Artificial Intelligence: Why It Needs to Be on Your Mind
EDGE COMPUTING MADE EASY

The influx of data generated from manufacturing technologies and devices is driving the need for a new edge computing infrastructure.

That solution is here. Stratus ztC Edge is a zero-touch, fully virtualized and self-protecting computing platform, specifically designed for industrial edge environments.

Purpose-built for operational technology, ztC Edge is easy to set up, configure and manage, with user-friendly tools and redundant, hot-swappable nodes that automatically verify compatibility and synchronize themselves.

LEARN HOW YOU CAN BRING YOUR MANUFACTURING TO THE EDGE
Visit Stratus at www.stratus.com/edge
Recently, it seems like everyone is talking about artificial intelligence (AI) and machine learning. In fact, IDC has forecasted that spending on AI and machine learning will grow from $12 billion in 2017 to $57.6 billion by 2021. While large, multinational industrial companies have already begun embracing AI in an effort to stay competitive in today’s digital environment, it’s time for small and midsize industrial companies to start thinking this way too.

As companies continue to collect data created from production systems with the rise of the Industrial Internet of Things (IIoT), many are finding that the insights collected are more than they can
Artificial Intelligence: Why It Needs to Be on Your Mind

Effectively consume. Data analytics itself is not enough—the data needs to be used to drive operations forward. Here is where AI will fit in to play an increasingly important role.

The power of AI

Machine learning is only half the story. Though it can be used to sift through massive amounts of Big Data to help identify patterns and business insights, the real value will come from the power of AI because it will allow companies to leverage those insights to make something happen. This could mean anything from automatic modification of production line scheduling due to lack of resource availability to managing that change across supply chains from start to finish to prevent conflicts and avoid interruptions. With the rise of the on-demand economy and increasingly complex global supply chains, intelligence driven by AI will allow companies to remain successful in highly competitive markets.

This all might sound a little too ambitious, so let’s break it down. There are essentially two types of AI—Big AI and Little AI. Big AI aims to solve complex issues at a large scale, across multiple businesses. It uses huge amounts of data—usually in the cloud—to do so. Little AI, on the other hand, is focused on micro problems, like optimizing single lines of production while minimizing the
Artificial Intelligence: Why It Needs to Be on Your Mind

amount of human interaction needed. On-premise situations, close to where the operation systems are being automated, is where you will find Little AI living. Essentially, Little AI is real-time, edge-based analytics deployed on systems that are highly available and driving intelligent automation.

**Start doing some Little AI now**

To effectively utilize the power of AI, your starting point must be to get your infrastructure up to speed. This typically involves upgrading your networking so that information can flow easily to the systems processing it at the edge. Then you can deploy sensors to collect data and the analytics to make sense of it. From there, data scientists will be brought in to implement optimizations to help you benefit fully from AI’s advantages.

Many industrial enterprises are just starting to dip their toes in the AI waters. However, with the pace of digital transformation happening across various industries, it’s necessary to start thinking about how AI can be used in your business today.

*For more information, visit Stratus at www.stratus.com.*
Get your business set for growth.

To grow your business, you need to not only streamline operations and expand into new markets, but act on opportunities to enhance the customer experience. Epicor provides industry-specific, tailored ERP solutions to get your business set for growth and scale with business demand, fast. Together, we are the Grow Getters.

Get your business set for growth at:
epicor.com/getsetforgrowth
Using PC Gateways to Connect Legacy Systems

BY JOSEPH YANG
Director of product management, Advantech

Using an ultra–small industrial PC that acts as an IoT gateway provides benefits such as communication, Big Data analytics and proactive maintenance.

Consumer goods have a life expectancy that ranges from 10 or more years for major appliances and systems to as little as 12-18 months for mobile technologies. Thus, new technology and related standards tend to propagate through consumer goods in relatively short order.

Industrial equipment, in contrast, tends to have much longer lifecycles. Consider an example of a technology used in both consumer and industrial applications—processors.

Processors for consumer products could have a production life span of about five years. However, processors for industrial systems
have much longer production runs, and industrial board makers, such as Advantech, take pains to keep any engineering changes to a minimum. This reduces the high cost of design changes, costly maintenance and upgrade efforts.

There are good reasons to take this approach. Industrial systems are subject to greater temperature changes, more vibration, increased dust and other environmental extremes than is the case for consumer applications. These facts require industrial systems to undergo special qualification and careful design to function properly. What’s more, these control and automation systems must often carry out tasks in a manner that can be certified as safe. Once a certification is obtained, there is even more reason not to make changes. For many applications that are only concerned with machine control, a simpler and less powerful processor might be more than enough, as proven by the still widespread use of 8- and 16-bit controllers in industrial applications.

