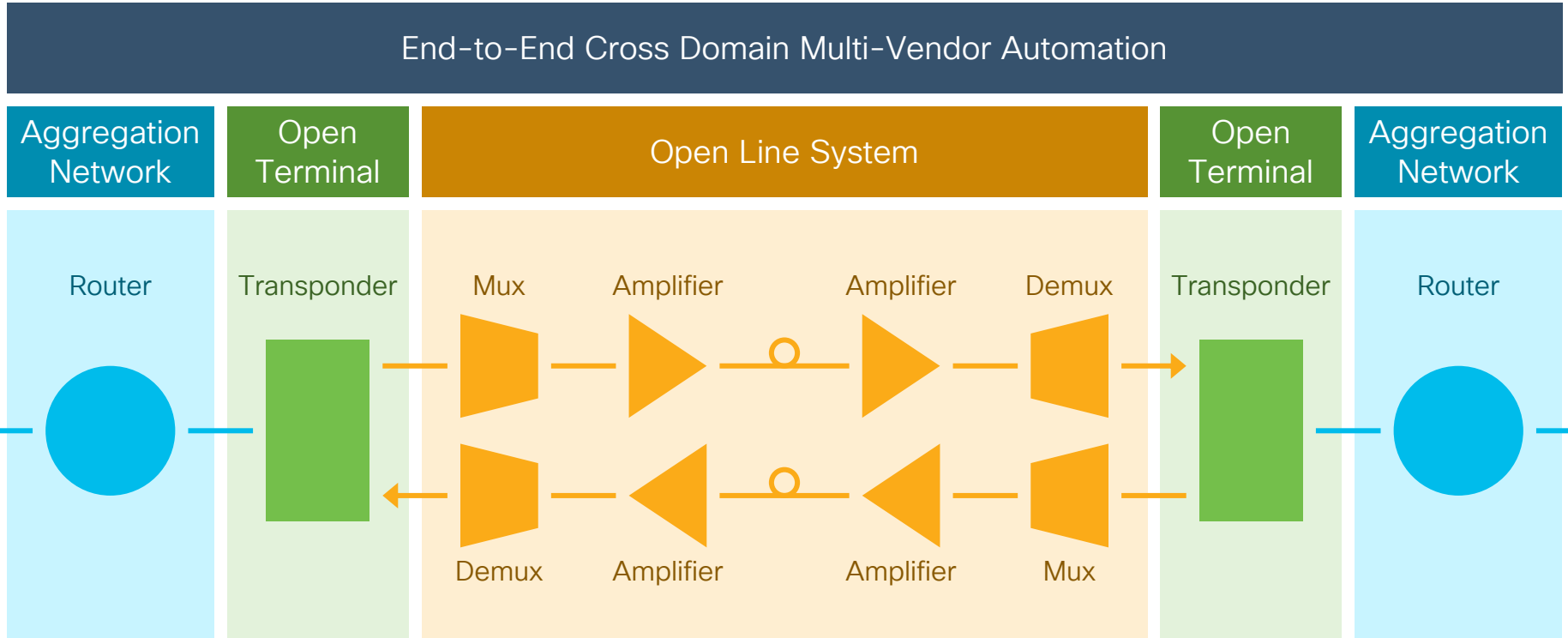
Network Disaggregation



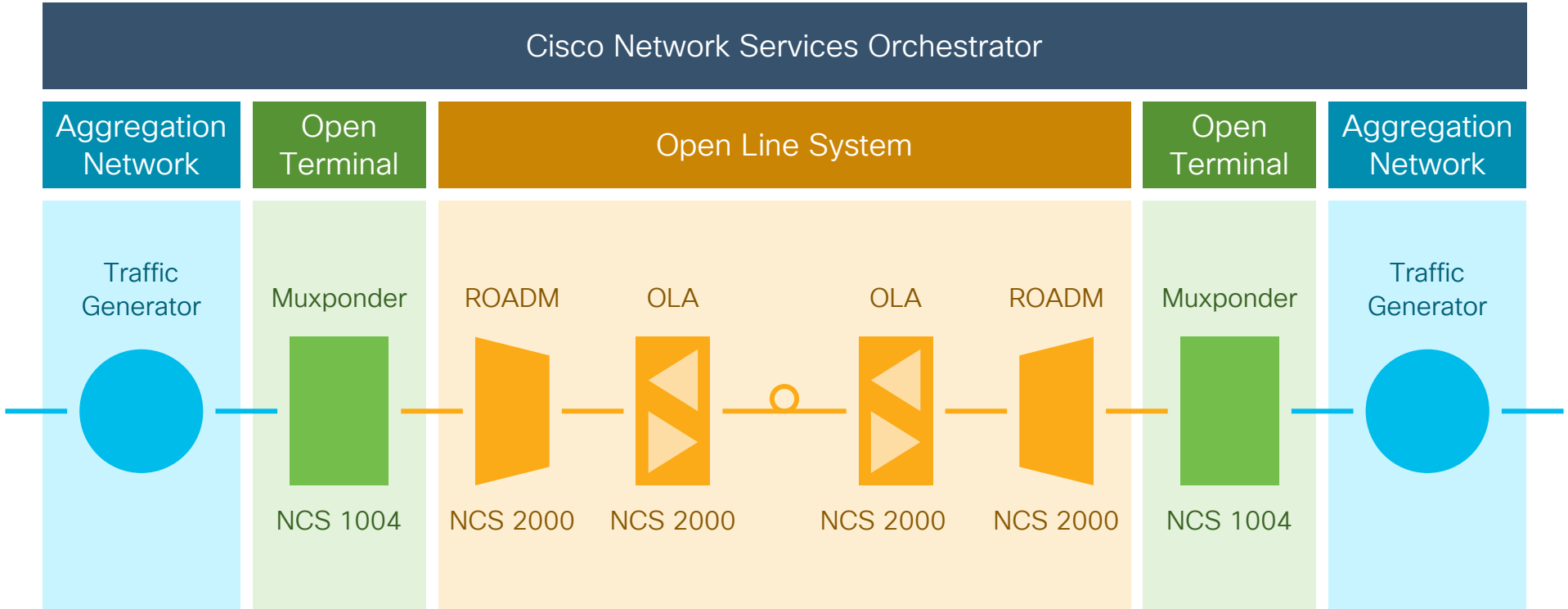
Network Disaggregation



Network Disaggregation



Network Disaggregation



OIF Transport SDN Interop

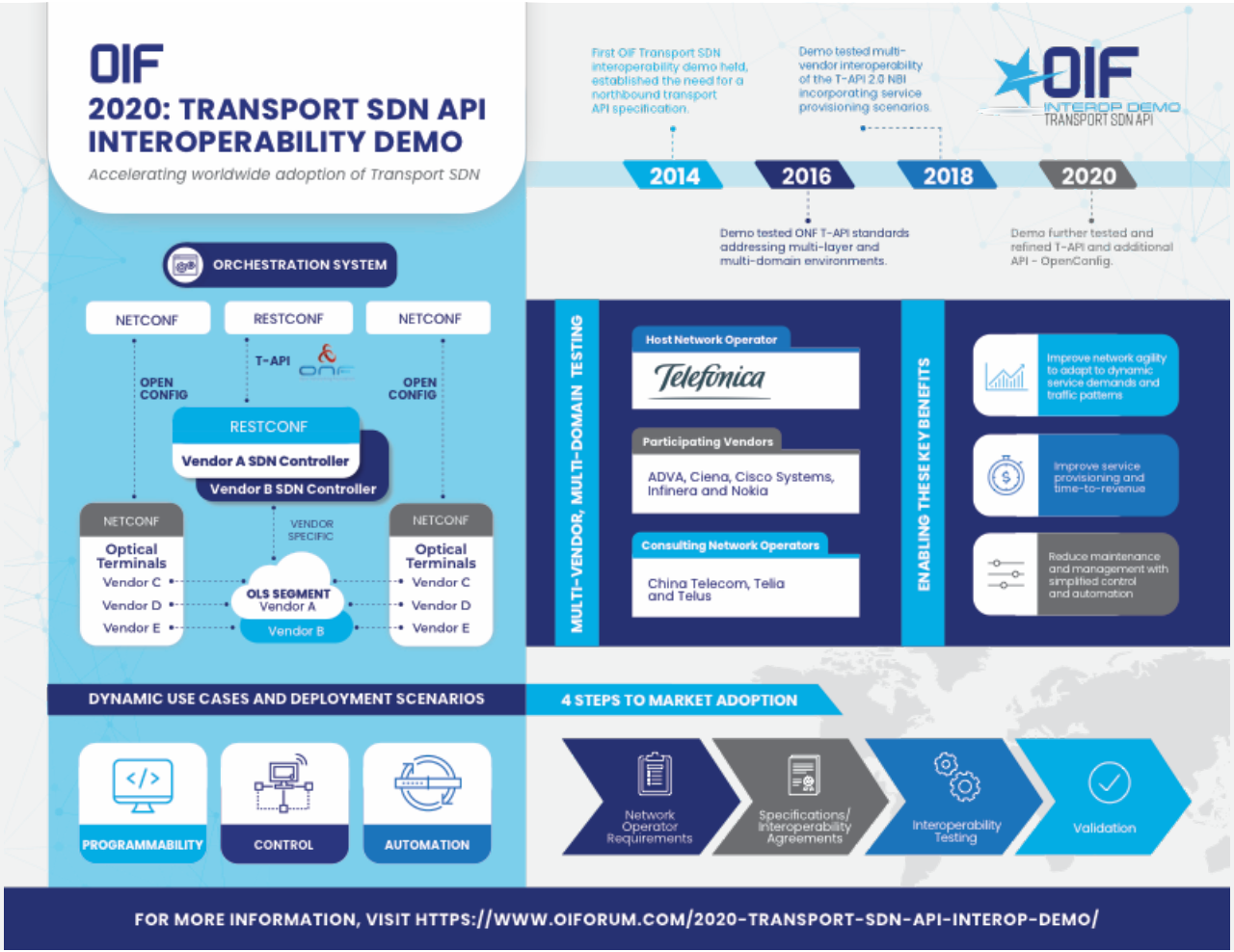
cisco Live!

OIF Transport SDN Interop

- Programmability, control, and automation
- Multi-vendor interoperability of Layer 0 OTN and Layer 1 OTN
- Open, standardized APIs
  - Open Networking Foundation (ONF) Transport-API (T-API)
  - OpenConfig

OIF Transport SDN Interop

5	10	21	29	31
system vendors	weeks of testing	vendor integrations	T-API use cases	OpenConfig use cases



OIF Transport SDN Interop Conclusions

- Good coverage of both T-API and OpenConfig use cases across vendors
- Adoption of T-API reference implementation
  - T-API models implemented by all vendors
  - SSE streaming for notifications widespread across implementations
  - Some RESTCONF / YANG compliance identified
- Good level of compliance to OpenConfig models
  - NETCONF widely supported across the industry with gNMI common for streaming telemetry

Cisco NSO

cisco Live!

