Industrial Internet of Things & Industry 4.0
Your complete guide to the Digital Industrial Revolution

Simple path to Industry 4.0 – edge computing for process technology

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People for Process Automation
Our cover

Modern system concepts tailored to Industry 4.0 or offer numerous advantages in terms of process efficiency, costs and quality. The ultra-compact range of Industrial PCs from Beckhoff are the ideal IIoT edge devices to utilise these advantages for new and legacy systems in the process industry. See this month’s cover story on page 4 for more.
4IR in South Africa
SAIMC involved from day one.

The Fourth Industrial Revolution (4IR), also known as Industry 4.0, has necessitated that countries develop new policies, strategies and innovation plans to enable an inclusive whole-of-society approach with government taking a leadership role. South Africa currently has different elements of the 4IR spread across government, the private sector and civil society, but currently, there is no single blueprint that gives all the key role players a single focus. While the discourse on the 4IR is usually dominated by the role of government, the private sector and other stakeholders in civil society also have a significant role to play. The 4IR manifests itself through technological innovations, while its impact cuts across all levels of society, hence the need for a broader perspective and approach (Government Gazette 4 December 2018).

The SAIMC (Society for Automation, Instrumentation, Measurement and Control) sits at the forefront and is an active participant in the implementation of these new technologies to the benefit of the South African economy and all its people. Industry 4.0 is about the use of decentralised intelligence to create intelligent networking and independent process management through the interaction of the real and virtual worlds. This represents a paradigm shift from centralised to decentralised production – made possible by technological advances that constitute a reversal of conventional production process logic. Simply put, this means that industrial production machinery no longer simply ‘processes’ the product, but that the product communicates with the machinery to tell it exactly what to do. Industry 4.0 connects embedded system production technologies and smart production processes to pave the way to a new technological age destined to transform industries’ production value chains and business models. The key to attaining the smart factory benefits successfully is a solid wired and wireless internet infrastructure making use of 5G communication capability.

Political and business leaders are convinced that future economies will be affected by this trend of change. Hence, governments carry the responsibility to provide a plan that can be applied across departments. Recently, president Ramaphosa appointed The Presidential Commission on the Fourth Industrial Revolution, with 30 representatives from all areas of industry and society as a cross-cutting enabler to work on the country’s blueprint. The Commission will coordinate the development of South Africa’s national response action plan to deal with the 4IR. As part of this effort the commission will identify policies, strategies and plans that are necessary to position South Africa as a leading country in the evolution and development of the 4IR. The prime goal is to set up legal and regulatory frameworks allowing the private sector to achieve easy implementation.

International collaboration is imperative for the success of Industry 4.0 in an emerging market such as South Africa. At the same time, positioning the country as the key technology driver for the African continent is part of the sustainable application of the new technologies. An example of international collaboration is the South Africa – European Union Strategic Partnership Dialogue Facility, which contributes to the strengthening of relations between the EU and South Africa. Its purpose is to facilitate the implementation of priority aspects of the SA-EU Trade, Development and Cooperation Agreement, the Strategic Partnership Joint Action Plan, and raise awareness of the special relationship between the EU and SA.

In Europe, the leading countries involved are Germany (Plattform Industry 4.0), France (Alliance Industrie du Futur) and Italy (Piano Nazionale Impresa 4.0). For many years these countries have invested in measures to guarantee the long-term contribution of Industry 4.0 to future economic growth. Take for example Germany’s Industrie Plattform 4.0, which started in 2011 as the ‘New High-Tech Strategy’. Today, better known as Industry 4.0, it is a strategy that should lead to extra economic growth worth €78 billion by 2025.

South Africa can surely benefit from a benchmark exercise with the Europeans; always focusing on the particularities of the country, particularly around poverty and inclusive growth.

The Digital Industrial Revolution offers huge opportunities for South Africa and its people. Globally, the 4IR train has left the station. The question is not whether, but when and how, South Africa will participate in this global paradigm shift.

I hope this industry guide helps you with your plans.

Marc Van Pelt.
Rittal – The System.
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Simple path to Industry 4.0-enabled process technology

Ultra-compact IPCs are ideal for edge computing.

Modern system concepts tailored to Industry 4.0 or the IIoT offer numerous advantages in terms of process efficiency, costs and quality. The ultra-compact range of Industrial PCs (IPC) from Beckhoff are the ideal space-saving, high-performance IIoT edge devices to fully utilise these advantages for new and legacy systems in the process industry.

By integrating comprehensive IIoT and analytics functionality, PC-based control technology opens up a wealth of options to optimise production. System consistency in the control platform ensures simple implementation and high transparency:

• A universal portfolio of components for explosion protection, including the ELX series EtherCAT Terminals, enables end-to-end automation of even large and complex processing plants.

• The TwinCAT software platform offers specific interfaces and libraries for process technology, and enables convenient cloud integration via TwinCAT IoT and data analysis via TwinCAT Analytics in perfect synchronisation with control cycles.

• A high-performance IoT edge device is available in the form of the C6015 ultra-compact IPC, a universally suitable machine control platform.

C6015: an exceptionally compact IoT edge device

Measuring just 82 x 82 x 40 mm, the exceptionally compact C6015 IPC with multi-core technology can be flexibly installed even in highly confined spaces. Equipped with an Intel Atom processor offering up to four CPU cores, the C6015 provides sufficient processing power for simple collection, processing and provision of process data and for the more complex tasks required of a modern IoT gateway. The Microsoft Azure certification of the C6015 underscores that the device is ideal for state-of-the-art Industry 4.0 applications.

The C6015 is predestined for such...
communication tasks especially when retrofitting and connecting legacy systems. Existing process technology systems can easily be equipped with additional IIoT capabilities using this edge device, or they can be readied to meet future communication requirements. In this way, operators of process technology systems gain access to the full wealth of IIoT and analytics solutions supported by Beckhoff technology, regardless of the automation technology used – be it PC-based control or third-party control platforms. This reduces production costs, optimises product quality and improves the overview and transparency of all process workflows. In addition, system availability and productivity can be increased and cloud-based services used, for example, to implement predictive maintenance.

**C6017: combines compact design with a variety of interfaces and integrated UPS**

With miniaturised dimensions, the C6017 is practically identical in design to the popular C6015, currently the smallest ultra-compact IPC from Beckhoff. The success of the C6015 quickly created additional demand, especially from applications with increased requirements for connectivity and data security in the event of potential power supply failures. The C6017 was developed precisely for this purpose: the existing C6015 configuration with DisplayPort connection, an onboard dual Ethernet adapter with two 100/1000Base-T connections as well as a USB 3.0 and USB 2.0 port, is extended on the C6017 with an additional two RJ45 and two USB 2.0 interfaces. Moreover, an optional capacitive 1-second UPS is integrated, which ensures storage of persistent data in the event of a power supply failure.

With dimensions of 82 x 82 x 66 mm, the size of the C6017 is almost identical to the C6015. Only the overall height is extended by 24 mm. Equipped with an Intel Atom CPU with up to four processor cores, the passively cooled IPC also features a robust aluminium and zinc die-cast housing so it is equally ideal for automation, visualisation and communication tasks up to the mid-performance range.

