Industrial processes in the age of big data, security breaches, and IT/OT convergence

In this issue

1
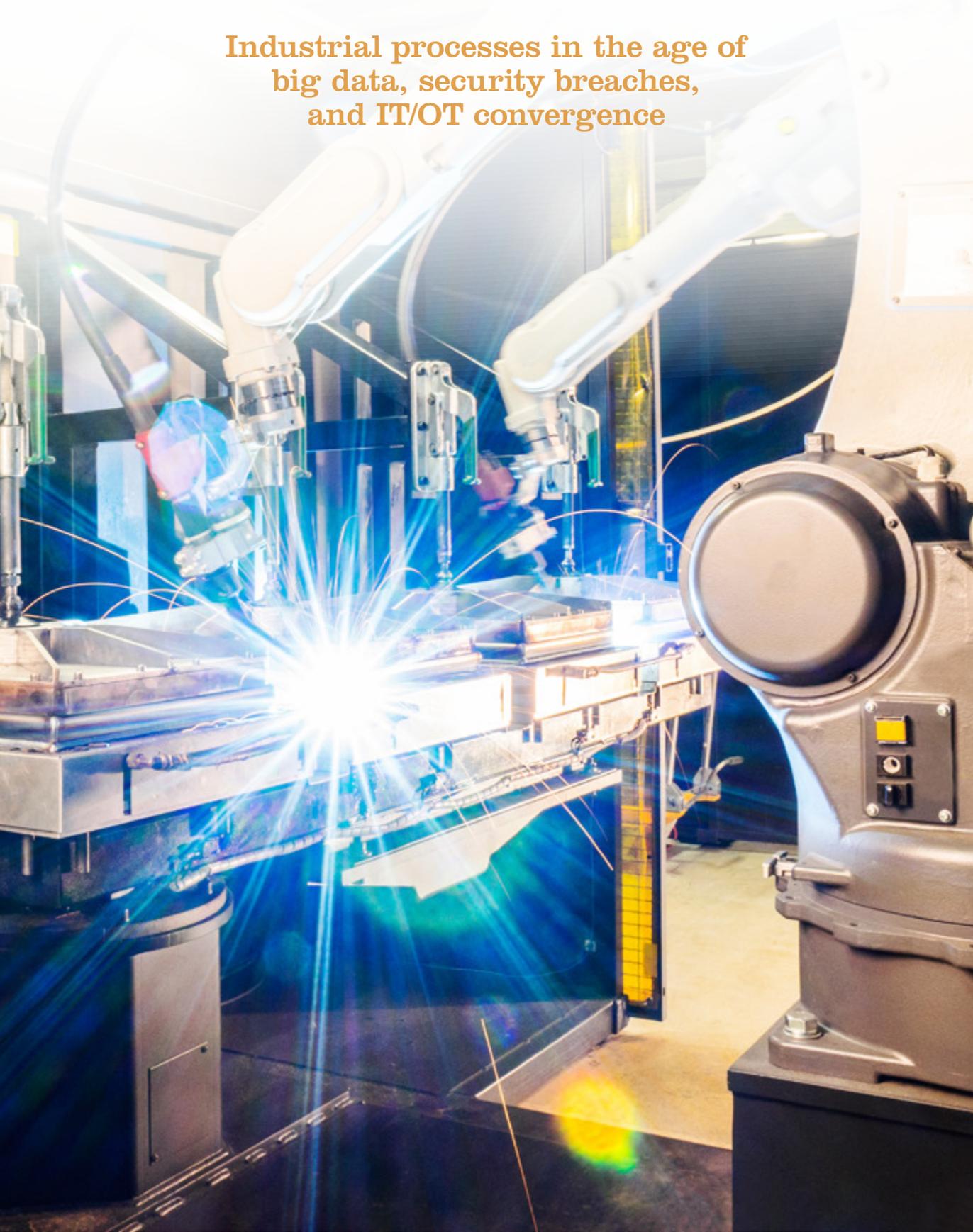
Internet of Things in the Age of
INDUSTRY 4.0

Irene J. Petrick, Ph.D. is director of business strategy for Intel's industrial and energy solutions division

Originating as a research project in 2012 in Germany, Industry 4.0 was primarily intended to revive manufacturing competetiveness. Industry 4.0 is a cyber-physical system that will drive manufacturing operations to be smarter, networked, and autonomous.

Machines will provide health and status information in real time; workers and flexible robots will collaborate to create unique products in small volumes; and software-defined (easily reprogrammable) industrial systems will create highly personalized, cost-competitive products on a mass scale.

