COMMSCOPE®

400GBase-SR4.2 puts OM5 fiber in the spotlight

OM5 reduces fiber count and increases reach 50 percent to enable future technologies

The historical and logical progression of fiber types in the data center began with Ethernet transmission technology, which has evolved challenging multimode fiber (MMF) over the past two decades. As networks continue to change and progress, so do the types of multimode fiber. When new fiber types have been announced, there has been a record of slow adoption rates due to the advancement of fiber outpacing the other components in the network.

When OM4 was launched in 2009, OM3 was the preferred fiber type, yet few were willing to embrace the new OM4 technology. It wasn't until advancements in Ethernet technology reduced the reach of OM3 to 70 meters that OM4 adoption took off. Today, OM4 is the preferred fiber type, but Ethernet technology is evolving once again—giving rise to OM5.

OM5 defined

As the latest generation of multimode fiber, OM5 (also known as "wideband MMF") was internationally standardized by ISO/IEC 11801 ed3 in 2017. An incentive for its development was the emerging use of short wavelength division multiplexing (SWDM) technology.

In 2016, CommScope introduced OM5 as part of its preterminated ultra low-loss fiber portfolio within our high-speed migration strategy.

OM5 fiber is fully backward compatible with OM4, to enable legacy applications, and offers two main advantages over OM3 and OM4.

First, the attenuation of cabled OM5 fiber (3 dB/km) is lower than that of OM3 and OM4 (3.5 dB/km).

Secondly, the effective modal bandwidth (EMB) specification for OM3 and OM4 is limited to 850 nm, whereas the EMB for OM5 extends from 850 nm to 953 nm. The extended EMB window makes OM5 ideal for SWDM, which transmits several data streams on multiple wavelengths over a single fiber. This capability also makes OM5 a key enabler of 400GBase-SR4.2.

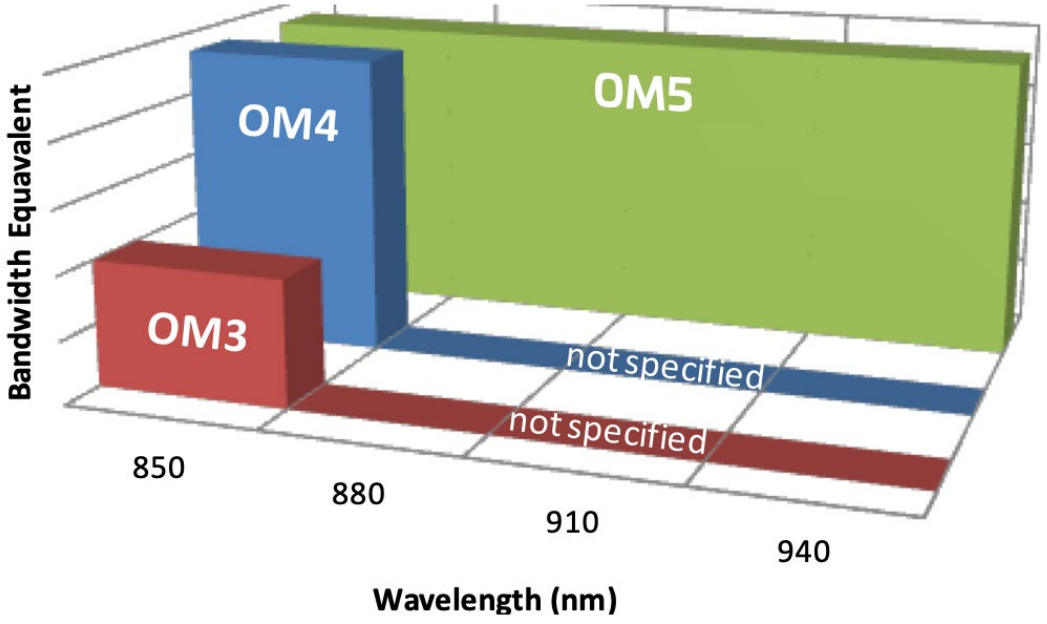

Figure 1: EMB comparison between OM5, OM4 and OM3

Fueling the evolution to 400GBase-SR4.2

400GBase-SR4.2 is the first instance of an IEEE 802.3 ethernet application that employs both multiple pairs of fibers and multiple wavelengths. Specifically, it uses two wavelengths to transmit 50G in full-duplex mode, or 100 GB per fiber pair. The result is the ability to support 400G bandwidth using eight fibers. Figure 2 illustrates the evolution of 400G toward the SWDM-based 400GBase-SR4.2 featuring higher capacity, fewer fibers and longer reach, the OM5 multimode fiber will be a critical enabler of 400G and beyond. In fact, 400G Ethernet is the first application to leverage the full power of OM5 technology. Especially important is the ability of OM5 MMF to extend the reach of 400GBase-SR4.2 by 50 percent, from 100 m to 150 m. This provides two significant advantages.