**(Universonally applied generation of control devices**)

The new ultra-compact IPC series is ideally suited to meet today’s demanding requirements in machine building, such as increased modularisation, reduced space requirements in control cabinets, higher processing power and competitive pricing. Designed precisely with these requirements in mind, the new device generation is ideal for a broad range of applications, for instance in distributed topologies and advanced Industry 4.0 applications. Computing power is scalable to match requirements:

- **C6015 and C6017** for the lower and mid-performance range.
- **C6030** – the high-end device with Core-i series processors with up to 3.9 GHz per core for highly complex machines, CNC or XTS applications, comprehensive multi-axis control, feature-filled HMI, applications with extremely short cycle times, and for handling large data volumes.

**C6032: high-performance for extremely short cycle times**

With dimensions of only 129 x 133 x 104 mm, the C6032 Industrial PC offers high-performance in a modular design. For this purpose, the C6032 adds a further circuit board level to the C6030 single-board IPC, which is comparable in terms of computing power, to allow for accommodation of modular interface and functional extensions. With the use of compact PCIe modules, the C6032 can be optimally adapted to the requirement profile of individual applications.

The use of an extremely durable, speed-monitored and controlled fan makes the C6032 suitable for a temperature range of up to 55°C. Available options are Windows 7 or Windows 10 operating systems, as well as a second M.2 SSD in RAID configuration. The C6032 offers storage capacity of 40 GB M.2 SSD, 3D flash even in the basic configuration.

**A device generation designed for universal use in the digital era**

The Microsoft Azure-certified devices of Beckhoff’s ultra-compact IPC series are ideal to meet current requirements in advanced machine building, such as increasing modularity, reduced space requirements in control cabinets, increased computing power and growing price pressure. Designed exactly with all these requirements in mind, the new device generation is suited for use in a broad range of application scenarios such as distributed architectures and the IIoT applications associated with digital transformation.

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Preparing fertile ground for a successful IIoT project

In common with many engineers, I do enjoy shopping for new power tools for my workshop. I therefore often find myself totally absorbed in hardware stores, captivated by new innovative devices for solving almost any problem. The low cost of modern mass-produced tools, particularly those from China, make it affordable to try out something new at relatively low risk. Sometimes, I leave with a new shiny object, full of intent to use it when I get back home. Frequently the new tool is used just once and is then delegated to the back shelf of the workshop, having served a very brief purpose.

The reason my track record in buying power tools is not that good, is that in most instances I purchase the tool without a clear understanding of the problem I want to solve. While this might seem like a trivial example, it is unfortunately analogous to the way many companies approach implementing information technology solutions. A new technology becomes available, and we become captivated by ‘shiny object syndrome’; feeling an urgency to try it out so that our organisation is not left behind. We push ahead with a technology pilot project, which inevitably is not left behind. We push ahead with a technology pilot project, which inevitably demonstrates the potential of the concept. But, in most cases (more than 75% for IIoT projects according to ARC Advisory Group), the initiative ends there – at the pilot phase.

According to Business Insider(1), manufacturing companies will spend about $70 billion on the IoT in 2020, up from $29 billion in 2015. The companies making these investments are set to increase their operating income proportionally; and as a result, the competitive landscape can be expected to shift.

Understanding the business problem

The Industrial Internet of Things (IIoT) is a collection of emerging technologies that together have the potential to create significant business value and even create new business models. But you will not get much traction with an IIoT project without first precisely understanding the business problem you need to solve.

The nature of the business problem will generally be different for different industries, for example:
- In mining the challenge might be to bring together field and business data into a common platform to generate useful operational insights.
- In a process manufacturing company, the requirement might be to improve energy efficiency, production performance and safety.
- In a discrete or batch manufacturing process the challenge might be to improve product quality, traceability, planning/scheduling and/or to reduce working capital.
- In consumer industries the challenge might be to gain deeper insights into actual customer use of the product to help prioritise new product research and development.
- In service industries the challenge might be to automate and streamline monitoring of equipment performance so that maintenance is proactive and service levels are improved.

For each of these examples, the specific business case for an IIoT implementation will be unique.

At the beginning of an IoT project, it is important to start with defining the exact problem you want to solve. This step must occur ahead of finding a technology solution. A well-defined business problem must be very specific. A poorly defined business problem like ‘improve operational performance’ is not as useful as ‘reduce the total cost of field service by 25% this year by remote monitoring and proactive maintenance of all compressors installed at customers’.

Not all of these technologies will be required to solve every problem. But, it is important when selecting a platform to make sure that it can grow to accommodate future requirements. The selected IIoT platform architecture should allow vertical integration (business processes connected to sensors) as well as integration along the value chain (connecting suppliers, manufacturing processes, logistics and customers). When designing the solution there might be a number of alternative approaches, for example:
- 1. Best-of-breed point solutions integrated through middleware.
- 2. Simplify towards a single vendor solution where possible.
- 3. Extending/upgrading your existing platforms systems.
- 4. Sandbox your legacy systems and surround these with loosely coupled proof of concept/pilot solutions.
- 5. On-premise versus cloud deployments.

Selecting partners for an IIoT implementation project

Your choice of platform will involve assessing the capabilities of your existing IT/OT environment together with a formal evaluation of specific vendor products. The vendors involved might include control and automation, MES, business systems, cloud platform providers,

Gavin Halse

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managed service providers and so on. In many cases your evaluation will be an iterative process where your solution will be influenced by the exact capabilities of the vendor solutions. At this stage of the process, you should introduce the business stakeholders to new ideas and technologies (for example artificial intelligence, digital twins and 3D printing), and work with consultants and vendors to help you identify possible breakthroughs. Other considerations at this stage will be cybersecurity processes and data/privacy protection.

Many vendors are competing for market share in the fast growing IIoT space and not all of them will survive. Selecting the right strategic IIoT partner is therefore also very important. Traditional instrumentation and control vendors are building new capabilities into the cloud from which data becomes universally accessible. Business systems vendors are working to incorporate data from physical sensors into their business applications. Middleware vendors are deepening their integration and analytics capabilities. And so on.

**Develop the business case for investment**

Having developed a good understanding of the business problem, identified several alternative feasible technologies and selected some potential partners; the next step is to estimate the costs of the solution and develop a detailed business case. At this stage you will typically still be dealing with a number of alternatives. The process of selecting the recommended solution will involve ranking alternatives against those criteria that are important to your business. These might include an assessment of vendor risk profile, total cost of ownership, time to implement etc. The costs, together with the relative advantages and disadvantages of the alternatives, are ranked and scored to eventually come up with a recommended solution.

The resulting business case for an IIoT project will typically include:
1. The problem to be solved.
2. Alternatives considered.
3. The recommended solution.
4. Risks and opportunities.
5. Human resources considerations e.g. mitigating job losses.
6. The project execution strategy (implementation approach, schedule, reinvestment strategy, pilot and rollout plans, resources, partners etc.).
7. Quantified business value (ROI, compliance, risk etc.).

**Reap the reward**

Abraham Lincoln once commented: “Give me six hours to chop down a tree and I will spend the first four sharpening the axe.” I suspect that in business he would also have spent most of the time on defining the business problem.