Hello NSO!

170+
Devices, platforms and OSes supported

All top 10 service providers use NSO in production

200
Customers

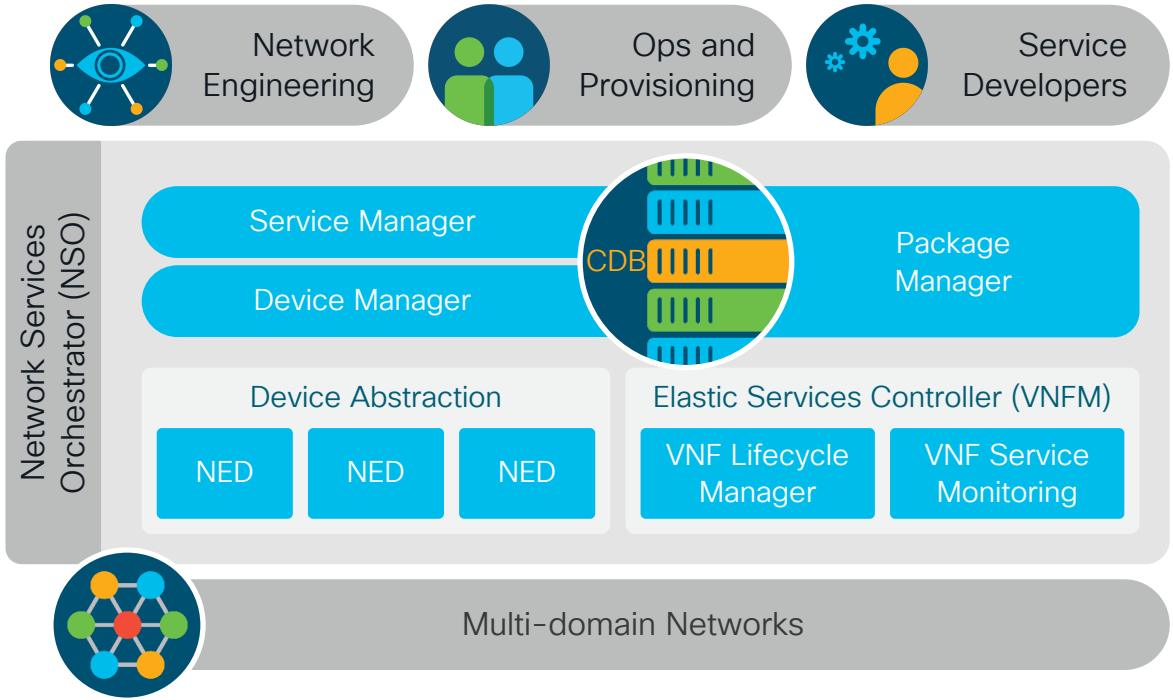
30+ Cisco products/offers using NSO or ConfD

5x
Post-acquisition growth in 3rd-party support

Rapid growth in large enterprises (financial services, healthcare, public sector)

NSO Key Features

NSO Architecture



- Strict YANG model driven, end-to-end service lifecycle management
- Only create case needs to be defined
- Seamless integration with existing and future OSS/BSS environment
- Loosely-coupled and modular architecture leveraging open APIs and standard protocols
- NEDs abstract complex device logic and error handling

The Industry's Broadest Multi-Vendor Support

Over 170 Supported NEDs – Customization Available

Network Programmability with YANG

Yet Another Next Generation (RFC 6020 and 7950)

A structured, well-defined representation of config and operational data types.

Providing a programmable network interface.

Decoupled from transport, protocol and encoding.

Wide standards support and open source tooling.

ONF Transport-API

cisco Live!

