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The Internet of Things: New Business Models for Manufacturers?

BY ARUN K. SINHA
Director of business development, Opto 22

The convergence of operational technology and information technology systems could help manufacturers embrace new service offerings using web-based business models.

Many years ago, one of my distributor partners took me to a very large industrial OEM for an automation demo. Afterward, we went into a stockroom, where she noted on a clipboard all the components she supplied to them that needed to be reordered. The form was dropped into the inbox of a purchasing agent on our way out.

This memory came to mind recently as I was thinking about new business models for manufacturers that could result from the Industrial Internet of Things (IIoT).
In addition to a purchase order being generated as a result of the form left for the purchasing agent at the OEM, I’m sure the information on that sheet made its way, probably manually, into an enterprise resource planning (ERP) system.

Of course, supplier-managed inventory (as my distributor partner was conducting with her manually completed form) is not a new concept. But imagine if a data source for an ERP system existed one level lower than supplier electronic data interchange (EDI) and was accessed directly from a machine?

Advances in automation technology today are helping make this kind of data exchange with IT software and cloud platforms simpler. Opto 22’s new groov EPIC (Edge Programmable Industrial Controller), for example, contains IIoT-enabling tools that eliminate the PCs, OPC servers, gateways and integration often required by traditional programmable logic controllers (PLCs).

With the operational technology (OT) data more easily available to IT systems, business leaders might start asking themselves, “What opportunities does the connected enterprise present for my organization?”
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The answer is likely to be new services that use Internet-based business models.

**IoT-based services**

Much has been said about how the convergence of OT and IT can help industrial companies operate more efficiently, reduce downtime, increase profitability and do things like move from preventive maintenance to predictive.

Most of these outcomes are facilitated by making plant floor data available to software platforms that can combine it with other data to perform advanced analytics. With that in mind, what if manufacturers used this new business intelligence to better serve or add value to their customers? Many forward-thinking companies are already doing this by leveraging IIoT technologies to develop new business models based on delivering services, rather than just products.

Some companies are even looking to integrate customer relationship management (CRM) and marketing automation platforms with operational and enterprise data. With this approach, new services that could add value for their customers include product lifecycle management (PLM), faster product development, data warehousing and product customization.
A compelling case for the use of Internet technology to provide service to customers can be found with OEMs and machine builders. The idea of delivering a machine to a customer and providing remote support (commissioning, troubleshooting, maintenance) as a service might not be a new idea. The difference today is that IIoT-enabling technologies in automation have removed some of the IT barriers and made this idea much more feasible.

Some innovative OEMs are taking this idea to the next level and offering what is known as product as a service. A great example of this can be seen at Kaeser Compressors, which offers its compressors as a service through its Sigma Air Utility. Charging for cubic feet per minute used rather than for the equipment itself offers value to Kaeser’s customers by replacing an often difficult-to-obtain capital expenditure with an operational one.

Speaking about their compressed air as a service business model, Kaeser likes to say, “You probably don’t generate your own electricity, water or gas, so why generate your compressed air?” This “servitization” through IIoT technology is very likely to grow with the ever-increasing interactive web mentality.

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When the Internet of Things (IoT) became the next logical step in the progression of the Information Age, it arrived with the promise of unlimited opportunities that could be provided with interconnectivity between humans, machines, communication devices and just about anything else that can be imagined. Though the advancements in IoT in the consumer market have been significant, the industrial IoT (IIoT) is experiencing sluggish growth in realizing the full potential of smart factories.

The reasons behind the slow advancement of the IIoT can surely be tied to the usual suspects of cost, time and manpower involved. Larger companies might have the resources to commit to a facility-
A Discrete Approach to the Internet of Things

A wide or enterprise-level IIoT platform. But smaller companies can be hindered by tighter budgets, engineering staffs that are already stretched thin, and a reluctance to fully commit to a facility-wide conversion to IIoT that would strain both of these resources.

There is a Chinese proverb that states, “A journey of a thousand miles begins with a single step.” There is wisdom here that can be applied to smaller companies looking to adopt IIoT strategies. This process can be approached in a discrete fashion rather than coming at it from an all-encompassing, enterprise-level approach.

A discrete approach to IIoT offers a more realistic starting point for many small to medium-sized manufacturing organizations, and even for some large ones. This allows progress to be made incrementally, without the financial or manpower burden that is associated with enterprise systems.

