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Taking stock of industry’s progress toward the Internet of Things reveals significant actions taking place in key areas, though we remain years away from full-blown applications.

I often wonder what the “silent majority” of automation engineers thinks about the Industrial Internet of Things (IIoT). Hilscher has been banging on about the benefits of IIoT for more than two years, and, in our netIOT range, we’ve launched a powerful, high-value proposition portfolio of products that I believe will help transform the automation market in the coming years.

I can tell you that our netIOT Edge Gateway, which takes field data and transmits it into IT and cloud-based applications, is generating more interest than any other new product we’ve launched in recent years. The basic job of this gateway is to sit on an automation network—
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any flavor will do—and either passively or actively get the data that remote services need to deliver fresh insights into plant operations.

The gateway does a whole lot more than that, of course, and if you’ve been following Hilscher, you’ll have some idea of how broad the capabilities are. Nevertheless, I know from experience that phrases such as “fresh insights” and “improvements in plant operations” can be viewed with suspicion by many. I don’t blame anybody for this, except perhaps ourselves. It is our duty to lead, but as an industry we tend to predict potential paradise too often.

What’s available now?
Many of Hilscher’s new business leads are end users wanting to take existing plants and improve them now, not in 10 years’ time. Our value proposition is attracting them on the basis that something new could offer incrementally better ways of working today, though not necessarily a leap into full-blown IIoT.

From my vantage point on industry, I wonder if the IIoT market is fragmenting into two parts—one dealing with existing brownfield applications and another geared to greenfield sites where all-new concepts can apply.
Real-World Challenges Lead the Way

Fortunately, our product offering can serve both challenges. For brownfield applications, the netIOT Edge Gateway can be a simple slave on a real-time Ethernet network to undertake familiar data gathering tasks. That data can be stored indefinitely—making stats and historian-like functions possible—or it can be accessed through OPC UA, MQTT or cloud applications in any number of ways. Plants where programmable logic controllers (PLCs) can’t be reprogrammed, perhaps because no one is left with the expertise, can easily access untapped data to find out what exactly is going on and fix it. And all of this can happen today without jeopardizing current working equipment or processes.

For greenfield installations, the netIOT family offers embedded chips and interfaces, which can make even the simplest sensor IoT-aware. This family of products also has gateways and a portfolio of software services for connections to leading IT and cloud infrastructures, such as those from IBM, Microsoft and SAP.

Experience shows that a few key champions tend to drive all technology leaps. These champions often work at major end users like the automotive manufacturers and their suppliers. But it takes far longer for the industrial community as a whole to catch on. Vendors seeking to serve the leaders start catching up quickly or they miss out.

I wonder if the IIoT market is fragmenting into two parts—one dealing with existing brownfield applications and another geared to greenfield sites.
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Real-World Challenges Lead the Way

on new business. Gradually, the wider community picks up success messages and climbs on board too. Over a period of years, the technology becomes the new go-to and a fresh status quo begins.
Considering this process, where do we stand now with IIoT? I would say “early on” is the best answer as complete IIoT installations are still some years away. I say this because IIoT forces IT and OT to collide and that adds complications at both the people level and the computing level. IIoT is not just a communications issue but a far bigger strategic proposition. Plus, new technologies and related terms are emerging. Take “digital twin” as an example. Or Node-RED. What do these mean to an engineer still locked into 4-20 mA?

Anyone wanting to sell IIoT products today must deal with this. Our vision of IIoT stands firm and we are not hesitating to support background IIoT developments, such as Time-Sensitive Networking (TSN), but we recognize that, in the real world, existing challenges are uppermost in the minds of our customers for the moment.

Facing the reality of the real world while actively supporting the IIoT vision is turning out to be one of the most interesting aspects of our job today.
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The IT/OT Mash-Up: It’s Time to Embrace Modern Tech

BY MIKE FAHRION
Director of IoT and product management, B+B Smartworx

Operations is starting to wake up to the possibilities offered by increased connectivity. It’s time to bring OT together with IT and make it happen.