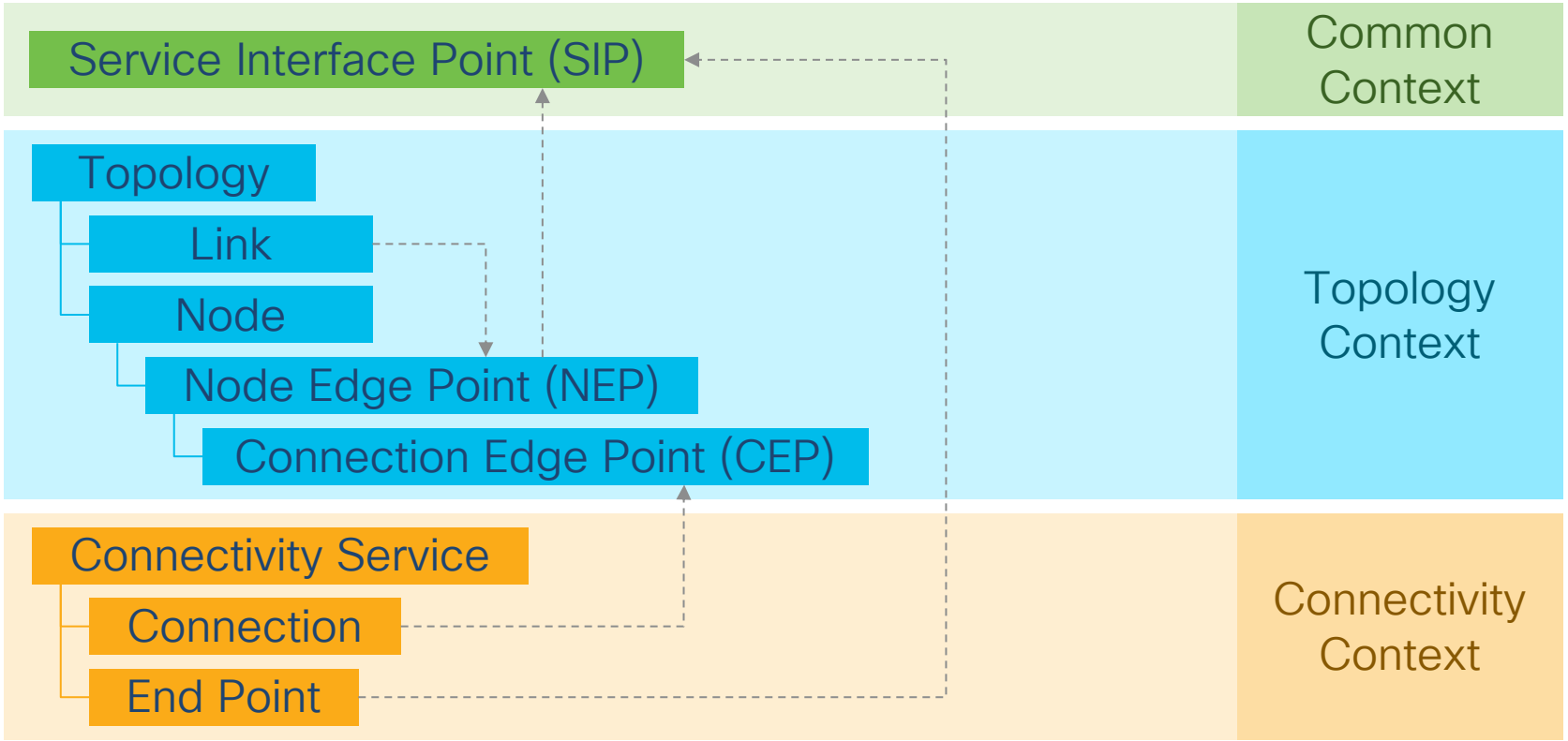
ONF Transport-API

- Standardized NBI for an SDN optical domain controller
  - Configuration and service provisioning
  - Models network topology and physical equipment
  - OAM monitoring and event notification streams
- RESTCONF / YANG
  - Query filtering (depth, fields, etc...)
  - JSON encoding
  - Notifications [ietf-restconf-monitoring] through SSE or WebSockets

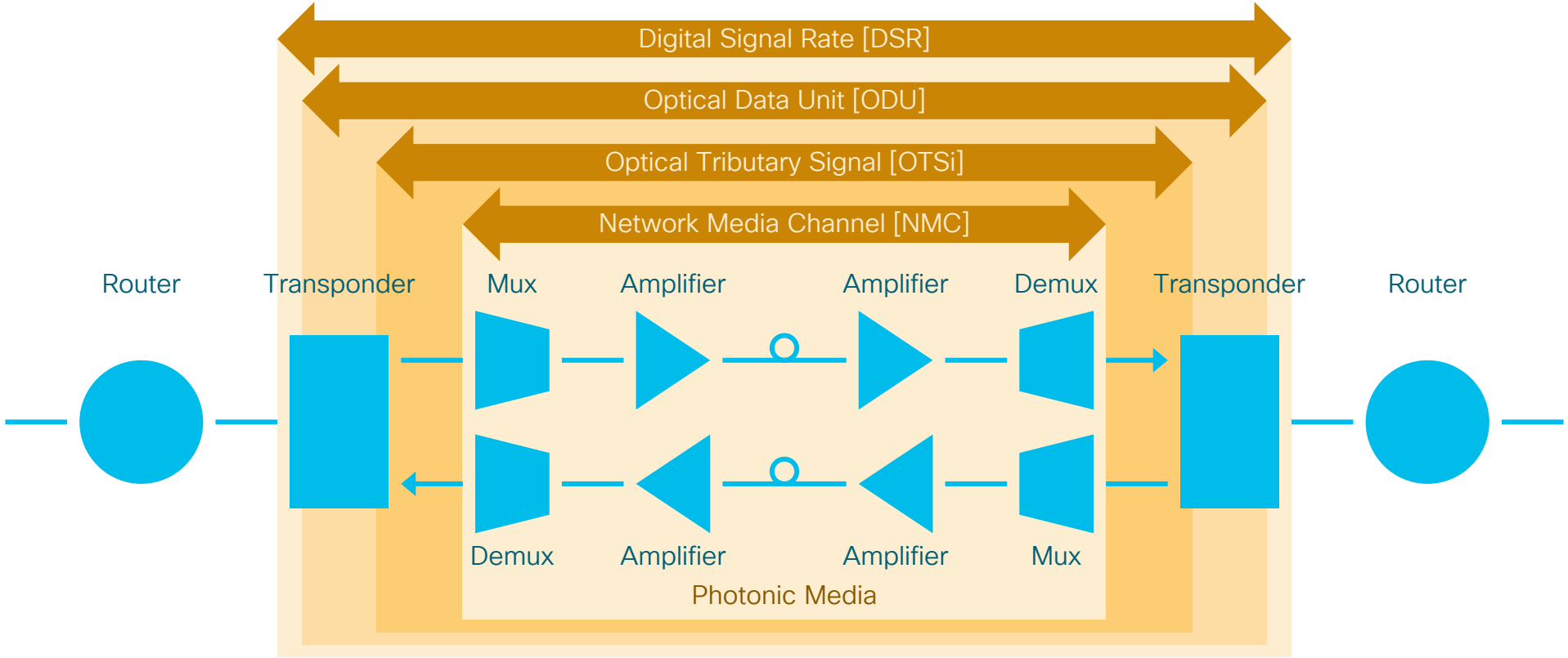
ONF Transport-API Functions

Topology Service	network topology, resource availability, and status
Connectivity Service	creation, modification, and deletion of connectivity services between service endpoints, with specified path constraints
Inventory Service	relationship of logical network objects and their physical location in, for example, chassis, slot, and port
OAM Services	instantiate OAM monitoring points and control fault and performance monitoring for network troubleshooting
Notification Service	subscription to autonomous or on-demand information about network events and monitoring data
Other	network virtualization/slicing and path computation services