An example of where a discrete implementation of IIoT would be a logical first step for a manufacturing business is pulling data from a compressed air system. Compressed air is expensive. Any effort to keep these systems running at peak efficiency is well worth it because losses due to leakage and inefficiency result in higher energy costs. Additionally, for any operation that relies
on pneumatics, being able to understand how the source of pneumatic power is functioning is vital.

For instance, inline sensors can be installed that monitor variables such as pressure, flow, humidity, temperature and, most importantly, power associated with the operation of a compressed air system. This data can then be sent to a platform, where it can be converted into information that is useful to a maintenance manager. This discrete point of data collection can then become the basis for a wider-scale pneumatics monitoring system, where leakage and other system losses can be identified.

**Four strategies**

A discrete IoT implementation project should always be preceded by thoughtful consideration of the project’s objectives and whether IoT is the best way to achieve those goals. With that in mind, these four strategies can simplify the process of implementing a discrete IoT solution:

- Target areas of concern. Which machines or processes have the most maintenance problems associated with them? Machines that are difficult or costly to repair in a timely way or have hard-to-source parts should top the list, as well as assets that could endanger employee health or safety if problems with them go uncorrected.
A Discrete Approach to the Internet of Things

• Define the parameters that need to be monitored to improve operating efficiency. As mentioned in the compressed air example, conditions like temperature, pressure, humidity and vibration often allow operators to evaluate that asset’s health. Collect the pertinent data and take a methodical approach to using this information.

• Select an Internet infrastructure that will support the data transmission needs of a discrete installation, but also has the capacity for expansion. The solution chosen should provide a centralized collection server that receives and transmits data from all the devices and sensors that might eventually be added to the network.

An example of an IO-Link module integrated with a pneumatic valve island manifold from Parker Hannifin. This module allows for simple integrated sensing of supply voltage and operational temperature to predict or prevent a failure. The vendor-neutral IO-Link protocol enables low-level machine components to connect to the factory network at lower cost.
A Discrete Approach to the Internet of Things

• Balance monitoring frequency with operational costs. Cloud-based solutions allow for round-the-clock monitoring, as well as alerting operations or maintenance personnel when conditions exceed preset limits. But there can be a point of diminishing returns. Focus on the quality of the data to be collected rather than quantity.

Starting with one very specific application, rather than trying to apply IIoT to your facility as a whole, makes approaching IIoT manageable. What’s more, it forces managers to focus on a specific problem, ensuring a quick payback on the effort. By following the steps outlined above, plant managers can harness the power of the information that is important to them today, without having to wait for the rest of the enterprise to get connected.

For more information about how Parker Hannifin is using discrete IIoT to help customers reduce risk, maintenance costs and unplanned downtime while improving efficiency, watch a video at http://awgo.to/900 or download a white paper at http://awgo.to/901.
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Not Your Father’s Fieldbus

BY MICHAEL BOWNE
Executive director, PI North America

As big as the move from fieldbuses to Ethernet-based networks was, the move toward Time-Sensitive Networking will be equally significant because it places all protocols on the same footing. This change puts the focus on protocol capabilities and ease of use.

The fieldbus wars from the days of yore are over. Closed fieldbuses simply don’t cut it anymore when it comes to running a modern manufacturing plant. Sure, they achieve the necessary performance, but at the expense of flexibility. Industrial Ethernet was a step in the right direction with its openness. Now that Ethernet is becoming deterministic by design, performance is no longer the deciding factor. Now, it’s all about the data.
Continued

Not Your Father’s Fieldbus

But in reality, it’s always been about the data. If you think back to what made fieldbuses so revolutionary—the move from analog to digital—it was nothing short of a step change. And though replacing 25 wires with just one wire was great, the real cost savings came from less tangible benefits. Increased data capacity, high-speed networks, diagnostics—these were the features that made it possible for us to sell 60 million Profibus nodes. They led to benefits like decreased downtime, increased transparency, shorter throughputs and overall higher efficiency.

The move from fieldbuses to Ethernet-based networks was another step change. Serial fieldbuses achieved their determinism by virtue of the fact that they were a closed network. Likewise, a control network that leverages standard unmodified Ethernet to allow deterministic data exchange to coexist with other protocols—all on the same physical layer—is monumental. This is what made it possible for us to sell 25 million Profinet nodes.

Now, as we move toward Time-Sensitive Networking (TSN), we can see the move to industrial Ethernet as an evolutionary step in the right direction.
Where does the future lie?