Somewhere around 50 A.D., Heron of Alexandria invented a working steam engine. If industry had taken an interest, the Industrial Revolution might have gotten started a heck of a lot sooner. Astronauts could have been playing golf on the moon when Attila the Hun was still in diapers.

But industry has traditionally been very careful about adopting anything new. Sometimes it’s because industry tends to have previous huge investments in equipment designed for long lifespans. Sometimes they’re just playing it safe. If the old tech still works, why take chances?
The IT/OT Mash-Up: It’s Time to Embrace Modern Tech

Consider Ethernet, for example. By the time industry started looking at Ethernet, our PCs had already been connected for a decade. Humans were downloading music, browsing websites, buying things on Amazon and selling them on eBay. Yet most machines were still muddling along with data protocols from the late 20th century. It wasn’t that connectivity tools like serial-to-Ethernet converters were unavailable. Industry and operations technology (OT) just took their sweet time adopting them.

Industry used to be dubious about wireless technology, too. Wireless got off to a bit of a rocky start in the conservative OT world, where there’s nothing funny about “Can you hear me now?”

Times change and technologies evolve. At this point, a number of different wireless technologies have matured and their costs have dropped dramatically. There are no longer many situations where some form of wireless can’t deliver reliable industrial connectivity at a reasonable price. I’ve noticed that although OT might have been slow to adopt new tech in the past, they are embracing wireless much more quickly than they adopted Ethernet. Wireless dramatically reduces—sometimes even eliminates—the labor costs associated with pulling wire in industrial applications. That makes it an attractive choice, even if OT tends to be hesitant about exploring new options.
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Wireless should be a key ingredient in modern machine-to-machine (M2M) communication and the Industrial Internet of Things (IIoT), just as it is in the consumer world. Industry could be doing a lot more with modern tech. Wireless should be a key ingredient in modern machine-to-machine (M2M) communication and the Industrial Internet of Things (IIoT), just as it is in the consumer world. Look at our ubiquitous smartphones with 24x7x365 data connectivity: We’ve redefined our personal expectations of what “connectivity” means. We can get alerts on things like weather, traffic, train delays and ski conditions, and we can have them customized any way we like. We can have the data delivered to us around the clock—virtually anywhere we happen to be. We can kill time in an airport by streaming a movie from Netflix. We can tuck ourselves into bed at night by downloading a bestseller for the Kindle. Humans expect to be fully connected—everywhere we go, all of the time.

So why shouldn’t machines have the same connectivity? Why in the world should I have to send a truck out to a worksite to see if things are running properly? Why should I have to walk around with a clipboard to collect readouts from sensors or meters?

With today’s tech, industrial equipment can be just as connected as the human beings who install it, whether it’s a motor in a quarry, a delivery truck out on the road, or a bin full of corn on an Iowa farm.
CONTINUED

The IT/OT Mash-Up: It’s Time to Embrace Modern Tech

Fortunately, OT is beginning to wake up to the possibilities. IT and OT are even starting to merge. They used to be two different departments, with differing operating rules and differing agendas. They were even supplied by different sets of vendors. That is changing. Vendors that traditionally played only in the world of IT are now...
stepping into the world of OT through partnerships, acquisitions and other creative means. Vendors that formerly focused on OT are doing the same.

Here at B+B SmartWorx, we’ve been connecting IT and OT all along. So it’s no surprise we’re forging partnerships with interesting players and being presented with some interesting opportunities. Many of the biggest names in the IT industry are beginning to engage in the world of operations, and they’re discovering that they need help when they reach past the IT closet out to the messy network edge. We’re happy to help.

This mash-up of IT and OT is inevitable, and there will be winners and losers. Some companies are going to struggle with it. Some will figure it out early, and they’ll earn the competitive advantages that will make them the new leaders in their fields. If you or your company has any questions about merging IT and OT, I’d love to hear from you.

And as for Alan Shepard’s Apollo 14 lunar golf shot, it’s estimated that it might have travelled more than 2 miles. I’m guessing that drive could still be the record.
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The State of the Industrial Internet of Things

BY MATT NEWTON
Director of technical marketing, Opto 22

As the next industrial revolution gets underway, here are some of the key Internet of Things trends, predictions and recommendations for 2017.

