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10Mb/s SINGLE PAIR ETHERNET AT A GLANCE

OPERATIONAL TECHNOLOGY NETWORKS

Single Pair Ethernet (SPE) is quite simply Ethernet transmission over a balanced pair of conductors. 10Mb/s SPE does some unique things that make it possible to bring Ethernet to the edge of OT networks.

WHAT ARE OT NETWORKS?

OT networks derive their name from their function - Operational Technology. OT networks in specific areas are often referred to as “automation” networks (e.g., building automation). These networks are found in buildings and in industrial settings like plants and factories.

While OT networks operate adjacent to traditional IT networks, most are siloed and do not form a cohesive business-wide network. The lack of convergence is driven by the wide range of OT physical layers and protocol stacks. Without specialized gateways performing network protocol translation this leads to incompatibility with the IT infrastructure

Building OT networks control building functions that ensure the comfort and safety of occupants. Examples of

these control functions include lighting control, HVAC and access control to name just a few.

Industrial OT networks manage the profit-making assets of businesses across a diverse palette of processes, ranging from making whiskey to painting automobiles to drilling for oil. Devices in these networks include sensors, transmitters and actuators.

INDUSTRY CHALLENGE

All forms of OT networks are at the application edge. Today these OT networks utilize several “built for purpose” communications methods that are dated, slow and cyber-vulnerable. “Built for purpose” is an important term since prior to SPE using Ethernet at the OT network edge often meant conforming to the physical limitations of Ethernet designed for IT networks rather than executing proven process configurations.

SINGLE PAIR ETHERNET OVERVIEW

IEEE 802.3cg-2019™ standardizes SPE which is designed for 10Mb/s transmission speeds over a balanced pair of conductors. The IEEE standard defines two PHYs - 10BASE-T1L and 10BASE-T1S - which provide SPE communications.

10BASE-T1L PHY:

- Enables point-to-point Ethernet transmission up to 1 kilometer, with optional power delivery.
- Enables the link to include up to 10 connectors. This feature is a necessity. While OT networks benefit from the extreme distance, it would be nearly impossible to pull 1000 meters of uninterrupted cable.

10BASE-T1S PHY:

- Supports point-to-point transmission up to 15 meters and multidrop communications at 10 Mb/s with up to 8 nodes connected on a single segment.

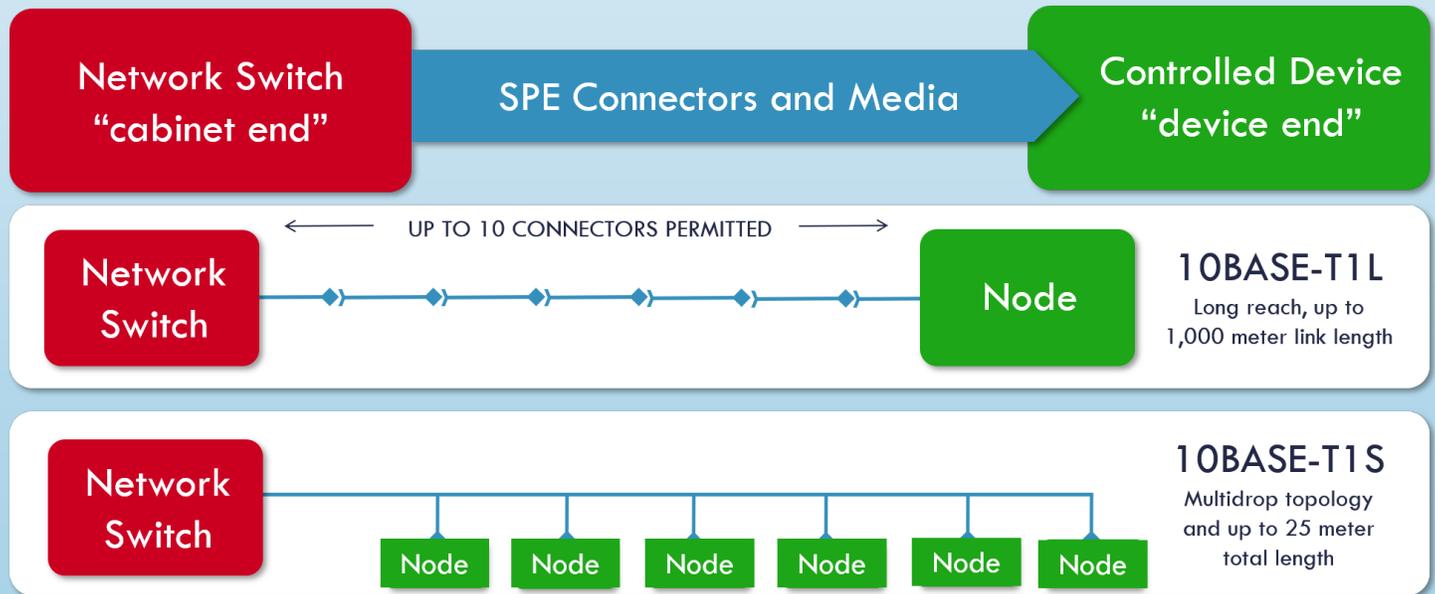
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Both PHYs support topologies that the “built for purpose” legacy networks do today. Therefore, a key SPE benefit is building OT networks as you always have and gaining the advantages of Ethernet.

The objectives of IEEE 802.3cg provision support for Ethernet transmission on a “balanced pair of conductors.” For the most part, SPE media is twisted pair cabling. However, the “balanced pair” definition includes backplane applications meaning SPE drives migration to Ethernet in physical layers like those inside IT equipment.



BENEFITS OF SPE FOR OT NETWORKS

- Seamless single protocol network from application edge to the cloud:**
 SPE simplifies network design and operation, eliminating the support and translation of legacy network protocols used in OT networks.
- SPE is Ethernet designed to support the way you build your process:**
 SPE PHYs allow the network edge to function like legacy protocols while doing so with Ethernet.
- Greatly enhanced security versus “cyber-vulnerable” legacy networks:**
 Since SPE is Ethernet, edge networks enjoy the robust security found in IP networks.
- Optional power delivery can transform OT network control power infrastructure:**
 Many edge devices are reliant on local control power. SPE allows a single connection with control power and communications transforming the network edge.
- Implement enhanced network services like TSN (Time-Sensitive Networking):**
 SPE enables higher functioning, more sophisticated networks cloud to edge.

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ABOUT THE ETHERNET ALLIANCE

The Ethernet Alliance is a global consortium that includes system and component vendors, industry experts, and university and government professionals who are committed to the continued success and expansion of Ethernet technology. The Ethernet Alliance takes Ethernet standards to market by supporting activities that span from incubation of new Ethernet technologies to interoperability demonstrations and education. The organization’s plans for 2020 may be found on the [Events](#) page of its website.

