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What Does Industry 4.0 Mean for Supply Chains?

BY JOHN ASHODIAN
Marketing manager—logistics automation, Sick

With characteristics ranging from visibility and interconnectivity to autonomous performance and predictive analysis, Industry 4.0 supply chains are poised to transform day-to-day supply chain activities and capabilities.

Industry 4.0 is a hot term these days, but what exactly is it? First defined in 2011 by Siegfried Russwurm, German professor and chief technology officer of Siemens, Industry 4.0 refers to the fourth phase of the industrial evolution. This era is characterized by interconnectivity between equipment and facilities throughout supply chains made possible by the Internet.

Industry 4.0 is a step beyond the digital era. In the digital era—in which many companies still operate—having data generated by and collected from discrete automated equipment is useful for determining both past and present operational states. However, most of the data
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What Does Industry 4.0 Mean for Supply Chains?

sits in silos, not easily accessed for analysis and certainly not passed among different systems automatically.

Conversely, although Industry 4.0 is also data-dependent, that data is more effectively utilized by leveraging the Industrial Internet of Things.
What Does Industry 4.0 Mean for Supply Chains?

Although Industry 4.0 is also data-dependent, that data is more effectively utilized by leveraging the Industrial Internet of Things (IIoT), which seamlessly connects industrial automation equipment and systems via the Internet. Supported by connectivity technologies embedded within previously isolated equipment and machinery, companies can automatically gather and use information in ways that are not just informative, but also predictive, proactive and actionable.

The impact on supply chains

Industry 4.0-empowered supply chains are characterized by four capabilities:

• Visibility into operational status at the device level throughout all physical locations via real-time information collected and processed by intelligent sensors.
• Interconnectivity of equipment, machinery, facilities and people for transparency throughout all levels.
• Autonomous performance of equipment and systems to complete tasks as efficiently as possible with minimal human intervention.
• Predictive analysis of all data to identify patterns and trends in inventory, purchasing, equipment usage and more, thereby enabling proactive decision-making.

With these four capabilities in place, companies can more effectively manage their upstream vendor and supplier arrangements, as well as respond faster to unforeseen events within their supply chains.
What Does Industry 4.0 Mean for Supply Chains?

Likewise, with a more holistic view backed by historic and real-time information, a more agile and resilient supply chain that minimizes time-to-customer-delivery can be designed or reconfigured, inventories optimized, quality enhanced, and labor utilization and safety improved. Other data-driven, Industry 4.0 benefits include better reporting tools for increased operator and equipment productivity, improved training practices and reduced product damage.

Further, unscheduled machine downtime can be avoided through more accurate planning of preventive maintenance. Industry 4.0-enabled supply chains will ultimately generate better customer experiences, higher performance and greater cost savings—giving companies a competitive edge.

Taking action

You might be wondering what actions your company can take to adapt your existing supply chain and navigate toward an Industry 4.0 operational state. Here are a few guidelines for consideration:

• Evaluate current data capture processes. If your data-capture methodologies are manual, they likely won’t be adequate to accommodate the real-time demands of an Industry 4.0-ready climate. Semi-automated or fully automated systems, on the other hand, do not require human interaction to trigger data capture and
information transfer. Replacing manual operations with a degree of automation will not only boost throughput, but also increase accuracy and efficiency while reducing labor costs.

• Assess customers’ service level expectations. Regardless of your company’s place within the supply chain (manufacturer, wholesaler, distributor, e-commerce shipper, etc.), your downstream customers want visibility into their orders, their location and their progress toward delivery. Without automatic identification and data capture systems in place to support the interconnectivity between each piece of equipment and each facility, that degree of transparency within the Industry 4.0 environment cannot be achieved.

• Establish service-level compliance requirements. An Industry 4.0-ready supply chain relies on consistent, reliable and easily verified transactional information. That means the information marked on a carton must meet a certain level of readability by sensors. Hence, vendor compliance requirements must be established for code placement, legibility, intactness and other factors. Without adherence to minimum standards, automated devices won’t be able to pull the data needed for autonomous operation or predictive analytics.
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REST APIs Unlock the IIoT

BY MATT NEWTON
Director of technical marketing, Opto 22

When it comes to connecting real-world physical assets like sensors, motors, pumps, relays and control systems to the cloud, imagine no middleware, protocol conversion or edge gateways.

Flash back to just over a decade ago when the fieldbus wars raged between vendors, inflicting casualties on early adopters and leaving automation engineers unsure of where to make their technology investments. Apprehension toward new technology became the industry norm.

Then the Internet happened—and it changed everything through Ethernet and TCP/IP. The Internet created the concept of easily and quickly sharing data and resources through open standards and technology—connecting people, businesses and customers like never before. It rolled out faster than almost any industry could keep up with. Almost overnight, companies that didn’t invest in the
REST APIs Unlock the IIoT

rising web economy found themselves at an increasing competitive disadvantage, or even out of business.