What this means in the context of the Industrial Internet of Things (IIoT) is that many legacy systems were designed a decade or more ago. Though the IIoT was certainly a possibility then, the basics of connectivity, protocols and programming languages were still being worked out. Consequently, industrial system designers frequently opted not to include any communication capabilities. Doing so
simplified the design, saving money and increasing security. After all, a system that is not connected cannot be hacked or otherwise compromised externally.

Designs and applications that did include a communication capability typically offered one of several competing approaches that were popular years ago. Whatever the selection was, it constrained the communication channel and capabilities available to the system for the life of its use.

Despite these issues, linking these legacy systems to the IIoT can bring substantial benefits. One is that doing so can help break the barriers that separate operational and information technologies. If the connection is done correctly, the distance between automation and control systems and data analytics packages can be erased. Data can flow from the factory floor, be analyzed, and appropriate actions and adjustments to manufacturing made. Remote access and monitoring of systems in a plant could also be enabled, leading not only to better control but also better maintenance.

**Bridging the gap**

An IoT PC gateway can overcome the challenge of connecting legacy devices for IIoT applications by linking systems on the
Using PC Gateways to Connect Legacy Systems

Factory floor to the cloud. In effect, these gateways supply legacy systems with their missing communication capability. What’s more, since it is a single, separate add-on unit, it can be upgraded and changed out as needed. It’s also possible to install them in

An illustration of how Advantech’s UNO line of IPC IoT gateways can be used to connect plant floor devices to the cloud for analysis.
CONTINUED

Using PC Gateways to Connect Legacy Systems

stages—deploying them first to those systems that provide the greatest return on investment and then rolling them out to others when doing so makes the most sense.

An IoT PC gateway, like any communication solution, must be cost-effective. This is an important consideration given that they might be installed on or alongside other equipment that is substantially or fully depreciated. Because any addition to an existing system could have a significant impact on the bottom line and profitability, it becomes imperative for the IoT gateway to be cost-effective.

Advantech’s UNO line of IPC IoT gateways.
A gateway should also offer wide and comprehensive protocol support. As an add-on, a gateway will have to successfully interface with a variety of programmable logic controllers (PLCs) and other devices, which might communicate via different interfaces and protocols. The gateway should also handle data acquisition and protocol conversion of the data into an appropriate format.

When considering an IoT PC gateway, remember that selecting one with extensive computing capabilities is not always necessary or preferable. This is because heavy-duty analysis can best be done elsewhere, such as in the cloud, where compute power can be added on an ad-hoc basis. Also, an industrial PC gateway can meet the need for higher computing requirements and satisfy several other important parameters at the same time.

Two other points to assess when investigating IoT PC gateways for legacy equipment are compactness and modularity. The need for compactness arises because any gateway will be an add-on to a legacy system. The amount of available space might be very limited, which means that a communication solution should take up as little volume as possible. Given what can be fit into a small and arbitrarily sized space, it might be necessary for a gateway solution to be tailored so that it offers only the bare minimum of functionality.

CONTINUED

Using PC Gateways to Connect Legacy Systems
That is easier to do if a gateway has as flexible a form factor and configuration as possible.

Finally, any IoT PC gateway must provide web and cloud access, as well as offer support for a human-machine interface (HMI). The first option is important for any remote access. The second is extremely useful when changes are going to be made locally. Again, a solution based on an IPC can offer such capabilities.

Reaping the benefits
Advantech’s various UNO offerings are examples of such IoT PC gateways. This product family includes X86 systems (UNO-2271G and UNO-2272G) as well as others based on RISC and Quark processors (UNO-1251G and UNO-1252G). Their compact designs support 3G, 4G LTE and low-power WAN connectivity. With Advantech WebAccess/HMI on these gateways, they can support more than 450 types of PLCs and I/O drivers.

Consider, for example, a lathe used to process a metal part or a laser that welds two pieces together. Using one of the Advantech gateways listed above, either machine could tally up how many parts are processed in an hour or a day, how long the operation...
Industrial Internet of Things

these data can also be combined with other inputs from machines or systems, either early in the production process or later, such as a final quality control sensor and associated QC checks.

All of this information can then go through analysis to allow, for instance, the spotting of trends. One machine might consistently output product that has a greater likelihood of being in spec and a lower chance of being rejected. A second might do just the opposite. Big Data analytics can reveal such trends, particularly those that involve interaction between machines or conditions that only arise in specific machine processing sequences. The insights possible with this type and volume of data include determining which machine or set of machines makes the best product and offers the highest productivity. Such information, in turn, can lead to better and more streamlined processes, thereby increasing throughput, reducing cost, improving quality and even cutting energy consumption.

