FUJITSU

Solution Brief
Data Center Interconnect

Connecting data centers with fully flexible and secure hyperscale optical transport

Introduction

Data center operators and cloud providers are continually looking for ways to cut cost per bit in response to massive growth in their network traffic. Fujitsu provides an optimized Data Center Interconnect (DCI) solution based on the 1FINITY™ portfolio of highly scalable, reliable hardware, software and services.

Traffic between data centers continues to grow exponentially, driven by ongoing increases in demand. New use cases enabled by 5G are on the horizon, such as autonomous vehicles, smart cities and The Internet of things; these are set to heat up bandwidth demand even further. Data center operators and Internet content providers must scale and upgrade their DCI networks while lowering cost per bit per km if they are to meet these demands and stay competitive.

The Fujitsu DCI solution has evolved to deliver greater flexibility and programmability at every level, delivering maximum functional and operational gains. Key requirements, such as higher density and data rates and better power efficiency, are now taken to extreme levels. Automation-enabling features such as streaming telemetry and zero-touch provisioning (ZTP) are "must-haves" for any DCI system, in addition to support for a variety of management interfaces. DCI networks must also provide the highest level of security in both operations and transmission.

Solution Benefits

The Fujitsu DCI solution enables hyperscale optical transport and is built around four key tenets:

- Flexibility across multiple dimensions
- Capacity to accommodate extreme data transport use cases
- Automation readiness and support
- Security of both the network infrastructure/operations and the data transported

Functional Elements

Transport nodes
- 1FINITY T600 Transport blade
- 1FINITY T400 Transport blade
- 1FINITY T100 Transport blade

CD ROADM nodes
- 1FINITY L100 Lambda ROADM-on-a-blade
- 1FINITY L110 Lambda channel add/drop blades
- 1FINITY L120 Lambda expansion WSS blade

Inline amplifier (ILA) nodes
- 1FINITY L200 Lambda ILA blade

DWDM nodes
- DWDM 48-Chanel 100 GHz multiplexer
- DWDM 64-Channel 75 GHz multiplexer
- DWDM 40-Channel 50 GHz multiplexer
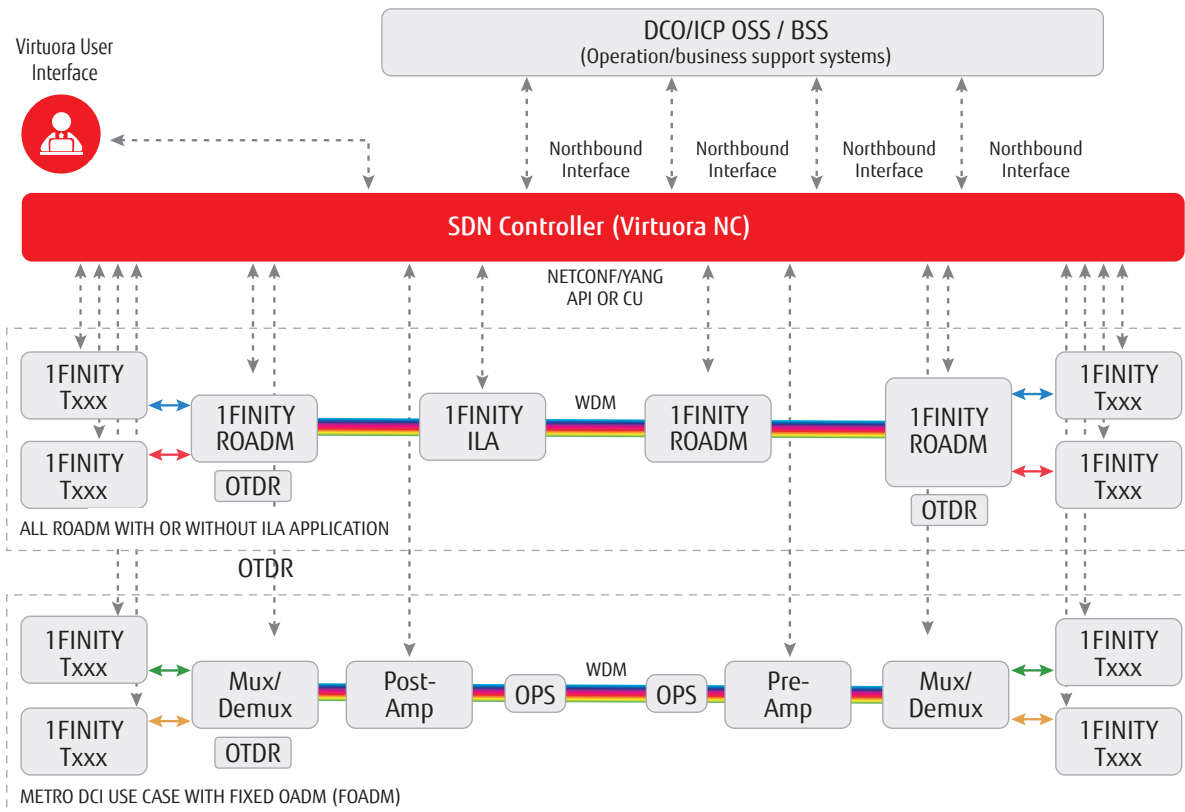- FLASHWAVE® 7120 C-band optical amplifier

