

Solution Brief

Open ROADM

Delivering optical network flexibility with industry specification compliance



Solution Benefits

- Open ROADM MSA compliance
- Freedom of vendor and element choice
- Pay-as-you-go financial flexibility
- Innovation acceleration

Functional Elements

This solution complies with Open ROADM MSA 1.2.

ROADM Node

- 1 FINITY L100 series blades, release 3.2.3
- 1 FINITY C201 Communications Integrator blade, release 3.2.3

Transponder Node

- 1 FINITY T300 Transport blade, release 1.2.4
- 1 FINITY C202 Communications Integrator blade, release 1.2.4

SDN Controller

- Virtuora Network Controller (NC), release 4.3.1

Introduction

Since the initial deployments in the early 2000s, ROADM networks have generally consisted of individual sets of tightly coupled, proprietary hardware and software supplied by a single vendor. Consequently, developing the design, functionality and architecture of ROADM networks has been in the hands of individual vendors rather than as a result of industry collaboration and mutually agreed standards.

Disadvantages of Proprietary ROADM Architectures for Operators

ROADM networks vary considerably from one vendor to another, so introducing a new vendor into an existing network requires significant cost and effort. Network operators become “locked-in” to specific vendors, which quickly reduces flexibility and interoperability that competition from additional vendors would have brought to the table.

An additional limiting factor is that service providers are “tied” to their chosen vendor’s innovation velocity. Promising new technologies may be introduced only to be “held captive” by propriety systems that lack the agility or interoperability to benefit from them.

Disadvantages of Proprietary ROADM Architectures for Customers

The widespread vendor lock-in phenomenon has significant consequences for customers as well as service providers. Because innovation is inhibited in proprietary networks, customers lose out in terms of missed opportunities for gains such as higher quality, greater reliability, higher bandwidth, reduced costs or flexible service offerings. Other “missed” innovations might speed service activation, improve responsiveness to outages, or offer subscribers the ability to self-select and configure their own services.

Multivendor Networks and their Challenges

What might seem like the obvious remedy—multivendor networks—brings its own operational challenges. Getting closed networks to “talk” to each other and reliably exchange traffic is inherently tricky and expensive. End-to-end services must be addressed by the vendor segment of the network and manually “stitched” together. A patchwork arrangement of this nature requires multiple vendor-specific management systems and, all too often, results in “swivel chair” operations, provisioning and management. What’s needed is a different strategy focused on open standards and open interfaces, with much less reliance on closed, proprietary technologies and systems.

Open ROADM Design and Technical Scope

The Open ROADM Project: a Collaborative Initiative

The Open ROADM initiative and Multi-Source Agreement (MSA) brought together multiple vendors and network operators to solve these issues and create an agreed approach to building networks that are scalable, cost-effective and flexible. Fujitsu has been a key contributing member since the project's inception. You can find more information at the Open ROADM project website, openroadm.org.

The Open ROADM MSA defines interoperability specifications for ROADM networks, including control and management. Through collaboration and co-creation, the MSA community developed a set of specifications to enable the industry's first multivendor optical network demonstration.

Areas Addressed in Open ROADM MSA 1.2

Release 1.2 of the Open ROADM MSA addressed three key areas:

- API specifications for management and control
- CD-ROADM specification for how the ROADM components interact
- Multi-wave specification for transponders, including mapping and error control

The following interoperability aspects are also addressed:

- Disaggregated core architecture for photonics, transponder, and pluggable optical modules
- Optical interoperability among photonics, transponders and pluggable optics
- Abstraction of network complexity with integrated YANG models at device, network and service layers
- Best-of-breed hardware and software solutions
- Simplified vendor integration through standardized YANG models
- Predefined interface specifications for increased interoperability
- Multivendor network solutions

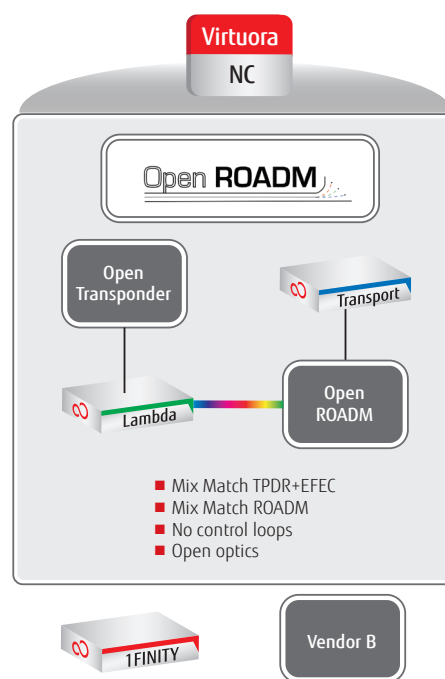
Open ROADM Devices

The Open ROADM MSA does not specify the physical design of Open ROADM devices, but it does define the following functional design:

- A ROADM capable of providing colorless and directionless add/drop functionality
- A transponder capable of mapping a single 100 GbE or OTU4 client signal into a 100G OTU4 DWDM signal for transport across Open ROADM infrastructure
- Common NETCONF/YANG APIs and single/multiwave optical interfaces on both transponder and ROADM
- Standards-based pluggable optics for the transponder
- YANG data model for abstracting the management, control and provisioning of multivendor ROADM and transponder devices
- An Open ROADM controller that controls the ROADM and provides device, network and service APIs to northbound OSS systems
- Open interfaces that define the optical specifications between ROADMs and transponders to enable interoperability

The Fujitsu Open ROADM Solution

The Fujitsu Open ROADM solution is specifically developed to meet the standards set forth by the MSA community. The solution brings together the 1FINITY™ disaggregated optical networking platforms; the Virtuora® suite of SDN/NFV software tools and applications; and expert multivendor integration services. The integrated solution was used to demonstrate the industry's first Open ROADM multivendor interoperability in collaboration with another vendor.



Fujitsu Open ROADM solution architecture

1FINITY Hardware

Fujitsu 1FINITY optical networking blades offer an architecturally flexible, disaggregated design together with APIs and software based on open-source standards. These platforms seamlessly deploy into an open environment

For CD ROADM functionality up to four degrees, the 1FINITY L100 Series blades provide a twin 1 × 9 WSS ROADM-on-a-blade and an optical muxponder with dual 4 × 16 add/drop plug-in units. The ROADM interfaces with the 1FINITY T300 Transport blade, a 10 × 100 GbE/OTU4 client transponder optimized for 100G/200G metro applications.

Management is via 1FINITY C201 and C202 Communications Integrator blades with the Fujitsu Rack Manager software tool, which provides a single management interface for the multiple blades in an Open ROADM node. Our open APIs extend management to a third-party optical Time-Domain Reflectometer (OTDR) supplied by EXFO, Inc.

Driving Innovation and Flexibility in Metro Networks

Virtuora Software

Using Virtuora Network Controller (NC), Fujitsu Open ROADM solutions support a multivendor environment for service activation, alarm management, performance monitoring, and topology discovery. Virtuora NC is an SDN network controller that combines open RESTFUL APIs with standard NETCONF interfaces, and uses YANG-based data models to deliver 100G services over the Open ROADM network.

Fujitsu Integration Services

The Fujitsu Integration Services team works as a trusted partner to help operators meet the challenges of deploying an Open ROADM network. Our expert project managers and engineers ensure efficient, timely communication and coordination with vendors, ensure the project is planned and executed on time, help minimize financial and other risks, and resolve issues that arise.

Network integration services include:

- Consulting
- Design and planning
- Systems integration
- Installation, test and turn-up
- Maintenance and support

Determining the Best Implementation Plan

Network providers can introduce a fully Open ROADM network, or variations tailored to their network, using the hardware and SDN controller from the Fujitsu solution. Our approach combines industry compliance with flexibility to define the level of open solution desired. By combining the blades needed to meet network requirements, including equipment from different vendors, and by leveraging the commonality of the APIs and management functions, it is possible to realize the operational efficiencies of provisioning across multiple vendors in an Open ROADM environment.

With the modular disaggregated approach in building networks and the elimination of vendor lock-in you can implement equipment at least one generation more advanced than traditional converged deployments.

Conclusion

Service providers need solutions for modular, scalable networks that offer both freedom of choice and pay-as-you-grow financial flexibility. These goals can be achieved via the Open ROADM MSA's vision of an open architecture and multivendor environment. This environment lets operators select the best product for their requirements while ensuring operational efficiency when combining equipment and software from multiple vendors.

The goal of the Fujitsu Open ROADM solution is to drive innovation, multivendor capabilities, and increased flexibility in metro networks. The solution provides a field-proven implementation of optical layer flexibility with software control that is fully-compliant with the Open ROADM MSA specification. The open, modular functionality of the Fujitsu 1FINITY and Virtuora platforms enable network operators to be more interoperable, innovative and ultimately, more competitive.

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