A key pillar of Industry 4.0, the Internet of Things (IoT) uses digital technology to enhance the collaboration between humans, machines, things, and enterprise systems.

The IoT is a key enabler for many important imperatives in the industrial sector, such as open-standards-based automation solutions, information technology (IT) and operational technology (OT) convergence, business intelligence, and dynamic collaboration.

> **"** The smart factory of the future fulfills customized customer requirements with state-of-the-art industry software that links all stages of the value chain. **"**
>
> **Irene J. Petrick, Ph.D**

IoT is the ubiquitous connection of people, things, and machines

3 Business Trends Facilitated By the Internet of Industrial Things

01 INNOVATIVE DIGITAL BUSINESS MODELS
Unexpected business opportunities and partnerships are powered by data analytics.

02 DIGITAL PRODUCTS AND SERVICES
Suppliers offer cloud-based services and platforms.

03 VALUE CHAIN DIGITALIZATION AND INTEGRATION
Increased connectivity among stakeholders improves collaboration and responsiveness.

Industry 4.0 and the End User

Across North America and Europe, Frost & Sullivan[1] conducted extensive research with end users, mostly small- to medium-sized companies, which constitute the bulk of the globe's manufacturing footprint. Companies had a wide range of expectations, including those listed on the right.

However, companies are generally unclear about the value and internal investment for the IoT solutions being promoted at this time. They wondered how the current lack of standardization would impede the progression to Industry 4.0. They also wanted to know how suppliers can help end users protect their plants and infrastructure from cyber threats that have become even more pronounced in an IoT age. Last, but not least, end users asked how suppliers could help integrate their legacy systems in order to move them from where they've been for the last two decades.

Companies were not apprehensive about technology and what could be done, but rather about the financial feasibility of this transition.

1. "Internet of Things in the Age of Industry 4.0" webinar with Frost & Sullivan Program Manager Karthik Sundaram.

6 ways
INDUSTRY 4.0 IS EXPECTED TO BRING BENEFITS

1 Digitalization
Increase level of automation

2 Reduced TCO
Lower operations costs (e.g., predictive maintenance)

3 New Service Models
Pursue new opportunities

4 Mass Personalization
Give customers what they want

5 Sustainable Production
Practice social responsibility

6 Agile Supply Chain
Keep critical supplier informed at all times

End-User Apprehensions

Value and ROI

Risk of Cyber Threats

Legacy Systems Integration

The Lack of Standardization

3

WHAT DATA CAN DO FOR YOU

Learn how an IoT solution at an Intel manufacturing facility produces operational efficiencies and cost savings.

HERE ARE A FEW EXAMPLES OF HOW AN IOT SOLUTION CAN BENEFIT YOU[2]

Improve Yields

Data provides insights into equipment performance. At Intel, defective testers can wrongly categorize good units as bad, which negatively impacts operation costs. To address this problem, Intel's IoT solution is able to detect defective tester components before they fail so they can be repaired or replaced before the testers incorrectly sort the units.

The solution's analytics capabilities can predict up to 90 percent of potential tester component failures, which is much better than the factory's online process control system.

Yields losses reduced by

25%

Reduce the Cost of Spares

Intel's IoT solution is the foundation for predictive maintenance program that saves on the cost of spares. It enabled Intel to switch from routine preventive maintenance with scheduled part replacement (e.g., air and water filters) to less costly predictive maintenance that continuously monitors systems to determine when service is really needed.

Spare parts costs cut by

20%

Intel is able to save on the cost of spares by replacing parts when needed instead of replacing them regularly—whether necessary or not—on a prescribed schedule.

Automated classification of defects completed

10X

faster than manual inspection

Higher Throughput

Image analytics can be used to shorten product screening and test times. At Intel, manual inspection of marginal units is cumbersome and can sometimes take many hours to separate true reject units from marginal ones. Automating this process, Intel's IoT solution records an image of each product on the assembly line and resizes, crops, and converts the image into grayscale before converting each pixel to binary. This data is fed into various machine-learning algorithms to distinguish true rejects from marginal rejects.

Read the full story ›

2. Intel white paper, "Optimizing Manufacturing with the Internet of Things," September 2014.

LACK OF STANDARDIZATION

The importance of open standards

Many industrial settings are held back by islands of sensors and machines and silos of data. A major contributing factor is that industrial devices are often based on proprietary designs that use nonstandard communications protocols, which keep them isolated. In fact, industrial settings with a large variety of proprietary, fixed-function devices tend to be rather inflexible.