Optical Time Domain Reflectometer (OTDR)

Optical Protection Switch (OPS)

SDN Controller
- Virtuora® Network Controller (NC)

A Complete Solution for Data Center Interconnect

Fujitsu 1FINITY DCI architecture

The Fujitsu Data Center Interconnect Solution

To address the totality of DCI needs, Fujitsu offers a complete multihaul solution. This solution incorporates a comprehensive suite of products and services specifically designed for data center operator (DCO) and Internet content provider (ICP) applications. The 1FINITY platform's fully disaggregated architecture means that each component can work with non-1FINITY systems. For example, Transport series blades can work with any open line system, and 1FINITY line systems can work with third-party transponders. Similarly, 1FINITY hardware can be managed with any SDN controller, especially in view of the variety of supported management interfaces.

1FINITY Optical Networking Platform

The Fujitsu 1FINITY platform family is a modular, blade-based physical architecture rather than a traditional converged, chassis-based design. Thus, various 1FINITY platforms can serve individualized functions in a DCI application:

1FINITY T600

- Provides 100 GbE, OTU4 and 400 GbE clients for 200G to 600G transmission per wavelength using innovative modulation schemes
- One transponder for multiple applications
- Supports Layer 1 encryption, LLDP snooping, and MAC-level statistics

1FINITY T100

- Provides 100 GbE clients for 100G and 200G transmission per

wavelength using DP-QPSK and 16-QAM respectively
- Supports Layer 1 encryption, LLDP snooping, and MAC-level statistics

1FINITY T400

- Performs Layer 1 aggregation of 10 GbE clients into 100 GbE, which can then be transmitted using the 1FINITY T100 or 1FINITY T600

1FINITY L100/110/120

- Performs flexible-spectrum multiplexing and DWDM ROADM functions to ensure growth potential via future services like 400G, 600G, and 1T
- Optical degrees can be added at any time, in-service if needed
- New services can be added without regard to optical infrastructure or shelf type
- Can be deployed as CD ROADM nodes that can be expanded incrementally up to four ROADM degrees and 128 add/drop channels

L200 Inline Amplifier

- Extends the distance between ROADM nodes via 35 dB spans

Optical Time Domain Reflectometer (OTDR)

- Integrates with the WDM line system to isolate fiber faults

Amplifier(s)

- Improves reach via pre- and post-amplification

Optical Protection Switch (OPS)

- Maintains system availability even in the event of fiber outage

Addressing the Totality of Data Center Networking Needs

Virtuora Software-Based Control for DCI Applications

Virtuora Network Controller (NC) provides SDN/NFV-based network management and service delivery. The system interacts directly with network devices through southbound interfaces using standard protocols, while operators and northbound software systems interact indirectly with the network through Virtuora NC's REST APIs.

