FUJITSU

Solution Brief

Meeting the Optical Performance Demands of Metro DCI

The explosive growth of video applications and the rapid migration of enterprise IT to cloud-based services are driving increased traffic to data centers. This burgeoning traffic requires more data center builds and increases the demand for data center interconnection (DCI). As service providers move content closer to the customer to improve performance and end use experience, the majority of spending on DCI is for metro networking equipment. The growth for metro DCI will outpace backbone DCI over the next five years, exceeding a 10% CAGR.

To address the capacity, reach and cost requirements of the metro DCI market, optical equipment suppliers are developing DCI options with attributes that more closely resemble datacom equipment than telecom equipment. These emerging requirements include equipment that is a smaller footprint, rack mountable, optimized for coherent 100G and beyond transmission, and SDN-enabled.

Vendors must meet these requirements and stringent price points to compete in the competitive metro DCI market or be left behind. Optical solutions for connecting data centers should include high-capacity transponders for getting services onto a lambda, muxponders/demuxponders for getting multiple services on a single fiber, and amplifiers to extend the reach between locations. To address this growing market, Fujitsu has developed a new breed of transponder to complement its existing family of multiplexers and amplifiers.

Fujitsu 1FINITY Delivers Metro DCI

Fujitsu 1FINITY is a disaggregated packet-optical networking platform that is designed with a simple, scalable and open architecture. The initial release of the platform comprises four distinct product families providing transport, switch, lambda and access functionality on modular 1RU blades. The 1FINITY T100 Transport and 1FINITY S100 Switch blades mark Fujitsu's focused entry into the point-to-point DCI market.

- The 1FINITY T100 is a high-density transponder that is purpose-built for metro DCI. This modular blade is built for efficiency of rack space and power because it is a 1RU stackable and hyper-dense blade with 800G (4 x 200G) line side transport capacity using DP-16QAM modulation. It supports both client-side (QSF28) and line-side (CFP2-ACO) pluggable modules, allowing the use of any vendor pluggable modules that meet industry standards.
- The 1FINITY S100 is a layer 2 switch that delivers dense 10 GbE to 100 GbE aggregation for CE 2.0-compliant E-Line services. The 1RU blade provides 1.2 Tbps switching capacity with four pluggable modules (12 x SFP+ or 3 x CPF4 100 GbE).

The system software of the 1FINITY T100 and S100 blades are built within the Linux framework and there are multiple management protocol options available to operators, including NETCONF, RESTCONF, SNMP and CLI.

100G/200G optical deployments are accelerating and shifting toward the metro network. This growth is being led by the DCI market. According to ACG Research, equipment suppliers are reporting that more than 50% of transponder/muxponder modules are shipping with 100/200G coherent DWDM support. Fujitsu believes that the 200G optical connections of 1FINITY T100 provide the most efficient technology for transporting large volumes of traffic between data centers and from data centers to Internet exchange points. The 1FINITY T100 also supports DWDM applications when used with optical C-band DWDM filters and C-Band DWDM amplifiers.

Metro DCI options using Fujitsu 1FINITY T100

Basic point-to-point DCI configurations simply require placement of dense transponders, such as the 1FINITY T100, at two or more data centers. Operators can deploy T100 blades, providing 4 x 200G connections via DC-16QAM modulation over multiple lambdas, without amplification or a muxponder/demuxponder. (See Figure 1). This network configuration will support distances up to 130 km, with fiber loss of 0.17 dB per kilometer.

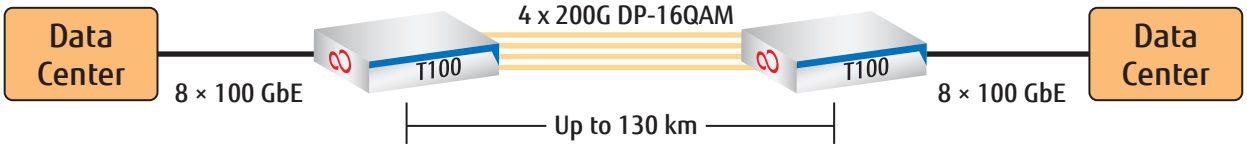


Figure 1: DCI without a Mux/Demux or Amplifiers

To save fiber, operators can add a muxponder/demuxponder to the T100 transponder-only application, providing 800G of transport over a single lambda (see Figure 2). This network configuration supports distances up to 88 km, with 7 dB of insertion loss and fiber loss of 0.17 dB per kilometer.

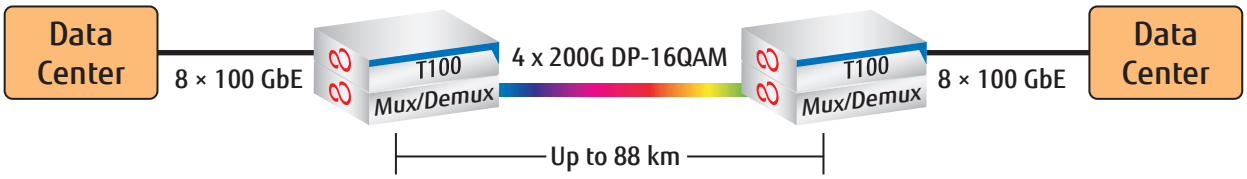


Figure 2: DCI with Mux/Demux but without Amplifiers

To achieve superior reach, operators can deploy optical amplifiers at each data center location. With the addition of optical amplifiers, 200 km distances can be achieved (see Figure 3).

