

Digital Transformation **ACADEMY**



More rapid digital transformation courtesy of access to more industrial information

“We can now see the results from the first open, deterministic industrial Ethernet that combines gigabit bandwidth with time-sensitive networking.”

By Tom Burke, global strategic advisor, CLPA, CC-Link Partner Association

What might it take for manufacturers to realize the full potential of smarter, more productive, and competitive factories?

Modern technology enables information from machines to guide immediate adaptation and real-time, human decision-making. Fully realizing that future state will take the coordinated efforts of industry vendors for the benefit of their customers.

It's vital that suppliers work in concert to bring about digital transformation. No one vendor can supply all the products needed to transform manufacturing; it is es-

sential that customers be able to select from the widest possible range of technologies and products to support their digitalization efforts. Partnerships, such as the [TSN Industrial Automation Conformance Collaboration](#), assure that products from different vendors can coexist on a single TSN network and suppliers can compete to provide new solutions, especially in communications.

With thousands of systems installed globally, this ensures continuity between time-sensitive networking (TSN) communication platforms, which prompts IT/OT convergence and enables automation vendors to deliver products that provide the right data from the right devices. As there

are a multitude of disparate devices and networks that may be connected via this TSN technology, this approach intends to have all these systems co-exist on the same physical wire. Over the years, systems have been assembled with different fieldbus and Ethernet technologies that will now be able to share the same physical wire. That benefits everybody.

IT and OT communication

The first step in this journey to smarter manufacturing is the proper integration of IT and OT, which until recently have operated in two different worlds, two separate networks. The aim is to strategically, comprehensively collect, organize, and analyze raw data from the factory so that it can be turned into information that IT systems can understand and utilize for predictive maintenance. (Without proper metadata and timestamps to provide context, for example, computers cannot find solutions and patterns hidden in raw data.)

Harnessing this data is necessary in order to use new technologies like artificial intelligence, big-data analytics, the cloud, edge computing, and virtual/augmented reality. The industrial communication required to support these tools must be made in milliseconds and nanoseconds.

The technology of time-sensitive networking (TSN) and CC-Link IE TSN enables full digital transformation. We can transform the data being acquired from all these legacy and new devices in the OT world at speeds we never dreamed of. We have terabytes of data we can collect through these high-speed data acquisition systems. The importance of high-performance deterministic systems and networking increase the availability and reliability of the data being acquired. IT applications and systems want the data transformed into information, the performance and throughput are different between OT and IT systems. Device and networks in the OT world have different network bandwidth requirements. With TSN technology, which essentially means GB Ethernet, we can make sure that time-critical data is delivered between different endpoints; consequently we will not miss key events in the data transitions. This is very important not to lose data so the right decisions can be made based on the information.

We can now see the results from the first open, deterministic industrial Ethernet that combines gigabit bandwidth with time-sensitive networking. It's transformative in building a bridge between OT and IT because it can handle smart factories' traffic-scheduling challenges by leveraging the new IEEE 802.1Q standard for Ethernet TSN enhance-

ments. This technology was introduced by Mitsubishi Electric at the end of 2018 and is called CC-Link IE TSN. This gigabit-bandwidth TSN technology improves visibility into manufacturing operations with real-time data that can be aggregated and analyzed. It also reduces development and support costs because business processes, insights, and controls are merged into a single environment.

Cloud and edge computing have critical roles to play in smart factories. Using edge-computing structures as a layer between the factory floor and IT systems ensures operational security. Edge computing enables filtering, timely reactions, and system resiliency. While cloud environments are more suitable for analyzing big data and finding patterns, edge devices ensure rapid, real-time response.

Open-software platforms contribute to smart factories as they enable unification, analysis and mobilization of data in real time across disparate devices. This open software delivers a contextualized view of enterprise operations, enabling machine operators and factory managers to quickly identify the root causes of process problems.

It's all about the data

Smart manufacturing—the collection, visualization and analysis of aggregated data for the optimization of manufacturing operations—requires shifting to a more fully connected factory. We all understand this.

We must recognize that data sources include, well, everything. And we now have the ability to connect all these disparate devices and networks that are constantly monitoring all of the machine and process data to make intelligent real-time decisions. We now have a mechanism for the IT and OT networks to run on the same physical wire.

This pervasive, always-on connectivity makes it possible to pull data from across an entire operation and use it to continually improve productivity and profitability. The bottom line is how important it is to have all the data all the time and to make intelligent decisions by converting that data into useful information...generating actionable insights. A key advantage of TSN technology, because it allows multiple different protocols to run on the same physical wire, is connectivity to everything. Improving the performance of process and manufacturing operations is dependent on the utilization of this TSN technology, where reliability of data is insured, leading to reliably intelligent decisions.