Flash forward to today and the industrial automation industry is faced with another technological advancement that is changing everything: the Industrial Internet of Things (IIoT).

**OT/IT technology convergence**

Adding Ethernet and TCP/IP to industrial assets was a huge leap forward in system interoperability. Ethernet and TCP/IP made configuration, connectivity, deployment and support of automation applications much easier. They also created the opportunity to share data from plant, factory or field networks with IT systems like databases and enterprise resource planning (ERP) and manufacturing execution system (MES) software.

However, moving data from OT systems into IT systems can be difficult, requiring complex middleware and lengthy, expensive integration work. These hurdles can also cause asset support and lifecycle management potholes down the road. That’s why it’s time for the industry to move further up the technology stack and enable OT/IT convergence at the software level.
REST APIs are poised to streamline that convergence and unlock the vast data our existing automation assets can provide. So what are REST APIs and how do they work?

**First, the API**

An API (application programming interface) documents how to interact with a software program. For example, the API shows how to format a request to obtain a given response. APIs have been around since computer programming began. But they got a lot more interesting around 2000, when they started emerging on the web. An example of a web API is the Google Maps API. When a business displays a map of its location on its webpage, often the webpage code uses the Google Maps API to structure a request to Google Maps to generate the map. When correctly requested according to the API, Google Maps renders the map and sends it back for display on the company’s website.

An API mashup is a technique by which a website or web application uses data, presentation or functionality from two or more APIs to create a new resource. Developers use API mashups to rapidly stitch together new web applications. For example, suppose a developer wanted to put together a mobile app for delivery drivers to find the quickest route between locations given the current traffic conditions.
The developer might mash up the Google Maps API with a database API to check delivery addresses and a traffic API to generate the fastest route to each destination. APIs mean using less code to create new applications in a much shorter amount of time.

**Now, the REST**

Today, there are more than 15,000 APIs to all kinds of applications. Yahoo Finance, Weather Underground, and even Big Data and predictive maintenance applications like IBM’s Watson, GE’s Predix and PTC’s ThingWorx all have APIs. New APIs are released every day. Lightweight mobile apps use APIs to cloud applications to put data-center-level computing power in your pocket.

Some vendors sell their APIs and provide support, spawning the API economy, a marketplace where developers purchase other developers’ APIs to generate a new application that they then sell. To ensure these APIs work with one another, they are designed using a common architecture called REST (Representational State Transfer). The REST architecture defines a set of constraints—like routines, protocols and tools—that API developers build their APIs against to ensure that it communicates and works with other APIs.
REST APIs Unlock the IIoT

REST minimizes the coupling between client and server components in a distributed networking application—for example, the IIoT. The IIoT requires a common application architecture to support the many different types of devices and applications that will be connecting to each other to exchange data and share resources. REST APIs are that common architecture. They provide a standard toolset for developers to rapidly build new IIoT applications.

So how do these REST APIs work? They operate like the client/server architecture of websites. A client like a web browser makes an HTTP/S request to a website for a webpage on an HTTP/S server. Then the server responds with the correct data payload and formatting information to display the webpage correctly.

But what do architectural styles of web applications have to do with moving data in and out of industrial automation assets? Simple. Using a REST API with a programmable
automation controller (PAC), for example, means that all of the tag values in the PAC can be made available to other applications in the same way—as resources accessible through HTTP/S hyperlink addresses to the PAC’s RESTful web server.

In an IIoT scenario, a predictive maintenance application (a client) could open a secure HTTPS connection to a PAC (the server) on the factory floor, requesting motor runtime data. Because of a well-documented REST API, the client knows exactly how to connect to the PAC, obtain a list of available data resources, and read and write the values of those resources. The PAC’s HTTPS server would respond back to the predictive maintenance application with the motor’s run time in JSON (JavaScript Object Notation) data format. JSON is important in IIoT system architecture because it uses a lightweight, key-value pair data interchange format that almost any software language can consume.

Another example involves using REST APIs directly within database applications. Microsoft’s SQL Server 2016 has built-in support for storing, managing and parsing JSON data. By using Transact SQL, developers can directly query PACs through the REST API and parse the resulting JSON into database tables—no middleware, OPC, ODBC or other software application required.
REST APIs Unlock the IIoT

Why REST APIs for IIoT?
Traditional industrial system architecture is built around a bus topology. Assets are connected to the bus and speak the same protocol. The problem with leveraging this architecture in IIoT applications is that systems that are not a part of the bus and do not understand the bus protocol cannot leverage the data and resources available on the bus.

But for the IIoT to be viable, IIoT hardware and software assets must connect and start talking to each other. REST APIs offer a standard form of sharing data and resources between IIoT devices and IIoT software. Ethernet and TCP/IP were the first step toward the IIoT. REST APIs are the next step in moving up the OT/IT technology convergence stack.