As Ethernet evolved, latency was sacrificed in favor of flexibility, since its largest use case was, and is, the Internet. But now the IEEE is adopting and standardizing many of the concepts we’ve invented for factory automation to engineer a deterministic-by-design version of Ethernet known as TSN.

This is a fundamental shift. It means any Ethernet-based protocol can theoretically gain the performance benefits previously associated only with deterministic control networks. You read that correctly: Any. Protocol. Think about this for a second. What does it mean for the future? It means that all protocols can share an equal footing, making the primary differences between them data access and feature functionality.

You might be asking yourself, “Why TSN? This is nothing new!” The answer is that TSN ensures robustness even in heavily loaded networks. Latency is low in lightly loaded Ethernet networks today. But as more traffic gets transmitted over the network, a near certainty in the future, TSN will ensure latency doesn’t suffer for time-sensitive control data.
Using the right tool for the task
Numerous Internet-based protocols exist, such as HTTP, FTP, SMTP, POP, SSH, DHCP, SNMP, LDAP and RSTP. The reason we have so many is that each is suited to its purpose. The same can be said for
automation networks that now share a common TSN foundation. Just because you can use a protocol for a certain task doesn’t mean you should.

A common example is Profinet vs. OPC UA Pub/Sub. It doesn’t make sense to use Profinet for information exchange between office-level computers due to routability and data format. Similarly, it doesn’t make sense to use OPC UA for data exchange between field-level devices due to telegram size and overhead. OPC UA simply doesn’t have the characteristics of a modern-day fieldbus, but it is great for modeling and moving information. As a result, Profinet and OPC UA Pub/Sub are complementary technologies, not competing ones.

Though your father’s fieldbus in the 1990s may have been focused on data exchange, modern fieldbuses do much more. Today, an industrial Ethernet protocol must be capable of motion control, data semantics, comprehensive diagnostics, functional safety, scalable media/system redundancy, energy management, process control and flexible topologies—including wireless and fiber, painless commissioning, asset management, IT integration and last-meter connectivity (IO-Link).
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Not Your Father’s Fieldbus

The key point to remember is that not all protocols situated for the same task are created equal. With performance otherwise guaranteed via TSN, and more than one flavor of industrial Ethernet on the market, differentiation comes from their capabilities and how easy they are to use. As manufacturing complexity increases, data access and usability should be your core areas of focus for any future-proof industrial Ethernet.

For more information, visit PI North America at us.profinet.com.
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Visit us at maplesystems.com to learn more about cMT products.
Manufacturers are accelerating the implementation of Industrial Internet of Things (IIoT) and Industry 4.0 tools and processes to maximize profitability. This transformation, sometimes referred to as the fourth industrial revolution, is encouraging manufacturers to migrate from legacy fieldbus systems to the modern industrial Ethernet, which is becoming the network of choice in harsh industrial environments for its simplicity, scalability, diagnostic capabilities and high performance.

To truly apply the Internet of Things, you need an industrial Ethernet network in place. Therefore, it is critically important to understand the codes that regulate the environment in which your industrial Ethernet cables are installed.

BY MIKE BAYDA
Industrial product manager, Nexans
Industrial Ethernet is still a relatively new technology in the manufacturing world. As such, it generates a lot of questions, particularly regarding codes and standards, installation practices, and harsh and outdoor applications.

The most commonly asked question we have received regards what codes and standards manufacturers need to be concerned about when installing cables in an industrial factory environment. A critical consideration to make when selecting cables is what code regulates the environment where the cable is installed.

Three areas of a typical factory that each have different associated codes and standards are:

- **NFPA 70**: Known as the National Electric Code (NEC), this applies to field wiring in-transit to the machine or control panel and terminated at the manufacturing site. This is the “building” wiring installed in the tray and communication raceway environments.
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The Code Questions Raised by Industrial Ethernet

- **NFPA 79**: Known as the Electrical Standard for Industrial Machinery, this applies to the wiring of electrical/electronic equipment, apparatus or systems of industrial machines operating from a nominal voltage of 600 V or less. This is the wiring that is used in/on machines.

- **UL 508A**: This provides the requirements for industrial control panels operating at nominal voltages of 1,000 V or less and in ambient temperatures that do not exceed 40 °C (104 °F).

To learn more about these standards and find the answers to other frequently asked questions, visit www.nexans.us/industrialfaq to download your copy of our new white paper.
How Abbott Nutrition uses Seeq to capture the company’s global knowledge to support collaboration and innovation and transfer that knowledge and expertise to its new generation of employees.