Over time, the IoT is expected to compel companies to move away from proprietary to open standards-based industrial solutions that promote easy connectivity and interoperability between devices. Moreover, companies will be able to choose from a broad array of solutions offered by an ever-growing ecosystem of IoT vendors, thus greatly expanding their options.

"The vendors who provide public APIs and support open standards will succeed in the long run. Likewise, the vendors who try to trap consumers behind proprietary software and non-interoperable products will eventually fail, to everyone's detriment," according to Mike Loukides, vice president of content strategy for O'Reilly Media, Inc.[3]

Two organizations focused on open standards

Today, Intel is working to make the IoT more open and cohesive by leading the creation of two important consortia to promote a standards-based and inclusive IoT development environment.

Industrial Internet Consortium (IIC)[4] is a not-for-profit group with an open membership that will take the lead in establishing interoperability across various industrial environments for a more connected world.

Open Interconnect Consortium (OIC)[5] seeks to define a common communication framework based on industry standard technologies to wirelessly connect and intelligently manage the flow of information among devices, regardless of form factor, operating system, or service provider.

Standards Increase Interoperability

Communication Standard

Enables Plug and Play

3. Mike Loukides, "Toward an open Internet of Things," April 21, 2014.
4. iiconsortium.org.
5. openinterconnect.org.

5

MULTILAYER DEFENSE

The threat of attack from Stuxnet, Heartbleed, and Havex, along with the malware du jour, is keeping industrial CIOs up at night. Protecting industrial environments and critical infrastructure against cyber attack is ever more difficult, due to the complexity and diversity of equipment. To cover all the bases, it's essential to implement a multilayer approach.

HERE ARE SOME OF THE WAYS YOU CAN PROTECT INDUSTRIAL ASSETS

Platform Security
Reduce platform vulnerabilities from boot-up, to normal operation, to shutdown:

- Prevent unauthorized changes to boot/ initialization software
- Use device authentication with an identity protection scheme, like TPM
- Separate security management functions from operational applications using virtualization

Runtime Security
Protect data at rest, in motion, and in use:

- Add a virtualized firewall on the device for additional separation between applications
- Implement malware protection, such as whitelisting or signature-based detection
- Encrypt and authenticate communication sessions between applications
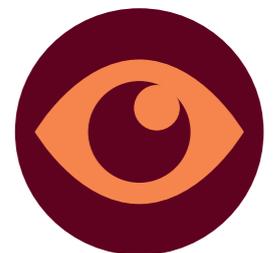
Monitor/Management Functions
Incorporate device and network security intelligence:

- Deploy security information and event management (SIEM) software
- Visualize, investigate, and respond to suspicious behavior
- Employ mutual authentication and encrypted tunnels

6

LEGACY SYSTEMS INTEGRATION

GATEWAYS
BRIDGE THE DIVIDE

Today, 85 percent of existing industrial embedded devices are unconnected.[6] The number of devices connecting to the Internet in 2015 is expected to be 15 billion, and that number is expected to grow to 50 billion by 2020.[6]

Intel® IoT Gateways make it easier to securely connect legacy devices (and new systems) to the cloud. They enable OEMs and ODMs to develop IoT solutions that seamlessly and securely transmit data between edge devices and the cloud, and make it easier for businesses to manage data. Plus, when it's time for businesses to expand their IoT footprint, Intel IoT Gateways have the performance headroom needed for cost-effective growth.