Provided the IIoT project remains focused on solving a well-defined problem, it has a reasonably high chance of success. During the project execution, proactive management of risks and opportunities should continue to ensure that the project outcomes always remain aligned to the business requirements. Remember that business is never static, and nor is technology – be prepared to redefine the problem and pivot to a new solution when it becomes necessary.

Back to my original analogy of buying a power tool from the hardware store: How much more sensible is it to first properly identify the problem before chasing the ‘shiny new object’? If we understand this simple concept, then why not follow the same common-sense approach in implementing IIoT projects in our businesses?

**References**

The art and science of treating raw water to drinking level quality, and of treating wastewater to environmentally acceptable levels, have been around for more than 100 years. They have provided the foundation in the United States and the rest of the developed world for our modern economy and lifestyle. Many of the technological marvels that we depend on today, such as cellular telephones, the Internet, and simple yet powerful software, would not have been developed without the advancement and adoption of water treatment processes. It’s ironic, then, that many think of the water and wastewater industries as being stodgy, and somewhat less than cutting edge.

However, the water industry is not as stagnant as some might believe. In this article, we will review a few buzzwords that are becoming common in the water sector and many other industries, and look at how the technologies behind these buzzwords are impacting water treatment.

Scada: One technology that demonstrates this industry’s acceptance of modern control technology is supervisory control and data acquisition. Scada has been around for a while and most in the industry are familiar with it by now. Many water systems have for years employed wireless communications to transmit remote data back to a central control centre.

IIoT: you have probably heard of newer refrigerators connected to the Internet. This is an example of the Internet of Things (IoT). The IoT has moved beyond the commercial world to the industrial world, where it’s become known as the Industrial Internet of Things (IIoT). The IIoT makes field devices smart, so they can send information anywhere that also has Internet connection. This is a cost-effective way to improve communications infrastructure. Rather than investing in expensive equipment, water professionals can rely on third-party providers for fast and convenient data.

Industry 4.0
You have probably heard about this, but what does it mean and how is it linked to the IIoT? The core of the Industry 4.0 initiative is the vertical integration of business value chains and the horizontal integration of production, using Internet services. The objective is the ability to produce customised products in low lot sizes. Imagine, in the future every product will have a digital counterpart – a digital twin – which contains all information pertaining to the real product. The information of the digital twin parameterises the settings of the production, enables simulation or support, and assists installation and use of the product.

M2M: machine-to-machine communications refers to using the cellular network and Internet so that devices communicate directly with one another. The implication is that there is no need for proactive human involvement (after the initial configuration of the system).

More than buzzwords: improving efficiency for water professionals
Scenario
A water utility company must monitor chlorine residual levels at the distant end of a vast distribution system, many kilometres from the plant’s main control room.

Solution 1 – manual monitoring
A staff person visits the remote site daily to manually check chlorine residual levels. The test takes five minutes. The round trip takes 60 minutes. In this solution, the staff dedicates nearly five and a half hours each week to checking chlorine residual levels.

How many buzzwords do you need to monitor your remote pump station?
Small costs include the testing kit and the ongoing wear and tear on the vehicle. The biggest expense, however, is losing a staff member for five and a half hours each week, when he or she could be performing more valuable work.

Solution 2 – scada monitoring

Today, many water systems rely on traditional scada systems, which typically use wireless communications to report the chlorine residual levels back to the treatment plant’s staff in the control room. This eliminates the hassle and cost of sending a staff person to check the levels manually, but usually requires a large capital cost. Installing a remote terminal unit (RTU) can cost nearly $10 000. It might also involve commissioning an engineering study, and in some cases, building a dedicated radio tower. Other possible costs include purchasing software, hiring a system integrator, and the ongoing costs associated with managing the server and software.

Solution 3 – the EAGLEi approach

Phoenix Contact now offers an option that brings the IIoT and M2M communications to the water industry – EAGLEi remote monitoring.

Most pumps in remote locations do not directly connect to the Internet, but with a properly equipped RTU, they can be connected. EAGLEi makes it possible to buy cellular-enabled RTUs that connect to a cloud-based scada service. This enables users to monitor their remote assets from a computer in the control room, or at home, or from the field using a smartphone or tablet. The modem/router in the EAGLEi RTU accesses a private Verizon access point name (APN) on a nearby tower, and transmits data from the pump station across the Internet, ultimately back to the control room, or via the Internet, to mobile devices.

The big benefit of leveraging the cellular carrier’s network is that the end user does not need to build any wireless infrastructure associated with the radio systems, as mentioned above. There is no software to buy or patch, no radio towers to build, and no servers to buy and maintain.

In addition to its affordability, EAGLEi also offers high levels of security. Each EAGLEi RTU contains the Phoenix Contact mGuard, an industrially rugged firewall/VPN device/cellular modem. The mGuard connects to a private Verizon cellular network, which is not accessible over the Internet. A secure data centre, with enterprise-class servers, cyber security, and UPS and generator back-up power supply, stores the data. Data access is password-protected, with individual rights for each user.

Conclusion

EAGLEi harnesses the IIoT, so that users are not tied to the control room. Data is available wherever there is an Internet connection and a device with a supported web browser. Alarms can be sent via email or text to those who are on call. EAGLEi makes it easy to access data on tablets, smartphones, laptops, and servers. This ultimately enables water professionals to focus on their core mission to enhance water system operations.

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In the past few years, we have often been asked to assist in creating an IoT or IIoT strategy for clients. Our method has always been, and will continue to be...

What is the business problem to be solved or the outcome to be achieved?

IoT (or IIoT as the case may be) is not an end in itself. It should exist to achieve some purpose. This can be to solve a business problem, increase operations or supply-chain efficiency and effectiveness, or merely to enable more accurate tracking (amongst others). There are a great many reasons or business cases out there, and an equal number of business questions to be answered. However, most of the companies we have dealt with ask the wrong question. The question is technology and architecture first, with business value as an after-thought – it should be the other way around.

Having a state-of-the-art architecture based on the most modern technology will not benefit any company unless it is tied to a specific purpose and business outcome. If the technology does not answer the business question or solve the business problem, it is money wasted. In light of the above, the first question in the IIoT journey should always be: Why?

Once we know what operational challenge we want to solve, the next question would be, where do we start? What plant, support service, logistics, warehouse or utility problem should we focus on first? This is important as we want to show value and payback with the first project. But, we should not be constrained in our thinking and design for a limited scope. We should also understand the full reach of the business and potential future requirements. We should design and architect with this vision in mind. There is a fine line between delivering a pragmatic solution to a specific problem and creating a long-term global vision for the company.

That brings us to the how? I have seen a number of IoT and IIoT strategies developed by different consulting companies. They are without exception great on the what, but extremely light on the how. We also need to answer the how question to make IIoT strategies real for companies.

IoT and IIoT architectures defined

Considerable time has been spent defining IoT and IIoT architectures by local and global forums. In our view, the IoT World Forum reference model comes close to defining a good overview model. However, we have adjusted this reference model to be more aligned with real-world challenges. In our view, the reference model in Figure 1 contains all the elements/components required to provide a complete IIoT solution.