REST APIs are the tools that allow OT and IT engineers to connect real-world physical assets like sensors, motors, pumps, relays and control systems to the digital world and communicate directly to the cloud—no middleware, protocol conversion, or edge gateways required. REST APIs are used all across the Internet today. They’re the technology that stitches the IIoT together.
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How the Convergence of IT and OT Impacts Engineers

BY MICHAEL BOWNE
Director of technology marketing, PI North America

From the domain expertise necessary to filter the required data in the correct way to expanding automation and IT networking knowledge requirements, the Internet of Things is dramatically altering the duties and expectations for control engineers.

A lot has changed in the past year in the Industrial Internet of Things (IIoT) space. Interestingly, advancements appear to be moving faster than ever. Instead of the hype abating, the excitement continues. Of note, there is a clear shift in language often used to describe the IIoT landscape. Many discussions now often revolve around a convergence of information technology (IT) and operational technology (OT). But it’s not just the messaging that has changed; product releases in the past year have been showcases for IIoT advances.
How the Convergence of IT and OT Impacts Engineers

A great case in point is IoT gateways, which are now offered by several manufacturers. These devices act like any other gateway, in that they can be programmed to speak an automation language (e.g., Profinet) on one side and a higher-level language (e.g., OPC UA) on the other. The practical need for gateways are many and varied. Perhaps the engineer does not want to load the programmable logic controller (PLC) with any further responsibility. Or there might be information that simply is not germane to the PLC that is desired on the IT side. Gateways are helpful in such instances because they can bypass the PLC altogether (which is fascinating in its own right) to connect IT and OT networks.

Though gateway devices have long featured plenty of connectivity options on the OT side, all that was needed for IIoT application was something to connect to on the IT side. Enter the traditional IT companies: IBM, Amazon, SAP, Microsoft and so on. From the IT side, these companies are beginning to offer IIoT-specific solutions to tap into the industrial market. These solutions generally consist of analytics packages designed to ingest data and output business intelligence. In short: The OT side provides the data and the IT side analyzes the data. Great idea, but…
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How the Convergence of IT and OT Impacts Engineers

Domain expertise
How do you know what to look for? It’s well known that the amount of data produced during a week of production in a factory can be huge. An analytics package cannot tell you what data is important and what data is irrelevant. With so much data to draw from, it’s often like searching for a needle in a haystack.

For example, in the grain processing industry, what metrics are tied to overall equipment effectiveness (OEE)? Only someone with expertise can discern the important data and separate the wheat from the chaff (pun intended). And, rest assured, such metrics will be significantly different from an engine assembly plant in the automotive sector where, again, domain expertise will provide the ability to filter on relevant data.

Engineering effects
So if some domain expertise is required, combined with the competency to link into IT-side systems, what does that say for the average control engineer? It means multi-disciplinary engineers will become the norm. In addition to knowing how to program a PLC, they will also need to know how that PLC fits into the wider plant network.
How the Convergence of IT and OT Impacts Engineers

A great example of this is seen with the move from serial fieldbuses to industrial Ethernet. From personal experience I can say that, nine times out of 10, when there is an issue with a Profibus network in the field, it’s because of installation errors.

Thankfully, Profinet is much easier to install, because it’s Ethernet. There is no need to worry about repeaters, segments, termination resistors, etc. However, because it’s Ethernet, it becomes part of the network infrastructure upon which Profinet traffic resides as well as other traffic, such as VoIP, HTTP, etc. Needless to say, additional complexities are introduced when this happens.

As a result, the control engineer must be familiar with networking an automation environment, but also networking in general. And as IIoT solutions become more prevalent, there will inevitably be more than one protocol sharing that network environment. This could be true even for small networks, where many Ethernet complexities would otherwise be inherently mitigated by the network’s small size. In other words: As IT and OT converge, there is no longer such a thing as a small network.
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IIoT, the Edge and the Energy Industry

BY STEVE SPONSELLER
Business development, Kepware Technologies

How the use of edge computing devices as a key component of an Internet of Things initiative addresses both bandwidth and security concerns.

Conceptually, the Internet of Things (IoT) and the Industrial Internet of Things (IIoT) have been discussed at great lengths over the past few years. During this time, questions like “Why IoT?” have been asked, use cases have been explored, and implementations have begun. The shift from concept to implementation is now sparking new discussions as users and system integrators explore what technologies are best and how integration will work between the applications.

To advance IIoT implementations in the energy industry, at least two concerns must be addressed. The first concern is bandwidth limitations of telemetry networks. A November 2015 report
IIoT, the Edge and the Energy Industry

by Gartner estimates that there will be 35 billion to 50 billion connected devices by 2020. A large part of this growth will come from the industrial segment—which is typically slower in adopting newer technologies, due in a large part to the robust requirements needed for industrial environments where a typical device could have a functional lifespan of 20-30 years.