In 1999, Abbott Nutrition began working with OSIsoft’s PI System to integrate, collect and contextualize data at the company’s manufacturing plant in Columbus, Ohio. Based on its success at this plant, the company entered into an OSIsoft Enterprise Agreement (EA) in 2012 to include all Abbott Nutrition manufacturing sites globally. This created a huge volume of data, which presented the challenge of extracting maximum value from the data.

About two years ago, Abbott began focusing on ways to obtain more value from the data. The company used OSIsoft’s Asset Framework (AF) to contextualize and organize the data using AF’s asset-centric models. The company also started using Seeq’s advanced analytics.
applications to reduce the time and effort needed to connect to AF, create models and find insights quicker.

Seeq can be used to contextualize time series data and create models to help engineers quickly derive insights and value from industrial process data. Abbott decided to use this approach to help reduce clean-in-place (CIP) rinse time while maintaining or improving product quality.

Multiple processes share a common CIP system.
In 2016, Abbott started a modest pilot project on one OSIsoft PI Server workstation to prove the return on investment of this idea. “By the end of the pilot, we felt confident in the value we could obtain and increased the project scope to include additional PI Servers,” says James Li, an engineering manager in the Abbott Nutrition division.

Abbott launched a formal analytics program globally at the beginning of 2017, with near-term plans to connect Seeq to all OSIsoft PI Servers globally.

Creating the model
Seeq’s three-stage model includes: 1) data wrangling, 2) engineering investigation and 3) sharing insights.

The first step, data wrangling, replaces the hours of manual effort typically required to aggregate, cleanse and contextualize data. Data wrangling turns specific asset data into useful information “capsules.”

Capsules, a Seeq innovation, consists of a user-defined slice of time that can be visually correlated with a unique identifier and then compared with other assets. Once defined, capsules can be overlaid on top of each other or compared side by side for analysis and visual comparison.
The second phase, engineering investigation, pertains to developing the model. Seeq’s analytics tools helped Abbott target the problem by searching and annotating the sensor data, pattern matching and historical benchmarking. This enabled the company to quickly identify and target previously unidentified problems.

The third phase, sharing insights, includes performance monitoring and reporting, dashboards and real-time collaboration. “Our engineers love their own spreadsheets with their own formatting,” Li says. “However, to improve collaboration and transfer process knowledge to newer workers, the information needs to be shared.”

Seeq Worksheets support the sharing of displays with a common URL; the software also exports data to Excel and their business tools for sharing and role-based dashboards. Both approaches improve collaboration globally.

Abbott Nutrition operates 14 manufacturing sites (with more than 70 manufacturing sites globally for all of Abbott). The company’s goals include:

- Improving asset utilization for CIP processing.
- Maintaining or improving product quality.
SECURE THE PROCESS

The industry requires a high level of protection in its processes because of the importance that its information represents. That is why CC-Link IE has the necessary safety certifications implementing corrective measures, control methods and safety curtains to generate confidence and efficiency. CC-Link IE is the future in communication technologies today.
• Reducing overfilling of products.
• Increasing production of saleable products, without increasing variable costs.

To meet these goals, the company used Seeq analytics technology in two use case pilots. The first involved CIP processes; the second focused on reducing overfills in packaging operations.

**Optimizing CIP systems**

To reduce CIP cycle times while maintaining or improving product quality, the company focused on asset utilization. Li explained that he wanted to be able to use Seeq to review the data stored in the PI Server to quickly identify periods of interest.

CIP is commonly used to clean process equipment between batches or production runs. While a process is in the CIP phase, the equipment is not available to produce product.

Typically, CIP is a centralized system that can connect to and be used to clean multiple process units. CIP systems typically comprise multiple circuits or steps that involve circulating caustic, acid and water to clean the process equipment. To determine the endpoint
for each CIP step, Abbott uses conductivity sensors to measure the water/acid/caustic parameters.

While Li had previously created trend reports to identify and isolate specific CIP issues, trend data alone does not always tell the complete story. For this pilot, he created a model using Seeq to validate and improve the way the available data was used.

“To be able to capture the most important data and assimilate the intelligence, we used Seeq capsules to break down the data into phases specific to the CIP process and equipment,” Li said. “This information allowed us to quickly create a phase capsule with information that compares circuits and equipment.”