If you are familiar with the IoT World Forum reference model you will know that it contains seven layers where the model we as Altron define contains eight layers. We make a distinction between local connectivity and global connectivity where the World Forum model does not. For us, machine-to-machine connectivity, or instrument to edge-device connectivity (such as Bluetooth, Smart Bluetooth, Zigbee and Wifi) is not the same as for instance GSM, NB-IoT, LTE, satellite and such, which we classify as global connectivity. There are of course networks like Sigfox and LoRaWAN that can be seen as both local and global, but they are mostly sold as global connectivity solutions. In terms of the Altron IoT reference model, this is the only area where we deviate.

We believe that especially for IIoT, local connectivity is the area that will make or break any solution. By virtue of the real-time environment IIoT operates in, sound local connectivity is critical in the successful implementation of any solution.

IoT Platforms

Talk to any technology provider, hardware or software, and they will tell you about their ‘IoT Platform’. When evaluating platforms against the above reference architecture, you will soon notice that most are incomplete, or if they are complete, it is only in a specific niche area.

Having evaluated a number of vendor’s ‘IoT platforms’, it has become clear that they fall into two broad areas, those with a hardware focus (levels 2 to 5) and those with a software focus (levels 5 to 8). Evaluation also indicated that software-focused platforms are typically strong on levels 5 and 6 with levels 7 and 8 available only for niche functionality.

Reading up on completed IoT projects, it is apparent that the above is a true state of affairs. It is estimated that a complete, value-adding IoT solution involves an average of 20 to 35 vendors. This is not necessarily a bad thing, as different customers have different requirements, but it does mean more points of potential failure. Some customers may have the bottom layers sorted out already, but need a software platform and applications, while others may need connectivity between...
the lower levels and their existing software applications.

**Factors to consider when selecting a platform**

There are many things to consider when selecting an IIoT platform and implementation partner. For instance, the types of services and service model provided by the vendor are important. Although most platforms are moving towards cloud and an ‘as a service’ model, some still provide ‘capex’ and ‘on premise’ solutions. Especially for IIoT in industries where real-time feedback and response are critical, this is a major consideration. For these, some vendors also make a ‘hybrid’ model available, where fast response edge devices and/or applications sit at plant level and reporting, data analytics and dashboarding is done in the cloud.

Domain expertise or platform ‘use-cases’ are also important, especially within the IIoT environment, as is the reliability of the connectivity, data storage and data extraction for business value. It is also important to know how easy it is to manage the devices connecting to the platform, and how easy the support of the platform and devices are going to be.

Cost or the costing model needs to fit the business need. Here it is important to not only look at the current business need, but also at the big (future needs) picture. Although a low per-device cost may be appealing for a small implementation, it can get very costly very fast. It is also important to understand how compatible the platform is to the business and how it will connect to the current infrastructure. Scalability and security are important, not only from a cost perspective, but also in terms of device management and support.

Platform security is a factor that is easily overlooked. Security is applicable across the various layers. Therefore it is important that any device connected to the platform should be authenticated and ideally the communication channel should be encrypted. The platform itself should be able to securely store the data and allow access and dashboards based on grouped user rights, i.e. administrative rights, write-back, read-only, and which sets of data that will be visible to which group.

The last big consideration is the tools and ability to integrate and handle data, both from bottom (level 2) to top (level 8), also called north-bound integration, and top (level 8) to bottom (level 2), also called south-bound integration. This is important as some vendors are good at north-bound integration but struggle with south-bound integration. Especially for IIoT, the ability to send information down to instruments is vital, as pure reporting within a fast-paced environment will be inadequate. Look specifically at the drivers or protocols supported by the platform and ensure that it supports IIoT protocols such as OPC, Fieldbus, Profinbus etc. for south-bound integration, and has adequate APIs etc. for north-bound integration. Again, access to the data should be secure, authenticated and tracked.

When selecting an IIoT platform it is very important to work through the various factors to ensure it fits your specific long- and short-term needs.

**Functionality required by an IoT platform**

Looking at the full stack of IIoT, a number of functions need to be available in the IIoT platform to ease the implementation and reduce the number of vendors involved in any solution. The platform needs a front end or user interface development environment that is easy to use. It must make provision for, and enable the handling of, a variety of communication protocols, both north and south-bound. It needs a user interface that enables device management, device status monitoring and device grouping (asset management). The platform needs to provide a data storage environment that is scalable and secure, but allows easy data access and retrieval. It needs to provide tools for the easy development of dashboards for live values and trending, as ultimately, this is the view the customer needs to make better business decisions.

Although multi-tenancy (one platform for multiple and separated users) is not required by all customers, it may be that a company wants to segregate data within a platform so that not everything is visible to all users, and each user company can have their own branding and look and feel. When used specifically in the IIoT environment, workflow management, notifications and alarming are crucial to inform operators, supervisors and managers when things do not go as planned.

Tools that enable advanced data analytics, such as machine learning, advanced pattern recognition (APR), artificial intelligence (AI), robotic process automation (RPA), acoustic analysis, and facial and image recognition, should be available. Ultimately, these are the tools that will increase the efficiency and effectiveness of a business, when applied correctly. If the platform does not have these tools (and very few do), then at least the data should be available and easily extracted via standard tools and protocols into other applications that have these functions available.

The platform needs to be flexible regarding where it will be hosted, especially for IIoT, as a hybrid model will most probably be best for real-time process industries. The availability of after-sales and back-end administration support is also important for a long-term sustainable solution.

**Conclusion**

Not all platforms are created equal. To get the best IIoT platform for your company, you need to take the time to evaluate the vendors out there. Do not just go with the first one to show pretty pictures. Look under the hood and ask the vendor to explain how they incorporate the various consideration factors. Look at all 8 layers, determine what forms part of the platform and what is ‘bought-in’ third-party functionality. Find the best fit to enable your company to solve its current and future business problems.

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Next-generation IIoT gateway solutions are transforming manufacturing

By Matthew Lee, product manager, Moxa.

Smart manufacturing and digital transformation, coupled with edge intelligence, are enabling manufacturers to increase productivity, reduce downtime, and increase product quality. A key factor in the success of this transformation is the deployment of intelligent edge-computing solutions that can bridge the gap between the operation technology (OT) and the information technology (IT) worlds by providing a number of benefits. In this white paper, we discuss what manufacturers need to benefit from the IIoT trend and how a new generation of IIoT Gateways are helping them reap the benefits thereby transforming their businesses.

Reduced latency: manufacturers are expected to be more responsive to customer needs by providing customised products and services on a global scale. In addition, time-sensitive applications need immediate processing of device data to be able to take timely corrective actions and facilitate quick decision-making. Edge intelligence can facilitate quick decision-making at the field sites as opposed to sending all the device data from the edge to the cloud for processing.

Independent remote operations: an edge-computing platform enables remote locations to reduce downtime and operate independently when the central system is inaccessible. For example, if there is a network outage and connectivity to the cloud system is lost, field sites can use local computing power to process and analyse data. Processed data can then be sent to the cloud for long-term storage when the connection is restored.

Data security: sending sensitive operational data from the edge to the cloud puts the data and edge devices at risk. Multiple levels of security need to be put in place to ensure that the data is securely transferred from the edge device to the cloud. Processing data at the edge helps prevent data breaches and enables faster responses.