ONF Transport-API Model



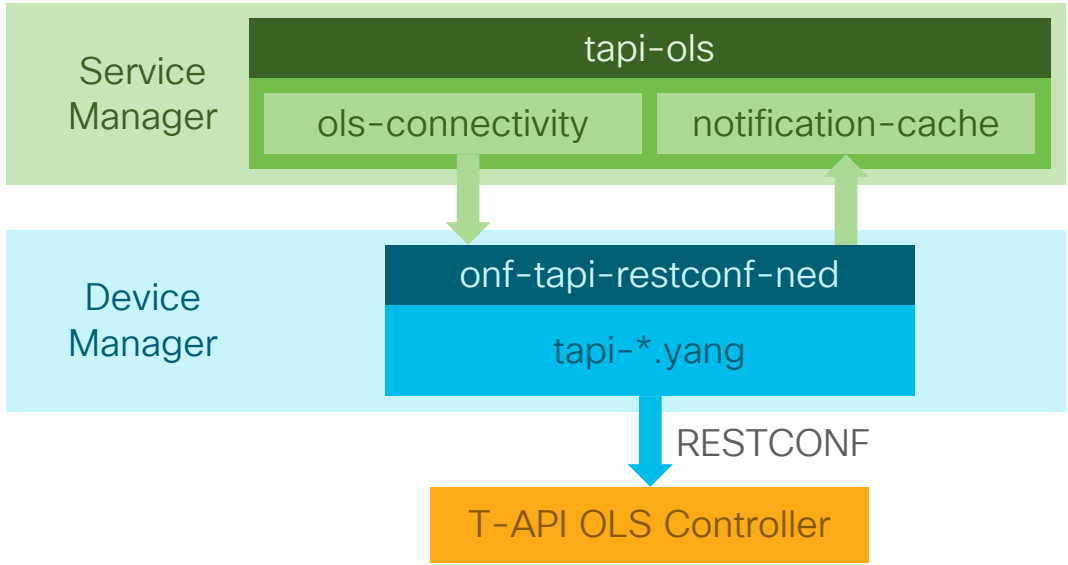
ONF Transport-API Layers



ONF Transport-API Observations

- Complex model
  - Many logical and physical elements modelled, all identified by UUIDs
- Context contains entire network, not just single device
  - GET requests can return large amounts of data
  - Only a subset of URLs may be supported
- Most of the YANG models use operational (config false) nodes
- No standard authentication mechanism
- Provisioning requests may be synchronous or asynchronous
  - Can make error handling difficult

