

BACK TO THE FUTURE: THE ROAD TO SINGLE-PAIR ETHERNET

Traditional Ethernet copper cabling, which uses an 8-conductor, 4-pair (8C4P) cable construction, has been used for decades to transmit data over local area networks and more recently to deliver low power via remote powering methods such as Power over Ethernet (PoE). With the ubiquitous RJ45 physical interface, 4-pair cabling has remained popular as a means to standardize the data link layer on a single protocol, allowing the convergence of historically disparate systems—such as physical security, lighting and automation—to become integrated over Ethernet-based networks.

However, with the rapid growth of the Internet of Things (IoT) and the need to provide cost-effective power, connectivity and security to billions of connected devices, there are gaps that exist in the current Ethernet wiring and application standards that limit the number of devices that can connect to the network via category-rated twisted-pair cabling. The most notable gap is that the physical reach of twisted-pair cable cannot exceed 100 meters (328 ft.) For example, there are numerous non-Ethernet protocols and devices used in industrial automation networks that have application distances up to 1 km that cannot be supported by the current Ethernet standards.

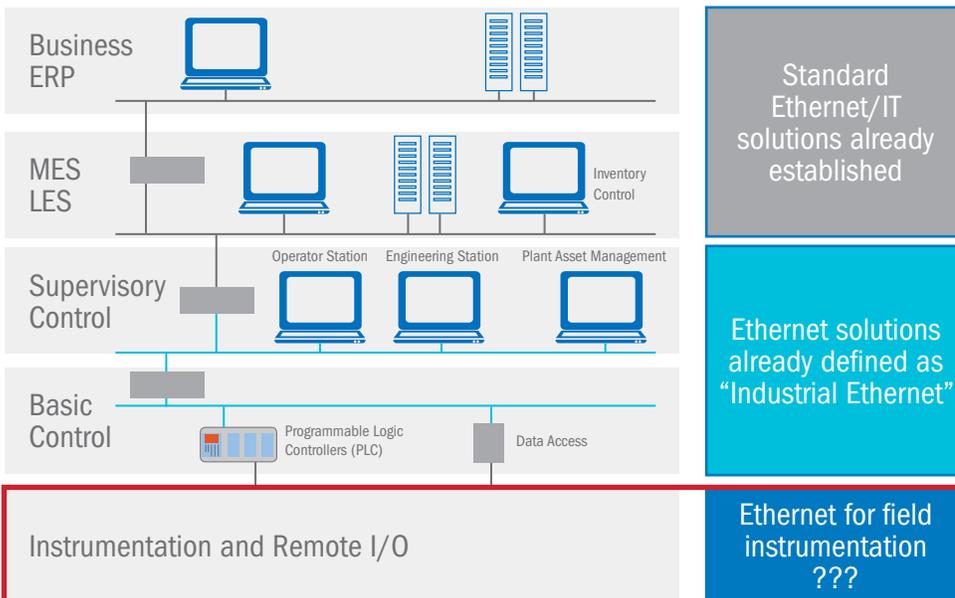
Additionally, there are automation protocols within commercial buildings that also exceed the 100 meter distance restriction of twisted-pair Ethernet. Commercial lighting, building management solutions and physical security are examples of solutions that can take advantage of a standard that provides Ethernet-based distance support beyond 100 meters for both data and low-watt power delivery to endpoint devices.

While much of the excitement of the Internet of Things is centered around consumer devices, such as the latest smartwatch or smart fridge, the majority of existing IoT devices are in factories, businesses and healthcare facilities. By 2025, it is estimated that the total global worth of IoT technology could be as much as \$6.2 trillion, with \$2.3 trillion coming from manufacturing alone.¹

The potential of the Industrial Internet of Things (IIoT) is enormous. It can greatly improve connectivity, efficiency, scalability, time savings and cost savings for industrial organizations, and many companies are already realizing the cost savings of the IIoT due to operational efficiencies, such as predictive maintenance and improved safety.