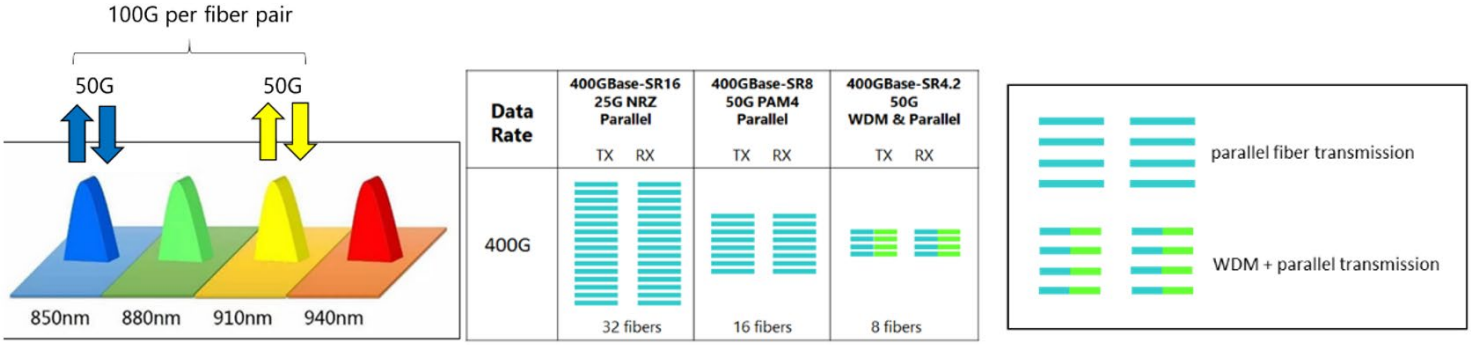

Figure 2: The evolution toward 400GBase-SR4.2

First, the extended reach allows a more flexible data center design. Transmission channels in data centers with cross-connect configurations often scratch at the 100 m channel length. The ability to extend the reach to 150 m enables more flexible cross-connect designs.

Secondly, the extended 150 m reach within the data center enables network operators to cover an estimated 97 percent of all fiber links in their facility. So, even on longer links, data centers can use less expensive multimode transceivers—reducing their overall cost compared to singlemode transceivers. 400GBase-SR4.2 also reduces the number of fibers by 50 percent compared to 400GBase-SR8.