NSO Package Architecture

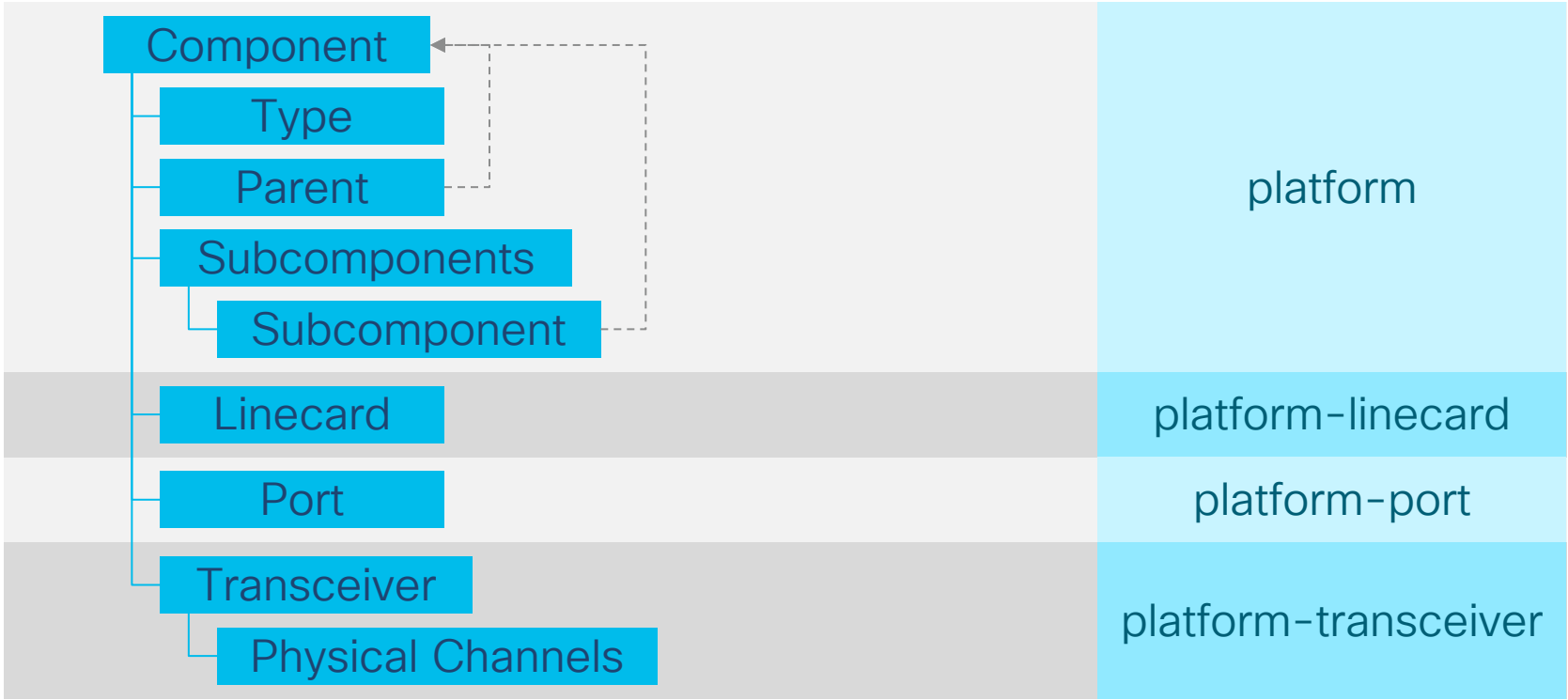


OpenConfig

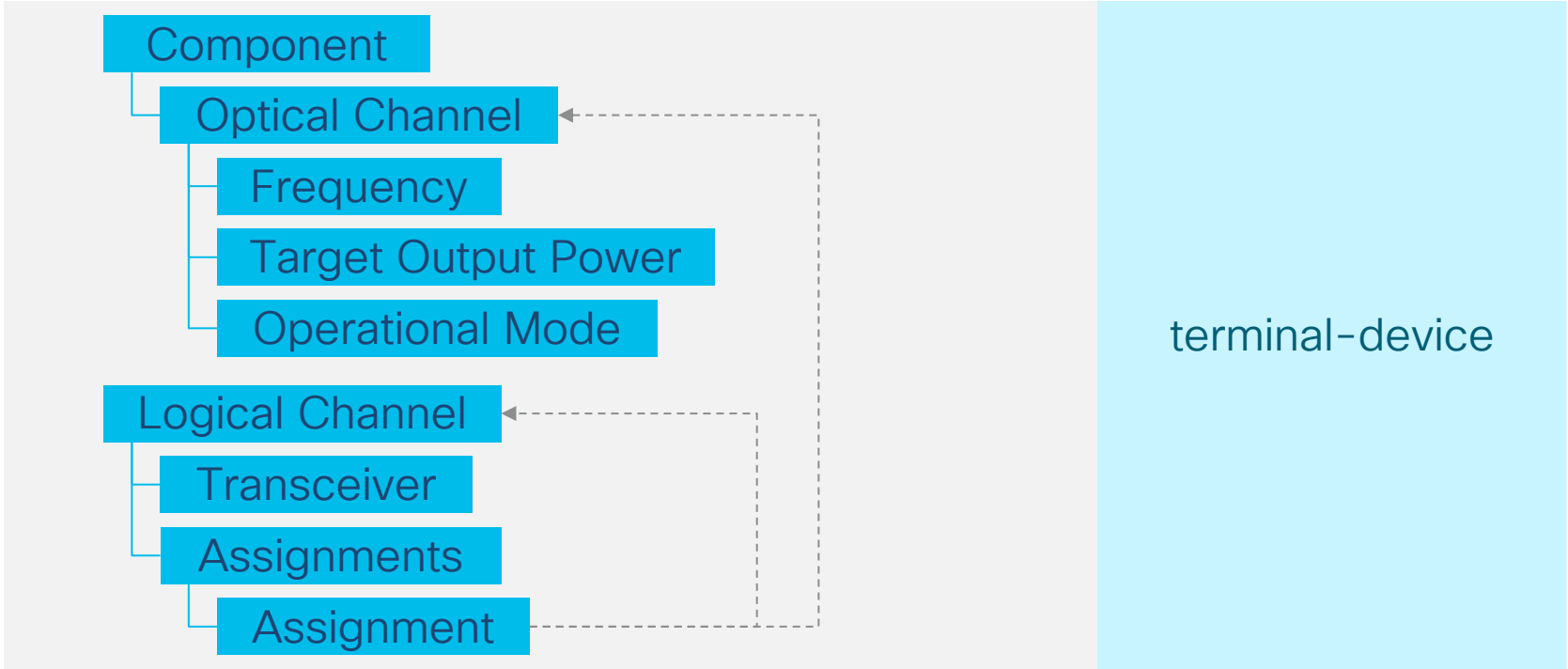
OpenConfig

- Set of common data models for device configuration and telemetry
- NETCONF / YANG
- Informal group of operators with the aim to develop programmatic interfaces for managing networks in a vendor-neutral way
  - Not a standards body
- Large number of YANG models supporting many device features
  - Including Platform and Optical Transport modules
- Emphasis on operational state data using config and state containers in every sub-tree to explicitly distinguish the two

