

Technology Brief

Metro DCI Optical Reach Configurations for the 1FINITY T100 Transport Blade

As burgeoning traffic demand fuels more data center builds, the need for 100G and 200G optical deployments overall and particularly for data center interconnection (DCI) is also building momentum. Owing to the overall trend among content providers of placing content delivery facilities closer to the customer, the majority of spending on DCI is occurring close to population centers.

Hence, growth in metro DCI is expected to outpace backbone DCI over the next five years, exceeding a 10% CAGR. According to ACG Research, equipment suppliers are reporting that more than 50% of transponder/muxponder modules are shipping with 100/200G coherent DWDM support. The 200G optical connections of 1FINITY T100 provide the most efficient technology for transporting large volumes of traffic between data centers and between data centers and Internet exchange points. The 1FINITY T100 also supports DWDM applications when used with optical C-band DWDM filters and C-Band DWDM amplifiers.

Emerging Platforms Engineered for Data Center Demands

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. Emerging platforms feature smaller footprint, rack-mount options, support for 100G and higher transmission rates, and SDN-ready design and capabilities. Vendors must meet these requirements amid stringent constraints on price points if they are to compete in the competitive metro DCI market.

Optical solutions for connecting data centers should deliver:

- High-capacity transponders
- High-density muxponders/demuxponders
- Amplifiers to extend optical reach between locations

1FINITY™ Delivers Metro DCI

The Fujitsu 1FINITY platform is a suite of disaggregated optical platforms designed with a simple, scalable and open architecture. Three 1FINITY families are available providing transport, switch, and lambda functionality on modular 1RU blades. The 1FINITY T100 and T400 Transport blades and the 1FINITY S100 Switch are especially suited to point-to-point DCI applications.



Built for Versatile Optical Reach Options

The 1FINITY T100 is a high-density transponder purpose-built for metro DCI. This modular blade provides wide flexibility in selecting the right combinations of capacity and optical reach. The form-factor is a 1RU stackable and hyper-dense blade with 800G (4 x 200G) line-side transport capacity. Either of two optical modulation schemes may be employed (DP-16QAM or DP-QPSK). The platform also supports open pluggable modules on both client-side and line-side (QSFP28 and CFP2-ACO respectively).

For data center locations that have 10 GbE client side inputs, the 1FINITY T400 Layer 1 aggregator or 1FINITY S100 Layer 2 switch can provide dense 10 GbE to 100G aggregation.

The network configurations and associated optical reach capabilities shown on page 2 are confined to data center locations with 100 GbE client-side inputs, using the 1FINITY T100 with the DP-16QAM optical modulation scheme. These configurations can achieve optical reach distances up to 1000 km. The 1FINITY T100 platform can also achieve distances of up to 3200 km, provided DP-QPSK modulation is used.

A Variety of Optical Reach Configurations

Up to 130 km

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 DP-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 km.

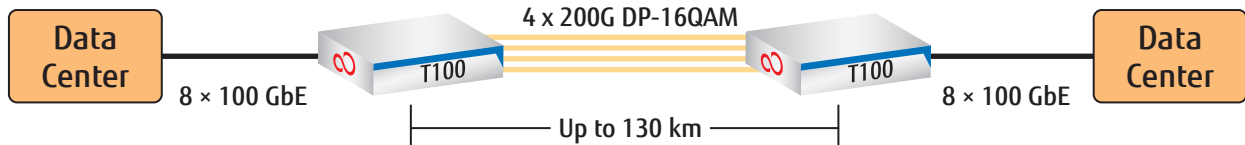


Figure 1: DCI without mux/demux or amplifiers

Up to 88 km

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 km.

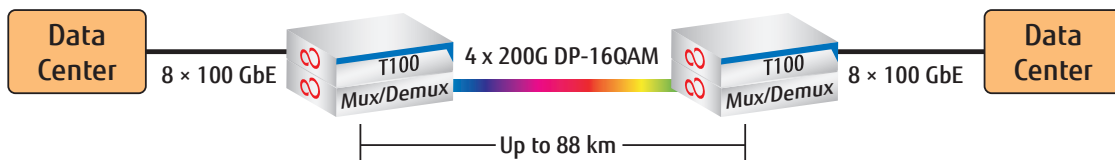


Figure 2: DCI with mux/demux but without amplifiers

Up To 200 km

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).

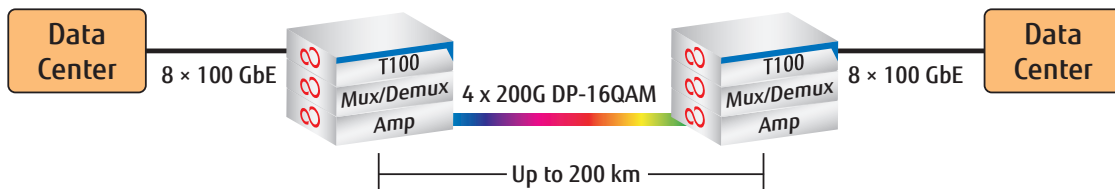


Figure 3: DCI with mux/demux and amplifiers

Up to 1000 km

To achieve even more distance, operators can employ inline 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).

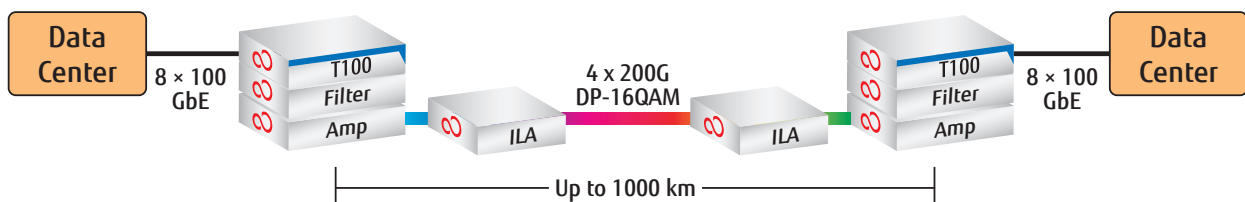
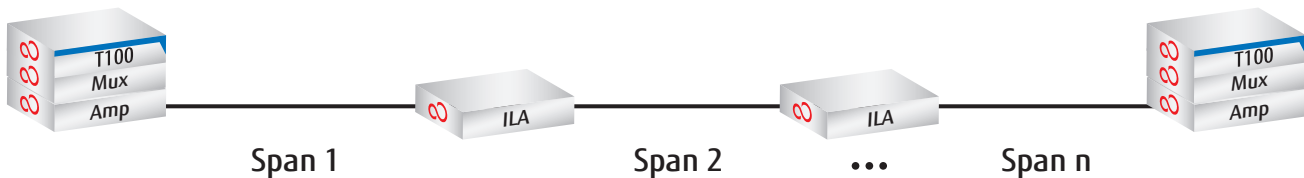


Figure 4: DCI with mux/demux, amplifiers and ILAs

Long-Reach Configurations

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 OSNR 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

Accelerated growth in data center applications is changing metro networking requirements. Optical equipment vendors are developing small form-factor appliances to meet this demand, and offering flexible options for optical performance and reach.

The Fujitsu 1FINITY platform includes the T100 Transport blade, which 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 third-party multiplexers, data center operators can achieve optical reach of 88 km and save fiber. Distances up to 1000 km can be achieved via amplifiers and ILAs, and if even greater distances are required, then the 1FINITY T100 can reach up to 3200 km with DP-QPSK modulation. Fujitsu data center solutions functionally and economically support each of these applications and scenarios.

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