Reduced data transfer costs: transferring large volumes of data from the edge to the cloud server can be prohibitively expensive. Furthermore, the cost of transferring this data on a daily basis could lead to unsustainable communication costs in the long run.

Manufacturers are looking for optimised computing solutions for their industrial-automation applications to intelligently process large volumes of data received from the sensors and field monitors, and send only critical data or a summary of the data to the cloud. Compact-sized, ruggedised industrial Arm-based computers, designed for low power consumption, are at the heart of these solutions and make edge-side computing more reliable and cost-effective.

Benefits of using an Arm-based Linux IIoT gateway solution
Arm-based Linux IIoT Gateway solutions provide industrial-grade security, manageability, performance, and reliability while still maintaining extensibility. They typically combine the hardware, OS, and software functions listed below to provide an optimised edge-computing solution for IIoT applications.

Longevity: industrial products are usually in place for 10 to 15 years. To meet this requirement, Arm-based CPUs typically come with a minimum lifespan of 15 years. In addition, Arm’s commitment to long-term support and access to their future enhancements, make Arm-based solutions an ideal choice for industrial applications.

Low power consumption: low-power processing is a requirement in many industries to ensure that the equipment does not overheat and pose a potential hazard. Fanless equipment is also preferred so as to mitigate
the effects of dust in industrial environments. Arm Cortex-A processors are highly optimised for performance and power efficiency.

Scalability: Linux is eminently scalable and is able to run on a variety of platforms. The basic functionality of a Linux platform – command line tools, configuration, and code – is compatible with any Linux-based device. This flexibility allows for easier upgrades and compatibility between different systems.

Enhanced security: while manufacturers are reaping the benefits of digitisation, they are also faced with data security risks and software-integrity issues. A Trusted Platform Module (TPM) can be deployed to guarantee the physical security of edge devices. In addition, Arm’s TrustZone can be used to create an isolated secure world, which can enhance security and maintain the integrity of edge-computing solutions.

Ready to run IIoT gateway solutions leading the way
A new generation of IIoT Gateways that are optimised for industrial applications are revolutionising the manufacturing landscape. Built around an open Linux-based platform, these IIoT gateways are secure, industrial-grade computing platforms that support multiple communication interfaces and run on low power.

Industrial-grade Linux
IIoT gateway solutions that include a high-performance industrial-grade Linux distribution and long-term support are better equipped to meet the growing needs of manufacturers. Currently, long-term support (LTS) offered on a Linux kernel is five years. In most industrial establishments, especially in critical systems such as energy, water, transportation and communication, it is not feasible to update the software systems every five years. Software vendors should commit to long-term maintenance of the Linux platform. A long-term commitment (10 years or more) to support a Linux kernel, which includes security patches and bug fixes, will address the needs for extended lifecycle of computing systems in industrial automation applications, making industrial projects secure and sustainable. Projects, such as the Civil Infrastructure Platform (CIP), aim to speed implementation of Linux-based civil infrastructure systems, build upon existing open source foundations and expertise, establish de facto standards by providing a base layer reference implementation, and contribute to and influence upstream projects regarding industrial needs. CIP’s kernel will be based on Linux kernel 4.4 and will include security patches and features backported from newer kernels.

CIP is driven by some of the world’s leading manufacturers of civil infrastructure systems and industry leaders including Codethink, Hitachi, Plat’Home, Renesas, Siemens, Moxa and Toshiba. This project is hosted by The Linux Foundation to create an open-source platform for managing and monitoring IoT-enabled civil infrastructure and make it safe, secure, reliable, scalable and sustainable.

Low power consumption
For low-power applications, Arm-based systems are a natural choice. x86-based IIoT gateways consume on an average 30 W of power while their Arm-based counterparts, for example, gateways built on the Arm Cortex-A processor, can provide industrial-grade performance in power budgets under 10 W. Low power computers and devices help substantially reduce your operational costs. They consume less power and hence generate less heat, which means no cooling systems are required.

Secure platform
Operational networks were simply not built for connectivity to the Internet/cloud. The key focus of these networks is quick data access for industrial processes. Manufacturers feel that implementing multiple security levels is a huge drain on network resources and may impact productivity. However, in the IIoT age, where the trend is towards more connectivity for edge devices, which may otherwise never be connected to the Internet, there is a quantum increase in possible attack points for malicious attackers. Security threats can extend to even low-level devices. Cyber attackers can target anything that is exposed to the Internet, including a thermostat in the field to a wireless device. Manufacturers can longer take this threat lightly. Information security, system hardening, security fixes and ability to backport fixes to existing cores without having to change the software, helps organisations better fight cyberattacks.

For example, Arm-based computers that support TPM v2.0: bringing TPM and Arm-based computers together gives system integrators and industrial engineers a powerful new tool in their security arsenal. By creating a specific cryptographic key for each individual device, which is hardcoded within the platform itself, the data stored on the computing system is secured and protected from being read by an unauthorised party. Moreover, the OS on the system can be locked from being overwritten to secure edge devices and data in distributed areas. Security utilities and tools that can conveniently build up the protection mechanism on the software platform to meet your cybersecurity requirements are other ways to secure industrial systems.

Support for multiple interfaces and protocols
IIoT Edge Gateways should come with multiple interfaces such as serial, CAN, Ethernet, Wi-Fi, and 4G LTE. IIoT gateways with carrier (Verizon/A&T) certifications and industrial-grade CE/FCC/UL certifications enable reliable connectivity for edge devices. Edge-side software that accelerates

Continued on page 14
mass configuration of devices, easy device management, and data acquisition can speed up system deployment. Modbus connectivity for data acquisition and processing and MQTT support for lightweight edge-to-core data transmission reduce development efforts. RESTful APIs and Modbus APIs for implementing gateway software functions enable easy integration with existing systems and with new-age IIoT applications.

Easy connectivity to the cloud

Edge intelligence and connectivity to the cloud are two faces of the same coin. Depending on the IIoT applications, connectivity to a private cloud, public cloud, or both may be required. To enable cloud connectivity and edge intelligence, generic Modbus and EtherNet/IP protocol support, MQTT/HTTPS and RESTful/C/Python API support are required. Built-in clients for AWS, Azure, Ignition Edge (Sparkplug), and Wonderware Online services may also be necessary, depending on the cloud services that are required for your IIoT applications.

Case in point

The following example illustrates how new-age IIoT gateways can help manufacturers speed up IIoT deployments and transform their operations based on intelligence from field data.

Enabling predictive maintenance in artificial lift monitoring systems

A leading oil and gas service company is building telematics solutions for its customers to run smooth operations and conduct predictive maintenance for artificial lifts in oilfields. With the trend of oilfield digitisation, telematics has been tremendously useful in understanding equipment status so as to avoid problems, also called predictive maintenance. The data generated by the equipment during the operations is the key to achieve this goal. As a result, this oil and gas service company needs a reliable and secure solution to ensure that the data needed is brought back to the control centre for further analysis (Figure 1).

A wireless-enabled Arm-based open computing platform that acts as a secure IIoT gateway, allows oil companies to aggregate data from variable speed drives (VSDs) and PLCs for their pumping systems and to transfer the data back to the control centre through LTE communication in the harshest environments.

