

H3C Campus Switches

Multi-Gigabit Ethernet Technology White Paper

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Overview

Technical background

The rapid development of network technologies and wide spread of WLAN and intelligent endpoints have brought higher requirements on data transmission rate. The maximum transmission rate has increased from 11 Mbps (802.11b) to 9.6 Gbps (Wi-Fi 6), as shown in [Table 1](#).

Table 1 WLAN communication specifications and supported maximum transmission rates

Specification	Maximum rate
802.11b	11 Mbps
802.11a/g	54 Mbps
802.11n	600 Mbps
802.11ac Wave2	6928 Mbps
Wi-Fi 6	9607.8 Mbps

As a result, 1-Gbps Ethernet over Cat5e and Cat6 twisted pair cables that has been widely deployed for a long time can barely meet the increasing rate requirements. To resolve the issue, the network infrastructure must be updated to provide 10 Gbps rate, which requires re-cabling and causes great cost. [Table 2](#) displays rates supported by each type of twisted pair cables.

Table 2 Rates supported by twisted pair cables

Cable type	1 Gbps	2.5 Gbps	5 Gbps	10 Gbps
Cat5e UTP	Supported	Supported	Not recommended	Not supported
Cat5e STP	Supported	Supported	Supported	Not supported
Cat6 UTP	Supported	Supported	Not recommended	Not recommended
Cat6 STP	Supported	Supported	Supported	Not recommended
Cat6a UTP	Supported	Supported	Supported	Not recommended
Cat6a STP	Supported	Supported	Supported	Supported
Cat7	Supported	Supported	Supported	Supported

To make full use of existing network infrastructure while improving the transmission rate, IEEE released new Ethernet standard 802.3bz, a multi-Gigabit 2.5/5GBase-T Ethernet standard.

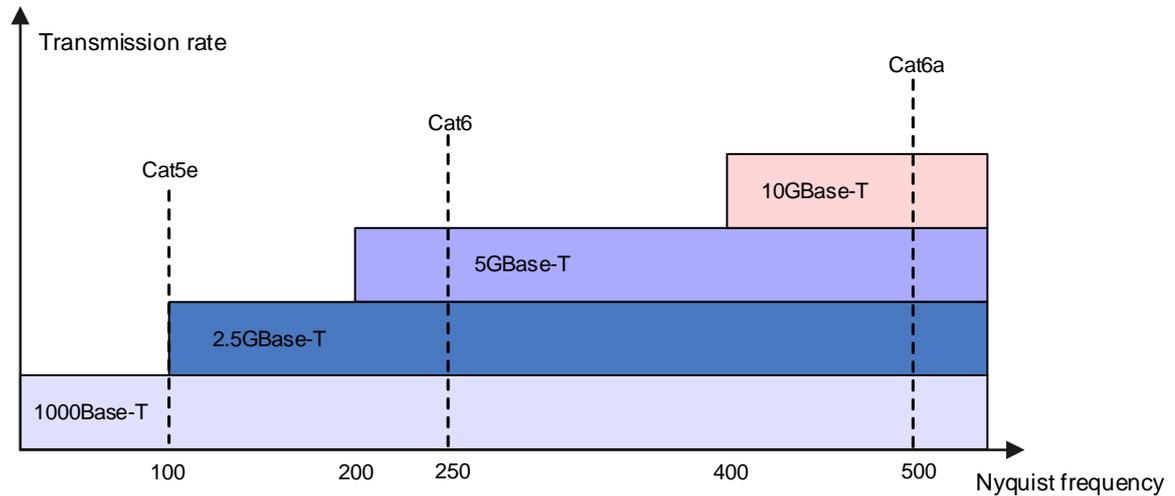
Technology implementation

Multi-Gigabit Ethernet

802.3bz utilizes all four pairs of a cable with a 6.25 bit/MHz transmission capacity on each pair. This allows 802.3bz to provide a transmission rate of up to 2.5 Gbps over Cat5e cables and 5 Gbps over Cat6 cables with a bandwidth of only 100 MHz and 200 MHz, respectively. The transmission distance over both Cat5e and Cat6 cables can reach 100 m (328.08 ft). 802.3bz has improved the transmission rate by about four times without re-cabling. For Wi-Fi 6, CAT6 S/FTP network cables or above and 10GBase-T Ethernet switches can meet the high bandwidth requirements.

802.3bz is fully compatible with PoE, and also supports 1000Base-T and 100Base-T rates.

Figure 1 Transmission rates supported by 802.3bz



PoE compatibility

802.3bz is fully compliant with 802.3af (PoE), 802.3at (PoE+), and 802.3bt (PoE++) at any data rate. It supports up to 90W DC power supply over Cat5 (or above) cables to endpoints, such as IP phones, APs, and network cameras.

NBASE-T

Developed together with 802.3bz, NBASE-T defines a new type of Ethernet signaling that can dynamically respond to changing signal interference to avoid unexpected disconnection.

