Manufacturing plants around the world now depend on Ethernet solutions for the real-time performance and ruggedness required by industrial applications. Compared to legacy fieldbuses, Ethernet offers faster speeds, better handling of large data volumes, and, ultimately, more savings via superior energy efficiency and more efficient equipment. It can also serve as the single networking technology connecting automation on the factory floor to the enterprise IT that controls the factory floor—simplifying overall network design while boosting performance.

Why and how does Ethernet work so well in manufacturing? There are many reasons behind its rise, but a few to note include:

- Most industrial Ethernet now operates in full duplex to avoid collisions. While collisions are possible in half duplex, they may not be a problem until the ratio of collisions to frames passes a certain threshold. Still, full duplex provides complete collision avoidance.¹
- Factories, like other popular settings for industrial Ethernet (such as wind farms and oil and natural gas refineries), are often subject to harsh environmental and operating conditions. Operators have to account for vibrations, particulate matter, and extreme temperatures, and they can do so by using industrial Ethernet cables and connectors in their automation and control systems.
- Industrial Ethernet offers a variety of options for topologies and protocols. Plants can move outside the star topologies that dominate commercial Ethernet and, for example, use ring topologies for redundancy and rapid recovery. Moreover, protocols such as EtherNet/IP® and EtherCAT® cover a wide range of use cases and system designs.
- This series on industrial Ethernet’s benefits for manufacturing will start off with a look at why Ethernet has become a viable option for in-plant automation. From there, we’ll consider how, going forward, both Ethernet and Wi-Fi can help factories move toward the Internet of Things and later discuss how a network built around something like EtherNet/IP could be implemented across the plant.

Ethernet’s Past and Future in Automation: Standardization and Performance Make All the Difference

Development of Ethernet began decades ago, and the technology cultivated a strong base of manufacturers to drive a rapidly evolving product ecosystem. As Ethernet performance improved, the combination of speed and maturity made Ethernet an increasingly feasible replacement for protocols that were built for serial-based interfaces.

For example, consider the development of controller and switches to support Ethernet-based automation systems. Today’s chips may be modified with a real-time operating system to support deterministic processing, while their I/O controllers are set up to work with any industrial automation protocol, from EtherNet/IP to Modbus/TCP.²

These products are indicative of what industrial Ethernet can do in the modern manufacturing plant. Cycle-response times can be optimized, while unwanted disconnects can be guarded against. As an added benefit, the vendors and standards bodies in the Ethernet community provide ongoing support for solving challenges through automation solutions.

“Ethernet and wireless both offer bandwidth greater than most dedicated automation networks and largely rely on established standardization organizations and a large supplier base for continued development,”³ explained Chantal Polsonetti, vice president of the ARC Advisory Group, in a 2013 article for Automation World. “Ethernet in particular has shown its ability to reliably deliver the right data to the right place at the right time, while manufacturers broadly apply cable-free wireless instrumentation to address business challenges ranging from improved process performance, reliability, and efficiency, to conformance with government mandates.”

Ethernet’s distinctive performance characteristics are also useful as a basis for automation systems that are integrated into the IoT. Much of the IoT’s promise is predicated on the concept of using real-time data and activities instead of historical information to support decision-making. The system level can be improved, overcoming the limitations at the machine and device levels, as Polsonetti pointed out in her article.
In the next entry in this series, we’ll return to a subject we’ve covered a few times here—namely industrial Ethernet protocols like EtherNet/IP and PROFINET®. Instead of reviewing their essential traits, though, we’ll examine how they can be implemented in a factory, especially for plant-wide automation and the creation of a converged network serving the key interests of both engineers and IT.

References


2 Industrial Networking ICs. Innovasic.