Beyond that, more data can also improve machine maintenance. For example, linking information on the status of a system with the quality of its output and analyzing this data can uncover patterns
that can be used to predict machine health—even if there is not active machine health monitoring in place. These patterns and the associated data could then lead to proactive maintenance, allowing manufacturers to move from a reactive stance, in which problems are fixed after they happen, to one in which issues are resolved before a machine goes down and product is possibly ruined.

There are many benefits to such a proactive approach. For example, maintenance can be scheduled in advance and at times when the impact on output is minimized. Maintenance processes could also be reduced by fixing machines only when there is a need and not according to a rigid schedule. Finally, the chance that production will be out-of-spec and therefore require either rework or scrapping can be lessened. Together with less unplanned downtime, these benefits can yield a substantial payback.

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

Using PC Gateways to Connect Legacy Systems

CONTINUED
Control, Monitor, Process: The Role of Industrial Ethernet in Manufacturing

BY MIKE BAYDA
Industrial business manager, Nexans

As industrial Ethernet becomes more critical to maximizing the profitability of an industrial operation, converging networks, virtual networking and a common ecosystem will become critical factors.

Reports show that the use of industrial Ethernet to connect, control and monitor factories is growing at a rate of 20 percent annually. This growth is being driven by manufacturers that are accelerating the implementation of Industrial Internet of Things (IIoT) and Industry 4.0 tools and processes to maximize profitability.

The digital transformation of manufacturing, 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.
Industrial evolution

The first industrial revolution in the 1780s was defined by the advent of the steam engine and mechanical production equipment. The second industrial revolution was marked by the introduction of electricity and the assembly line to mass produce things (think Henry Ford’s “You can have it in any color you want as long as it’s black”). The third industrial revolution started in the 1960s with the introduction of electronics, IT networks and the first stages of manufacturing process digitalization.

Today, we are in the midst of the fourth industrial revolution, characterized by the introduction of cyber-physical systems—a mechanism controlled or monitored by computer-based algorithms tightly integrated with the Internet and its users.

Reliable connections between the machines, the people and the Internet are, in a word, everything. One bad connection can mean the flow of information is disrupted, which could have devastating results on your operation and your bottom line.
Massive growth of connected devices

It is projected that somewhere between 20 billion and 75 billion devices will be connected to the Internet by 2020. A significant number of these devices will be on the factory floor.

What does that mean to the industrial network? It means that industrial Ethernet solutions will become even more critical to maximizing the profitability of an industrial operation. Converging networks, virtual networking and a common ecosystem will be the pieces that matter most.

Common ecosystem vs. piecemeal solutions

In the office environment of the 1970s and 1980s, we had piecemeal solutions. Most were proprietary like Wang, IBM and Xerox. The office environment has since moved away from piecemeal solutions and settled on Ethernet as a common ecosystem to connect everything. The same transition is now happening in the industrial space. Piecemeal fieldbus solutions are being replaced by industrial Ethernet solutions at a rate of 20 percent per year.

With industrial Ethernet networks connecting machines, devices and sensors on the factory floor and synchronizing them with the office network, technicians on the shop floor can make real-time
adjustments to ensure targeted numbers are hit. At the same time, the front office can see the results in real time. This eliminates the Tuesday meeting to talk about Monday’s results.

In another example, floor technicians can more efficiently analyze improvements and the office can quickly see the expected results. This saves significant amounts of time and cuts back on unnecessary spending.

Floor technicians can also now create what is known as a virtual twin of their factory environment. They can run experiments and analysis on these twins to determine how to maximize output and quickly forecast potential bottlenecks along the critical path.

To learn how Nexans can help you leverage industrial Ethernet to your advantage, visit www.nexans.us/industrial.
MOVE SECURELY INTO THE CLOUD

DIRECT FIELD TO CLOUD CONNECTION WITH THE PFC SERIES CONTROLLERS

- IIoT-ready with native MQTT and TLS encryption
- Built-in VPN and Firewall for increased network security
- Simplify data routing and reduce latency
- Interface with existing controls via onboard fieldbus gateways

www.wago.us/pfccloud
3 Major IIoT Concerns and How to Address Them

BY JEAN FEMIA
Information architect, Opto 22

A different model for data communications offers engineers options for Industrial Internet of Things applications.

As automation engineers look toward the future and their work on Industrial Internet of Things (IIoT) projects, three concerns often surface: security, working with IT and scalability.

