FUJITSU

Application Note

Adding Capacity to FLASHWAVE® 9500 Networks

An evolutionary approach to network growth and migration using the 1FINITY™ platform

Application Benefits

- Higher density
- Spectral efficiency
- Superior optical signal quality
- Better performance

Functional Elements

- FLASHWAVE 9500
- 1FINITY T200
- NETSMART 1500
- Virtuora

The process of migrating networks to an open, virtualized architecture involves a period of transition where existing and new technologies need to interoperate. Service providers are faced with the open question of how to preserve still-valuable existing equipment while preparing for disaggregated, cloud-friendly SDN/NFV networking.

Options for Meeting Capacity Demand on a FLASHWAVE 9500 Network

The typical way to increase FLASHWAVE 9500 network capacity would be to populate empty chassis slots with 100G units, such as the next-generation, slim 100G transponder (TDA2) or the 100G muxponder (TPE2). However, until now, if an installed FLASHWAVE 9500 had no remaining space for client-side drops, the only way to increase capacity would be to add another FLASHWAVE 9500 chassis.

1FINITY T200 Blade Offers Cost-Effective Expansion

With the introduction of the 1FINITY T200 and Release 9.4 of the FLASHWAVE 9500 Packet ONP, it is now possible to increase bandwidth per wavelength by adding independent transport blades to the FLASHWAVE 9500 network. The 1FINITY T200 is a 400G multi-modulation transponder that combines carrier-grade performance with simplified operations for metro to long-haul applications. The modular 1RU design of the T200 blade optimizes use of rack space and provides an open, simple and scalable architecture that easily accommodates rapid bandwidth growth.

Asset Preservation, Progressive Migration

Adding 1FINITY T200 blades not only prolongs the life and value of existing FLASHWAVE 9500 equipment, it can also form part of a progressive migration strategy. This approach reduces capital cost in comparison to the current options for increasing capacity. Additionally, this approach is a means to spread the cost of migration and promote adoption of SDN/NFV architecture. The 1FINITY T200 also confers additional benefits, since it supports multi-modulation up to 200G for long-haul or ultra-long haul transport, and delivers a density advantage over any option based on the FLASHWAVE 9500 platform.

FLASHWAVE 9500 Readiness and Requirements

In order to support this application of the 1FINITY platform, existing FLASHWAVE 9500 equipment must be upgraded to Release 9.4. Upgraded networks must meet the following connectivity or hardware requirements to support migration:

- 10G/100G DWDM network
- Dispersion compensation modules (DCM)
- Classic or multihaul ROADM WSS and amplifiers (but not both)

1FINITY T200 Transport Blade Highlights

- 400G transponder
- Multi-modulation (QPSK, 16QAM)
- 4 × 100 GbE CFP4 client ports
- 2 × network plug-in units (PIU)
- Metro and long-haul applications

Addressing Interoperability Requirements

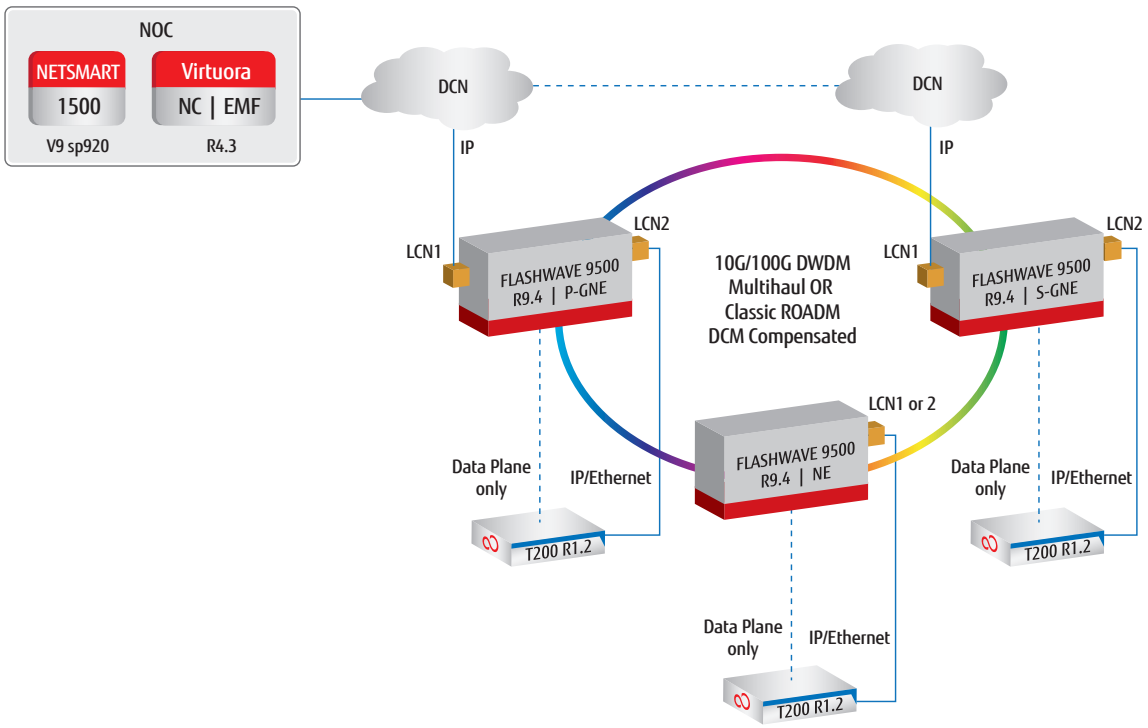
Platform Interoperability and Data Communications