Seeq enabled Li to quickly identify patterns, see the duration time for each circuit and phase, identify the longest CIP run, and drill down to determine the reason for the longer run. He was also able to analyze the incremental costs accrued. The capsules helped identify excessively long CIP runs, over-rinsing and/or when and in which CIP circuits the acid or caustic was overused. Then, he could drill down to quickly identify the root causes, such as valve leakage or another instrument failure.
The ability to quickly identify the root cause enabled the company to fix the issues to improve operational efficiencies through more consistent CIP duration. In some cases, Abbott was also able to decrease CIP cycles to increase production availability.

Another benefit was the ability to reduce product contamination by quickly identifying conductivity peaks. For example, if it was revealed that a valve leak caused a conductivity spike, an operator could put the batch on hold to prevent product contamination.

For the CIP cycle use case, the tool helped Abbott identify key areas to focus on for production improvements.

**Reducing product giveaway and scrap**

The second Seeq pilot use case focused on Abbott powder filling equipment. Here, it’s important to reduce product filling errors to enable the company to meet its filling label claims for product weight, while minimizing costly product giveaway. In the past, it was time-consuming to examine the filling data and obtain batch information.

Using Seeq, Li could contextualize continuous data streams using a model that calculates product giveaway and aggregates the information over the time periods of interest. He did this by creating
capsules that enabled the company to review the weight data vs. the target and filling state and compare filling operations, analyzing loss-per-fill and aggregating by product and shift. This enabled the company to determine if the target was met in about five minutes, providing a resolution to the overfilling problem.

To assess total giveaway across shifts and find variability, Abbott uses dashboards in PI Coresight (now called PI Vision) to visualize the data. Also, by monitoring the filler head actual weight distribution, the company can determine when filler maintenance is required.

For more information, visit Seeq at www.seeq.com.
To optimize processes, manufacturers have been leveraging the Industrial Internet of Things (IIoT) to gather and analyze large amounts of data across the entire production chain for some time now. By doing this, many have quickly discovered the immense value that can be derived by pushing computing to the edge of the network. Some of this value comes from access to real-time insights that improve operational efficiencies, decision making and costs.

In fact, edge computing is gaining so much popularity that Gartner predicts that by 2021, 40 percent of enterprises will have an edge strategy in place, up from about 1 percent in 2017.
With the rise of IIoT and edge computing, the use of information technology (IT) at the operational level has become more prevalent, and the line between IT and operational technology (OT) is being blurred. As we see more and more convergence of IT and OT, OT professionals are being asked to support more and more complex environments and infrastructures. However, they usually do not have the necessary resources or experience needed to manage them, which has led to a number of challenges that today’s OT professionals must face and find ways to address.

**Limited IT resources**

Most OT specialists are not IT specialists. However, they are still tasked with installing and supporting industrial automation systems, as well as finding forward-thinking technology solutions to keep their businesses current. This means that the need for dual IT/OT roles is larger than ever. We’re beginning to see the emergence of a new breed called the “hybrid OT” or “industrial IT” professional who bring a combined IT/OT perspective to the plant floor. With this skillset, they are able to appropriately manage optimized IIoT operations.

The issue of limited or no available IT resources on-site at plants becomes especially heightened with the introduction of edge computing because most of these deployments are located in remote
areas that are not easy to access. Solutions that OT professionals are able to “set and forget” and that are operationally simple will be of paramount importance here.

**Complex environments and virtualization**

OT professionals also face challenges regarding the complexity surrounding the plant automation environments where they work. They must navigate different workstation classes for workers, separate networks for process control and plant management, and standalone servers for production applications, among others.
These configurations can be difficult. For example, if each application is run on individual servers, it could result in many wasted processing resources. Not to mention, the high-cost ownership of various application licenses culminates in a generally inefficient process. By virtualizing servers onto a single platform, OT professionals can reap many benefits. These include reduced server sprawl, simplified diagnosis and repair, reduced systems management workload, improved scalability and lower infrastructure costs, to name a few.

Many industrial automation companies are leveraging virtualization as a foundational technology to set their organizations up for success when it comes to IIoT readiness. Though it is clear virtualization provides many positive improvements, it can also come with several risks. If multiple applications are running on one platform, that one platform’s reliability becomes critical.

If one virtualized server goes down, so will all of the various applications it supports. This is a huge risk to OT professionals, whose responsibility is keeping production lines up and running no
matter what. It is imperative that virtualized servers are fault-tolerant and highly reliable. This takes some of the fear out of the equation for these OT professionals.