Early adopters of the Industrial Internet of Things (IIoT) have identified competitive advantages and new business models to increase revenue, cut costs and improve customer service and support. Terms like predictive maintenance, artificial intelligence, smart manufacturing, and augmented and virtual reality are no longer buzzwords. They’re ideas, technologies and concepts that are being adopted and applied to these industries every day.

But IIoT adoption challenges remain.

Information technology (IT) and operations technology (OT) integration and collaboration are required to implement successful
The State of the Industrial Internet of Things

CONTINUED

Obtain a holistic, historical, real-time and predictive view of enterprise-wide operations to identify opportunities to develop competitive advantages.

IIoT applications. This continues to be a challenge on both the technical and cultural fronts. OT and IT teams exhibit significant cultural differences within their organizational units. For example:

• IT lives in a world of constant change and never-ending upgrade cycles, seeking the newest, fastest computing hardware and software to gain competitive advantage the enterprise can use to its benefit.
• The OT team functions in the realm of physical value creation within the enterprise, where upgrade cycles are often decades apart and legacy technology is the norm.

The ongoing challenge lies in connecting these two very different types of technology in very different disciplines. But the primary objective remains: Obtain a holistic, historical, real-time and predictive view of enterprise-wide operations to identify opportunities to develop competitive and comparative advantages.

To help streamline integration between both organizations, one suggestion is to nominate a single individual within the organization to own the overall development of an IIoT strategy, with supporting efforts coming from all organizational units.
This person should be well versed in both the OT and IT realms and be able to understand the overall business objectives and long-term value in connecting OT assets and IT assets together. It’s also imperative that this individual be well versed in information security. The key to successful management of OT and IT teams for IIoT is that both teams have an equal seat at the engineering, design, production and support tables.

The adoption of open IIoT standards, specifications and architectures will also help streamline teamwork between OT and IT.

Standards, specifications and architectures
During 2015 and 2016, two organizations dominated the IIoT headlines:

• Industrial Internet Consortium (IIC), which takes a more cross-domain approach to the IIoT.
• Plattform Industrie 4.0, rooted in the concepts of efficient manufacturing and the smart factory.

Both groups developed reference architectures to help streamline standardization and adoption of IIoT technology. Though similar in some respects, they also differ on many points.
For some years to come, the root problem with IIoT will be the need to connect legacy systems and devices to cutting-edge IT systems.

The IIC is primarily focused on developing a standard reference architecture to address the overall enterprise that could be adopted globally as opposed to regionally. The IIC’s Industrial Internet Reference Architecture (IIRA) was first published in 2015 and is a standards-based architectural template and methodology that IIoT system architects can use to design their own systems, based on a common framework and concepts. The IIRA is designed to address the intelligence and connectivity now being built into the sensors, actuators and other low-level devices deployed in a variety of applications, including smart manufacturing, the smart grid, the connected hospital, smart transportation and others.

Plattform Industrie 4.0, on the other hand, is shaping a digital structural shift of industry specific to Germany. Industry 4.0 began as a German government project to promote computerized manufacturing. As a result, the primary focus of Industry 4.0 is to optimize production to develop what the organization has deemed the smart factory. Using the four pillars of smart factory design and operation—interoperability, information transparency, technical assistance and decentralized decision-making—Industry 4.0 attempts to build smart factories that can mass produce customized products flexibly.
There is still much debate between the organizations, leaving many companies unsure of where to invest. At this point, a wait-and-see approach is recommended. Though it’s likely that a combined joint effort between the organizations will eventually materialize and an overall industry standard developed, the timeline is currently unknown.

While the standards bodies debate which protocols, architectures and terms are best for IIoT, industry is already beginning to answer the calls of customers looking for IIoT platforms that offer ease of use, security and interoperability—leading to the rise of the IIoT platform wars.

