

Preserve Your Investment with 40-Gbps Cisco QSFP BiDi Transceiver Solution

What You Will Learn

As a result of data center consolidation, server virtualization, and new applications that require higher data transport rates, lower latency, and better link utilization, the data center network is shifting to 10 Gbps at the access layer and 40 Gbps at the aggregation layer. High-performance and high-density 10- and 40-Gbps network devices, such as the Cisco Nexus® 6000 and 7000 Series Switches and Nexus 5600 and 7700 platforms, are now available at attractive prices for this transition. However, to support 40-Gbps connectivity, data center architects are challenged by the need for a major upgrade of the cabling infrastructure. This can be expensive and disruptive to allow data centers to adopt and migrate quickly to the 40-Gbps technology.

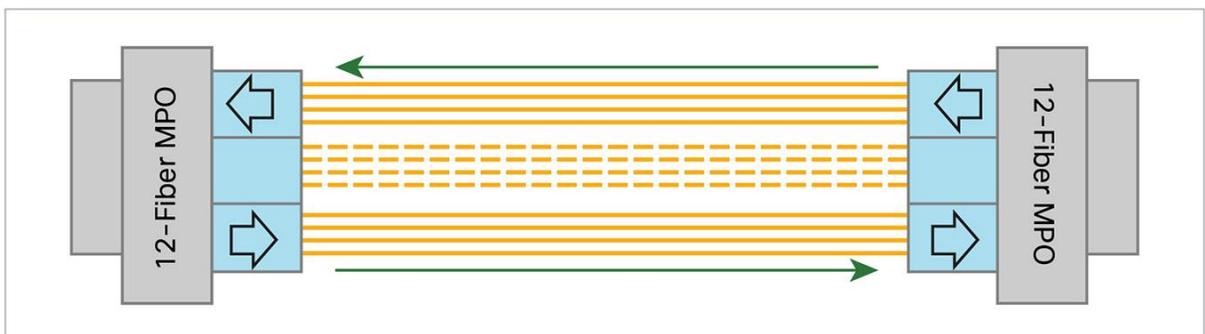
Cisco recently launched a new 40-Gbps bidirectional optical (BiDi) module, providing another option in addition to the 40-Gbps Quad Small Form-Factor Pluggable (QSFP) optical modules. The 40-Gbps BiDi optical module supports 40 Gigabit Ethernet over one pair of multimode fiber (MMF) cables while allowing 40 Gigabit Ethernet to be deployed using the same infrastructure as 10 Gigabit Ethernet (10GBASE-SR). This innovative 40-Gbps QSFP BiDi technology offers customers a no-cost fiber migration.

This document introduces the 40-Gbps Cisco® QSFP BiDi Transceiver and demonstrates its cost savings of at least 50 percent compared to non-BiDi QSFP 40-Gbps deployments.

Challenges with Existing 40-Gbps Transceivers

Existing short-reach (SR) transceivers for 40-Gbps connectivity in a QSFP form factor, such as QSFP SR4 and QSFP CSR4, use independent transmitter and receiver sections, each with 4 parallel fiber strands. For a 40-Gbps connection, 8 fiber strands are required. Both QSFP SR4 and QSFP CRS4 use MPO 12-fiber (MPO-12F) connectors. As a result, 4 fiber strands in each connection are wasted. Figure 1 shows the existing short-reach 40-Gbps QSFP solutions.

Figure 1. Concept of Existing 40-Gbps Transceivers (MMF)



With existing QSFP transceivers, each direct connection between two devices requires an MPO-to-MPO 12-fiber cable. In the case of structured cabling with patch panels and fiber trunks, a 40-Gbps connection needs MPO-to-MPO fibers between devices and patch panels and 4 duplex multimode fibers (MMF).

In most of today's data center networks, the aggregation-layer fiber infrastructure is built for 10-Gbps connectivity that either supports direct connections between devices over LC-to-LC MMF or uses LC-to-LC fibers to attach devices to patch panels and provides one duplex MMF fiber in the fiber trunk for each 10-Gbps connection.