Because many of the networks available to connect to assets in the field have limited bandwidth, numerous companies are already struggling to support the number of SCADA systems and devices they have today. For example, an industrial oil and gas operator could have 10,000-20,000 legacy devices located remotely across multiple production sites with limited connectivity, power and network bandwidth. Depending on the device, there could be a couple thousand bits of data or even gigabytes of data being produced and updated in milliseconds. As more devices come online, data production will increase exponentially, consuming new levels of required bandwidth that could result in service degradation, data latency and increased costs.
IIoT, the Edge and the Energy Industry

The second concern is security. The energy industry is already a target because of the volatile nature of its products and the catastrophic impact that man-in-the-middle cyber attacks could have on infrastructure and society. Companies must accommodate for the influx of connected devices sending data and assess the risk in opening up networks to the Internet to minimize the threat of exploitation.

Solutions to these concerns are being discussed and proposed by industry leaders. Collecting and analyzing data at the “edge” has the potential to alleviate both network bandwidth limitations and security concerns. As Moore’s Law continues to prove, price and form factors of processors keep decreasing, thus allowing unnecessary computing and data storage to be moved away from the central server where enterprise-level applications reside. This enables companies to distribute their computing to the edge of the network through low-cost gateways and industrial PCs that can host localized and task-specific actions in near real time, requiring them to transmit much less required data back to the enterprise. Collecting and analyzing data at the edge also increases security because information is kept within a local network. Instead of using
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IIoT, the Edge and the Energy Industry

insecure legacy device protocols for communications across a wide area network, companies could use more modern communication techniques specifically designed for secure and efficient network communications, which deploy encryption and security certificates to strengthen access controls and prevent man-in-the-middle attacks.

The transmission of more data across an enterprise for the purpose of achieving the benefits of IoT can appear to be challenging and risky business. By employing edge solutions and technologies, energy companies can push IoT initiatives forward in a safe and effective way.
More than 50 billion devices will be connected to the Internet by 2020, according to estimates from Gartner Research. Potentially, many of these connected devices will be the manufacturing machines supported by smart controls located on the shop floors of many small and mid-sized manufacturing enterprises. This advance has been underway across industry for many years now. Without even knowing it, many small and mid-sized manufacturers have been on the forefront of the connected workplace for some time.
Internet of Things?

Not so fast! There’s a huge gap between the Internet and your industrial things.

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The Foundation of the Factory of the Future

Machine controls in the manufacturing industries—through their use of legacy distributive numerical control (DNC) technologies—have been connected to other aspects of plant operations (e.g., other machines and other systems) for decades. However, this type of connectivity was often used solely to manage the numerical control (NC) and computer numeric control (CNC) machine programs to ease the burden of distributing those machine programs from the central front office file server to the machines on the factory floor.

With the advent of the Industrial Internet of Things (IIoT) and the ability to connect not just machines to other machines, but also machines to parts and—potentially—to humans through wearable devices, the opportunity for leveraging this data for improved insight and customer service will only increase and is the foundation for the factory of the future, often referred to as Industry 4.0, particularly in Europe.

But as more connected devices bring an exponential increase in available data, how will a small to mid-sized manufacturer be able to leverage and take advantage of this data? On a practical level, this data presents an opportunity for the manufacturer to take advantage of increased insight related to machine maintenance. One of the principal issues manufacturers look to solve with this kind of data access and analysis is the ability to better manage the impact when
a machine goes down for emergency or unexpected maintenance. Large-scale data analysis is critical to this process because, prior to such unscheduled maintenance, it is likely that the machine has started to produce parts that are out of tolerance. This reduction in quality serves to increase the actual cost of the product as well
as the risk of missing a customer delivery date due to the rework required. As a result, the impact of machine maintenance extends well beyond the individual machine or specific maintenance issue and into product quality, capability to deliver and business success. Using data analysis to imbue a machine with a deeper level of connectedness, the machine could proactively or predictively communicate directly to the shop foreman or maintenance manager (regardless of where he is, or the time of day). This kind of automated trigger or alert, based on past history or trends, could communicate to the person responsible for maintenance that they should monitor the machine more closely or execute a preventive maintenance shop order before more significant maintenance is required.

Imagine the positive impact that it would have on a factory floor operation to never have emergency or unanticipated downtimes. How profitable could an operation be where maintenance would be scheduled during times that would have the least impact to throughput or capacity because it was being conducted on a predictive basis?

This is the practical reality and impact that the IIoT could bring to a small or mid-market manufacturer.
In this era where the pace of technological change will continue to increase, it has become a business imperative to find practical ways to leverage technology where and when it makes sense.

Though some consider IIoT to be a bleeding-edge technology application, it’s really not—as the technologies and processes that enable have been around for decades. It’s the grander possibilities enabled by general advances in computing technologies that have expanded into an IIoT vision. This means that practical and conservative small to mid-sized manufacturers can take advantage of some of these new and emerging technologies without putting their businesses at risk or needing to invest in technologies that are yet unproven.