Platforms rising

IIoT platforms and middleware are the software that must exist between physical devices (sensors, actuators, relays, etc.) or data endpoints and higher-level software applications like artificial intelligence, predictive analytics and cognitive computing. IIoT platforms and middleware move data between the physical and digital realms and provide software resources powerful enough to cope with the Big Data generated from billions of IIoT devices in brownfield industrial application opportunities.
For some years to come, the root problem with IIoT will be the need to connect legacy systems and devices to cutting-edge IT systems. With the massive gap that exists in technology, communication protocols and standards between equipment designed several decades ago and the equipment shipping today, IIoT middleware is trying to fill that gap.

The State of the Industrial Internet of Things
Before considering any platform, it’s important to first define the scope of your IIoT project and the value it’s designed to deliver. Match your platform choice to what you’re trying to accomplish. Rather than committing to a specific vendor platform, perhaps consider adoption of enabling technologies rooted in open source and open standards.

**Interoperability via open source and open standards**

Though there has been widespread adoption of open communication bus standards like Ethernet for industrial networks and TCP/IP for addressing and data transmission, software applications in the OT and IT realms still lack interoperability. Here are some current technology solutions to help overcome these hurdles in 2017:

- RESTful (representational state transfer) APIs are the software development tools that stitch together the Internet and mobile computing as we know them today. Opto 22 SNAP PAC automation controllers come with a built-in HTTP/S web server and RESTful API to the controller’s I/O and system variables.

- Node-RED is an open-source, visual wiring tool to connect edge computing systems such as industrial automation controllers to cloud services such as Amazon Web Services and IBM Watson IoT.
Node-RED allows IIoT application developers to leverage pre-built software code and deploy it directly into their applications. Opto 22’s groov IIoT application development appliance comes with Node-RED—natively and securely built in.

- OPC was designed to connect applications running on Windows operating systems to industrial automation devices for data access.
- MQTT is a transport protocol that pushes data using a publish/subscribe (pub/sub) architecture, and offers several distinct advantages in IIoT applications such as open standards and suitability for remote or tenuous connections and for communication with devices behind a firewall.

Roadblocks ahead

Three major roadblocks exist that are impeding the adoption and rollout of IIoT on a mass scale:

- Cybersecurity
- Overall systemic lack of experience and manpower to create and implement IIoT applications
- Difficulty in identifying and quantifying ROI in IIoT applications

Learn more about how to overcome these challenges in our complete industry report at http://op22.co/2017-State-of-IIoT.
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So much has been written about the Internet of Things (IoT) and its subset, the Industrial Internet of Things (IIoT), that the hype seems endless. No wonder Gartner’s Hype Cycle ranked it as one of 2016’s most ascendant emerging technologies for the third year in a row. But it does boggle the mind to consider the potential that billions of devices capable of communicating with each other—most bypassing humans altogether—have to unleash new and transformative business models.

Often, however, a key enabler gets overlooked: the digital thread interconnecting all those “things.” This digital thread is the highly available, secure and ubiquitous connectivity provided by
5 Ways Industrial Communications Connect the Digital Enterprise

advanced industrial communications over industrial Ethernet, an open global standard.

This thread consists of real-time, continuously updated information that runs end-to-end through all industrial operations, even beyond walls to the ecosystem of suppliers and customers. It provides critical stakeholders with consistent visibility anytime, anywhere to operational data to make faster, better informed decisions. Everyone involved can be more aware, responsive and decisive as needed.

It’s important to realize that industrial connectivity isn’t the best-effort Wi-Fi like you have in your home, office or local café. In those cases, if data packets get lost or held up due to network congestion, other packets are sent and latencies of a few seconds are not problematic or even noticed.

When industrial machinery is involved, however, network data communications must be highly deterministic. This means that when packets containing commands to open or close valves, switches or other devices are sent, they get where they’re going quickly and when the receiving device or devices expect them. If a command doesn’t arrive in time, then a machine’s cycle can be disrupted, stopping
production or worse. If a valve isn’t closed when it’s supposed to be, safety can be at stake.