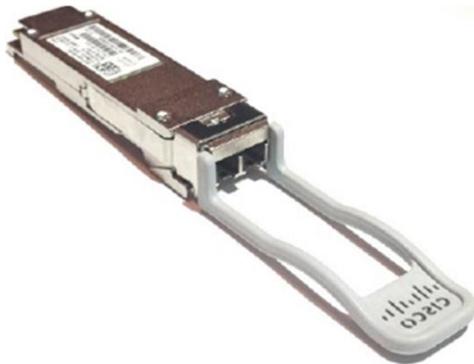
Regular duplex LC-to-LC fibers cannot be directly reused for a 40-Gbps connectivity using traditional 40-Gbps transceiver. In addition, four to six times greater fiber density is needed in the fiber trunks to meet the requirements of a 40-Gbps connection. These characteristics make it expensive for customers to migrate from 10- to 40-Gbps connectivity in their existing data centers.

Cisco Innovation with 40-Gbps QSFP BiDi Solution

The Cisco QSFP BiDi Transceiver addresses the challenges of fiber infrastructure by providing the capability to transmit full-duplex 40-Gbps traffic over one duplex MMF cable with LC connectors. In other words, the Cisco QSFP BiDi Transceiver allows 40-Gbps connectivity to reuse the existing directly connecting 10-Gbps fibers and the existing fiber trunk without the need to add any fibers.

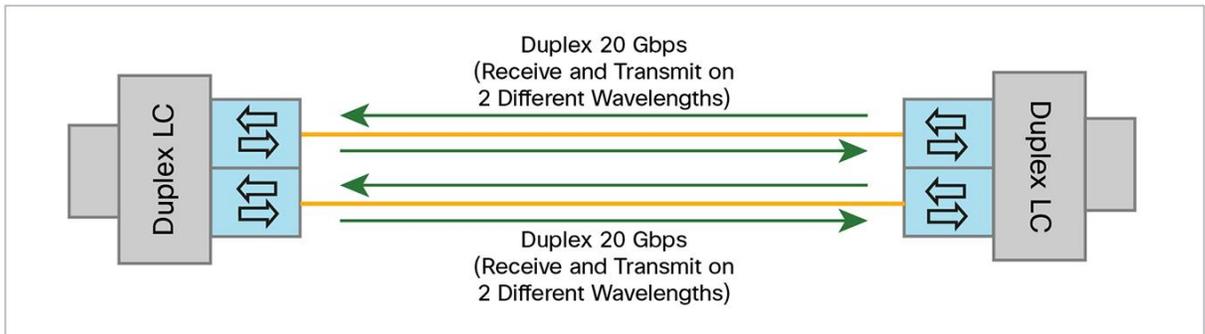
The Cisco QSFP BiDi Transceiver (QSFP-40G-SR-BD) is a short-reach optical transceiver that delivers 40 Gbps over a duplex OM3 or OM4 MMF connection. The connection can reach 100 meters on OM3 MMF or up to 150 meters on OM4 MMF. The Cisco QSFP BiDi Transceiver is identified by a gray bail latch or pull tab and is MSA compliant. Figure 2 shows a Cisco QSFP BiDi Transceiver.

Figure 2. Cisco QSFP BiDi Transceiver (QSFP-40G-SR-BD)



The Cisco QSFP BiDi Transceiver has two 20-Gbps channels, each transmitted and received simultaneously on two wavelengths over a single MMF strand. The result is an aggregated duplex 40-Gbps link over a duplex fiber of two MMF strands. Figure 3 shows the technology concept of the Cisco QSFP BiDi Transceiver. Cisco products such as Cisco Nexus 6000 and 7000 Series and Nexus 5600 and 7700 platform switch models, support the Cisco QSFP BiDi Transceiver. For a complete list of supporting products, refer to the Cisco 40 Gigabit Modules optical transceiver product page at <http://www.cisco.com/en/US/products/ps11708/index.html>.