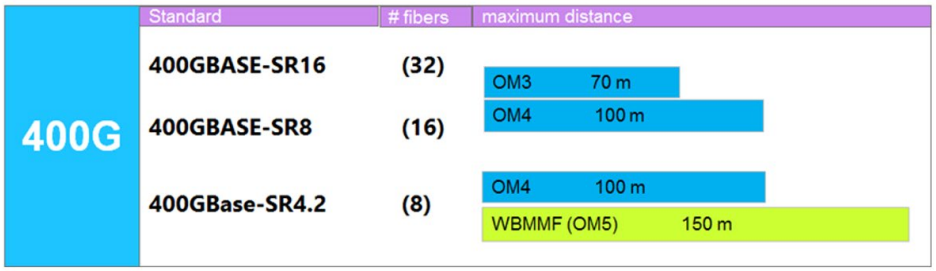

Figure 3: The distance advantage of OM5-enabled 400GBase.SR4.2

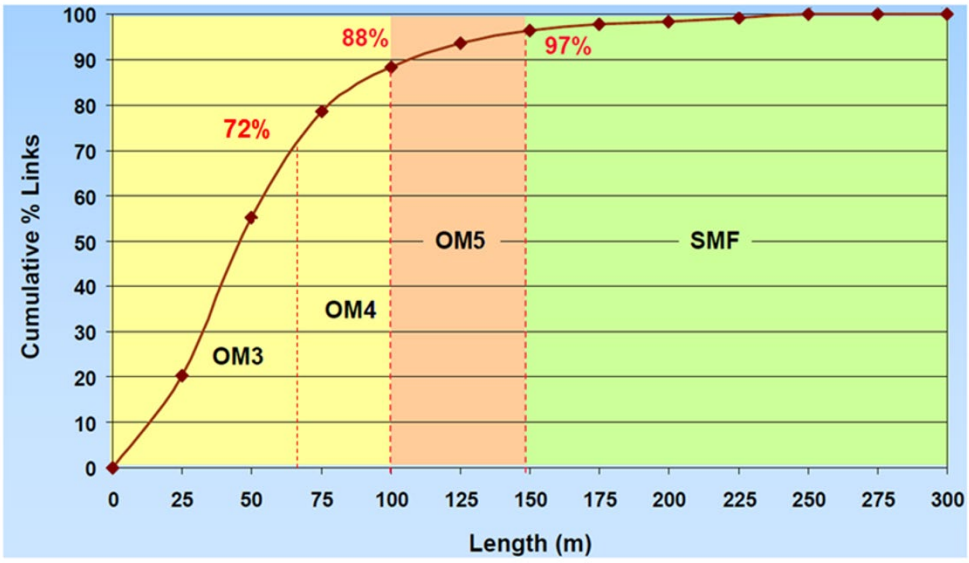

Figure 4: Link length distribution in non-hyperscale data centers

The ability to run applications using fewer fibers prevents expensive cabling upgrades by enabling next-generation Ethernet to run on the existing cabling. For example, 400GBase-SR4.2 can run on the same eight-fiber infrastructure as 100GBase-SR4 and 200GBase-SR4.

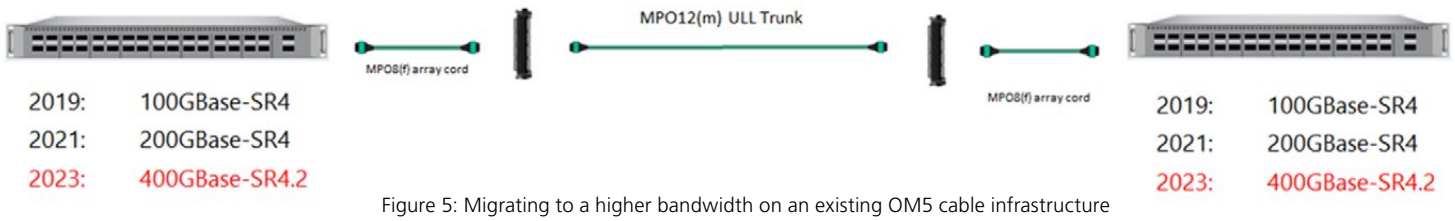

Figure 5: Migrating to a higher bandwidth on an existing OM5 cable infrastructure

On-going developments

During a 2019 Cisco Live presentation, Cisco—the pioneer in SWDM technology—demonstrated a possible breakout of 400GBase-SR4.2 that would allow a "switch-efficient" distribution of 100G in the data center backbone.

At the same time, standards bodies worldwide are already working on defining 800G Ethernet using 100G lanes. Based on 100G lanes, an 800G SWDM version could run on eight fibers, similar to 400GBase-SR4.2 using 2 x 100G data streams and two wavelengths per fiber pair.

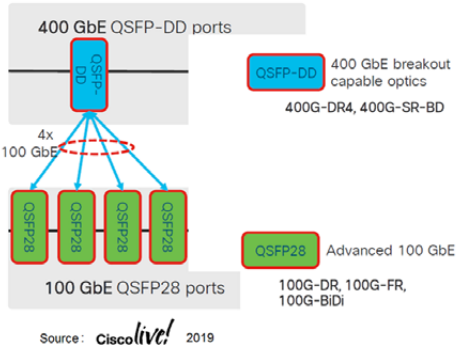

Figure 6: Configuration of Cisco's 400GBase-SR4.2 switch-efficient distribution

Conclusion

With a longer link length than OM4 and being optimized for SWDM, OM5 is destined to overtake OM4 in the marketplace. Data center managers are at yet another crossroads as they decide whether to upgrade to OM5 or stay with their legacy OM4 fiber.

Three factors weigh in favor of making the switch to OM5. First, when making adds or changes in the data center, the smart play is to implement the best available multimode fiber. Second, OM5 is now the recommended multimode fiber for greenfield data center builds. Lastly, staying one step ahead of the Ethernet curve enables data centers to avoid unnecessary upgrades. All this suggests a move forward to OM5.

For more information and insight into CommScope's position on OM5 and the Ethernet roadmap, consult a CommScope data center specialist.

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