As IIoT and edge computing continue to gain popularity across industry, the challenges increase as well. Luckily for OT professionals, there are some easy requirements to address when looking for solutions that can help ease these issues. Making sure OT has access to solutions and systems that are self-protecting, self-diagnosing, always available, and easily maintained and serviced will be the key to IIoT success at the edge.

For more information, visit Stratus Technologies at www.stratus.com.
Realizing the Opportunity Arising From the Internet of Things

BY TOM FRANCESKI
Vice president and general manager of DocStar, a division of Epicor Software

Building out the value chain to realize the promise of IoT-enabled innovation is the difference between an Internet of Things and an Innovation of Things strategy

Though the Internet of Things (IoT) might be built with innovative technologies, real innovation is found in how it allows organizations to become more intelligent, agile and adaptive. Organizations must look past the hype of the IoT to see the real opportunity to enable the “Innovation of Things,” notes Benson Chan, senior partner at research and consulting firm Strategy of Things.

The IoT refers to a network of connected devices collecting and exchanging data over the Internet autonomously. Business process management (BPM) software analyzes, discovers, designs, implements, executes, monitors and evolves collaborative processes.
across organizations. Until recently, however, teams and resources dedicated to deploying and managing IoT and BPM have operated in silos. Organizations must bring these two disciplines together to fully realize the potential for change and innovation.

While the IoT is a building block for the factory of the future, it’s also dictating change on the factory floor. “Unless it is made actionable, and connected to a responsive loop, the petabytes of data generated by the IoT are merely a burden, not a benefit or a source of competitive advantage,” comment analysts at BPM.com. “Resolving this challenge is what will drive a rapidly growing volume of IT investments in the era of the fourth industrial revolution. While there will be investments in data generating devices, there must be connected business rules and processes for this data to be actionable.”

Historically, processes have been run, measured and evaluated—in that order—with improvements then implemented to optimize performance. Today, with the IoT, all these critical phases may take place simultaneously and near instantaneously. The opportunity for continual operational optimization is exciting, but systematic processes must be in place to support this innovation.
CONTINUED

Realizing the Opportunity Arising From the Internet of Things

In its report Predictions 2018: IoT Moves From Experimentation to Business Scale, Forrester Research emphasizes the need to build out capabilities around IoT-enabled products and experiences, such as remote product management, monitoring and control, and the ability to integrate IoT-enabled business assets into cohesive business processes.

BPM capabilities with manufacturing execution systems (MESs), enterprise resource planning (ERP) systems and enterprise content management (ECM) systems all play roles in the orchestration of
data consumption, analysis and action—creating seamless handoffs between systems, people, processes and machines to revamp processes in the IoT age.

However, having the right technologies and systems in place is just the beginning—manufacturers also need new thinking and leadership strategies. Following are three strategies to evaluate for your business:

• **Process mapping**—understanding the impact on existing operations. Equipping machines with sensors is a foundational IoT strategy that offers significant value. If a sensor sends out an alert when a machine goes down, it will likely have implications for the shop floor schedule, customers, raw material requirements, etc. Process mapping exposes the waterfall effect of data and events across the manufacturing organization and how existing business applications can be optimized with connected factory-floor data streams.

• **Enlisting a tiger team.** Completed process mapping identifies specific areas where an IoT-enabled approach can add significant value—an excellent starting point to enlist a “tiger team” to move forward. Accessing the right talent to integrate your connected factory initiative might involve pulling in resources from outside
your organization, such as local university academics and students, as many undergrad- and grad-level programs seek to partner with manufacturers to offer students real-world experience. Your business software vendors can also provide a consultative role.

- **Closed-loop actions and compliance in the connected factory.** The advent of the IoT does not reduce governance and compliance for manufacturers. The need to document corrective actions and other reporting to meet safety, compliance and environmental compliance requirements is constant. ECM can help digitize this documentation and streamline associated processes, ensure they are routed and reviewed by the right human stewards, and secure and manage information according to disposition schedules.

Though the connected factory demands new and emerging technologies to be overlaid and interwoven into the manufacturing environment, it’s important to recognize that existing systems, such as MES, ERP and ECM, are also at the forefront of IoT enablement. Together, with new thinking and new approaches around IoT, manufacturers now have the framework for the Innovation of Things.

For more information, visit DocStar at www.docstar.com.
CONNECT & CONVERGE

Downtime is lost time. And lost time means lost profitability. With Nexans Industrial Ethernet Solutions, you’re getting a solution you can trust; one that supports your requirement for 100% uptime.