- **Security** is vital. We want to get valuable data out of control systems and equipment without allowing access to those systems.
- **IT departments** are busy and have other priorities. They’re understandably reluctant to poke holes in firewalls or create special networks for control needs.
- **Scalability.** We can acquire data from local systems and remote equipment, but IIoT demands vast amounts of data from far-flung sites. How do we scale data acquisition?
To address these concerns, let’s step back and understand how computers and similar devices exchange information on a network. For example, how does a YouTube video get to your phone or a value from a field sensor get to your human-machine interface (HMI)? To better understand this, let’s compare two network communication models: request-response and publish-subscribe.

**Request-response**
The standard model for computers communicating on a network is request-response. A client device or software requests data or
Extract Your Machine Intelligence With Advantech’s Industrial IoT Gateways

Seamless Connection, Aggregation, and Transmission

Advantech’s wide selection of Industrial IoT Gateway Solutions are designed with Industry 4.0 technologies in mind. With their advanced communication capabilities, these smart factory solutions make connection to the cloud easy.

- Compact Edge Gateway
  UNO-2271/UNO-2272

- Intelligent RTU
  ADAM-3600 Series

- Industrial Control Computer
  APAX-5580 Series

- Wireless I/O
  WISE-4000 Series

www.advantech.com
services and a server computer or software responds by providing the data or service.

When you watch a YouTube video on your phone, your web browser or YouTube app is the client that requests the video over that giant network, the Internet. YouTube’s web server responds by serving the video page to you.

In automation, a typical client is an HMI on a PC and the server is a programmable logic controller (PLC) or programmable automation controller (PAC) connected to field sensors. The HMI requests data from the controller, and the controller responds. Request-response is like a client sending an empty truck to be filled with data. The server fills the truck and sends it back.

Each client must open a direct connection to each server. Because clients don’t know when data might change, they request data at regular intervals. So each PC HMI opens a direct connection to each controller and repetitively sends requests, and servers repetitively respond. There’s nonstop truck traffic over all of these connections.

If the server has the capacity to respond and the network can handle the traffic volume, request-response is a proven, reliable
communication method. It’s particularly useful for communications over a secure internal network. But if you have multiple servers with multiple clients, the volume of traffic can quickly become a problem.

**Publish-subscribe**

A different way for devices to communicate on a network is publish-subscribe, or pub-sub. Here, a central source called a broker (or server) receives and distributes all data. Pub-sub clients can publish data to the broker or subscribe to data on the broker, or both.

Clients that publish data send it only when it changes (also known as report by exception). Clients that subscribe to data automatically receive it, but only when it changes. The broker stores no data; it simply moves it from publishers to subscribers.

Compared with request-response, the number of connections shrinks, replaced by one lightweight link from each device to the broker. This link stays open, and only two things travel over it: changed data and a tiny heartbeat so the broker knows the client is still there.

In our truck analogy, there are fewer roads and fewer trucks and all trucks are full. A client publishing data sends a full truck to the broker. The broker doesn’t unload the truck; it routes it intact to subscribers.
For IIoT, pub-sub makes sense because it efficiently moves data among several sources and destinations. It also makes sense because its lightweight, single link minimizes difficult client-server connections and works on low-bandwidth, expensive or unreliable networks—like monitoring remote equipment.

**Pub-sub with MQTT and Sparkplug**

The pub-sub transport protocol MQTT (www.mqtt.org) is an OASIS standard and an ISO standard with an industrial history. It was

![Diagram of publish-subscribe network model]

This graphic depicts the publish-subscribe network model.
invented in 1999 for an oil and gas pipeline application to reduce expensive communications via satellite lines.

To industrialize MQTT further, Cirrus Link Solutions released the Sparkplug spec in 2016 (www.cirrus-link.com/oem-device-data-integration). Sparkplug added binary encapsulation, device state and topic definition to make MQTT easier to implement and more suited to critical applications.

In addition to the pub-sub advantages of fewer connections, less traffic and report by exception, MQTT and Sparkplug offer these advantages for IIoT:

• Compressed payloads and stateful communications for remote devices with irregular connections.
• Automatic reconnection and data transport for offline devices.
• An important security advantage: outbound connections from clients to the broker.

The bottom line

With pub-sub in mind, let’s review our three IIoT concerns: security, IT and scalability.
Security and IT concerns are both minimized with outbound connections from pub-sub clients to the broker. All firewalls block inbound traffic (for example, an external client requesting data from an internal server), but typically allow outbound connections. Since all MQTT/Sparkplug data is outbound, VPNs and port forwarding are not required. Often, you can securely move data where you need it with little assistance from IT.