OpenConfig Platform Model



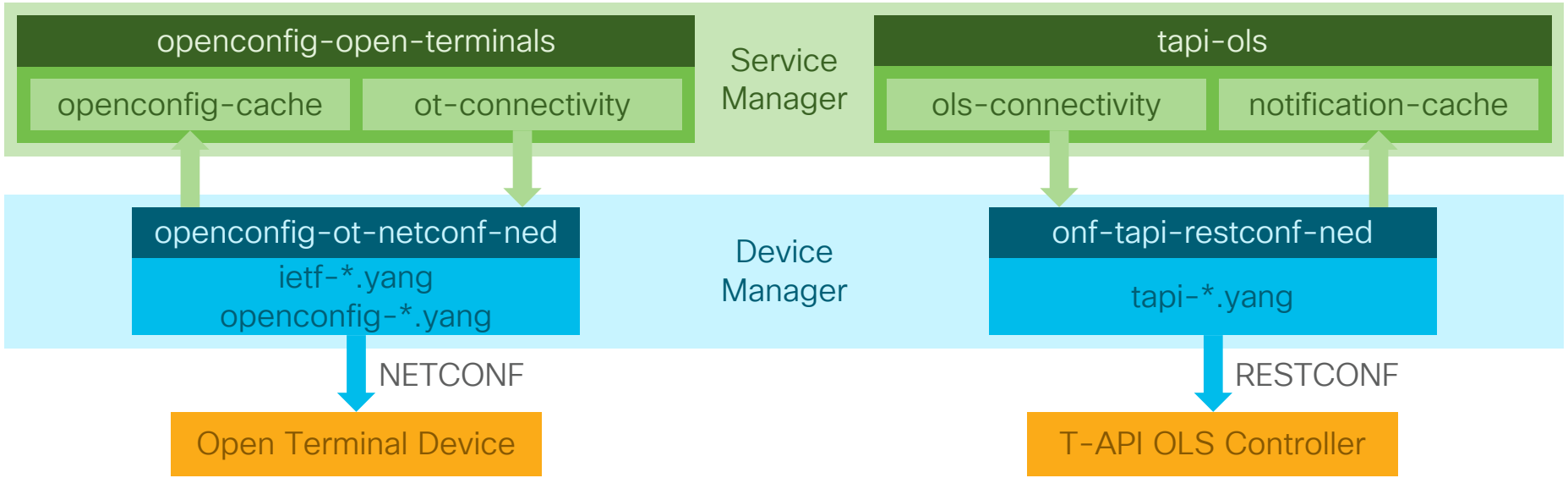
OpenConfig Terminal Device Model



OpenConfig Observations

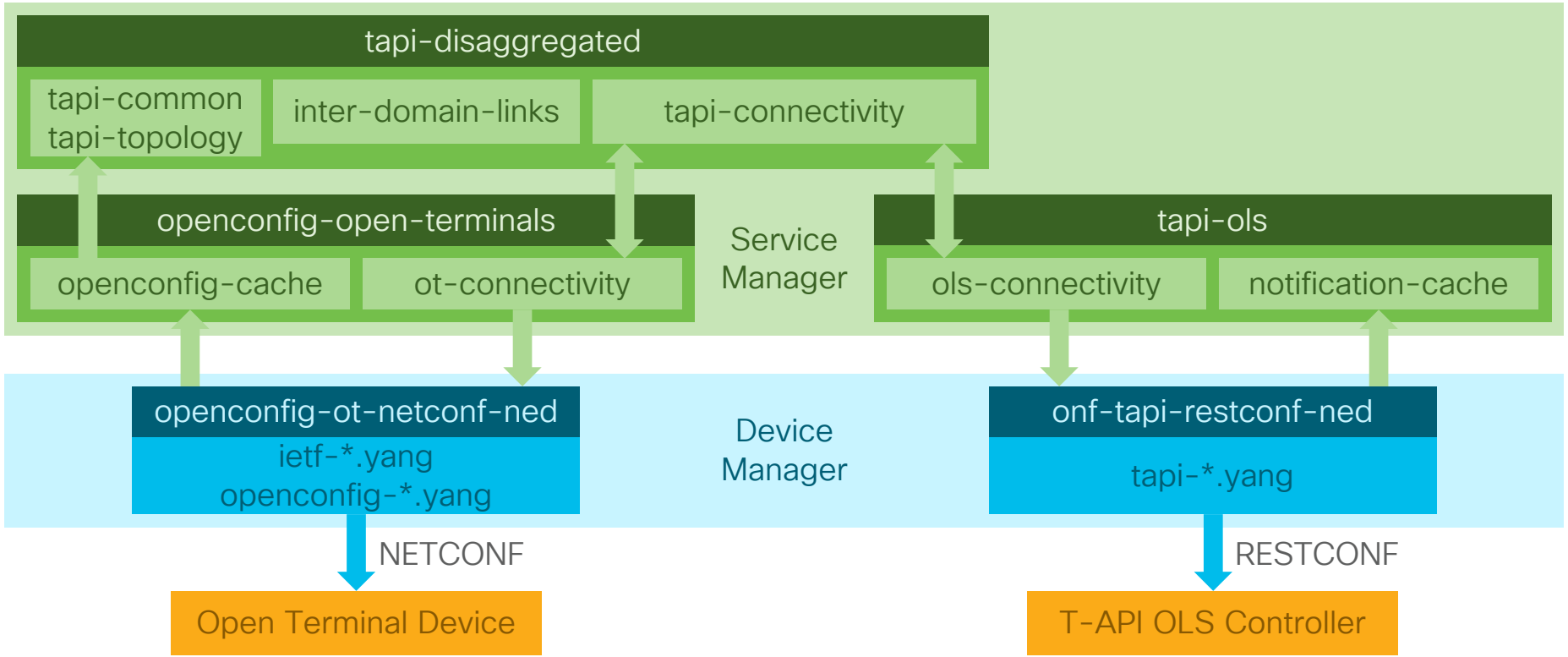
- OpenConfig models a single device (unlike T-API)
- Inventory containment relationship not enforced by YANG model
- No standard naming convention for components
- Requires config data to be populated for components which may not have any configuration