Here are five ways that advanced industrial communications can best interconnect the digital enterprise and, by extension, the enterprise with the IIoT:

1. **Redundancy.** In the event of a fault, a plant’s high-availability industrial communication can take over automatically without any production disruptions or safety concerns. System redundancy involves backup systems operating in parallel with immediate failover should the primary system go down. Media redundancy provides alternative communication paths, should primary ones be disrupted.

2. **Network segmentation.** Virtual local area networks (VLANs) enable the partitioning of one physical LAN into several smaller, logical LANs. These LANs help separate the networks connecting OT automation systems from IT systems for better security and optimized real-time performance. In case of a disruption, especially a security breach, the compromised LAN can be quickly isolated until the issue is addressed.
3. Bridging IT and OT. It’s good to connect IT and OT environments in secure and accountable ways that respect the strengths and requirements of each. A robust network backbone should be established to create a structured and reliable interface between dedicated production and office networks. The former will include cell-to-machine and shop-floor-to-cell sub-networks, all with specific IP addressing for fully managed components and systems, plus the use of real-time, deterministic communication protocols.

4. Facilitated data interchange. Production often has varied data interfaces due to field-level devices from different suppliers. These elements must communicate their data to—and often get instructions from—higher-level control systems and human-machine interfaces (HMIs), web interfaces, PCs, tablets and even smartphones. OPC UA, an open standard, allows field devices to communicate with each other across Ethernet, thanks to its underlying TCP/IP communication protocol.

5. Wireless, near and far. Wireless industrial connectivity is growing fast. It offers greater configuration flexibility and speed and eliminates long lengths of costly cabling. It includes low-power, short-range near-field communication (NFC) technology used in radio-frequency identification (RFID) solutions for product authentication and asset
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Intelligence at the Network Edge

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tracking. Another NFC use is for machine diagnostics. Longer-range wireless using 802.11n Wi-Fi can facilitate communications up to 300 ft between access points, while 802.16 WiMAX has a range up 30 miles. 3G and 4G LTE cellular and satellite communications can handle even greater distances.

It’s important to emphasize that, although the hype around the IIoT focuses on billions of interconnected devices, production environments will interconnect devices numbering many orders of magnitude less: from hundreds to many thousands of devices only.

Those must stay segregated and protected from IIoT’s billions of devices, because any one of them can and will harbor malware of some sort or another. That’s why always-updated cybersecurity protections are critical and defense-in-depth, layered strategies remain best practices.

Today’s digital enterprises, supported by advanced industrial communications, can simplify operations and lower both capital and operating costs. They can vastly improve the reliability, visibility and security of dynamic production environments to boost availability and asset utilization.
CONTINUED

5 Ways Industrial Communications Connect the Digital Enterprise

Ultimately, these digital enterprises will enjoy distinct competitive advantages. For example, with data running end-to-end through their operations, they can execute their business strategies faster, gain performance feedback and insights sooner, respond to market changes and opportunities more quickly, and improve their time to market with new products and services.
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Real-World IoT Strategies for the Mid-Size Manufacturer

TERRI HISKEY
Vice president, manufacturing portfolio marketing, Epicor Software

Though many manufacturers are waiting to see how current technology trends develop, it’s time for smart businesses to get over the Internet of Things and get on with it.

If you’re a bit mystified about the Internet of Things (IoT) and Industry 4.0, you’re not alone. Most manufacturers are more focused today on the shift changes taking place every day on their shop floors than the paradigm shift that is being ushered in by IoT.

But it’s time to get real about IoT. Those fears and misconceptions holding you back from moving forward and putting an IoT strategy into place? They could potentially be opening the door for smaller, smarter and leaner companies to surge ahead.

Self-reporting, connected technologies are poised to disrupt industry as we know it and savvy manufacturers want to be on the right side
Many small and mid-market manufacturers have taken a "wait-and-see" approach because IoT initiatives can seem daunting. You don’t need to boil the ocean; there are processes in your facility today that can likely be IoT- and/or cloud-enabled. Start there and start now!

It’s important to get moving with understanding how and where IoT can aid your business. But how do manufacturers determine the how and where?