In this era where the pace of technological change will continue to increase, it has become a business imperative to find practical ways to leverage technology where and, more importantly, when it makes sense. Every manufacturer needs to figure out what issues or low-hanging fruit can be addressed to further streamline operations, increase throughput, minimize bottlenecks, and deliver exceptional customer service to maintain or expand their competitive advantage.
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The Industrial Internet of Things (IIoT) is becoming a clearer concept with each month that passes. Whether the forecast of tens of billions of devices connected by 2020 is right or not (it seems an exaggeration to me), we at Hilscher are now certain of the IIoT future for automation. And our customers are confirming that we are on the right track.

You may have heard about our partnership with IBM in implementing John Deere’s strategy—the Smart Manufacturing Platform—for getting more from their factory data. Their aim is to make better products more effectively. We’ve also announced an agreement with SAP to provide field-level data access via our netIOT Edge Gateway.
A New Era, a New Lexicon, a New Challenge

to the SAP HANA Cloud Platform and the SAP Asset Intelligence Network for improved asset management.

These are very exciting developments for Hilscher, but I keep hearing: “So, how much does all this cost?” In response, I say that, in hardware terms at least, it is very cost-effective indeed and can fit all budgets. We believe even simple, one-off machines can now be linked to the cloud to benefit from the kinds of analytics that only the big boys could afford in the past.

Application software, public cloud platforms and other essential elements of an IIoT architecture are widely available on an as-used basis; plus, you pay only for what you use. Multimillion-dollar investments are no longer needed to deploy an advanced IT system. Another reason IIoT will be central to automation’s future is that it does not adversely affect existing systems and equipment. Real-time Ethernet networks, such as EtherNet/IP and Profinet, routinely operate at much less than 100 percent capacity, and it’s that spare capacity that is used to transmit IIoT data from the field to the edge gateways and up to the cloud. It happens invisibly with little or no impact on normal control operations.
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A New Era, a New Lexicon, a New Challenge

Who knows what other benefits will arise as users become familiar with what’s available? It’s a genuinely disruptive scenario that could put early adopters well ahead of competitors.

Along with the change IIoT is bringing to industry, a new lexicon is emerging that we must all get familiar with. For example, we hear more and more about “on-premise” data processing—a straightforward solution to the need for fast, low-latency responses. Rather than send data to the cloud and wait for a reply, processing happens within the edge gateway. That might not sound like a full-blown IoT implementation, but believe me it fills a big gap, especially in automation. On-premise gateways support open-source software as well as a variety of “as a service” solutions, so running applications such as IBM Watson locally becomes feasible. Imagine having the ability to bring the power of Watson to analyze your equipment today!

Then there’s the tantalizing “promiscuous mode” of operation. Hilscher’s netIOT Edge Gateway has the ability to listen to everything on the network—including regular control activity—and write data to the cloud. In this scenario, remote applications can be configured for “read only,” which ensures the separation of IT and the field to prevent security breaches.

Node-RED, an open source solution for configuring IIoT structures, is another term and technology gaining prominence. It is at the heart of Hilscher’s Thing Editor, which makes designing and building
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A New Era, a New Lexicon, a New Challenge

IIoT functions really easy. I guarantee you’ll be seeing much more of Node-RED in the IIoT future.

Amid all this change and new terms, many things remain the same. Well-proven technologies like OPC UA are becoming increasingly relevant. OPC UA offers multiple benefits. It supports secure data collection both horizontally and vertically within a network, and even upwards into the cloud. Via its embeddable OPC UA Nano and Micro profiles, it facilitates reading data from field devices that no programmable logic controller (PLC) would be interested in and will encourage the evolution of smarter devices that deliver data such as temperature, vibration, current and voltage from field devices in parallel with real-time monitoring and control data.

With all these features—and more—IIoT is destined to add a new dimension to operations. New ways of monitoring and control
will evolve and could lead to new ways for vendors to work with customers; for example, the leasing of machines or the continuous monitoring and improvement of equipment by the OEM in real time. Who knows what other benefits will arise as users become familiar with what’s available? It’s a genuinely disruptive scenario that could put early adopters well ahead of competitors. The opportunities appear limitless. But don’t worry, even with the major changes being brought by IIoT, you stay in control; it’s your skills, experience and creativity that ultimately count.

The biggest question of all is: What exactly do you want to achieve? I believe every plant operator should be investigating the opportunities now and, without a doubt, the answer will be different for each user. If you’re not actively pursuing an IIoT strategy yet, I suggest you start researching things right away because the benefits might surprise you—and they may give your competitors a surprise in turn!

IIoT is kick-starting a new era in automation. Are you up for the challenge?
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Airbus has been using Internet of Things (IoT) manufacturing technologies at its manufacturing facilities around the world for years, according to Simon Bradley, Airbus vice president of product and cybersecurity program directorate, who spoke earlier this year at the Internet of Manufacturing event in Munich, Germany.

“For us it’s nothing new—it’s just a new spin on the technology,” he said. “But we’ve been looking at collecting information from sensors from our factories for years.”

Airbus started its journey toward IoT via its use of RFID to track parts, Bradley explained. “Now we’re moving towards IoT devices.
Given the insights we learned from Airbus during the first event this year, we’re excited to learn even more next year.