Virtuora provides several functions to support DCI applications:

- Coordinating services between data centers
- Managing and requesting services between data centers
- Enabling dynamic allocation of services
- Managing physically distributed data centers as a single entity

Virtuora Software Products

- Virtuora Network Controller – An open-source framework for a collection of applications and interfaces, enabling control and management center of the DCI network
- Virtuora Design and Planning – Comprehensive design, planning and inventory solution that provides comprehensive reporting tools and multi-technology support
- Virtuora Network Management – Element, fault and performance management, together with network analytics to optimize service delivery in a multilayered network

Customizable Fujitsu Services

DCI solutions require specialist integration services to bring together a variety of hardware and software from multiple vendors. Data center operators and Internet content providers typically have extensive in-house IT expertise, but little in the way of optical expertise. Fujitsu can provide this optical expertise as a service, augmenting in-house staff with needed optical networking skills and eliminating the customer risk of hiring these resources.

Applications

Fujitsu's DCI solution supports multihaul DCI applications. For example, the 1FINITY T600 offers 200G–400G per wavelength modes on 75 GHz grid for metro/regional and long-haul applications over 1FINITY or an open-line system. The solution also supports 500G–600G modes on a 75 GHz grid for short-haul DCI to achieve the highest fiber spectral efficiency. The 1FINITY T100 can support 100G–200G modes on 50 GHz grid metro and long-haul applications.
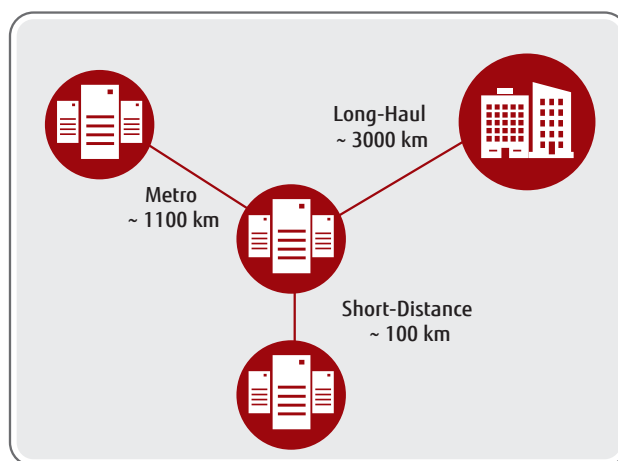
Multihaul DCI Applications
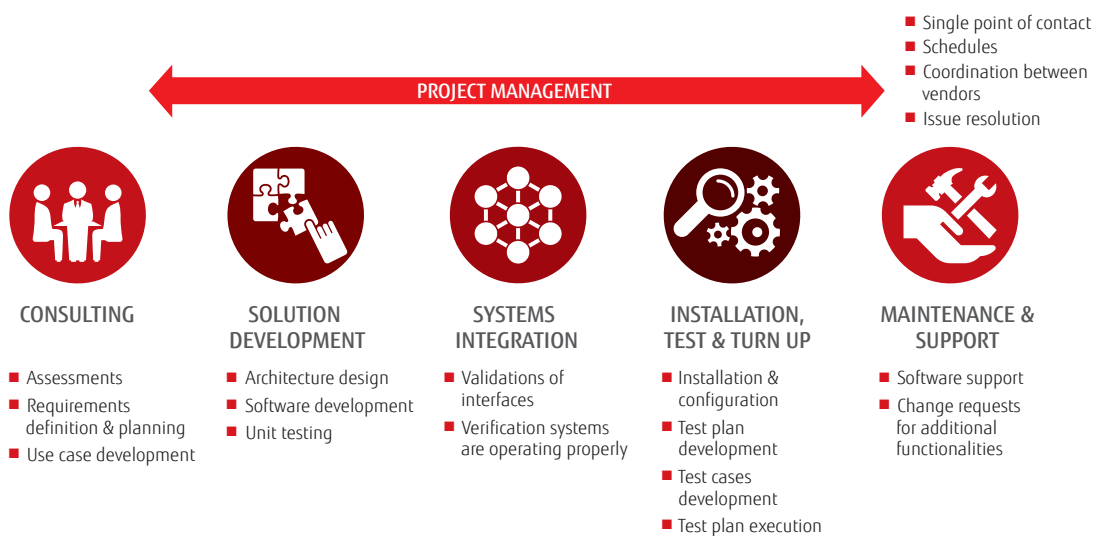
The Fujitsu Integration Services team delivers optical expertise throughout the network lifecycle