A built-in Trusted Platform Module (TPM) in the IIoT gateway ensures that each individual device is hardcoded by a cryptographic key to ensure the data is only accessible by authenticated parties.

System requirements:

- Low power consumption because oil wellheads are often located in harsh environments where powering is sometimes difficult.
- Reliable 4G LTE connectivity in high operating temperatures for constant data aggregation.
- Computers must feature Trusted Platform Module (TPM) to ensure data integrity.
- Open Linux platform for flexible application development.

Moxa’s wireless-ready IIoT gateway solutions

Moxa’s UC series IIoT Edge Gateways are industrial-grade, wireless-ready Arm-based computing platforms that are designed to operate reliably in a temperature range of -40 to 85°C. These gateways are built around the Arm Cortex-A processor and come with Moxa Industrial Linux (MIL) to address the need for extended lifecycles in computing systems for sectors such as solar/wind power, water and wastewater, oil and gas, transportation and factory automation. Key benefits include:

- Industrial-grade Linux.
- Low power consumption.
- Secure platform.
- Support for multiple interfaces and protocols.
- Easy connectivity from the edge to the cloud.

For more information contact RJ Connect, +27 11 781 0777, info@rjconnect.co.za, www.rjconnect.co.za
Siemens Digital Industries (DI) is an innovation leader in automation and digitalization. Closely collaborating with partners and customers, DI drives the digital transformation in the process and discrete industries. With its Digital Enterprise portfolio, DI provides companies of all sizes with an end-to-end set of products, solutions and services to integrate and digitalize the entire value chain. Optimized for the specific needs of each industry, DI’s unique portfolio supports customers to achieve greater productivity and flexibility. DI is constantly adding innovations to its portfolio to integrate cutting-edge future technologies.
Imagine a world where you do not run out of the necessities because a supplier restocks your shelves, silos or tanks before they reach empty. In the home, this could eliminate last minute runs to the grocery store for bread or milk, and in business, it would eliminate outages and unnecessary surpluses. The Industrial Internet of Things is making this a reality in many industries already.

This paper will explore how one construction materials hauling company used level measurement sensors and IIoT networks to manage their operation while simultaneously securing its customers’ supply chain, and keeping costs low.

**Two halves of the same process**
Ready-mix concrete companies operate as a network of plants, each servicing a surrounding geographic area or territory. A batch-person coordinates with trucking companies to maintain the raw materials at these plants to meet daily production demands. This person has one objective every day: ‘Do not run out!’ Running out for the ready-mix plant means lost revenue and lost reputation with construction companies. More often than not, ready-mix operations are unsure of how much cementitious material is in their silos because of how they manage inventory. Inventory has traditionally been tracked manually using a method called perpetual inventory. When a load of materials arrives, it is marked on a spreadsheet. This method, however, leaves a lot of room for human error in the busy environment at a ready-mix plant. Loads are unaccounted or forgotten, incoming amounts can be inaccurate, and leaking silos can go unnoticed. All of this eventually leads to a distrust in inventory count and leaves batch managers using a best guess to keep their operation running.

Trucking companies are responsible for hauling cementitious materials from depot sites to the individual ready-mix plants throughout the day. The hauling companies cannot see inventory levels at individual ready-mix sites, leaving them at the mercy of the ready-mix plant’s perceived demands. The ready-mix plant inherently distrusts its inventory, which, when combined with the ‘don’t run out’ objective, causes the batch-person to order loads based on their desire to keep the silo full, instead of the need to not run out. This causes inefficiencies in the supply chain: the equivalent of going on a road trip and filling up at every gas station you pass just so you do not run out.

**Meeting wants instead of needs**
Ready-mix operations start running early in the morning, which is when they place their first orders with their hauling company – whether they need it at that time or not – just so they do not run out. This scenario leaves the trucking company with long lines waiting at the depot, stuck in rush hour traffic, and waiting in more lines at the ready-mix plant before they can unload. All this waiting adds up to lost time, equivalent to an additional delivery every day.

For trucking companies, money is made when wheels are moving on the road and deliveries are made. With fewer deliveries, the cost per delivery goes up, and that cost gets passed on to the ready-mix companies – all to meet an imagined demand and false desire to keep the silos full. The ready-mix operations need more accurate measurements in their silos and the trucking companies need to see those measurements to maximise their drivers’ delivery capabilities.
IIoT to the rescue
This is where IIoT – a network of interconnected sensors and intelligent systems sharing information over the Internet – can help significantly and give organisations a competitive advantage if they are willing to embrace the technology. Smart sensors connected to a network and presented on an easy-to-read display can easily solve this problem of inefficiency.

VEGA, a manufacturer of process instrumentation, has extensive experience providing logistical solutions to customers, using level measurement instrumentation technology and the IIoT. The combination of reliable and accurate level measurement sensors for better inventory tracking and a web-based software platform for information transparency can improve efficiency all around.

The first hurdle is accurate knowledge of silo inventory because an organisation cannot manage what it does not know. The Vegapuls 69, an 80 GHz radar, provides a non-contact level measurement that can deliver continuous outputs to track inventory. This sensor is the ideal measuring device to use with aggregates and cementitious materials because the sensor has no moving parts, and withstands dust, build-up, and noise. Once installed at the top of a silo, the radar sensor emits a microwave signal to the material below. The signal reflects off the material and returns to the sensor, the signal’s time of flight is then used to calculate level.

Data from every sensor is displayed on the VEGA Inventory System (VIS), a web-based software platform for remote inventory monitoring that pairs with VEGA measurement sensors to deliver up-to-date information about inventory, consumption patterns, and free space in storage silos. The VIS uses a convenient colour-coded configuration, making it easy to understand inventory levels at a glance. When a silo’s bar is green, there is no need for a shipment. When it is yellow, the silo can take at least one load. And once the bar turns red, a shipment is needed right away.

All of this information can be securely viewed anywhere with an Internet connection by the ready-mix plants and the hauling company. The transparency of inventory information is empowering, and it benefits both parties: hauling companies can focus on making more efficient deliveries and maintaining inventory while the ready-mix plants can focus on their own drivers and customers instead of worrying about replenishment plans.

Using an IIoT solution like VIS allows hauling companies to plan better and avoid time-wasters like rush hour traffic and busy times at replenishment depots and ready-mix plants. Busy days with a big concrete pour run more smoothly with this system in place, and conversely, if inclement weather brings the ready-mix business to a halt, truck drivers can maximise that downtime by topping off silos and making additional deliveries instead of going home for the day and losing out on potential revenue. At the same time, ready-mix concrete plants maintain a secure supply chain.

Conclusion
The ready-mix and construction materials trucking industries are only just beginning to see the improved efficiencies the IIoT can provide. The greatest gains for both industries are likely still ahead as more companies adopt this technology and way of doing business. This same application could easily be extended to similar industries with vast supply chains.

The ultimate goal for transportation companies is a scenario where drivers are not designated to a particular loop, but the entire truck fleet can move in an orchestrated and efficient way from terminals to plants, ensuring customers stay adequately stocked and drivers can keep hauling. This improved, more economical process will result in a better return for the trucking companies, which will allow them to keep costs down, and pass those savings along to their customers.