How to start
In the beginner’s mind, there are many possibilities. Got a tech-savvy intern or a young professional on your team? Assign them to research and develop recommendations on where and how an IoT approach might benefit your business. They’ll relish the opportunity for a chance to think outside the box and you’ll kickstart the IoT ideation process with minimal investment.
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Network with your peers at events or in online communities to learn how they got started on their IoT journey. What vendors were beneficial in educating them on IoT strategy and execution? Perhaps you can then visit their website, attend a webinar and/or arrange for an onsite visit to get their take on the IoT potential and opportunity in your business.

Next, consider doing some journey mapping. This process of documenting the customer experience can give you an understanding of how customers are interacting with your business today so you can identify areas for improvement moving forward.

**Where to start**

In every business, there are gaps and areas for improvement in processes that impact the customer experience and add extra time and cost into the transaction. These represent tremendous opportunities for IoT.

Next, think about how improvements can be quickly and easily attained. Don’t make the mistake of thinking you must bring in an expensive consultant; in many instances, you can work with what you already have to digitally enable processes. Case in point: If your enterprise resource planning (ERP) system is mobile-first, you already have a solid framework for Industry 4.0.
Imagine providing a mobile interface to a sales person who can provide a quote or critical status updates to a customer while on the road. Or a mobile IoT strategy to assist with delivery scenarios, where personnel armed with tablet devices can eliminate paper bills of lading, support greater agility and streamline invoicing.

Adding inexpensive sensors to machines can provide real-time alerts when consumables are running low, when temperatures are out of range, etc. This proactive monitoring and management can help manufacturers maximize uptime, quality control and output.

All great things start small. By keeping IoT initiatives focused and manageable, manufacturers can achieve small wins that provide great advantage.
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- Increased software quality
- Lower maintenance costs
- Reduced investment risk
- Increased machine availability
The Importance of Open Standards

BY MICHAEL BOWNE
Executive director, PI North America

As the data from factories scales exponentially, the ability to access that data transparently becomes critical. If we want the Industrial Internet of Things to truly be a game changer for the manufacturing industry, open standards will be a major enabler of that transformation.

Where open standards exist, innovation is driven; disruptive technologies emerge. Things become more valuable, smarter and easier to use. This pattern has been shown time and time again in almost every industry on the planet. The examples are endless. Open standards foster a broad selection of products and vendors for end users to choose from. This competition is what drives innovation. More importantly, open standards allow small and medium-sized companies to compete. Disruptive technologies often emerge from such companies that are agile enough to innovate based on open
The Importance of Open Standards

standards. At the end of the day, the end user wins by not being locked into one large company’s method of doing business.

What exactly is an open standard?
The world of open standards is an alphabet soup of organizations, consortia and institutes. In some industries, there is disagreement about what an open standard even means. For our purposes, IEEE, Internet Society (ISOC), World Wide Web Consortium (W3C), Internet Engineering Task Force (IETF) and Internet Architecture Board (IAB) have jointly affirmed these five principles of open standards:

1. Cooperation
2. Adherence to principles
3. Collective empowerment
4. Availability
5. Voluntary adoption

Cooperation
We at Profibus and Profinet International (PI) have long promoted cooperation among standards organizations. For example, in 2007, we initiated a Wireless Cooperation Team that included Fieldbus Foundation (FF) and HART Communication Foundation. The goal was to avoid creating a PI-specific or FF-specific wireless technology for process applications and instead provide a unified approach
The Importance of Open Standards

benefitting end users. Also in 2007, PI, FF, FDT Group and the OPC Foundation formed a team to unify an approach combining electronic device descriptions (EDDs) and field device tools (FDTs) into a common technology. This became the FDI Cooperation; in 2015 FDI finished its work with PI and FieldComm Group cooperating to provide the resultant standard.

Adherence to principles

There are certain principles a standard should follow to affirm its openness. Basically, it all comes down to transparency. Consensus about decisions should be as broad as possible. The process by which decisions are made among participants should be well-defined, including the opportunities to appeal. Records should be kept throughout the process. We at PI observe these guidelines through an extensive Call for Experts process where all members equally provide input. Our technical standards are developed in PI Working Groups, the processes and guidelines for which are published online.