Significant Long-Term Cost Benefits

Solution Benefits

Flexibility

The Fujitsu DCI solution provides flexibility at every level, driving down total cost of ownership throughout the network lifecycle:

- Connectionless, directionless 4-degree and 8-degree flex-grid 1FINITY L100 ROADM and flexible-width FOADMs, including 40-channel 50 GHz and 64-channel 75 GHz multiplexers
- Flexible amplifier options
- Multiple transponders providing data rates ranging from 100G to 600G per wavelength
- Reach distances from short-reach DCI to metro/regional to long-haul, with options that fit into 50 and 75 GHz WDM channels
- Pay-as-you-grow "everything pluggable" architecture for reduced up-front cost and maintenance overhead
- Common look and feel across all 1FINITY blades, via full-featured Fujitsu System Software (FSS2), enabling consistent and simplified management, which helps lower integration and operations costs
- Open-source technologies, such as YANG modeling and standardized management application programming interfaces (APIs), support operational flexibility via multiple management interfaces and YANG models and simplify integration and operations
- For total functional flexibility, the T600 transponder serves all DCI applications with the optimal balance of capacity and reach

Capacity

From an operator's perspective, achieving the highest possible transport capacity is paramount. The Fujitsu DCI solution dramatically increases bandwidth, particularly via the T600 platform's superior support for both C and L bands, which practically doubles available bandwidth:

- The 1FINITY T600 transponder supports both C and L bands with comparable OSNR characteristics at all data rates from 200 to 600G per carrier, packing up to 76.8 Tb onto a single fiber while delivering stable optical performance in both bands
- In addition to higher line-side capacity, the T600 extends client-side capacity by providing 100G client ports now and leaving the option available to upgrade to 400G and OTU4 in upcoming releases

Automation

Network automation is critical to lowering operational costs. Fujitsu 1FINITY blades are ready to support automation, starting with the new FSS2 system software. This system offers the open management interfaces and tools needed to implement the level of automation needed for DCI applications:

- FSS2's YANG model supports multiple open initiatives including OpenConfig, OpenROADM and IETF

- Comprehensive interfaces including familiar ones such as CLI, Web GUIs and SNMP, as well as newer ones better suited for machine-to-machine communications, such as RESTful APIs, NETCONF and gNMI.
- FSS2 can automate various tasks by hosting third-party scripts or applications on the network element (NE), so that users can run custom code or "agents" locally.
- Zero-touch provisioning and streaming telemetry enables auto-configuration and systematic data collection
- The Fujitsu Virtuora Network Control solution enables end-to-end operational automation, in addition to service orchestration and network programmability

Security

As the Internet of things becomes the "Internet of everything," network and security are becoming inseparable. Fujitsu 1FINITY transport blades are fully secure on the data, control and management planes. By securing all three planes of optical transport networks, these blades provide a solid basis for the most secure communications.

1FINITY blades not only transport the highest capacity per fiber in the industry, they do so securely and transparently using Layer 1 encryption with ultralow latency and zero bandwidth overhead. The blades are also equipped with security on the management interfaces, applications, and physical system, meeting Level 2 and even some Level 3 requirements of the US government's Federal Information Processing Standard (FIPS) 140-2, a standard used to approve cryptographic modules for secure applications.

Conclusion

By choosing a Fujitsu 1FINITY DCI solution to provide connections between data centers or between a data center and an Internet exchange provider, you can achieve significant long-term economic benefits. 1FINITY DCI solutions break through traffic bottlenecks while dramatically increasing density and reducing power usage at the optical, transponder and Ethernet layers. By deploying a DCI solution based on 1FINITY, you can reduce both capital and operational costs, cut time to market for new services, and ultimately merge your data centers into a single managed network.

Fujitsu Network Communications, Inc.

2801 Telecom Parkway, Richardson, TX 75082
Tel: 888.362.7763

us.fujitsu.com/telecom

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