Release 9.4 of the FLASHWAVE 9500 platform provides a bridge between the FLASHWAVE and 1FINITY platforms by introducing the following new software features for 1FINITY interoperability:

- **General Communications Channel (GCC0) with IP**
  As implemented on the FLASHWAVE 9500 OTN interfaces, GCC0 has traditionally supported the OSI protocol. Introducing the IPv6 protocol on the GCC0 supports communication between FLASHWAVE and 1FINITY platforms. The IP protocol is supported on both network and client interfaces on the GCC0.
- **Dual-stack communications interface (OSI/IP)**
  A large embedded base of FLASHWAVE 9500 units still supports OSI, while the 1FINITY platform uses IP (OSPF) for inter-nodal communication. Enabling both OSI and IP protocols on the ODCC, GCC0 and MVLAN facilities enables seamless management of all Fujitsu network elements that use current- and next-generation network management systems.
- **Local Communication Network 2 (LCN2) enablement**
  Enabling the LCN2 port provides LAN connectivity between FLASHWAVE and 1FINITY platforms in a non-top-of-rack switch environment. Additionally, the FLASHWAVE 9500 platform has the ability to advertise the Local Communication Network (LCN) port without running the OSPF protocol.
- **Network Area Translation (NAT) support**
  NAT provides the flexibility to reduce the number of IP addresses assigned to a network. With one-to-many mapping, NAT maps the private IP addresses of all devices to a single public IP address. NAT also provides the capability to segment IP addresses for internal traffic from IP addresses for external traffic (public IP). Three modes are supported: NAT44, NAT64 and NAT44PT.

Network Control and Management Software

While network management of the FLASHWAVE 9500 is accomplished using the Fujitsu NETSMART 1500 Network Management System, 1FINITY platforms are supported by virtualized management using an SDN controller such as Fujitsu Virtuora® NC. A combined FLASHWAVE 9500 and 1FINITY T200 network enables incremental roll-out of SDN programmability to existing rings, enabling you to leverage key network management elements and dynamic service provisioning for 1FINITY T200 while seamlessly maintaining legacy infrastructure.



Cost-effective capacity expansion with the 1FINITY T200 Transport blade

Build your Network Forward with the 1FINITY T200

Virtuora Network Management Platform Components

- Virtuora Network Controller
- Virtuora Network Management Suite
  - Element management
  - Fault correlation
  - Fault management
  - Performance management
  - Network analytics

The Benefits of 1FINITY T200

If a FLASHWAVE 9500 shelf is at capacity, migrating wavelengths to the T200 not only eliminates the capital expense associated with adding another 13RU converged platform shelf. This approach also enhances capacity up to 200G per wavelength. However, there are additional reasons to consider migrating to the 1FINITY T200 even if desired network capacity is 100G per wavelength:

- **Higher density**
  Supports 2 × 100G over 2 wavelengths (QPSK) or
  4 × 100G over 2 wavelengths (16QAM) in a 1RU shelf.
- **Spectral efficiency**
  Enables more spectrally efficient wavelengths with multiple modulation schemes for future migration.
- **Superior optical signal quality**
  Provides better chromatic dispersion and polarization mode dispersion tolerance, in addition to superior Optical Signal to Noise Ratio (OSNR).
- **Better performance**
  Offers non-linearity performance optimization and superior performance in long-haul applications

The Migration Path

Network migration is a complex process involving multiple phases occurring over time. This migration application of the 1FINITY T200 can immediately reduce transport cost per bit by increasing service density. The 1FINITY T200 also increases the amount of bandwidth on each wavelength. Overall, this combination of hardware and software enhances the value of the FLASHWAVE 9500 embedded base as well as facilitating ongoing migration to SDN/NFV architecture. Additional options for strategic migration will include:

- Scalable OTN switching
- ROADM interoperability
- In-line amplification
- Next-generation packet functionality

Fujitsu Network Communications, Inc.

2801 Telecom Parkway, Richardson, TX 75082
Tel: 888.362.7763

us.fujitsu.com/telecom

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