Expanding the horizons of TSN technology

Protocols provide TSN with the needed extra application layers for industrial automation applications

As the digital transformation of industry continues to advance, Time-Sensitive Networking (TSN) has become a must-have for the factories of the future. While this technology offers advanced capabilities able to enhance production, it is not a standalone solution. In fact, TSN is part of the Ethernet standards and still needs upper-level protocols to support industrial automation applications effectively. So what will be the future relationship between TSN and these higher level protocols?

Thomas Burke, Global Strategic Advisor at CLPA, explains why industrial automation will continue to require protocols even as it embraces TSN.

Time-Sensitive Networking is a game-changer for digital manufacturing applications, supporting the convergence of multiple types of data on a single network while providing deterministic behavior and improved performance. By merging the information technology (IT) and operational technology (OT) worlds, companies can obtain unique actionable insights into their processes and activities that can boost overall productivity and flexibility.

Anyone ready to implement TSN should not leave the existing industrial Ethernet protocols behind. These will remain key components of network technologies for the foreseeable future and will be needed to implement the various application functions required.

A layered approach to industrial communications

More precisely, TSN technology only addresses network functions at Layer 2 (Data Link) of the Open System Interconnection (OSI) model for communications. Hence, it is only responsible for getting data from one place to another in a deterministic manner without looking at what the data is. What needs to be done with the data is typically handled at the higher-level layers that address application requirements. These are managed by specific protocols, e.g. industrial Ethernet technologies.

Since most industrial Ethernet protocols were also created to make Ethernet deterministic, it can be asked, why do we need these and TSN too? The answer is convergence. Typically, most of these protocols do not allow different kinds of traffic to be merged on the same network. TSN takes things one step further by adding this missing capability. Hence, the combination of the required protocols with TSN creates a system that provides all the necessary application flexibility while allowing multiple traffic types to share the same network while being handled in a deterministic way.

Identifying the right industrial Ethernet protocols

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To fully leverage the advantages of a TSN-compatible protocol, machine builders and end users should look closely at its specifications to make sure it can address the requirements of their intended applications. In particular, a suitable solution should encompass I/O and motion control as well as safety.

An example of an innovative technology that can address all these needs is CC-Link IE TSN, the first open industrial Ethernet that combines Gigabit bandwidth and TSN functionalities. CC-Link IE TSN's protocol uses the layers 3 to 7 of the OSI reference model to build on the layer 2 TSN capabilities. By doing this, it allows I/O, motion and safety control to be integrated with standard TCP/IP traffic in a deterministic way. Hence, it provides the kind of transparency Industry 4.0 applications demand.

A comprehensive development ecosystem

In addition to TSN solutions encompassing higher-level protocols, businesses should look for technologies that have a comprehensive development ecosystem, which supports industry standard development options. In choosing such a system, there will always be a development solution for device vendors, no matter what kind of design approach they have in mind.

Conclusions

Higher-level protocols are needed to successfully implement innovative industrial Ethernet systems that leverage TSN, particularly to support demanding automation applications on the factory floor. CC-Link IE TSN is characterized by a strong backbone for safety communications as well as I/O and motion control. In effect, it relies on a proven industrial Ethernet protocol that was specifically developed to run these applications, namely CC-Link IE. This has been widely used in industrial settings around the world, particularly in Asia where the CC-Link IE and its fieldbus counterpart, CC-Link, are the *de facto* standards.

In addition to supporting even the most challenging and demanding applications, CC-Link IE TSN also offers a broad spectrum of device development options, both hardware and software, simplifying the creation and utilization of TSN-compatible automation components. By adopting CC-Link IE TSN, companies can rely on a proven technology and truly realize the potential of TSN with state-of-the-art products and applications.

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CLPAUS046 Why do we need protocols on top of TSN

Captions:

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Image 1: TSN in practice

Image 2: Combining TSN and protocols is an improvement to the reliability of Industry 4.0 (Copyright: iStock/ metamorworks)

Keywords: CLPA, TSN, Time-Sensitive Networking, protocols, technology, industrial ethernet, Industry 4.0, factories of the future, IT/OT, OSI, industrial automation

About The CC-Link Partner Association (CLPA)

The CLPA is an international organisation founded in 2000, now celebrating its 20th Anniversary. Over the last 20 years, the CLPA has been dedicated to the technical development and promotion of the CC-Link family of open automation networks. The CLPA's key technology is CC-Link IE TSN, the world's first open industrial Ethernet to combine gigabit bandwidth with Time Sensitive Networking (TSN), making it the leading solution for Industry 4.0 applications. Currently the CLPA has almost 3,800 member companies worldwide, and more than 2,000 compatible products available from over 340 manufacturers. Around 30 million devices using CLPA technology are in use worldwide.

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