Airbus Relies on IoT to Make Better Planes and Bigger Revenues

to track tools in the factory so that engineers know where their key tools are, the tools can tell them if the torque is correct for implementation and determine if products need maintenance,” he said. “So we’re looking at a whole raft of things to not only improve products, but also reduce cost and improve production capability.”

The manufacturer’s current backlog of 10-11 years of plane orders is affecting production capacity, but Bradley sees IoT as being key to helping clear the backlog and increase cash flow.

Airbus is also working with IBM’s Watson team to collect more data on its flights and ground operations. As part of the company’s new Smarter Fleet platform, it will collect about 250 GB of data per flight on its A350, with this information expected to improve not only the in-flight experience for passengers and crew, but aircraft operations and maintenance.

Given the insights we learned from Airbus during the first Internet of Manufacturing event this year, we’re excited to learn even more next year when representatives from Airbus, Konecranes, Siemens, German Federal Ministry, Caterpillar and Rolls Royce present at next year’s Internet of Manufacturing event Feb. 7-8 in
Airbus Relies on IoT to Make Better Planes and Bigger Revenues

Munich. This event will bring together more than 150 European manufacturing leaders to explore how to realize the potential of IoT and stay competitive in a rapidly evolving market. Keynotes will be combined with results-driven case studies and perspectives from government and standardization bodies to help accelerate the industry’s readiness for change.

View the full speaker list, agenda and testimonials from the Internet of Manufacturing 2016 at www.internetofbusiness.net/manufacturing.
The Plant Manager’s Guide to IIoT Connectivity

BY THOMAS NUTH
Global manager, smart factories, Moxa

An explanation of the four key steps required to connect disparate devices effectively and enable your factory for the Internet of Things.

Whether you refer to it as the Industrial Internet, the Industrial Internet of Things (IIoT) or Industry 4.0, the basic tenets are the same. The Industrial Internet describes a progression and unification of technology that offers business-to-business, device-to-device and people-to-device connectivity across the Internet. The typical operations or plant manager today is at ground level, trying to make sense of all the new technologies on the market to do one thing: optimize his or her operation. It can be intimidating, but at Moxa, we can help.
To start, it helps to recognize the four Internet of Things (IoT) enablement steps that are helping plant managers tackle the challenges of connecting devices and making factories smarter.

**Step 1: Assess your operational pain points**
Identify your operational challenges and shortcomings. These could be instigated by environmental or technical causes, or they could be process improvement demands specified by executive management. They could be as specific as converting one legacy portion of your operation to Ethernet or as broad as lowering company-wide manufacturing costs by 10 percent within the next five years. For each case, presenting the pain points and challenges up front makes a huge difference for your connectivity provider.

**Step 2: Develop and prioritize operational goals**
Develop operational goals around your pain points and prioritize them in order of importance. The objective here is to identify mission-critical solution improvements. Additionally, prioritizing operational goals will allow you, the integrator and the supplier to select the most scalable smart factory solution possible. This will ensure that operational goals will be met at the point of project completion, and long-term operational and maintenance costs will be considered as well if there is a need to scale up or down in the future.
For example, consider a plant operator for a beverage company who must seamlessly connect all legacy bottling lines to a new manufacturing execution system (MES) to allow for more top-level control and visibility at both the control and corporate levels. After determining the main problem was a lack of visibility and control on the plant lines, the plant operator came to the conclusion that the priority was to achieve maximum visibility of all the sensors on lines 1-8 in real time on the plant’s MES dashboard. From here, sensors and protocols could be audited to see what solutions and technologies were available to connect various sensors and actuators to the SCADA system, and sensors plus SCADA to MES. To do this, a network audit is required and should be conducted in conjunction with a distributor, system integrator or system provider.

Step 3: Understand the interoperability status of key processes
A central consideration and challenge in achieving a connected smart factory is protocol division. Depending on the specific operation, you may encounter numerous disparate and proprietary fieldbus automation protocols that must be connected to achieve your operational goals. To uncover all relevant devices and protocols, work with internal resources and integration teams to record and organize all devices, end nodes and equipment that exist within your solution space. From this point, register their corresponding protocols,
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physical interface, plant location and operational purposes. Also, include any specific limitations or details relevant to the technology, device or piece of equipment that could be important for a networking supplier or system integrator to know.
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Step 4: Choose the right devices to help you get connected
The validation process of any investment can be a difficult one, especially to the upper management of a large company when your expertise domain is focused on a particular manufacturing operation that is merely a small part of a much larger business. Uncovering potential hidden costs and savings of a connected, smart factory solution investment requires identification of explicit, as well as projected, operational costs and savings. In addition, by carefully formulating savings projections, combined with a payback timeline on the initial investment, a very strong operational prospectus can be calculated.