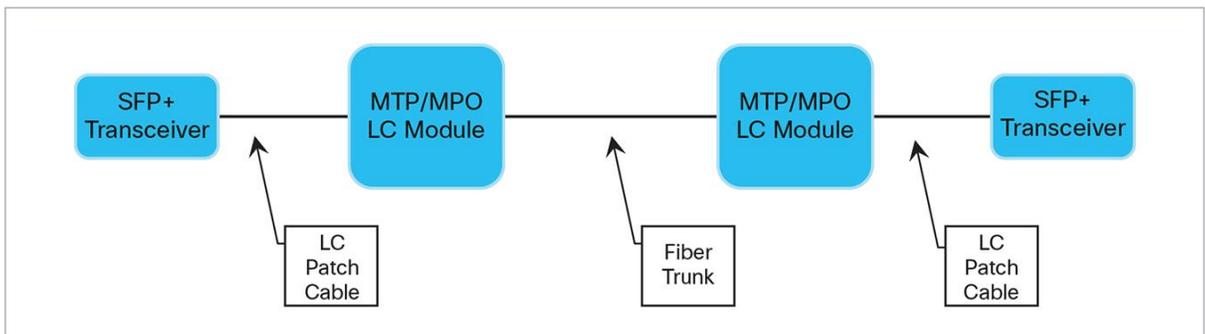
Figure 3. Bidirectional Transmit and Receive Concept of Cisco QSFP BiDi Transceiver



Investment Savings with Cisco QSFP BiDi Transceiver

A structured cabling system is commonly deployed in data center networks to provide a flexible and scalable cabling infrastructure. Structured cabling uses short patch cords to attach devices to a patch panel and then uses fiber trunk cables either to consolidate the cables in a central location for additional connectivity or to direct the cables to another patch panel, to which the remote devices are attached. Figure 4 shows a simple example of a structured cabling design how it is used today for 10-Gbps links.

Figure 4. Simple Example of 10-Gbps Structured Cabling

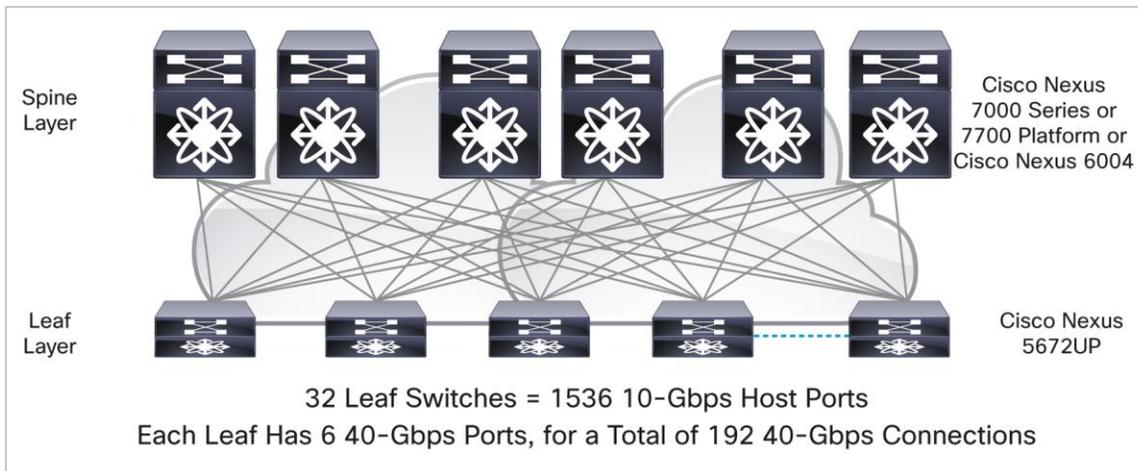


The case study below shows how Cisco QSFP BiDi technology can remove the cost barriers that hinder migration and expansion of the existing 10-Gbps cabling footprint to 40-Gbps infrastructure to provide a higher data rate in the data center network.

Case Study: 192 x 40-Gbps Connections with Structured Cabling

This case study examines a simple high-performance, low-latency, two-tier folded Clos unified fabric design (Figure 5) that provides 1536 10-Gbps host ports on its leaf layer. Its spine layer is composed of six Cisco Nexus 7000 Series or Nexus 7700 platform models or Cisco Nexus 6004 Switches, and its leaf layer consists of 32 Cisco Nexus 5672UP Switches, each with six 40-Gbps links toward the spine layer. Between the leaf and spine layer, there are a total of 192 40-Gbps links.

