Industry 4.0: Interview with Brendan O'Dowd

Brendan O'Dowd, the general manager for industrial automation at Analog Devices, answers questions and shares insights about Industry 4.0. Brendan has more than 30 years of experience in the semiconductor industry.

To what extent is the industrial market sector following Industry 4.0 guidelines?

The Industry 4.0 trend is not new. In 2016, many governments recognized that a transformation of the industrial sector through the principles of Industry 4.0 would help close the productivity gap. Especially in EMEA, the Industry 4.0 initiatives provide incentives to:

- Invest in advanced Industry 4.0 technologies
- Carry out relevant research and development
- Improve knowledge and understanding of Industry 4.0 in factories, as well as colleges and universities

Now it is a worldwide initiative that merges many formerly separated disciplines such as IT, design and development, production, database management, security, and others.

Analog Devices, a solution-oriented semiconductor company, has seen a rise in the number of requests for technologies related to Industry 4.0, such as condition-based monitoring and industrial Ethernet.

Despite this government-led drive to implement Industry 4.0 practices, the industrial sector faces the same set of opportunities and risks as companies do in every advanced economy. Manufacturers cannot afford to wait on the sidelines and risk missing out on first-mover advantages. At the same time, there is a risk in making big investments today that might quickly become obsolete and never pay off.

And the transition to Industry 4.0 is not simply a matter of specifying and installing equipment or even building a new factory: it fundamentally affects the way in which manufacturing companies operate. In particular, the need for expanded expertise in domains such as software, security, and IT presents manufacturers with difficult trade-offs and choices about where to invest, who to partner with, and how to ensure organizational agility.

Which is the critical element in the implementation of a digital/4.0 factory?

The critical, enabling element of Industry 4.0 is an integrated communications network that can support connectivity throughout the factory. The essence of Industry 4.0 is data, and the intelligence that you can derive from data. And you have no data to work with until you can transfer it from and between machines and operational technology (OT) and enterprise (such as IT) computing systems.

We expect the backbone of connectivity in factories to be a deterministic Ethernet network. While a mix of industrial Ethernet protocols are in use today, there are huge benefits to industry in standardizing on the time-sensitive networking (TSN) Ethernet protocol. Manufacturers should be specifying TSN-ready solutions with a roadmap of other enhancements if they are to ensure their network investments are part of a longer-term plan.

What does the 4.0 transformation of industrial automation look like?

The purpose of investing in Industry 4.0 is to upgrade from a labor-intensive footprint to a more sophisticated automated infrastructure. Some common features of this new approach to industrial automation are beginning to become clear.

- Repetitive tasks are now being performed by collaborative robots commonly known as cobots. These are smaller robots that work in collaboration with humans. While the traditional large-scale industrial robotics industry remains healthy and growing, the newer collaborative robotics market is in the early stages of growth.
- A predominantly rigid and centralized control architecture is being replaced by a decentralized and flexible factory floor. Here, robots operate in tandem with many other systems, including PLC controllers and a vast array of sensors and actuators. These machines or devices are designated as either inputs or outputs. An Analog Devices innovation—software-configurable I/O—allows universal selection and configuration of many types of input and output devices. This enables customers to easily install and reconfigure their automation equipment. Manufacturers using software-configurable I/O typically benefit from an eight-week reduction in installation time, engineering cost savings, and a significant reduction in factory space requirements. Factory

production flows can be adapted more easily and changes that would once have taken hours can be completed in minutes.

- Predictive maintenance and condition-based monitoring are helping to improve factory-wide productivity and reliability. Operating parameters such as vibration patterns can reveal early signs of wear which can be repaired before a machine experiences any faults or downtime. This is a prime example of the importance of accurate sensor measurements, intelligent data analytics, and high bandwidth networking in Industry 4.0 systems. And successful implementation of predictive maintenance is about more than the underlying technology—it also calls for deep domain expertise in automation and industrial machine operation to develop the algorithms and software that turn machine health data into operational intelligence.

How do you see the evolution of sensors and software in the context of Industry 4.0?

Sensors generate raw data; software turns the data into actionable information. As the previous example of predictive maintenance illustrates, it is the integration of sensors and software that provides value in a digitized, connected factory.

In a system for monitoring machine health, sensors produce a stream of raw measurements of vibrations, temperature, and other parameters. Signal processing technology makes this stream of data suitable for analysis, for instance, by eliminating noise and distortion, and linearizing the output.

Software and analytics then turn the data into information by correlating data from multiple sources, detecting abnormal patterns, and identifying and locating actual or potential faults.

Integrating the two—the physical world of sensors and the digital world of software—calls for two different kinds of know-how:

- Technology expertise
- Domain or application expertise

Analog Devices has invested heavily to build domain expertise in the industrial sector alongside its expertise in analog and digital electronics. This enables it to bring valuable insights to customers as they implement Industry 4.0 programs, and to help customers understand how to apply new technology in a way that benefits their specific operation.

How, and at which level, can Analog Devices' technologies support Industry 4.0?

Industry 4.0 is about building and using cyber-physical systems to enable new possibilities. It is rooted in the ability to bridge the physical and digital worlds in new ways, a domain in which Analog Devices has been a pioneer for more than 50 years.

But Analog Devices is not a typical semiconductor company: we push the boundaries of silicon technology, investing heavily in software, systems expertise, and domain knowledge within our key markets. And we combine this knowledge with an unmatched set of analog-to-digital capabilities: to sense, measure, interpret, connect, power, and secure. We approach industry's challenges at the system-level and help customers find the best way to deliver successful outcomes.

What would you recommend to a manager who is considering the digitization of production facilities?

Look as far into the future as possible.

It is easy to get caught up in today's hype about Industry 4.0. In fact, some investments made today need to remain relevant 15 to 20 years from now, so it is important to be confident that new systems or technologies have a long lifetime.

This means:

- Choosing scalable connectivity technology using standards-based solutions rather than proprietary systems.
- Specifying sensors that are robust and have a long operating lifetime, as well as providing accurate and precise measurements.

Every move towards a more digitized, connected factory also increases the threat of cyber attack, so security is the other crucial priority for managers as they evaluate Industry 4.0 initiatives.

Optimizing security requires a system-level approach instead of thinking about the requirements of any particular device or end point. Security can be delivered in a variety of ways throughout the system—within edge devices, controllers, gateways, or further up the stack. Before focusing on the "how" at any given point in the network, systems specifiers should focus on questions of where and how much.

This should consider both the threat level at each point, as well as the cost of countering the threat, with a view to adding effective security with the fewest trade-offs in power, performance, and latency. A layered approach will result in a superior overall security posture.

Conclusion

Manufacturers would be wise to invest time and resources, either organically or by choosing a partner such as Analog Devices, in a system-level approach that expands security expertise beyond the machine level.

About the Author

Brendan O'Dowd has over 30 years experience in the industry working for companies like Tellabs, Apple, and Analog Devices. He is currently the general manager of Analog Devices' industrial automation business. He can be reached at *brendan.odowd@analog.com*.

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