Moxa offers a toolkit that can be customized and applied to a broad set of scenarios and factory automation sectors. The toolkit includes Moxa’s IoT Connectivity Workbook and Network Audit Sheet, as well as the Smart Factory Payback Calculator. We think these tools will help you make sure that no technical or cost considerations go unconsidered when you validate an investment decision to internal stakeholders. In particular, the payback calculator can help you:
  • Calculate the cost of downtime.
  • Estimate the annual savings with your IIoT investment.
  • Calculate the payback period on your IIoT investment.
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Based on three decades of experience supplying connectivity and networking solutions to the automation sector, Moxa has a unique understanding of the numerous factors that make an investment in a smart factory realizable and practical. Moxa has connected more than 40 million devices, and has witnessed the power that bringing data-driven decision-making to the field or factory floor can provide to help raise profits by securely connecting previously isolated industrial serial networks to the Industrial Internet.

Red Lion has been connecting devices and moving data for years, enabling customers to easily advance to the Industrial Internet of Things (IIoT). Our IIoT-ready industrial automation and networking products:

• **Connect:** Extend equipment lifespan with protocol conversion
• **Monitor:** Improve process visibility with visual management
• **Control:** Push control to the edge with remote monitoring
• **Network:** Expand network reliability with industrial Ethernet

Learn more today at [www.redlion.net/moreIIoT](http://www.redlion.net/moreIIoT)
The growing interest in the Industrial Internet of Things (IIoT) and the technology ecosystem surrounding it is opening the door for huge business opportunities in the coming years. At the core of these opportunities involving integrated IIoT applications and cloud services is the realization that software is the key factor to success in the IIoT era.

To address this movement, Advantech has focused its efforts on developing its WebAccess Enterprise Application software. To serve as the core of Advantech’s IIoT solutions, WebAccess has been transformed from HMI/SCADA software into a comprehensive IIoT platform to better address the vision of the Industrial Internet of Things and Industry 4.0 concepts.
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From HMI/SCADA to an Enterprise Platform

software platform to provide a gateway for system integrators and our partners to develop IIoT and cloud applications.

As Advantech’s new IIoT application software, WebAccess allows users to monitor and control their projects through a web browser. For the device layer of IIoT, Advantech WebAccess supports ample
protocols and drivers to connect to more than 450 controllers and devices, making Advantech WebAccess flexible and suitable for a magnitude of IIoT applications and projects. WebAccess also provides the foundation of IIoT data collection and management with its open architecture and open interfaces, which are helpful for developing specific applications for different industry verticals.

To more completely address the vision of the IIoT and Industry 4.0 concepts, Advantech is advancing the WebAccess architecture to a public cloud design, targeted to provide centralized Big Data for large equipment vendors, system integrators and enterprises to configure, change, update or monitor their equipment, projects and systems all over the world in real time.

Advantech has made these changes because we believe that, as IIoT and Industry 4.0 initiatives increase across industries, user behavior related to SCADA software will evolve from strict data acquisition and manipulation to business intelligence and Big Data analysis.
Decentralized Control and the Internet of Things

BY NUZHA YAKOOB
Senior product manager, electric automation, Festo

By allowing for a building-block approach when adapting machine functions to application requirements, the CPX modular control platform allows engineers to mix and match different technology modules to perform specific tasks.

The Industrial Internet of Things (IIoT) holds the promise of fully networked, adaptive production. Unlike centralized, top-down factory control systems, IIoT-enabled components, machines, processes and factories will exchange data and information in real time with each other and with higher-level enterprise management systems. Components will interact with one another, in an intelligent way, carry out their own configuration with minimal effort, and independently meet varying production requirements.

A cornerstone of decentralized intelligence and control is Festo’s CPX automation platform. The CPX is a scalable and modular control
Decentralized Control and the Internet of Things

Platform that permits a building-block approach to adapting machine functions to application requirements. Engineers can mix and match different technology modules to perform specific tasks and easily scale or modify it in terms of size and capacity. For example, the CPX has the flexibility to serve as a remote I/O station, motion controller or a modular control system; it also has diagnostic and condition-monitoring capabilities.

In addition, Festo recently incorporated OPC Unified Architecture (OPC UA) as the communication interface into the CPX, positioning it to play a key role in IIoT and smart factories. OPC UA is a standard protocol that supports industry-standard programming languages and permits interoperability and communication between devices, machines and systems from different manufacturers and to the cloud. It lets users move data from factory floor sensors and actuators beyond the realm of the industrial controller and into the information technology (IT) world of enterprise asset management, manufacturing execution systems (MES) and enterprise resource planning (ERP) systems.

Thus, OPC UA permits the exchange of data between intelligent devices and cloud-based systems for analytics, diagnostics, equipment-effectiveness reporting and many other applications. OPC UA will be essential for communication between intelligent...
Decentralized Control and the Internet of Things

components, as well as to higher-level MES and ERP systems.

CPX also has a module that can be used to connect to IO-Link devices. This is critical because another key to making IIoT a reality is permitting two-way traffic between low-level sensors and actuators and higher-level controllers and automation systems. IO-Link is an industry standard that allows point-to-point communication between field devices and the automation system.