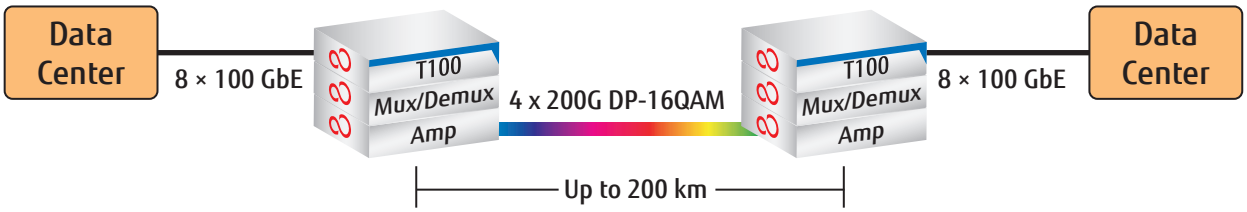


Figure 3: DCI with Mux/Demux and Amplifiers

To achieve even more distance, operators can employ in-line amplifiers (ILAs) between data center locations. ILAs extend the reach up to 1000 km between data centers, depending on the number of patches, finer splices, fiber quality and distances between each of them (see Figure 4).

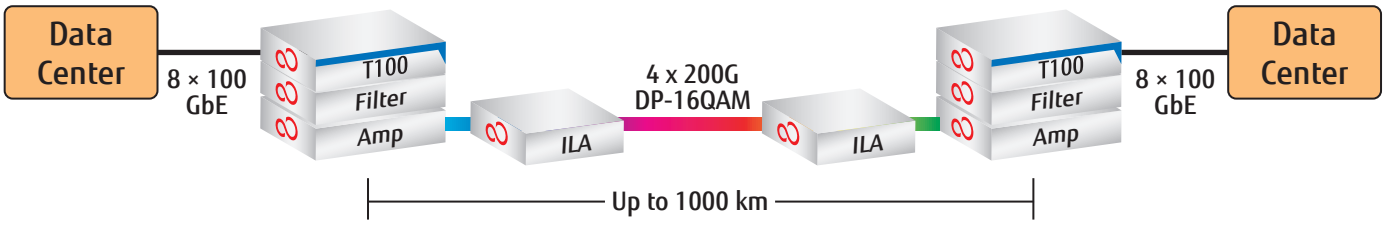
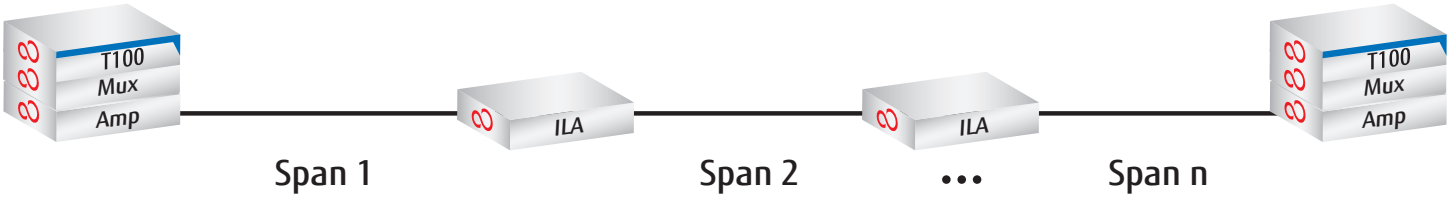


Figure 4: DCI with Mux/Demux and Amplifiers and ILAs

Long Reach Use Case

The optical budget design for this extended configuration is shown in Figure 5. The T100 blade has an OSNR tolerance of 20 dB. Each span amplifies both the signal and the noise, reducing the OSNR margin with each span. When the ONSR margin drops to 20 dB, no more spans can be added and the maximum distance is reached. Based on 10 spans between data center locations, along with the associated fiber loss and OSNR, the calculated distance for reach is 1000 km.



Span #	NF (dB)	Fiber Loss (dB/km)	Reach (km)	Losses* (dB)	Rx (Dbm)	Topology	OSNR Margin** (dB)
	0	0.17	0		0	AWG (–3.5 dB)	
1	5	0.17	80	4	–17.6	ILA1 + inline GFF	32.4
2	5	0.17	110	1.1	–19.8	ILA2 + inline GFF	28.1
3	5	0.17	110	1.1	–19.8	ILA2 + inline GFF	26.0
4	5	0.17	110	1.1	–19.8	ILA2 + inline GFF	24.6
5	5	0.17	110	1.1	–19.8	ILA2 + inline GFF	23.6
6	5	0.17	110	1.1	–19.8	ILA3 + inline GFF	22.7
7	5	0.17	110	1.1	–19.8	ILA4 + inline GFF	22.0
8	5	0.17	110	1.1	–19.8	ILA5 + inline GFF	21.4
9	5	0.17	110	1.1	–19.8	PreAmp	20.9
10	0	0.17	40	4	–10.8	AWG (–3.5 dB)	20.9
Distance (km) 1000							

** Losses include AWG (3.5 dB), connectors (0.25 dB + 0.25 dB), and inline GFF (0.6 dB)*

*** 3 dB margin includes aging, dispersion, PDL, passband narrowing, and crosstalk*

Figure 5: DCI Distance Calculation Table

Summary

The accelerated growth of data center applications is driving a change in metro networking requirements. Optical equipment vendors are developing small form factor appliances to meet this demand and offering flexible options to achieve the needed operational performance and reach.

The Fujitsu 1FINITY platform provides a T100 Transport blade that is purpose-built for high-capacity metro DCI applications–delivering 200G transport up to 130 km, using DP-16QAM modulation. When combined with Fujitsu or 3rd party multiplexers, data center operators can still reach 88 km, while saving fiber. Or, longer distances up to 1000 km can be achieved with the inclusion of amplifiers and ILAs. Fujitsu data center solutions functionally and economically support each of these applications and scenarios.

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