The scalability problem is minimized by efficient, stateful data communications and lower network traffic in an MQTT/Sparkplug pub-sub architecture. Masses of data can flow freely among many sources and destinations.

To increase security, reduce reliance on IT and scale data communications for IIoT, automation engineers are taking a closer look at MQTT/Sparkplug.

*For more information on how Opto 22 is helping you keep up with these industrial technology developments, see Opto 22’s groov EPIC system with Ignition Edge Onboard for MQTT/Sparkplug communication at info.opto22.com/groov-epic-intro-offer.*
INDUSTRY 4.0

WELCOME TO THE FUTURE...WE’VE BEEN WAITING FOR YOU.

A future-proof industrial network is one that provides performance for today and flexibility for tomorrow. PROFINET is the only Industrial Ethernet standard built to handle the requirements of the shop floor while supporting multiple protocols like OPC UA for the top floor.

Are you ready for Industry 4.0?
For more information visit http://us.profinet.com.
Empowering Your Sales Organization in the Digital Era

BY CARMEN CASTRO
Product marketing manager, Epicor Software

There is a digital transformation of the workplace going on and it’s deeply affecting the way manufacturers approach CRM strategies. Providing your sales team with the right technology and data can be a game changer that leads to sales growth.

Do you recall life without a smartphone? It is becoming difficult to remember those days. With the ever-evolving digital transformation in the consumer world happening, it is easy to find an application that can manage every aspect of our lives. This is not only transforming our user experience at a personal level, it is also affecting the way manufacturers work.

Instead of being disrupted by this change, companies are investing in the digital transformation now, and many are starting that journey by looking at technology solutions that can support an Industrial Internet of Things (IIoT) framework. Companies leading the way
for digital transformation are not only focusing on their customers’ experience, but also turning to their employees to empower them with the right tools and connectivity they need to be more effective. The workforce of the digital workplace not only wants the data they need to do their jobs, they want easy-to-use technology that has the familiar look and feel of the apps they use every day.

A report on this topic from Deloitte notes: “Technology enables the digital workplace. Each organization already has a digital workplace toolbox with different tools. Depending on your industry and business needs, the tools needed to support your digital workplace will vary. The key is to adopt the right tools for your employees to do their jobs.”

One of these tool areas still ripe for disruption in the IIoT era is customer relationship management (CRM). To keep customers at the focus of their business today and stay one step ahead of competitors, manufacturers need a CRM technology that enables them to respond to customer requests fast, from wherever they are and from whatever device they are using. Equally important—and here’s where IIoT comes into the CRM equation—they must also understand how inputs provided by both customers and their own machines can be leveraged in a CRM system.
fido5000 CHANGES THE GAME FOR INDUSTRIAL ETHERNET DESIGN.

fido5000 makes it easy to incorporate a single Industrial Ethernet interface that supports multiple protocols for any Intelligent Factory application. Ready for tomorrow, fido5000 provides a clear path to TSN—to future-proof applications as protocols evolve in smart, connected Industry 4.0 environments.

For videos, technical articles and more information on the FIDO REM SWITCH: analog.com/industrial-ethernet
How CRM and user experience can lead to growth

If you provide the right CRM solution loaded with the right data to your sales team, it can make a great difference to your business. A modern CRM interface will result in improved productivity and employee engagement because your sales team will be able to do business anytime and anywhere, and better understand your customers’ behaviors.

These are the key things you need to look for in an effective CRM solution ready for the IIoT:

• **Great user interface—in both the front and back ends.** When discussing user experiences, it’s widely accepted that the user is king. But CRM in the IIoT age needs an interface that is also friendly for the IT professionals managing it. With so many data inputs to consider and manage, the need for IT professionals to be able to manage and distill the CRM system’s information is just as important as its user friendliness.

• **Full access to CRM data for all users.** Your sales team needs to have full access to the CRM features and data on their mobile devices. Make the data transfer from your customers to your CRM as well as from your machines to your CRM as seamless as possible.
CONTINUED

Empowering Your Sales Organization in the Digital Era

Your sales staff should be able to use the mobile CRM to manage the entire sales cycle from lead to quote, as well as to dissect all the relevant information from anywhere they are.
• **Broad compatibility.** Until a common, open-source operating system for all your machines outputting data into an IIoT data repository arrives on the scene, be sure the CRM has a browser/operating system-agnostic application that works on the device of your choice.

• **Easy to install and implement.** The user experience should start with an installation process that’s as easy as going to your app store and downloading an app to your device. In addition, look for a simple licensing model that doesn’t increase your costs.