6. IMS research

4 ways
IOT GATEWAYS CAN HELP

1

Automated discovery and provisioning of edge devices to ease deployment

Gateways are ideally located to support Plug and Play setup of edge devices

2

Protocol abstraction to increase interoperability

Gateways perform protocol translation and data normalization

3

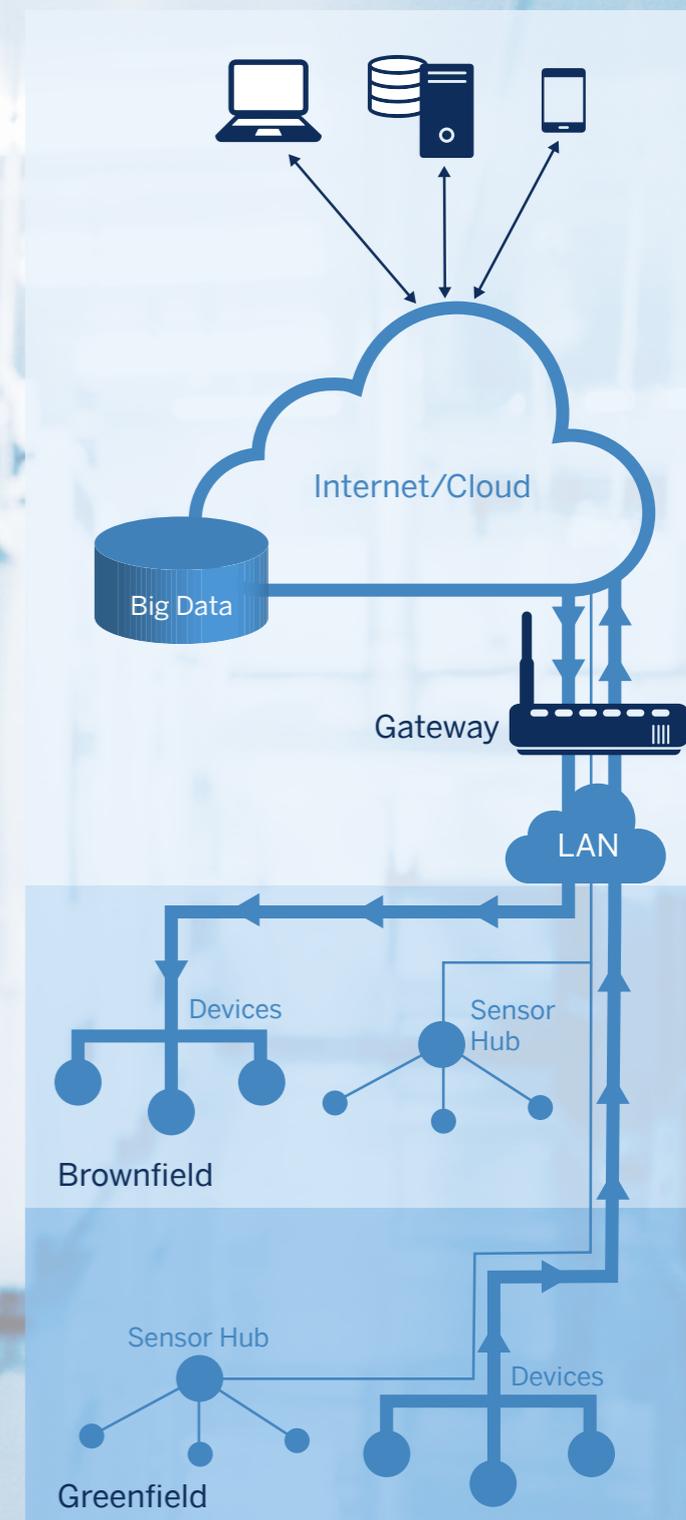**Fast, closed-loop response to improve operations**

Gateways have the computing power to run data analytics software locally

4

World-class security to safeguard unprotected edge devices

Gateways implement robust hardware and software-level protection

Connecting Legacy Devices to the Cloud

Internet/Cloud

Big Data

Gateway

LAN

Brownfield

Devices

Sensor Hub

Greenfield

Sensor Hub

Devices

INSIGHT
FROM AN INDUSTRY RESEARCHER[7]

WHAT'S THE INTEREST LEVEL IN INDUSTRY 4.0?

Most end users are quite enthused about Industry 4.0 because they understand they cannot continue to do business the way they have been doing all along, considering the growing competition coming from many different parts of the globe.

Karthik Sundaram is a program manager for the Internet of Industrial Things at Frost & Sullivan

How long will it take?

Frost & Sullivan estimates a six- to eight-year time frame before Industry 4.0 processes mark their presence in the global manufacturing space.

ON BUSINESS OPPORTUNITIES

End users in the small- and medium-sized enterprise space hold the largest potential for Industry 4.0 solution providers.

Does Industry 4.0 face any major roadblocks?

When it comes to taking the theory into practice, key questions remain, especially with regard to return on investment.

On supplier business models

Major product markets in the industry will undergo a structural transformation, with service becoming the go-to market strategy.

ON RETURN ON INVESTMENT

Suppliers and end users who try to understand the opportunities from IoT through the lens of Industry 4.0 will possibly find a stronger financial justification.

7. "Internet of Things in the Age of Industry 4.0" webinar with Frost & Sullivan Program Manager Karthik Sundaram.

Industrial Solutions
EXAMPLES IN BRIEF

Many companies are already providing IoT solutions in support of Industry 4.0—and using data in new ways to improve ROI.

Here is a brief sampling of what's being done.