NSO Package Architecture

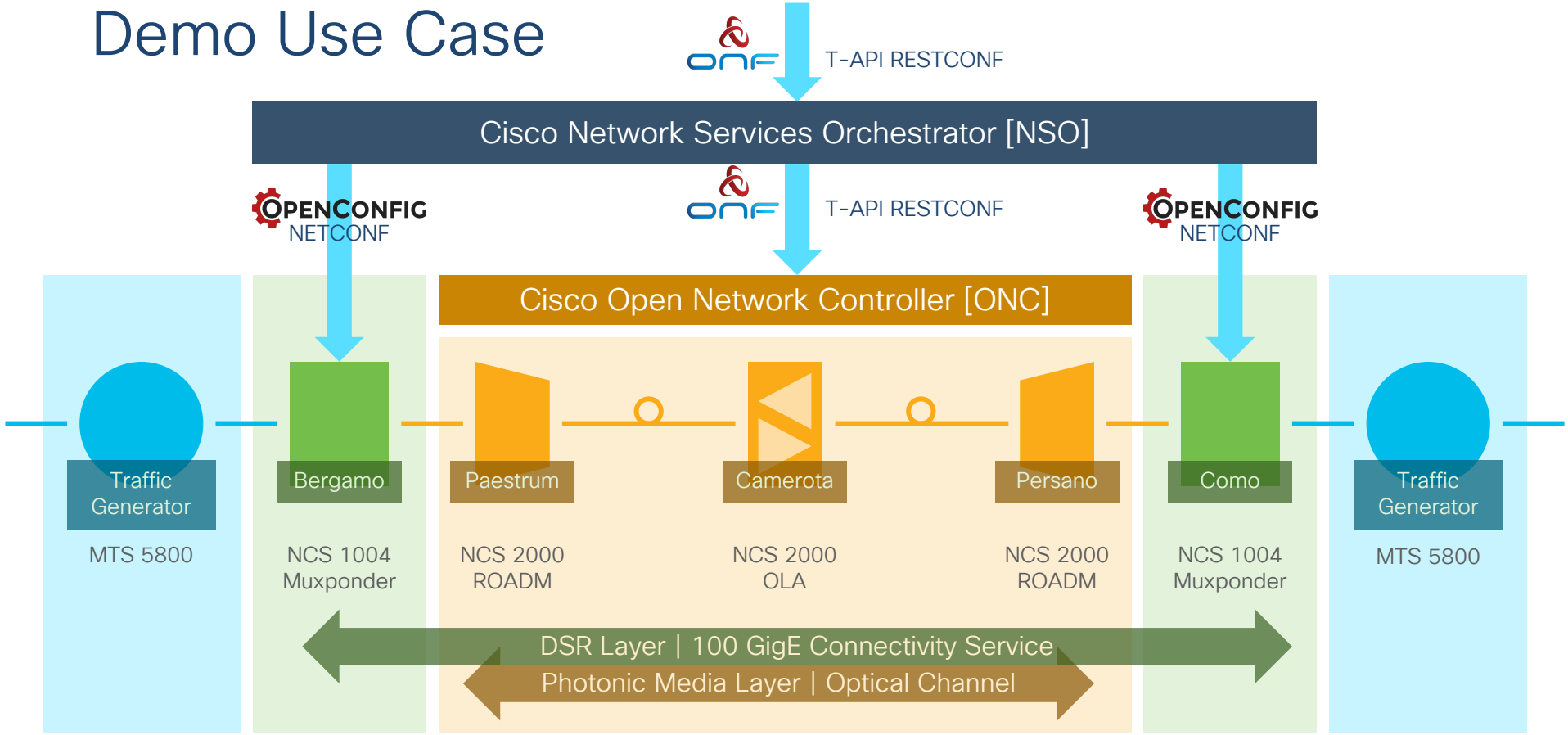


End-to-End Demo

NSO Package Architecture



Demo Use Case



Conclusions

- Very feasible to automate end-to-end services across partially disaggregated optical networks using T-API and OpenConfig
  - Some work is required at the automation layer to use the APIs together
- T-API is a comprehensive but complex API
  - Some workarounds are required for different vendor implementations
- OpenConfig is well supported but has YANG compliance issues
  - More features are supported through device native CLI / APIs

More Information

- NSO on DevNet and NSO Developer Hub

  https://developer.cisco.com/site/nso/

  https://community.cisco.com/t5/nso-developer-hub/ct-p/5672j-dev-nso

- OIF Transport SDN Interop

  https://www.oiforum.com/technical-work/2020-oif-transport-sdn-api-interoperability-demo/

Recommended sessions

- BRKOPT-1003: Open DWDM Systems and Use Cases
- BRKOPT-1004: Building Faster Networks with Silicon Photonics and Digital Coherent Optics
- BRKOPT-2007: Managing Your Optical Network Using Open APIs and Cisco NSO
- BRKOPT-2010: Routed Optical Networking Solution
- BRKOPT-2011: Cisco 400G Optics Applications
- BRKOPT-2012: DCI to Subsea Multi Haul Optical Transport
- BRKSPG-2669: Optimize with Routed Optical Networking

The bridge to possible

Thank you


cisco Live!
TURN
IT
UP
#CiscoLive