The digital transformation happening in the workplace is not just a trend, it’s here to stay. That’s why it’s important to understand what future technologies can look like so your business can stay ahead of the curve.

*For more information, visit Epicor at www.epicor.com.*
This is EPIC.

The world's first Edge Programmable Industrial Controller

**Edge** — Collect, process, view, and exchange data where it’s produced—at the edge of network. Securely share data among databases, cloud services, Allen-Bradley® and Siemens® PLC systems, and other equipment using tools like Ignition Edge by Inductive Automation®, Node-RED®, and MQTT. Visualize data on the integral touchscreen, an external HDMI monitor, or from any web browser or mobile device.

**Programmable** — Options for programming include flowchart-based PACControl® and future support for OPC-UA. Shell access lets you run your own custom-developed application on an open, Linux®-based automation system.

**Industrial** — From plant floors to remote sites, the edge demands industrially hardened equipment—like operating temperature specs from -20 to 70 °C, solid-state drives, and UL and ATEX compliance. And, it’s made in the USA.

**Controller** — Reliable real-time control and guaranteed-for-life I/O provide the solid base for all other functions. groov intelligent I/O offers up to 24 channels per module, optical isolation, hot swapping, and 14 A/sG spring-clamp terminations.
Network Performance in the Converged Future

BY MICHAEL BOWNE
Executive director, PI North America

How industrial Ethernet developments are fostering an expanded relationship between the field level and the MES level.

The foundational reasons for employing industrial Ethernet to enable Industry 4.0 are well known: They create enterprise-wide transparency, ease data access, and provide standardized interfaces with broadly familiar mechanisms.

Though it might be popular to dismiss phrases like “enable Industry 4.0,” which I used above, it’s important to understand that this is not just some flippant turn of phrase. Sure, it might have once seemed that such phrases were just different words for what we’ve been trying to do all along. But it’s becoming increasingly clear that something more is happening—and it appears that a convergence
of information technology (IT) and operational technology (OT) networks is the key.

But what does it all really mean? From a classic ISA95 perspective, it means that the field level and the manufacturing execution system (MES) level are getting closer.

In the traditional ISA95 model, industrial Ethernet plays a role only at the lowest level (OT) in the field. From there, it connects to the controls level, which then interfaces to an MES (IT), with the primary goal being to run the plant. With Industry 4.0 and the Industrial Internet of Things (IIoT) entering the scene, however, the boundaries between these levels are blurring. As a result, the relationship between the field level and the MES level is set to expand.

**The role of OEE**

Achieving maximum overall equipment effectiveness (OEE) is the primary goal of any MES, and it’s where an expanded relationship directly with the field level via industrial Ethernet can help. By definition, OEE is the product of three variables: availability (A), performance (P) and quality (Q). As such, \( A \times P \times Q = OEE \).
MORE TO BUILD ON.

All new PLCs to grow your process.

Maple Systems now offers a complete line of simple, low-cost programmable logic controllers (PLCs) with built-in I/O. These powerful, affordable PLCs offer digital and analog I/O and support high-speed counters and pulse width modulation (PWM).

**FX-Series and EX-Series PLCs:**
- Fixed and Expandable I/O
- 17 Base/12 Expansion Modules
- Simple to Advanced Control
- Class I, Division 2

maplesystems.com  425.745.3229
High availability (A) correlates directly to uptime. Among other things, it means shortening downtime, if not eliminating it altogether. Through comprehensive diagnostics, an industrial Ethernet such as Profinet can pinpoint unplanned errors by providing complete what/who/where/when/how information. This can be made available in common control-level components such as programmable logic controllers (PLCs), human-machine interfaces (HMIs) or supervisory control and data acquisition (SCADA) systems. Since Profinet can use TCP/IP for diagnostic messages, this information can be programmed to be made available wherever required. In fact, these methods are nothing new on the OT side.

So how can we take a step forward in terms of diagnostics in the context of Industry 4.0? The answer is OPC UA. Currently, within Profibus/Profinet International (PI), we are working diligently on a companion specification between Profinet and OPC UA. One of the first areas of our focus is on diagnostics. By mapping Profinet diagnostic data to OPC UA, this information can more easily be consumed by IT software packages like MES. Such standardized information flow should ultimately help minimize unplanned downtime.

As far as performance (P) is concerned, the path is clear: Run production at the rate that maximizes throughput. For Profinet,
Network speed and determinism have always been priorities. Like anything, throughput itself is a complex equation, and network performance is just one part. But maintaining an open network infrastructure while simultaneously providing high performance is nothing new.

