Breaking down walls to build e-F@ctories

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Integrating robots in industrial communications networks is a key step on digital transformation journeys

The number and complexity of robotic applications is continuing to grow at a spectacular pace, helping to make digital manufacturing strategies a reality across various sectors. To succeed in the creation of highly effective and competitive robotized setups, it is important to consider how these and their constituent elements can communicate to support smart, data-driven operations.

Thomas Burke, Global Strategic Advisor at the CC-Link Partner Association (CLPA), looks at how industrial automation vendors, machine builders and end users can futureproof robotic systems with value-adding network technologies.

The adoption rate of robotic solutions has accelerated to the point that installations increased by over 30% in 2021 and have more than doubled since 2015. The American market has been particularly receptive to the benefits of robotized operations in industrial settings, with nearly 35,000 new units set up across the U.S. in 2021. In this region, robots have been implemented in multiple sectors, the most common projects being in automotive, food & beverage, plastic and chemical, metal and machinery as well as electrical and electronics manufacturing.[1]

The heightened acceptance and adoption of robotic systems in recent years has also been supported by a considerable reduction in associated capital expenditure

(CAPEX) and operational expenses (OPEX). In addition to lower total cost of ownership (TCO), more intuitive and user-friendly solutions are becoming available, supporting entry-level users to begin their digitalization.

From islands of automation to interconnected e-F@ctories

Independent of the level of automation within an organization, in many cases, robots are installed as single, stand-alone automated systems. Commonly confined to a work cell, they can be considered 'islands of automation', with limited communications requirements.

However, as businesses advance in their digital transformation journey, increasingly more ambitious frameworks are being developed to create smart e-F@ctories. For example, it is possible to combine multiple automated, articulated units that work in sync on a single line or create cooperative as well as collaborative environments where humans and machines safely share the same working space. In effect, the number of collaborative robot (cobot) applications has almost quadrupled since 2017, with 39,000 new global installations in 2021.[1]

These new, highly automated setups require an unprecedented level of interconnectivity between machines as well as with other automation components, control systems and users. Technologies including cameras, sensors and other vision systems, SCADA as well as condition monitoring platforms need to seamlessly communicate.

These elements are key, for example, when several industrial robots are running in parallel and their movements need to be coordinated to ensure that operations run smoothly and potential collisions are detected and avoided, especially in confined spaces. Similarly, cooperative or collaborative robots need to be able to reduce their

speed or come to an immediate halt depending on the movement and proximity of operators.

In addition, to support digital manufacturing applications, the ability to share data across the shop floor and the enterprise offers a competitive edge by improving flexibility, reliability and responsiveness. For example, ever more accurate maintenance strategies rely on data from robots and their parts to monitor their status, wear and tear as well as prevent equipment failure by means of predictive analytics.

The right communications technology for robot connectivity

These requirements can be addressed solely by enabling highly effective communications, connecting all relevant elements together to share key data and ultimately supporting coordinated activities as well as the creation of value-adding business intelligence. More specifically, it is extremely important for robots, their components and the overall network infrastructure to be able to support TSN standards, as these enable the reliable transfer of multiple types of data and traffic.

In effect, this innovation is an enhancement to standard industrial Ethernet that is intended to drive convergence and interconnectivity. Network technologies with TSN functions, such as CC-Link IE TSN, can simultaneously handle time-critical messages, e.g. dealing with robot motion control, as well as TCP/IP packets, such as videos from cameras and other vision systems. This is achieved by scheduling data traffic queues and prioritizing the most urgent frames, while less-transient messages are sent when sufficient bandwidth is available.

Besides opening the door to convergent communications, which are at the core of Industrial Internet of Things (IIoT) applications, where information technology (IT)

and operational technology (OT) can merge, these capabilities offer a number of benefits to robot users. They can simplify network configurations and architectures, reducing costs while improving immediate diagnostics and troubleshooting activities. In addition, they can enhance the overall performance and productivity of machines and shop floors.

Supporting the creation of TSN-compliant robots

To enable the realization of e-F@ctories that leverage the full potential of robots on their shop floors, different players should look at how they can incorporate TSN. While end users, machine builders and system integrators should favor solutions that are compatible with this technology to improve productivity, industrial automation vendors should incorporate it into their products to open up enhanced performance opportunities.

As TSN is a relatively new addition to industrial Ethernet, robot vendors may be wondering if the time is right to adopt it. In effect, the number of robots, controllers and other devices is continuing to increase. Therefore, offering compatible, futureproof solutions is a safe bet to support market demands and enhance competitiveness.

The creation of robots and other automation components with TSN functions should leverage the most suitable development tools available, which ultimately depend on the network technology selected. For example, CC-Link IE TSN provides a broad ecosystem, characterized by multiple hardware- and software-based solutions, to help developers select and deploy what works best for their intended applications and customer needs.

Even more, the CLPA is actively taking part in the TSN Industrial Automation Conformance Collaboration (TIACC) to drive standardization and interoperability by developing a unified conformance test plan for TSN-compliant automation devices. By committing to the TIACC, the organization is aspiring to ensure the industry-wide alignment of TSN-based network components. As a result, robot developers, machine builders and end users can benefit from seamless interconnectivity within their e-F@ctories.

[1]International Federation of Robotics (IFR). (2022). World Robotic Report 2022. Available at: https://ifr.org/ifr-press-releases/news/wr-report-all-time-high-with-half-a-million-robots-installed [Accessed: 7 November 2022]

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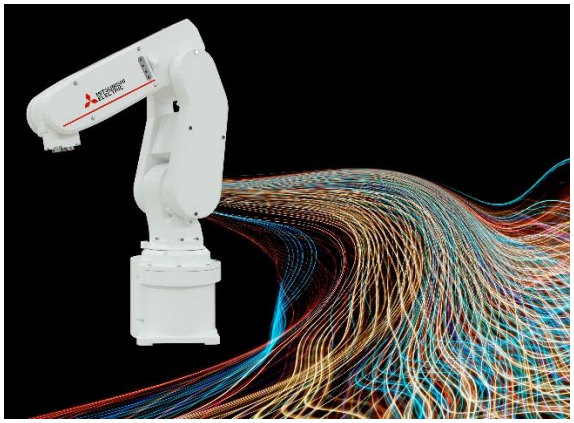

Image 1: To enable the realization of e-F@ctories that leverage the full potential of robots on their shop floors, industry players should look at how they can incorporate TSN.

About The CC-Link Partner Association (CLPA)

The CLPA is an international organization 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 open industrial network family. 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 over 4,100 corporate members worldwide, and more than 2,000 compatible products available from over 370 manufacturers. Around 38 million devices using CLPA technology are in use worldwide.

Anyone interested in joining the organization can apply here: https://www.cc-link.org/en/clpa/members/index.html

Press contact:
CC-Link Partner Association Americas
Thomas Burke
Global Strategic Advisor
Tel.: (847) 478-2100
tom.burke@cclinkamerica.org

PR agency:
DMA Europa
Chiara Civardi
Progress House, Great Western Avenue, Worcester,
WR5 1AQ, UK
Tel.: +44 (0) 1905 917477
chiara.civardi@dmaeuropa.com
news.dmaeuropa.com