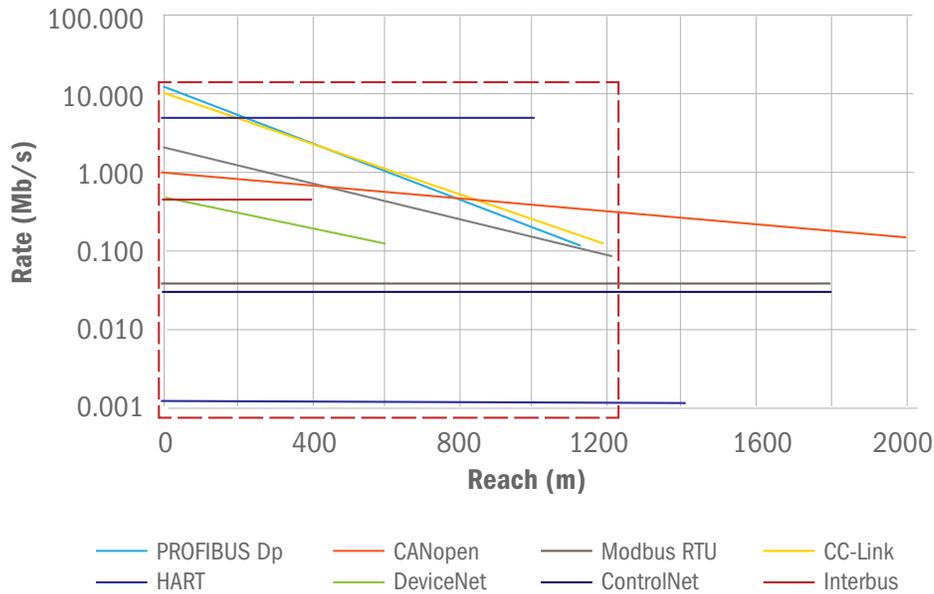
To address the emerging IoT and IIoT markets, the IEEE 802.3 formed the 802.3cg Task Force to develop a standard to address device support twisted-pair cabling beyond 100 meters. The standard – IEEE 802.3cg 10 Mb/s Single Twisted-Pair – envisions a unified network based on single-pair Ethernet as an alternative to the hugely fragmented fieldbus landscape.

ETHERNET GAP AT THE “EDGE”



Credit: Dr. Raimund Sommer, Endress and Hauser, ODVA Industry Conference, Oct. 2014.

Fieldbus Reach and Rate



Source: IEEE 802.3 CFI_01_0716.pdf

This group is focused on single-pair Ethernet for three key reasons:

- It provides advanced power and data capabilities. Advancing standards and technologies enable single-pair Ethernet to potentially support speeds up to 1 Gb/s. Additionally, single-pair Ethernet can leverage the existing 802.3 PoE standards to provide power and data to a broad spectrum of devices. The current proposal calls for support of 10 Mbps operation in automotive and industrial environments (e.g. EMC, temperature) over single balanced twisted-pair cabling up to at least 15m up to at least 1km. The standard will also specify one or more optional power distribution techniques for use over the 10 Mb/s single balanced twisted-pair link segments. Early proposals are looking at delivering roughly 13 watts of power to powered devices with an installed cabling distance not exceeding 1km.

- Single-pair Ethernet is only about 25 percent the mass and weight of traditional four-pair Ethernet, making it a space- and cost-efficient alternative. It takes up less space in cable pathways, enabling more routing options, including connecting to smaller high-density devices.
- Data security is a primary challenge in deploying wide-scale IoT. Since IEEE 802.3 applications have built-in security features, it provides network protection.

Single-pair Ethernet offers a more cost-effective solution for connecting IoT devices to a network, which is essential in smart buildings, where all systems and devices are integrated with the network. While single-pair Ethernet lacks the higher data rate and remote powering capacities of traditional four-pair Ethernet, it provides a more compact and cost-efficient solution for IoT devices, most of which do not require nearly

as much bandwidth and power as the devices using traditional Ethernet.

However, connecting the various sensors, controls, cameras and other devices in an efficient way can present challenges. As a result, there has been increasing demand for industry-standard end-to-end industrial Ethernet network protocols, with significant focus on single-pair Ethernet.

For more information on the ever-growing Internet of Things and the role of single-pair Ethernet, visit anixter.com/commercialbuilding.

¹ Strategy Analytics M2M Strategies advisory service, McKinsey Global Institute, NYTimes.com.

To learn more about smart building infrastructure, visit anixter.com/sbguide