BECKHOFF

A leading supplier of industrial automation technology.

Challenge: Implement real-time tracking throughout a manufacturing plant.

Solution: Kitchen manufacturer Nobilia increased its production flexibility using Beckhoff automation technology. The IoT solution made manufacturing processes data-driven, thus minimizing the need for human intervention. As a result, the company is a low-cost producer of an enormous number of fitted custom kitchens, with over 600,000 manufactured per year in two plants.

Key Benefits

- Supports lot sizes of one, per the Industry 4.0 approach
- Improves coordination of suppliers, production, and shipping
- Increases product traceability
- Enables faster problem resolution

Learn more about this IoT solution ›

NATIONAL INSTRUMENTS (NI)

A global leader in test, measurement, and control solutions.

Challenge: Boost throughput, improve efficiency, and reduce downtime.

Solution: NI's IoT solution analyzes large volumes of data to help improve decision making and operations in industrial settings. It supports all the necessary connectivity and data analytics while meeting requirements of latency, synchronization, and reliability. With the NI platform, engineers perform data analysis and execute control commands anywhere analog data is converted to a digital signal—otherwise known as "the edge".

Key Benefits

- Analyzes vast amounts of data
- Aids in making meaningful business decisions
- Improves equipment uptime
- Takes action in real time

NEXCOM

A supplier of intelligent systems for industrial computing.

Challenge: Increase operations efficiency and reduce maintenance costs.

Solution: Given the fact that different communication protocols are used from factory to factory, the NEXCOM NIFE* 100 IoT Controller can interface to different types of fieldbus modules and support many fieldbus protocols, including PROFINET*, PROFIBUS*, EtherNet*/ IP, DeviceNet*, EtherCAT*, CANopen*, and Modbus*. The controller communicates downstream to manufacturing modules over various fieldbus protocols and upstream to an on-premise SCADA system or to the cloud (or data center) via LAN, Wi-Fi, or 3G/4G networks.

Key Benefits

- Reduces TCO by lowering maintenance effort and energy usage
- Improves production line performance by enabling big data analytics
- Provides an easy-to-integrate device monitoring and control system
- Supports remote diagnosis and recovery for higher equipment availability

FUSHENG INDUSTRIAL

A global air compressor manufacturer.

Challenge: Reduce air compressor-related downtime.

Solution: Compressors are ubiquitous in modern day life, from visiting a dentist's office to generating electrical power. As a result, Fusheng's customers place a high level of reliance on their machines, expecting them to run efficiently and without failure. Every air compressor manufactured by Fusheng will integrate Intel chips and IoT gateway solutions that help predict and detect maintenance needs.

Key Benefits

- Detects equipment malfunction, energy consumption, and component deterioration
- Provides equipment performance reports and recommendations electronically
- Improves service delivery by allowing Fusheng to remotely monitor their machines
- Allows Fusheng's customers to realize better operational efficiencies

9 **CONCLUSION**

Connected, intelligent industrial systems are bringing both challenges and opportunities to the pursuit of Industry 4.0. IoT-based solutions are now available to help you gain advantages from integrating data analytics technologies and future-proofing your industrial assets.

Intel is committed to bringing the scalability, manageability, security, and reliability inherent in its technology offerings to solutions for the IoT and Industry 4.0. Our long-standing expertise in adapting technologies to vertical requirements, combined with our innovation in big data analytics and IoT, is helping to shape a standardized and interoperable ecosystem.

Intel® IoT Gateway
Intel® IoT Gateways connect to legacy and new systems, and enable seamless and secure data flow between edge devices and the cloud. The Intel IoT Gateway integrates technologies and protocols to enable networking, embedded control, enterprise-grade security, and easy manageability, while supporting software applications at the edge.

10 # Resources

Big data and IoT are enabling industrial process transformation. Intel and its ecosystem partners deliver industrial solutions optimized for scalable Intel® architecture, designed to reliably interoperate with the entire industrial environment.

Intel® Internet of Things Solutions Alliance
Members of the Intel® Internet of Things Solutions Alliance provide the hardware, software, firmware, tools, and systems integration that developers need to take a leading role in IoT. **Learn more ›**

Intel® IoT Gateway Development Kits
Intel IoT Gateway development kits enable solution providers to quickly develop, prototype, and deploy intelligent gateways. Available for purchase from several vendors, the kits also maintain interoperability between new intelligent infrastructure and legacy systems, including sensors and data center servers. **Learn more ›**

For more information about Intel solutions for industrial automation, visit intel.com/industrial.