Collective empowerment

Organizations should create standards that are chosen based on technical merit, provide global interoperability, enable competition and innovation, and contribute to the creation of global communities. PI is a uniquely global organization in that it is highly decentralized.
Organizations should create standards chosen based on technical merit, provide global interoperability, enable competition and innovation, and contribute to the creation of global communities.

Regional PI Associations (RPAs) exist in dozens of countries, and are completely independent. However, membership anywhere in the world entitles participation in the standardization processes noted above. Competence centers, training centers and test labs all create an ecosystem in which the technologies can thrive.

**Availability**

Organizations define procedures to develop specifications that can be implemented under fair terms. That might mean open source, where licensing agreements are employed. Or it could mean royalty-free. In other cases, they might follow FRAND (fair, reasonable and non-discriminatory) terms. The Profibus and Profinet standards are available to all from the International Electrotechnical Commission (IEC). Patents cover some PI technologies, but we make them available per FRAND guidelines. Note: It is not uncommon for even IEEE specifications to be covered by patents; for example, IEEE 1588 uses patents from Intel.

**Voluntary adoption**

For a standard to be truly open, the market—where adoption is voluntary—must determine its success. We are very proud of the adoption of Profibus. It is far and away the most installed fieldbus on the market. The industrial automation market was free to choose its network during the fieldbus wars of the 1990s. That choice is now clear. We expect
The Importance of Open Standards

Profinet to see the same adoption that Profibus did. In fact, 2015 was the first year more Profinet nodes were installed than Profibus nodes. And it’s not as if Profibus is going away, it’s just that users are adopting industrial Ethernet and Profinet at an exponential clip.

S-curves

If you are familiar with innovation, you have probably heard of S-curves. This is the concept that, as a technology matures, it slowly provides more value and then quickly accelerates up a hockey-stick growth path before leveling off. Meanwhile another disruptive technology is lurking behind the scenes that, initially, doesn’t provide as much value as the current state of the art. This is the case until that new disruptive technology undergoes its own exponential growth and becomes the new standard. This type of innovation is impossible without open standards.

This is exactly the kind of innovation we are seeing in the Industrial Internet of Things (IIoT) space. In the context of Industry 4.0, this path becomes even clearer. The first industrial revolution was driven by hydraulics and pneumatics. The second saw networking via electrical signals. In the third, we see the rise of digital communication. Now, in the fourth industrial revolution, analytics and Big Data collected via increased connectivity are being driven by open standards.
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Revitalizing U.S. Manufacturing With Industry 4.0

JONNEY CHANG
Associate vice president, Advantech iAutomation System & Solution Group

Successfully leveraging the huge promise of Industry 4.0 and the Internet of Things will allow companies to transform their business models to accommodate shifting customer demands.

In the U.S. today, every dollar earned in manufacturing contributes $1.37 to the macroeconomy; and for every job in manufacturing, about three jobs are created in other fields. Therefore, efforts to reinvent U.S. manufacturing by leveraging the latest technologies to establish intelligent factories will have a substantial impact on the nation’s long-term economic growth.

The growing use of interconnected intelligent machines to support activities along the entire value chain, as well as the adoption of Industry 4.0 and the Industrial Internet of Things (IIoT), is creating a fully digital manufacturing landscape. In this smart manufacturing landscape, customers are increasingly demanding customized,
Revitalizing U.S. Manufacturing With Industry 4.0

Flexible automation equipment that enables them to use the same set of production equipment to produce multiple products. Moreover, with the application of digital systems and advanced manufacturing technologies, such as data acquisition, automation, adaptive processes and cloud computing, production can be moved closer to the markets that originate the demand using smart manufacturing. Automation allows smaller companies to grow, be profitable and employ more people.