IO-Link enabled devices not only transmit machine data to factory management systems, they let a control system download parameter data to the device, which, in turn, can send status information back to the controller. This means that IO-Link devices facilitate machine commissioning, can make adjustments while a machine is running, and provide monitoring and diagnostic capabilities. The end result is increased machine and process flexibility, better overall productivity and less downtime.

Festo is already integrating IO-Link into various sensors and actuators such as valve terminals, electric drives and stepper-motor controllers. Festo’s CPX control platform has been a proven success in countless industrial and process automation installations. It supports several types of motion control technologies, including electromechanical
Decentralized Control and the Internet of Things

motion, intelligent servo-pneumatics for precise positioning and force control, and discrete pneumatics, such as controlling simple cylinders and air valves. It also can function as a pneumatic valve terminal, with air valves mounted right on the CPX; and it has integrated safety functions.

The CANopen master integrated in the unit’s control system can actuate pneumatic and electric axes intelligently via fieldbus, all synchronized
Decentralized Control and the Internet of Things

over the backplane of the CPX using Codesys V3 (IEC 61131-3). An extensive software function library simplifies programming. It can be used as a standalone PLC on a remote station to completely control individual machines and systems, eliminating the need for higher-level controllers, or a number of CPX units can mount on different machines to network with each other and the host controller.

The CPX can also serve as a remote I/O station by connecting a fieldbus module and adding various analog and digital I/O modules. It communicates with a host PLC and handles up to 512 inputs and 512 outputs from standard sensors, actuators, valves and similar devices.

CPX supports a multitude of fieldbus protocols. Common industry-standard protocols include DeviceNet, EtherCAT, EtherNet/IP, Ethernet Powerlink, Profinet and Sercos, to name a few. So it is extremely flexible in connecting with various controllers.

The CPX can control multiple drives and functions via one platform, can easily be expanded or reconfigured, saves on engineering and installation time, and offers an extremely compact footprint. It easily adapts to almost any electric and pneumatic application possible today and is ideally positioned for future needs as well.
Approaching the Internet of Things

BY DEAN NORTON
Vice president of marketing, Wago

How a company recognized for its electrical interconnection and automation products positions itself in response to one of the biggest industry technology movements in more than a decade.

Wago is a company well-known for its industrial automation terminal blocks, connector systems, controllers and I/O modules—core products used in applications ranging from industrial and building automation to lighting technology and traffic engineering. Increasingly, however, we are being asked about how we fit into the movement toward the Industrial Internet of Things (IIoT). Here’s how we respond to these increasingly asked questions.

What is Wago’s position on IIoT?
We see IIoT as more of a progression than a trend. In the late 1990s, Wago recognized the need to get plant data off the factory floor and
approaching the internet of things

launched our first ethernet-based programmable logic controller (plc) and bus coupler. then, in the early 2000s, we expanded this range and added features we called it functions, which facilitate many of the requirements for iiot applications today. we see this progression continuing as technology advances and the industrial world catches up with the consumer world.

what solutions does wago offer for iiot applications?

wago is uniquely positioned to put every physical signal into the cloud and back again into the field. our ethernet-based plcs and bus couplers are robust, proven solutions in the industrial market place and feature many internet protocols to support iiot applications. protocol support includes http, sntp, smtp, ftp, snmp, dhcp, dns, ntp and more. our products also support emerging machine-to-machine (m2m) protocols such as opc ua, mqtt and mtconnect. also, we offer remote visualization via mobile apps or a web browser (html5).
What are some of the challenges of IIoT today?
The major challenges we see today are: No standard for IIoT; multiple M2M platforms to provide connectivity to, such as OPC UA, MTConnect, etc.; security; IIoT return on investment; and presenting role-based information (plant floor, plant manager, maintenance, enterprise user, etc.).

How is Wago addressing these challenges?
As far as standards and M2M platforms go, Wago has always been an automation company that believes in being open—going back to the fieldbus wars in the 1990s when our position was to support all the relevant networks and not isolate our customers into a specific architecture. Interoperability is what matters and Wago has a long history of providing connectivity to all relevant platforms. IIoT will be no different.
Regarding security, we are currently the only PLC supplier with a built-in VPN and firewall. This further reduces the risk when considering ROI, as our PLCs are IIoT-ready in terms of security features, Internet and M2M protocols, etc. Customers using our automation products can implement IIoT measures on their own schedule and not have to worry about hardware additions or complete hardware replacement and their associated costs.

**What is the future for Wago and IIoT?**

It’s not enough to collect and distribute the data; you also need to aggregate the data for trends, analysis, etc. The company that makes this integration easiest (with configuration tools, connectivity to M2M platforms, etc.) will be the company that others look to for IIoT solutions. Wago intends to continue to be ahead of this curve as we were in the late 1990s when we first introduced our Ethernet-based automation products for getting plant data off the factory floor.
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