So how can we take a step further in terms of network performance in the context of converged IT/OT networks? The answer is Time-Sensitive Networking (TSN). The techniques that have allowed Profinet networks to be both high-performing and open since the early 2000s are now becoming IEEE Ethernet standards. Eventually, TSN will become the first layer in the foundation of a converged IT/OT network. And since Profinet is based on standard unmodified Ethernet, as TSN becomes integrated into Ethernet itself, those features will be inherent.

The combination of Profinet and OPC UA plus TSN provides a recipe for success in the growing relationship between the conventional ISA95’s field and MES levels. This is particularly true under the growing pressures of Industry 4.0 and you can see it happening already today as field devices with OPC UA capabilities are being introduced into the market. These devices provide the communication means for direct information flow to the MES level.
Of course, all these developments mean that industrial Ethernet resources will be taxed as a result of increased non-control-related network traffic. However, TSN will help ensure that the primary purpose of an industrial Ethernet network (i.e., controlling the plant via an industrial Ethernet protocol such as Profinet) will remain unaffected while allowing it to do even more in the future.

For more information, visit PI North America at us.profinet.com.
REST ASSURED

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.
3 Must-Have Features for Automation Networks

BY PHIL MARSHALL
CEO, Hilscher North America

With all the technology advances occurring today, there’s no shortage of advice out there when it comes to the capabilities your automation networks will need. As a network technology company, here’s what we think should be your key points of focus.

I’m being asked more and more often: What are the must-have capabilities for automation networks in 2018? The answer depends on what area of automation you deal with. Are you designing an automation device, upgrading a network or supporting a new project?

From Hilscher’s viewpoint as a network technology company, here are the capabilities we think are important.

First, there’s Time-Sensitive Networking (TSN), one of the most talked about technologies of recent years. Touted as the way to bring a new
level of interoperability to our universe of industrial communication protocols, it will undoubtedly become widely adopted—and soon. But don’t assume it’s the answer to all your prayers for a single network solution; it might be even better than that.

What do I mean? Fundamentally, TSN provides a common way of synchronizing critical networks. Every networking technology organization is currently embedding it into their protocols and it will certainly be easier for different elements of our networking world to work together. For example, EtherNet/IP, Profinet and Sercos III could all become application layers with a common physical layer and with the performance of CIP Sync or IRT-based systems. When this happens, interoperability becomes the new normal. Engineers can use a common set of network diagnostic tools, making plants simpler to design and maintain.

Coupled with OPC UA (our second must-have feature) and its clever information model concept, TSN promises network transparency—literally from plant floor to the sky (as in cloud apps). And this is not just for basic automation data, but also for other sources such as video. With the Industrial Internet of Things (IIoT) becoming ever more important, some experts believe it could open up new ways to architect plants.
Our third must-have capability for 2018, and perhaps the most important, is security. Cyber attacks are so commonplace that I fear we have become complacent. For an individual, a security breach is scary enough, but it’s not on the same scale as an industrial process or national resource being hacked. Raw data will be a target in plants and processes—and for many industries that is a big issue. The potential for local and national disruption is of even more concern.

Security should encompass the entire lifecycle of products and plants. Suppliers must be trustworthy, and every component part should be delivered free of suspicion. Products must be securely booted to underpin the “chain of trust” so that firmware and app software can be loaded safely. Systems must exhibit resistance and resilience against attack and be able to deflect or neutralize any effects.

Data integrity is key too. Since operational data streams can be compromised anywhere between source and recipient, each party to the transaction—including any intermediates—must prove their security before transmission is allowed. Fortunately, authentication procedures are plentiful, well understood and widely available.

We at Hilscher can’t solve all the issues for you. However, as networking interface specialists, we can handle your connectivity-
3 Must-Have Features for Automation Networks

level concerns. For example, consider the netX 90 network chip, Hilscher’s latest slave device interface. The netX 90 is one of the most advanced and innovative chips we’ve ever produced. At its heart, it’s a powerful and versatile gateway for popular sensor and IIoT protocols to connect with real-time Ethernet networks and IT infrastructure. But it also supports the security features described above, and more.

For instance, most attacks will likely arrive via the external network. To limit the harm that could be caused, the netX 90 chip is split into two functional segments—one handling the network-facing functions (i.e., communications), the other handling the applications-facing functions (i.e., operations). In this way, it’s possible to mitigate the effect of external attacks on control-side activity. We believe the netX 90 to be a first in our industry, marking the beginning of an important trend for automation product design.

Few of us have much leverage over national security issues. But for the automation and control equipment we design and use, we all have a huge responsibility. Put simply, our automation networks are only as good as they are secure.

