What types of transceivers are there and what are the differences?

1. What types of transceivers are there?

SFP, SFP+, SFP28, QSFP+ and QSFP28 are different optical transceiver types. And all of them are hot-pluggable network interface modules used for connecting a network switch and other networking devices for data transmission. Then, SFP vs SFP+, SFP28 vs SFP+, QSFP vs QSFP28, what are the differences?

1.1 Introduction on the Types of Transceivers

Before figuring out the difference in SFP vs SFP+, SFP28 vs SFP+, or QSFP vs QSFP28, it's necessary to know what SFP, SFP+, SFP28, QSFP and QSFP28 are.

1.1.1 SFP

SFP (small form-factor pluggable) can be regarded as an upgraded version of GBIC (Gigabit interface converter). Its volume is only 1/2 of the GBIC module, which greatly increases the port density of network devices. And the data rate of SFP ranges from 100 Mbps to 4 Gbit/s.

1.1.2 SFP+

SFP+ (small form-factor pluggable plus) is an enhanced version of the SFP. It supports 8 Gbit/s Fibre Channel, 10 Gigabit Ethernet and Optical Transport Network standard OTU2. SFP+ also introduces direct attach for linking two SFP+ ports without additional fiber transceivers, including DAC (direct attach cable) and AOC (active optical cable), which are quite brilliant solutions for the short-distance direct connection between two adjacent network switches.

1.1.3 SFP28

SFP28 (small form-factor pluggable 28) is an enhanced version of SFP+. SFP28 has the same common form factor as the SFP+, but supports 25Gb/s over a single lane. SFP28 provides a new

way for networking upgrade: 10G-25G-40G-100G, which is an energy-efficient solution to meet the growing demands of next-generation data center networks.

1.1.4 QSFP+

QSFP+ is an evolution of QSFP (quad small form-factor pluggable). QSFP can carry 4 channels simultaneously and each channel can handle 1 Gbit/s data rate- hence the name Quad SFP. Unlike QSFP, QSFP+ supports 4x 10 Gbit/s channels. And the 4 channels can be combined into a single 40 Gigabit Ethernet link. The QSFP+ transceiver can replace 4 standard SFP+ transceivers, resulting in greater port density and overall system cost savings over traditional SFP+ products.

1.1.5 QSFP28

QSFP28 (quad small form-factor pluggable 28) is designed for 100G applications. It offers four channels of high-speed differential signals with data rates ranging from 25 Gbps up to potentially 40 Gbps, and finally, meet 100 Gbps Ethernet (4×25 Gbps) and 100 Gbps 4X InfiniBand Enhanced Data Rate (EDR) requirements. Note that, QSFP28 can do 4x25G and 2x50G breakout connection, or 1x100G depending on the transceiver type that is used.

1.2 Comparisons in SFP vs SFP+ vs SFP28 vs QSFP+ vs QSFP28

After figuring out what SFP/SFP+/SFP28/QSFP+/QSFP28 are, the following part will give detailed comparisons of SFP vs SFP+, SFP28 vs SFP+, QSFP vs QSFP28 and SFP28 vs QSFP28.

1.2.1 SFP vs SFP+: Same Size with Different Speed and Compatibility

SFP vs SFP+ transceivers, both are virtually identical in size and appearance. This allows the equipment producer to reuse existing SFP physical designs for network switches with SFP+ ports. As for the difference, the clear one is that they support different transmission speeds, SFP is up to 4 Gbit/s while SFP+ is 10 Gbit/s. Besides, they comply with different specifications. SFP is based on SFF-8472 protocol, and SFP+ conforms to SFF-8431 and SFF-8432. And in terms of SFP vs SFP+ compatibility, SFP+ ports often accept SFP optics but at a reduced speed of 1 Gbit/s. And SFP+ transceiver cannot be plugged into an SFP port, otherwise, the product or port may be damaged.

1.2.2 SFP28 vs SFP+: Can I Use SFP28 Transceiver in SFP+ Ports?

The answer is definitely yes. From the above, it's clear that SFP28 is the upgrade version of SFP+ that SFP28 has been upgraded to handle 25 Gbit/s per lane. They use the same form factor, and the pinouts of SFP28 and SFP+ connectors are mating compatible. So SFP28 will work with SFP+ optics but at a reduced speed of 10 Gbit/s. And SFP+ module will work well with SFP28 port on a network switch if the port can be set up for 10G transmission, otherwise the SFP+ modules can not work. When it comes to copper cable, SFP28 copper cable possesses significantly greater bandwidth and lower loss compared with SFP+ version.

1.2.3 SFP28 vs QSFP28: Work on Different Principles

Though there is a number “28” in their names, SFP28 and QSFP28 transceiver actually adopt different sizes and working principles. SFP28 supports only one channel with 25 Gbit/s, while QSFP28 supports 4 separate lanes, and each is 25 Gbit/s. Both of them can be used in 100G networks, but the SFP28 is applied in the form of QSFP28 to SFP28 breakout cables. The following shows a direct connection for 100G QSFP28 to 4x SFP28 DAC.

1.2.4 QSFP+ vs QSFP28: Different Speeds for Different Uses

QSFP+ and QSFP28 transceivers integrate 4 transmitting and 4 receiving channels and share the same size. Besides, the product family of QSFP+ and QSFP28 both includes transceiver module and DAC/AOC cable, but with different speeds. QSFP+ module supports 1x 40 Gbit/s and QSFP+ DAC/AOC cable supports 4x 10 Gbit/s. QSFP28 module is capable of transmitting data at 100 Gbit/s, and QSFP28 DAC/AOC cable can run at 4x 25 Gbit/s or 2x 50 Gbit/s. Note that, usually, QSFP28 modules can’t break out into 10G links. But it’s another case to insert a QSFP+ module into a QSFP28 port if switches support (how to realize 4x 10G mode on QSFP28 100G port, please visit QSFP28 100G Port Play with 40G, 25G and 10G). In this situation, a QSFP28 can break out into 4x10G like a QSFP+ transceiver module.

1.3 Conclusion

SFP vs SFP+, SFP28 vs SFP+, and QSFP+ vs QSFP28, all their differences in the various types of transceivers have been stated clearly in this article. Though some of them share the same design, they are designed for different data rates. And from the comparisons, it’s clear that the main driving force behind the evolution of optical transceivers is the need to achieve higher bandwidth rates with smaller form-factor. For example, QSFP28 provides more bandwidth than QSFP+ in the same form factor.