Nexans gives you the confidence to make the connection. Visit [nexans.us/industrial](https://nexans.us/industrial) to learn more.
Upgrading Legacy Systems for the IIoT

BY CHRISTINE STEELE
Application engineer, Maple Systems

How Maple Systems’ Smart Communication Gateways with HMI data processing capabilities can be used to quickly build an Industrial Internet of Things environment with existing devices.

Does exchanging data between different types of machines always give you a headache? Integrating miscellaneous legacy equipment for factory automation has never been an easy task. Each machine uses a different controller, and integrating with supervisory control and data acquisition (SCADA) and enterprise resource planning (ERP) monitoring systems is difficult because of the multitudes of different protocols. This is one of the obstacles that makes productivity improvement efforts so hard.

Take changing standard machine parameters as an example. With no networked and distributed system, the operator needs to walk to each machine individually and manually enter parameters. In this system, because of a lack of data accessibility, the potential problems
Upgrading Legacy Systems for the IIoT

Take changing standard machine parameters as an example. With no networked and distributed system, the operator needs to walk to each machine individually and manually enter parameters. In this system, because of a lack of data accessibility, the potential problems in the factory might not be easily found and could eventually lead to defective products being made.

Enter Maple Systems’ cMT Smart Communication Gateways. Designed to add new communications protocols to existing systems, the cMT-G01 and G02 will get your legacy systems talking to your management network in a low-cost, low-effort way. With Industrial Internet of Things (IIoT) protocol standards such as MQTT and OPC UA built in, and the ability to process data like a conventional human-machine interface (HMI), the cMT-G01/G02 fits well into
many applications to integrate real-time data from different devices, providing a standard communications interface.

Protocol integration and data analysis
Unlike other gateway products with limited connectivity, the cMT-G01/02 products come standard with drivers to communicate with more than 300 brands of controllers. They are able to transmit all the data from the controllers to SCADA and ERP systems, completely integrating multiple devices into one system.

OPC UA is a communication protocol supported by many SCADA, manufacturing execution system (MES) and ERP software providers. This protocol has built-in security with signed and encrypted data transfer using state-of-the-art encryption algorithms. Any data accessible to the cMT Gateway can be added to the OPC UA server and accessed securely via an upstream device. The configuration interface used to add data to the OPC UA server is simple to use and allows data to be organized into multi-level objects with descriptive names. An OPC UA client connecting to the cMT Gateway will see data organized in the same intuitive way.

MQTT is a widely supported, extremely simple and lightweight publish/subscribe messaging protocol, designed for constrained
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devices and low-bandwidth, high-latency or unreliable networks. Our cMT Gateway products are also able to integrate with existing cloud data centers like Amazon AWS IoT and Microsoft Azure, simplifying and expediting field implementation.
The cMT-G01/02 products are also equipped with the ability to perform the same data acquisition and analysis functions our advanced HMIs feature (e.g., store event log). They can not only implement data transfer functions (e.g., recipe data) between devices, but also run macros to perform arithmetic and logic operations and convert raw data into meaningful information. In addition, these communication gateways support our Scheduler feature, offering the ability to trigger events at specific times.

**Alerts and networking**

The cMT-G01/02 can send emails to inform users about the operational status of onsite machines and use the MQTT Publish function to send updated data or messages to immediately notify subscribed users. EasyAccess 2.0 can remotely debug or update devices without the need for adjusting firewall settings. With the EasyAccess 2.0 Push Notification function, users can receive immediate notifications about the operation status of onsite machines on their portable devices (iOS/Android), which greatly improves efficiency and reduces the losses caused by unplanned downtime.
With the introduction of IO-Link smart connectivity, Parker enables its partners to increase productivity and profitability, while reducing complexity. Connected valve technology enables better machine-to-machine control in a cost-effective way.

parker.com/pdn/io-link
Unique to the cMT-G02 is built-in Wi-Fi 802.11b/g/n support with strong resistance to interference. The detachable antenna can be replaced with third-party antennas suitable for the environment. Wi-Fi settings can be quickly configured using the web interface.

Legacy upgrade

cMT Gateways are a compact, low-cost and flexible way to get your legacy systems talking to current technology. These gateways address the demand for protocol integration of different controllers, data acquisition and analysis from onsite machines, secure data transmission to upper layer data management systems, and real-time event/alarm notification to the operator. They also fulfill key operations requirements by communicating with a wide range of existing equipment and support emerging IIoT protocols such as MQTT and OPC UA. They are an efficient, reliable, scalable and secure way to upgrade any factory to a smart factory.