For more information, visit Hilscher North America at www.na.hilscher.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 to learn more.
Every day the world is becoming more digital, and the industrial world is no exception. It’s clear that the Industrial Internet of Things (IIoT), Big Data, Industry 4.0, and fog, edge and cloud computing aren’t merely buzzwords—they are quickly becoming the standard mode of operation.

In light of this new and still developing reality for industry, it’s important to realize that every smart device has three core elements in common: a physical component (mechanical or electronic), intelligent components (sensors, processors or control units) and networking components. The interoperability of these elements offers the potential for optimization and further automation.
And because interaction with these devices can be done remotely (i.e., via the cloud), dynamic ad hoc adjustments are possible, thereby allowing production executives to gain a holistic view of not just one plant, but several. The result is user-directed data control, remote operation and continuous optimization.

With this level of interconnectivity, data collection and data allocation become essential elements to contemporary automation success. But beyond enabling the connection, how does the cloud add to the equation?

**The key to IIoT**

The cloud is more than just a trend-setting data collection point. The very nature of its structure provides a robust backbone to the production chain in connection with physical production systems. It supports product and production databases, analysis platforms for evaluating processes and intelligent production application to automatically control and optimize production machines during operation.

The degree of control over all the information that can now be collected and analyzed with the aid of the cloud means that the data can be enriched with proprietary company data from enterprise resource planning (ERP), customer relationship management (CRM)
netIOT Edge Gateways Merge Production Operations with IT and Cloud Applications

- Connects operational IoT data to IT and cloud services for asset management, business analytics, predictive maintenance, and more
- Collects data as a slave on the I/O network or polls data from the controller as a master
- Runs parallel TCP/IP and IoT channels over real-time Ethernet, OPC UA and MQTT
- Ideal for “brownfield” and “greenfield” applications
- Can function in promiscuous mode, with an air gap for secure physical isolation
- Integrated tools to support vertical communication to the cloud
- Multi-cloud support: IBM Bluemix and Watson; SAP Cloud Platform; Microsoft Azure, and more

Learn more from Hilscher:
call 1.630.505.5301, email: info@hilscher.us or visit www.hilscher.com, www.netIOT.com

©2017 Hilscher North America, Inc. All trademarks are the properties of their respective companies.
Get Your Head in the Cloud

and product lifecycle management (PLM) systems. External data, such as raw material and energy costs, traffic or weather data, can also be integrated into the analysis process.

For industry, the advantage of cloud services with respect to classic, in-house IT lies in higher levels of flexibility, particularly in relation to the scalability of systems. In addition, costs can be saved due to simplified administration because cloud service providers offer standardized basic structures, like hardware, operating systems and networks.

Connecting to the cloud

Currently, connecting to the cloud is a multi-step process. Typically, a programmable logic controller (PLC) connects to a supervisory control and data acquisition (SCADA) system, which then connects to a historian or archive before ultimately connecting to the cloud. As a result, the classic automation pyramid, using conventional central controllers, is gradually disappearing and giving way to this new normal.

PLCs from Wago, like the PFC 100, have the ability to forego the multi-step connection process by connecting directly with the cloud. Once securely connected, these PLCs can access data from field sensors and equipment. Also, they can connect to existing controllers via industrial fieldbus protocols like Modbus, EtherNet/IP or Profinet.
Security concerns, as always, are of the utmost importance and remain the greatest obstacle to the immediate proliferation of cloud technology. Wago PLCs are equipped with comprehensive security systems consisting of TLS, VPN and a firewall. The onboard firewall will maintain an updated white list for approved connections. With Linux as the base for implementing encrypted technologies via TLS 1.2, an IPsec or OpenVPN connection can be implemented directly from the PLC, allowing the use of encrypted data. All of these systems
Get Your Head in the Cloud

are consistently being updated to thwart new and future threats. This high level of integrated protection within our PLCs means high security can be maintained.

Additionally, Wago PLCs can communicate via the MQTT protocol—an increasingly popular communication method used by many cloud service providers to connect plant floor devices to the cloud. Using this protocol offers the potential to retrofit connections between the PFC family of controllers to multiple cloud service platforms such as Microsoft’s Azure IoT Suite, Amazon Web Services, IBM Bluemix or the Wago cloud. A simple drop-down tab allows users to choose the cloud service they desire while automatically providing the necessary fields for each given platform. For applications requiring context-rich information, the Sparkplug open standard provides connection to MQTT servers with no configuration required.

Clearly, there are many ways to get your head in the cloud; the difficult part is keeping your feet on the ground during the process. Fortunately, there are easily implemented solutions that allow operators to gain a strong foothold as their familiarity with the IIoT grows.

For more information, visit Wago at www.wago.us.