Figure 5. Two-Tier Clos Unified Fabric Example



If the cabling for this network is an expansion to the existing cabling 10-Gbps infrastructure, the 192 40-Gbps connections can be built using MMF cables and QSFP SR4 transceivers or QSFP BiDi transceivers. Figures 6 and 7 show design examples for these options. If the 192 10-Gbps cabling infrastructure is to be reused to construct this network, no additional spending on cabling will be needed, if Cisco QSFP BiDi Transceiver are used. Table 1 compares these two scenarios with the estimated savings including the jumper cables. As the tables show, the design with Cisco QSFP BiDi Transceivers offers a savings of at least of 50 percent over the design with QSFP SR4 transceivers.

Figure 6. Structured 40-Gbps Cabling with Cisco QSFP SR4 Transceivers

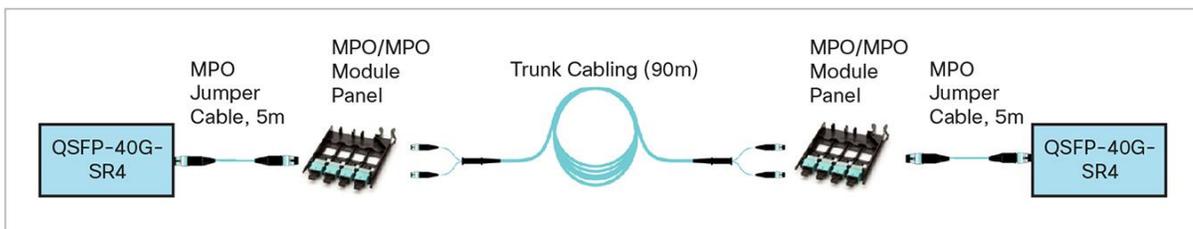


Figure 7. Structured 40-Gbps Cabling with Cisco QSFP BiDi Transceivers

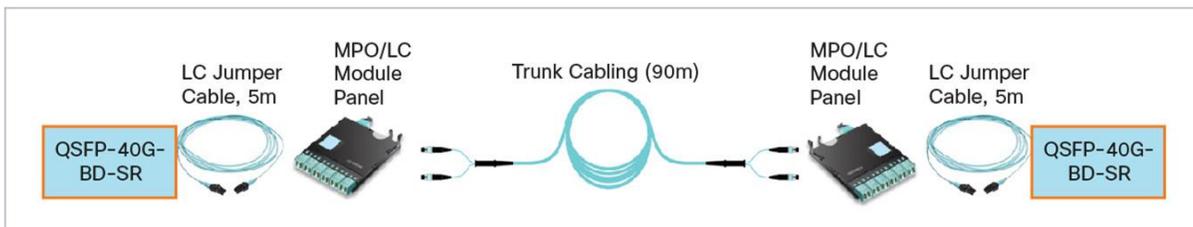


Table 1. Structured 40-Gbps Cable Infrastructure Comparison with Cisco QSFP SR4 versus BiDi Transceivers per Link

	Quantity QSFP SR	Quantity QSFP BiDi	Savings
12-fiber MPO-MPO trunk cabling (90m)	67% (8 fibers)	17% (2 fibers)	50%
12-fiber MPO-MPO trunk module	67% (8 fibers)	17% (2 fibers)	50%
Jumper cable 5m	2 x 12-fiber MPO	2 x 2-fiber LC	75%*
Transceiver Costs	2 x QSFP-40G-SR	2 x QSFP-40G-SR-BD	63%*

* This example is based on typically estimated real world costs.

Conclusion

Cisco QSFP BiDi technology removes 40-Gbps cabling cost barriers for migration from 10- to 40-Gbps connectivity in data center networks. Cisco QSFP BiDi Transceivers provide 40-Gbps connectivity with immense savings and simplicity compared to other 40-Gbps QSFP (MMF) transceivers. The Cisco QSFP BiDi Transceiver allows organizations to migrate the existing 10-Gbps cabling infrastructure to 40 Gbps at no cost and to expand the infrastructure with low capital investment.

Together with the Cisco Nexus 6000 and 7000 Series and Nexus 5600 and 7700 platforms, which provide excellent investment protection with attractive pricing for networking devices plus Cisco Unified Fabric innovations, Cisco QSFP BiDi technology provides a cost-effective solution for migration from 10- to 40-Gbps infrastructure to meet the demands of today's data center.

For More Information

For more information about the Cisco 40-Gbps BiDi Transceiver, please visit <http://www.cisco.com/en/US/products/ps11708/index.html>.



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