It offers the following features:

- Support for full duplex 2.5G/5G rate over Cat5e/Cat6 (or above) cables.
- Support for multi-Gigabit interface modules on wide product series to increase expandability and reduce cost.
- Full support of 802.3bz to allow copper cables to support higher rates.
- Compatibility with PoE, PoE+, PoE++, and Energy-Efficient Ethernet.
- Support for autonegotiation of Ethernet rates.

Hardware compatibility

This section describes the H3C campus switches and interface modules that provide multi-Gigabit Ethernet ports.

H3C S6520X Ethernet switch series

[Table 3](#) shows 802.3bz-compatible S6520X switches and the switch ports. [Table 4](#) shows the maximum transmission distance and required cables at each rate.

Table 3 Compatible S6520X switches and ports

Model	Ports and slots
S6520X-26XC-UPWR-SI	24 × 10G/5G/2.5G/1000/100Base-T autosensing Ethernet ports 1 × interface module slot
S6520X-54XC-UPWR-SI	48 × 10G/5G/2.5G/1000/100Base-T autosensing Ethernet ports 4 × QSFP+ ports 1 × interface module slot
S6520X-10XT-SI	8 × 10G/5G/2.5G/1000Base-T autosensing Ethernet ports 2 × SFP+ ports
S6520X-16XT-SI	14 × 10G/5G/2.5G/1000Base-T autosensing Ethernet ports 2 × SFP+ ports
S6520X-26MC-SI S6520X-26MC-UPWR-SI	24 × 5G/2.5G/1000/100Base-T autosensing Ethernet ports 1 × interface module slot

NOTE:

These ports also support PoE, PoE+, and PoE++ on the S6520X-26MC-UPWR-SI, S6520X-26XC-UPWR-SI, and S6520X-54XC-UPWR-SI.

Table 4 Maximum transmission distance and required cables at each rate

Model	Transmission rate	Network cable type	Maximum transmission distance
S6520X-26XC-UPWR-SI S6520X-54XC-UPWR-SI	10 Gbps	Cat6 S/FTP or above	100 m (328.08 ft)
		Cat6 UTP	55 m (180.45 ft)
		Cat5e	55 m (180.45 ft)
	5 Gbps	Cat5e or above	100 m (328.08 ft)
	2.5 Gbps	Cat5e or above	200 m (656.17 ft)
	1 Gbps	Cat5e or above	140 m (459.32 ft)
S6520X-10XT-SI S6520X-16XT-SI	10 Gbps	Cat6 S/FTP or above	100 m (328.08 ft)
		Cat6 UTP	55 m (180.45 ft)
		Cat5e	55 m (180.45 ft)
	5 Gbps	Cat5e or above	100 m (328.08 ft)
	2.5 Gbps	Cat5e or above	200 m (656.17 ft)
	1 Gbps	Cat5e or above	140 m (459.32 ft)
S6520X-26MC-SI S6520X-26MC-UPWR-SI	100 Mbps	Not supported	Not supported
	5 Gbps	Cat5e or above	100 m (328.08 ft)
	2.5 Gbps	Cat5e or above	200 m (656.17 ft)
	1 Gbps	Cat5e or above	200 m (656.17 ft)

NOTE:

Whether the maximum transmission distance can be reached also depends on the capability of peer devices and the quality of the cables used.

H3C S5130S Ethernet switch series

Table 5 shows 802.3bz-compatible S5130S series switches and the switch ports. Table 6 shows the maximum transmission distance and required cables at each rate.

Table 5 Compatible S5130S series switches and ports

Model	Ports and slots
S5130S-28ST-EI S5130S-28ST-PWR-EI	24 × 10/100/1000Base-T autosensing Ethernet ports 2 × 10/5/2.5/1GBase-T autosensing Ethernet ports 2 × SFP+ ports
S5130S-52ST-EI S5130S-52ST-PWR-EI	48 × 10/100/1000Base-T autosensing Ethernet ports 2 × 10/5/2.5/1GBase-T autosensing Ethernet ports 2 × SFP+ ports
S5130S-28MP-EI S5130S-28MP-HPWR-EI	24 × 10/100/1000Base-T autosensing Ethernet ports 2 × 5G/2.5G/1000Base-T autosensing Ethernet ports 2 × SFP ports
S5130S-52MP-EI	48 × 10/100/1000Base-T autosensing Ethernet ports 2 × 5G/2.5G/1000Base-T autosensing Ethernet ports 2 × SFP ports
S5130S-10MS-UPWR-EI	8 × 2.5G/1000/100Base-T autosensing Ethernet ports 2 × SFP+ ports

NOTE:

These ports also support PoE, PoE+, and PoE++ on the S5130S-10MS-UPWR-EI.