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Calibration in times of digitalisation

What will tomorrow’s process industry look like?
Almost everyone today owns a smartphone that, without them being aware of it, is equipped with a variety of sensors and communication technologies. Worldwide, there are now 5.1 billion users of mobile devices and the number is growing at an annual rate of 4%. Whether with a smartphone or directly on your computer, you are most likely a private individual, who purchases comfortably from your sofa at home and are hardly surprised, if, underneath the product you have selected, it says, “Customers who bought this product were also interested in these products.” At home, the future seems to have made its way long ago. Behind these platforms, hide the technologies that have made your private life easier and more convenient, and these exact technologies are currently making their way into the process industry within the framework of Industry 4.0. So what does your work environment look like? Are you still working with outdated technologies, or are you seeing a wave of modernisation on the horizon?

The fact is, many employees are worried about terms such as machine learning, robotics and smart factories, and what will happen tomorrow. You may also be afraid that your future colleagues will be made of metal and make ‘blip’ noises. Or, you may think, that you will hardly meet any people on the shop floor in the factory of the future. To take away your future colleagues will be made of metal and make ‘blip’ noises. Or, you may think, that you will hardly meet any people on the shop floor of the factory of the future. To take away at least some of these worries in advance, the industrial production of tomorrow will rely much more on the latest information and communication technologies than it does today. And no, the factory of the future cannot be imagined without people. They will play a very important role. This should be reassuring, and it is, but there is a good chance that things will change in your environment in the future.

Since digital technologies in modularly organised plants of the future will make processes flexible, the maintenance of such machines will be equally affected, as will the calibration of the growing number of process sensors that make Industry 4.0 possible in the first place. In other words, the digital factory will automatically lead to digital maintenance, and that could happen faster than you think.

But, what we can tell you in advance is that if you work in a calibration environment, then your work will gain in importance. Factors that will play a role in the future, will be explained, step by step, in this paper. To start with, it is important that you understand the technologies and the interrelationships that form the basis of these digital changes.

Leaving the comfort zone step by step
There are trends that you should accept, if you cannot stop them. For example, when the first computers came onto the market, the then CEO of one of the leading technology companies made a forecast: “I think there’s a world market for maybe five computers.” Maybe you’re smiling while reading it, because this forecast seems completely absurd to you. At the beginning of the computer industry, nobody really knew where this new technology would take us, but the explosion of desktop computing has changed our lives. Even if you think that the role of a computer in your private environment is limited, in our modern society nothing would work without computers. By the way, the same applies to the role of the Internet in our society. Was it not then to be expected that computers and above all ‘Internet technologies’ would sooner or later find their way into the process industry?

In the Industry 4.0 era, production is closely interlinked with information and communication technologies, making it more flexible, efficient and intelligent. There is even talk of batch size 1, which might perhaps raise a question mark, rather than an ‘Aha’ moment. Well, it’s quite simple: with the expectation to meet ever faster and more comprehensively changing consumer requirements, customers expect individualised products that meet their requirements, but at prices that only series production can offer. How is that possible? The answer lies in the technologies of Industry 4.0.

Industry 4.0 has set itself this goal and offers a variety of concepts, guidelines and technologies for building new factories or retrofitting existing ones, which, thanks to modular production lines equipped with flexible automation and ICT technologies, make it possible for customers to choose custom variants at series production prices. In addition, the interconnection of the value chain extends far beyond the manufacturing company. The entire value chain, including suppliers, is also to be connected horizontally. Connectivity even goes one step further: products that leave the factory should also
report regularly to the manufacturer, e.g. for status updates and maintenance requirements.

Nevertheless, there are big differences between the time when the already-mentioned CEO ventured to forecast the world computer market, and the present time. Although the term Industry 4.0 today causes similar social uncertainties as computers did at that time, it is decisive for the future of the process industry, especially for the manufacturing industry. Where the computer was a fundamental new technological invention, Industry 4.0 consists of composite technological components, some of which already exist as modules, but interoperability for fast and flexible plug-and-play deployment is still in its infancy. It should be noted that the first three industrial revolutions were only subsequently classified and recognised as revolutions. In contrast, the so-called 4th Industrial Revolution is more like a controlled process, which from today’s point of view takes place in the near future and is currently in the process of unfolding.

### Sensors as key technology

The fact that Industry 4.0 is more like a controlled process than a wild revolution is of great benefit to many participants, even though it is not possible to say exactly where the journey will lead. What we can predict, however, is that tomorrow’s world will be much more digital than it is today, and that will certainly affect your work as process workers, both in production and maintenance. If you are working in calibration, the following may be particularly important to you.

For the factory of the future to exist at all, smarter objects (whether machines or end products) will need to be used to orchestrate manufacturing processes according to Industry 4.0 objectives. Objects without sensors are blind and unfeeling and can neither see how they have to act in connection with other modules nor can they report their own condition to top-level systems about, for example, the need for timely and optimised maintenance to prevent costly system failures.

Sensors therefore, do not only play an important, but an essential role, in the implementation of Industry 4.0. They form the interface between the digital and the real world. Data generated by these sensors must be correctly interpreted for further processing, and they must always be of excellent quality. Industry 4.0 also means that, in the future, sensors will be used far beyond the actual production processes. They will also play a role in upstream, downstream and parallel sub-processes, such as predictive maintenance. One could therefore say that without the right sensors, all higher-level systems are blind, and with incorrect measurement data, wrong decisions are made. What should hardly surprise maintenance staff then is that the quality of measurement data will become paramount, and dependant on the professional and prompt calibration of sensors.

For more information contact QTEK Instrumentation & Calibration Solutions, +27 11 391 4598, jacques@qtekics.co.za, www.qtekics.co.za
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A USB stick which offers you access to neural network functionality and can incorporate computer vision and AI to your IoT and edge devices.
In the latest version 10.3 of its Comos CAE software solution for the process industry, Siemens has focused on increasing efficiency in engineering. Using the Comos Engineering Portal included in this version, engineering processes can be significantly shortened. In addition to this, new developments and functional expansions are available for the current version in modular engineering and for mobile applications.

Fast engineering processes
The engineering portal in version 10.3 of Comos speeds up the engineering process. The portal can be reached directly in Comos from the product selector. The user enters all the requirements the component has to fulfil and then selects the most appropriate option from the current product offers provided from a range of manufacturers. After downloading all the necessary information, the data sheets and specifications are imported into Comos from the engineering portal. For example, this allows the selected cable to be quickly and easily integrated into a circuit diagram – without any expensive and time-consuming customisation. All information and documents are directly allocated to the component in Comos. This saves time during the engineering phase and bills of material can be generated fast. Potential sources of error are reduced, as are any rectification costs. The Comos Engineering Portal is available in German, English and Chinese.

Users can now modify the Web application of the Comos software solution to suit their own individual requirements. Engineering data from Comos can now be easily integrated, edited and validated and then be reimported into Comos. This provides greater flexibility and mobility in the design of workflows. For the first time, Comos Version 10.3 also allows object queries to be edited and batch processes to be completed in the Comos Web application. The new 2D client makes it possible to call up objects in Comos without any previous revision. The data is therefore always up-to-date and can be seamlessly visualised in 1D, 2D or 3D. This provides the user with extremely high transparency and minimises sources of error at the same time.