Until recently, however, it was difficult for separate pieces of industrial automation equipment to communicate with each other. IMS Research estimates that 85 percent of legacy devices lack this ability because of incompatibility between manufacturers. The lack of compatible standards and programming languages means that integrating data is a costly and time-consuming challenge.

Although device programming still lacks standardization, technological advances are enabling manufacturers like Advantech to develop integrated hardware and software solutions that facilitate communication between devices. Advantech’s UNO series of industrial computers are renowned for their high performance, rich I/O and flexible expandability. Featuring hot swappable SSD/HDD bays with RAID 0/1 support, and equipped with motion and frame
CONTINUED

Revitalizing U.S. Manufacturing With Industry 4.0

Advantech’s SRP-FPV220 process visualization solution-ready package
grabber expansion cards, these devices are ideal for factory and machine automation.

Manufacturing needs durable, strong infrastructure to thrive. The implementation of IoT solutions involves placing sensors on equipment, leveraging software to collect data, and using data insights and analytics to optimize the entire manufacturing process. Because most existing manufacturing assets will need to be retrofitted with intelligent sensors and programmable logic controllers, some companies, particularly small to medium-sized businesses, find that the high upfront costs of retrofitting pose a significant barrier.

Fortunately, most products currently available offer smart connectivity (i.e., remote access and control from a wide range of Internet-based devices) and can be easily monitored from web-enabled SCADA management software using Ethernet or wireless networks. Such products also often do not require the use of a gateway. Advantech’s WebAccess/HMI platform featuring HMI Runtime software is an example of such a product with its remote display technology that facilitates remote monitoring and control.

The challenge for manufacturers now is how to use these kinds of products to monitor legacy equipment.

Regardless of how Donald Trump’s presidency unfolds, the future of U.S. manufacturing is being redefined. Industry expectations of a more business-friendly environment with looser regulations have already encouraged growth.
This is where solution-ready platforms (SRPs) play an important role. Advantech’s iFactory SRPs are quick-start tools that enable a stepwise approach to achieve Industry 4.0. They offer a modular way of adding flexible functionality to a range of devices through the addition of Advantech’s iDoor modules.

Currently available iDoor solutions include modules that support fieldbus protocols, such as Profibus, Profinet, EtherCAT and Powerlink; memory expansion and storage with backup RAM, CFast/compact flash and SD/mSD; digital and analog I/O such as multifunctional I/O, analog I/O, digital I/O and counters; smart sensors such as smart meters, pressure sensors, temperature sensors and light sensors; and communication technologies such as GPS, 3G, LTE, Wi-Fi, GPS, GPRS, ZigBee, RFID, Bluetooth and LTE. These modules eliminate the need to purchase additional devices to serve as a gateway between UNO and legacy equipment.

By standardizing networking methods and allowing devices to use established industrial networking technologies to communicate via Ethernet, new and existing devices can be connected to the same network and communicate with manufacturing execution systems (MES) and enterprise resource planning (ERP) systems. Once data from devices and machines are filtered and converted into a standard...
protocol, they can be transferred to servers over the Internet to facilitate remote monitoring and control of all machines and systems on factory production lines.

**Leveraging the full potential of Big Data**

Despite widespread adoption of digital systems and data acquisition devices, most industries have not even come close to realizing the full potential of data and analytics. Companies that do collect process data typically only use it for tracking, conducting minimal data analytics without fully appreciating how to transform data into actionable insights.

For these companies, the challenge will be to adopt a long-term perspective and invest in the systems and technology that will enable them to not only collect data, but analyze it thoroughly to glean actionable insights.

Regardless of how Donald Trump’s presidency unfolds, the future of U.S. manufacturing is being redefined. Industry expectations of a more business-friendly environment with looser regulations have already encouraged growth, with many manufacturers establishing initiatives to upgrade their infrastructure.
Once old and new devices are connected and communicating with each other, the next step in creating a successful future with IIoT is collaboration. To gain an advantage, technology companies should establish partnerships aimed at advancing a particular field or building end-to-end customer solutions that harness the best of their assets and capabilities. The resulting emergence of ecosystems and platforms will deliver a whole new level of value and business opportunities.
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