Technical Article

Accelerating the adoption of Ethernet in factory automation with highly integrated processors

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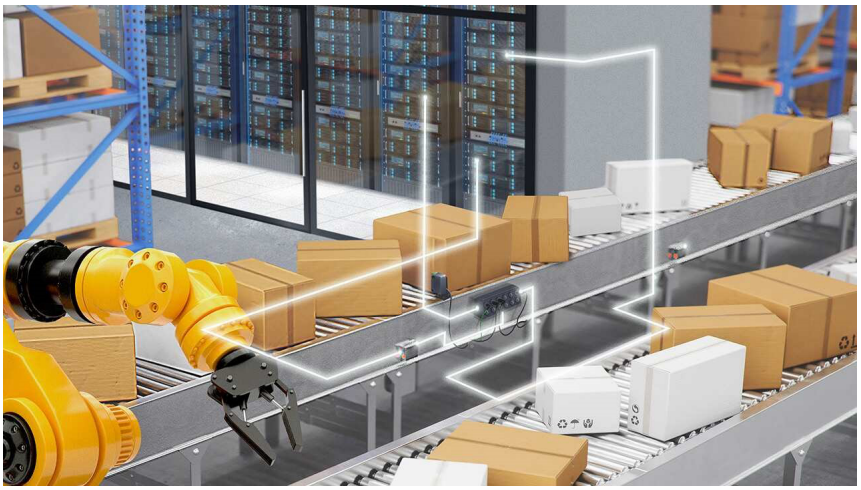


Ethernet-based industrial communications is not a far-off, unattainable vision of factory and process automation. It is being adopted at a rapid pace.

But with cost, complexity and scalability challenges, serial interface are still the standard for wired communications. And understandably so given the cost-effectiveness and reliability of IO-Link and RS-485. Design and software engineers are also familiar with these standards.

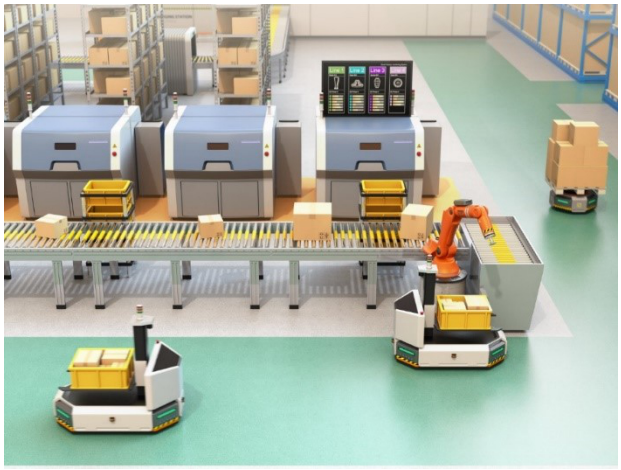
However, new embedded processor technologies are helping accelerate the shift to Ethernet by integrating MAC support as well as support for various industrial Ethernet Protocols like EtherCat and Profinet. Our processors team interviewed several TI experts to get their insights on industrial communications design challenges, and the role embedded processors play in the adoption of Ethernet.

The key advantages of Ethernet for industrial communications

Meeting the demands for increased efficiency and flexibility in modern manufacturing processes requires using communication protocols that can handle the rapidly growing bandwidth of connected systems. With more sensors and higher-level processing capabilities such as edge artificial intelligence (AI), the systems in these settings need to reliably and quickly transmit more and more data.

This is where Ethernet is advantageous and provides a mechanism for transferring latency-critical data – especially for Time-Sensitive Networking and protocols such as EtherCAT and Profinet.

“We’re in the middle of a transformational journey to Industry 4.0, where more factories are adopting Ethernet to meet the high-bandwidth demands of modern systems and take advantage of more data-driven decision-making,” said Alex Weiler, general manager, factory automation and control. “Ethernet enhances the real-time capabilities of factory and process automation, allowing for next-generation manufacturing to incorporate more machine learning, predictive analytics and autonomous robotics.”



To learn more about industrial Ethernet protocols and their role in the evolution of Industry 4.0 designs, read our company blog post, "How New Connectivity Technologies are Lowering the Barriers to Industry 4.0."

How embedded processors are enabling the transition to Ethernet

In industrial communication designs, embedded processors ensure reliable communications between systems. They will still fill that same role in an Ethernet-based network, but have the potential to do more – especially in terms of predictive maintenance and system monitoring.

"Embedded processors, from microcontrollers to microprocessors, play a crucial role in the transition to Ethernet-based communications by helping manage the growing amount of data between connected systems and ensuring interoperability across network protocols," said Roland Sperlich, vice president, processors. "Devices such as TI's AM2432 microcontrollers are helping expand the potential for real-time control and communications in industrial systems with more processing power and integrated components, as well as open-source and easy-to-use software."

While the role of embedded processors in industrial communications designs hasn't changed, modern devices, paired with the right software, can optimize Ethernet-based designs.

"As computing performance in today's embedded processors continues to increase, engineers can enhance their real-time control over Ethernet-based protocols through complex software," Weiler said.

TI's semiconductor device portfolio ranges from cost-effective microcontrollers to high-performance Arm® Cortex®-A72x-based systems on a chip. These devices combine traditional real-time control and sensing functions with communication, storage, security and data-processing functions previously found only in higher-level systems. These devices also help designers better manage their transition to Ethernet by supporting a variety of fieldbus protocols, as well as industrial Ethernet protocols at speeds as high as 1Gbps.

What's next for the transition to Ethernet in process and factory automation

Enhanced connectivity between an expanding ecosystem of Ethernet-connected devices inside and outside of factories will continue to increase efficiency and optimize entire supply chains. Being able to support more data from a growing number of sensors and increasing processing capabilities also means being able to support more flexibility in the manufacturing process, while enabling more intelligence and decision-making at the network edge through edge AI capabilities.

"The journey to broad Ethernet adoption in factories started with higher-bandwidth, real-time communications and is now expanding to include AI processing", said Pekka Varis, senior member technical staff. "Advances in semiconductor technology are allowing for more data to be transmitted between connected applications, allowing for more decision making to happen at the network edge, where sensors are actively collecting data. This will lead to lower latency and, ultimately, more efficient and safer operation."

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