For more information, visit Maple Systems at www.maplesystems.com.
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Shortening Industry 4.0 Implementation Time

BY CHUCK HARRELL
IIoT product management, Advantech

Few manufacturing operations have fully implemented comprehensive factory monitoring as outlined in Industry 4.0 because of the intensive time and resource requirements. Advantech focuses on delivering technologies to reduce these complexities.

With the emergence of Industry 4.0 and the ongoing development of real-world applications for it, manufacturers wishing to maintain their core competitiveness are increasingly adopting new technologies in an effort to gain long-term advantage. The reason Industry 4.0 is revolutionizing the entire industry is due to its potential to transform numerous operations, including processing, equipment monitoring, factory management, energy consumption and logistics, all of which can be integrated into innovative automated systems.
However, without a standard method for transformation, many manufacturers remain unsure how exactly to implement Industry 4.0 or what steps should be taken to initiate the smart factory transformation.

**Connectivity and process visualization**

“The previous industrial revolution, Industry 3.0, emphasized automation and computerization to enable automated machine production and digitalized data management,” said Wilson Dai, market development manager of Advantech’s Automation Computer Business Unit, speaking of the challenges faced by manufacturers today. “Now, in order to move towards Industry 4.0, connectivity and visualization are the key prerequisites—specifically, equipment connectivity process visualization.”

With equipment connectivity and the collection of machine data for real-time display, manufacturers can develop a variety of transparent, predictable, optimized and adaptive smart applications. This will enable the optimization of production lines and corporate resources for low-volume multi-customized production with the highest cost effectiveness.

As a passionate promoter of smart applications, Advantech has an extensive portfolio of IoT hardware and software products to help users achieve connectivity and process visualization, including...
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sensory devices, mid-layer intelligent hardware and a top-layer multifunctional WebAccess cloud platform. Advantech continues to develop new solutions and services to assist manufacturers in implementing Industry 4.0 technologies.

**Integrating smart applications**

When it comes to implementing equipment connectivity for broad visualization applications, manufacturers and system integrators
Shortening Industry 4.0 Implementation Time

will encounter the same issue—all processes, including planning, design, testing and deployment, will need to be redesigned. Thus, the entire transformation process will take at least six to 12 months to complete. Because of the amount of time and energy required, few have fully implemented comprehensive factory monitoring. The resulting slow pace of adoption not only weakens the potential benefits, but also impacts the development of Industry 4.0.

Leveraging its wealth of industry experience and diverse resources, Advantech has developed its iFactory solution-ready platforms (SRPs) aimed at realizing smart factories by combining hardware and software into integrated applications. These SRPs comprise three main components: Demo AP, Domain AP and a Node-Red template.

“Advantech iFactory SRPs can dramatically reduce development time by providing pre-developed programs and modules for easy customization and expansion,” Dai said. Manufacturers that have adopted Advantech’s SRPs have been able to successfully develop Industry 4.0 applications in just three months.

**Wireless data collection**

Advantech’s SRPs support numerous programmable logic controller (PLC) communication drivers and brands of PLCs for easier
networking. The use of standard protocols allows for the integration of monitoring and management systems to enable comprehensive data collection, flexible protocol transition, and operational technology (OT) and information technology (IT) convergence. The efficacy of Advantech SRPs has been further enhanced with the inclusion of RESTful APIs, which eliminates the need to convert collected data for manufacturing execution systems (MESs).

“Customers desire a monitoring solution that can increase production efficiency by 30 percent and be installed without disrupting operations or additional wiring,” Dai said. “Currently, there are few solutions capable of satisfying these requirements, except for Advantech’s SRPs. Our three-color monitoring system is not only a turnkey solution for rapid implementation, but also provides a non-invasive tool to satisfy customer demands.”

Using iFactory SRPs combined with Advantech’s WISE series wireless modules, users only need to install data collection modules at every workstation.
Aimed at three main applications—equipment networking, process visualization and informatization of factory management—Advantech’s SRPs enable machine control, equipment monitoring and optimization, MES data integration, production optimization, productivity management and intelligent surveillance. Advantech plans to continue developing additional SRP systems for machine wear-and-tear detection, intelligent assembly monitoring, temperature monitoring, factory environment monitoring, productivity visualization, comprehensive monitoring and management, and production line management (eSOP).

For more information, visit Advantech at www.advantech.com.