Table 6 Maximum transmission distance and required cables at each rate

Model	Transmission rate	Network cable type	Maximum transmission distance
S5130S-28ST-EI S5130S-52ST-EI S5130S-28ST-PWR-EI S5130S-52ST-PWR-EI	10 Gbps	Cat6 S/FTP or above	100 m (328.08 ft)
		Cat6 UTP	60 m (196.85 ft)
		Cat5e	60 m (196.85 ft)
	5 Gbps	Cat5e or above	100 m (328.08 ft)
	2.5 Gbps	Cat5e or above	200 m (656.17 ft)
	1 Gbps	Cat5e or above	200 m (656.17 ft)
	100 Mbps	Not supported	Not supported

Model	Transmission rate	Network cable type	Maximum transmission distance
S5130S-28MP-EI S5130S-28MP-HPWR-EI S5130S-52MP-EI	5 Gbps	Cat5e or above	100 m (328.08 ft)
	2.5 Gbps	Cat5e or above	200 m (656.17 ft)
	1 Gbps	Cat5e or above	200 m (656.17 ft)
	100 Mbps	Not supported	Not supported
S5130S-10MS-UPWR-EI	2.5 Gbps	Cat5e or above	200 m (656.17 ft)
	1 Gbps	Cat5e or above	200 m (656.17 ft)
	100 Mbps	Cat5e or above	200 m (656.17 ft)

NOTE:

Whether the maximum transmission distance can be reached also depends on the capability of peer devices and the quality of the cables used.

Interface modules

Table 7 shows 802.3bz-compatible interface modules and the service ports. Table 8 shows the maximum transmission distance and required cables at each rate.

Table 7 Compatible interface modules and service ports

Model	Ports	Available switches
LSWM2MGT8P	8 × 5G/2.5G/1000Base-T autosensing Ethernet ports	S6520X series
LSWM2XMGT8P	8 × 10G/5G/2.5G/1000Base-T autosensing Ethernet ports	S5560X series S5500V2-EI series

Table 8 Maximum transmission distance and required cables at each rate

Model	Transmission rate	Network cable type	Maximum transmission distance
LSWM2XMGT8P	10 Gbps	Cat6 S/FTP or above	100 m (328.08 ft)
		Cat6 UTP	55 m (180.45 ft)
		Cat5e	55 m (180.45 ft)
	5 Gbps	Cat5e or above	100 m (328.08 ft)
	2.5 Gbps	Cat5e or above	200 m (656.17 ft)
	1 Gbps	Cat5e or above	140 m (459.32 ft)
	100 Mbps	Not supported	Not supported
LSWM2MGT8P	5 Gbps	Cat5e or above	100 m (328.08 ft)
	2.5 Gbps	Cat5e or above	200 m (656.17 ft)
	1 Gbps	Cat5e or above	140 m (459.32 ft)
	100 Mbps	Not supported	Not supported

NOTE:

Whether the maximum transmission distance can be reached also depends on the capability of peer devices and the quality of the cables used.

FAQ

What benefits can multi-Gigabit Ethernet provide?

Multi-Gigabit Ethernet can provide a transmission rate of up to 2.5 Gbps over Cat5e cables and 5 Gbps over Cat6 cables, increasing the transmission rate by four times at a low cost.

Which transmission rates can multi-Gigabit Ethernet operate at?

Multi-Gigabit Ethernet supports 100 Mbps, 1 Gbps, 2.5 Gbps, 5 Gbps, and 10 Gbps transmission rates and cannot operate at 10 Mbps.

Does multi-Gigabit Ethernet support autonegotiation of transmission rates?

Yes.

Is re-cabling required to implement multi-Gigabit Ethernet?

No. Multi-Gigabit Ethernet can use Cat5e and Cat6 cables to provide a transmission rate of 2.5 Gbps and 5 Gbps, respectively.

What kinds of network cables do multi-Gigabit Ethernet require?

The required network cables depend on the transmission rate. For 2.5 Gbps, multi-Gigabit Ethernet requires Cat5e cables or above. For 5 Gbps, multi-Gigabit Ethernet requires Cat6 cables or above. At both rates, the transmission distance can reach 100 m (328.08 ft).

The required network cables for 100 Mbps, 1000 Mbps, and 10 Gbps are the same as other Ethernet standards.

Can multi-Gigabit Ethernet provide the 10 Gbps transmission rate?

Yes, but specific cables are required. For more information about required cables, see "[Hardware compatibility.](#)"

Signals are prone to be affected at 10 Gbps. To use the 10 Gbps rate, route cables to be far from interference sources.

How do two multi-Gigabit Ethernet ports negotiate the transmission rate with each other?

Two multi-Gigabit Ethernet ports transmit data at the maximum rate supported by both devices and the network cable. For example, if the local and peer devices support a maximum of 10 Gbps transmission rate but the network cable supports a maximum of 5 Gbps, the ports use 5 Gbps.

Does multi-Gigabit Ethernet support PoE?

Yes. Multi-Gigabit Ethernet supports PoE (15.4 W), PoE+ (30 W), PoE++ (60 W), and PoE++ (90 W).

How can multi-Gigabit Ethernet guarantee network connectivity?

The NBASE-T technology used by multi-Gigabit Ethernet includes a downshift feature, which enables the system to dynamically select the optimal speed for each cable as the noise in the network changes. It protects the network from unexpected disconnection and allows users to locate and reroute noise sources.