Modular engineering for all disciplines
In addition to this, Comos makes it possible to consistently implement modularised engineering for all disciplines with central data storage and the use of intelligent templates – from tender preparation and engineering all the way to project completion. Using smart templates engineers and operators have access to a high degree of bidding and planning efficiency. Quotations can be compiled quickly, creating a solid base for a clear and structured cost calculation. Significant amounts of the basic engineering are already complete when the order arrives. So-called over-engineering or under-engineering can be substantially reduced by using the Comos modularised engineering solution. The standardised modules allow customer requests to be individually and concisely implemented. Regulatory requirements such as compliance can also be safely included. Comos allows companies to build up a solid knowledge base, secure their expertise, and remain successful for the long term.

In the latest version 10.3 of its Comos CAE software solution for the process industry, Siemens is focusing on increasing efficiency in engineering. Using the Comos Engineering Portal included in this version, engineering processes can be significantly shortened. In addition to this, new developments and functional expansions are available for the current version in modular engineering and for mobile applications.

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Thanks to increased processing power and the availability of increasing volumes of data, the discussion about Artificial Intelligence (AI) is gaining momentum.

The current status
In the case of the advancements required for Industry 4.0, such as predictive maintenance and networked, efficient production, the use of adaptive algorithms offers enormous potential. Many manufacturing companies are realising that AI presents an opportunity to increase OEE and therefore combine reduced costs with increased productivity.

However, there is still something of a chasm between the desired status and the reality of the situation: many of the AI solutions advertised on the market, which are often cloud-based, have significant requirements in terms of infrastructure and IT. These solutions also work with an overwhelming amount of data that is laborious and time-consuming to prepare and process. The question of added value often remains somewhat murky as it is difficult to determine whether and how the investment in AI will provide a return.

The fact that system designs for the mechanical engineering sector are generally both complex and unique is another contributing factor. As a result, it is not a matter of simply transferring learnt experiences from other machinery as one might see for mass-produced products in the consumer goods industry. The majority of systems are generally so complex that it is not possible to map out the entire system mathematically (as a ‘white box’) and maintain costs at an acceptable level.

Omron’s solution
It is Omron’s view that a ‘black-box approach’ is more practical. Typically, the available data in most systems is undetermined for AI algorithms, and reliable operation can only be confirmed through testing, optimisation, and frequently, over-dimensioning.

Given these conditions, how does one go about designing and integrating AI that creates tangible added value in the production process? Instead of laboriously searching a huge volume of data for patterns, in addition to the processes that are currently running, Omron tackles things from the other direction. The required algorithms are integrated in the machine control system, thus creating the framework for real-time optimisation – at the machine, for the machine. In contrast to edge computing, where individual manufacturing lines or sites are analysed using limited processing power, the AI controller used by Omron, which features adaptive intelligence, is closer to the action and learns to distinguish normal patterns from abnormal ones for the individual machine.

The AI controller integrated in the Sysmac platform – a complete solution for factory automation featuring modules for control, motion and robotics, image processing and machine safety – is primarily used in the manufacturing process at the points where the customer is experiencing the greatest efficiency problems (bottlenecks). The processes gain intelligence based on previous findings and improvements that have been made and subsequently drive holistic optimisation of the entire manufacturing process.

Although OEE values of 80% and above have been achieved in isolated cases, in the automotive industry in particular, many of the systems currently in live usage have been generating figures of around 50%. If quality is improved and predictive maintenance is used to prevent machine downtimes, it is possible to make significant efficiency gains. The AI controller provides optimisation in exactly these areas. It is driven by practical requirements aimed at improving the OEE. It is important to note that an improvement of just a few percent can result in significant efficiency gains and cost reductions. With its new AI solution, currently in the testing phase with pilot customers, Omron hopes to drive added value and practical improvements, thus helping to create a smarter industry.

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Securing the smart factory?

Secomea provides secure remote access without the need for advanced firewall configuration.

Industry 4.0, IIoT and the connected factory are beyond the point of just being buzzwords. In reality, they offer huge opportunities for manufacturers. But as a smart factory goes online, how secure are communications in and out of the site? How can companies enable remote access and protect themselves against cyber threats at the same time?

Remote access to machines has become vital for OEMs and system integrators to meet response-time and up-time obligations. Engineering resources and budgets are limited, therefore efficiency is key. Resolving issues without the need for onsite visits saves time and money, but as businesses embrace connectivity, the threat of a cyber attack increases. Protecting data when connected to a network can be a complicated challenge.

Cyber security is top priority for the Danish solution, Secomea. Designed specifically for remote programming, monitoring and data-logging, it provides secure remote access without the need for advanced firewall configuration.

Moving on from VPN

Traditional VPN technology is widely used and suits the job of connecting networks remotely or providing remote access to a central site. However, it has some serious limitations for remote device monitoring and management.

VPN solutions can be complex. Connecting different engineers to different sites around the world by traditional VPN solutions would be an onerous task. Setting up a VPN is resource heavy, time consuming and requires the involvement of IT personnel. Subnet conflict issues, firewall setups and single level authentication can also trigger security concerns.

Secomea has developed an Internet-based technology that specifically addresses the security and usability requirements of linking service engineers with industrial equipment.

Each machine has a SiteManager, a small piece of hardware that the engineer connects to and uses to control the machine. The SiteManager can connect to industrial equipment via LAN, serial or USB ports. There are also multiple Internet access options including LAN, 3G and 4G or Wi-Fi. The LinkManager Windows based client provides (VPN-like) access to serial and USB devices, no configuration is required. A web version, the LinkManager Mobile, can be operated from multiple platforms with a browser allowing users to remotely access equipment via a phone or tablet.

The solution also includes a GateManager, a M2M server that is either hosted by Secomea, or by the customer themselves. All communication between the factory and the engineer through GateManager is via an encrypted connection. Through the web-based GateManager Portal, users can administer accounts, manage SiteManagers, and also manage devices. It is straightforward to determine who has access, what equipment and which sites can be accessed, and also when and for how long that access remains active. The engineer can securely log on to the system via a X.509 certificate and associated password. GateManager also logs all events.

Secomea has two- and three-factor security authentication, event audit trails, role-based account management and standard measures for eliminating the risk of vulnerabilities from configuration or human errors.

Future-proofing

Secomea says it has achieved Industry 4.0 certification by enabling these connections in a secure way. Unlike an open VPN network, restricting access to certain devices for a specified time is easily achieved using a simple folder, and drag and drop system.

The development of smart factories offers significant benefits for the automation industry. If companies are to take full advantage, they must make timely decisions about how to utilise new technology that is designed to keep those connections secure.

Secomea has not only made its system secure, it has also utilised third-party test laboratories to assess its system and ensure they comply fully with the requirements of Industry 4.0. Unfortunately we live in an age where criminals, fraudsters and hackers have upped their cyber game. No one can afford vulnerabilities in their system.

New technologies afford many benefits, but they need to be kept secure and stay ahead of the threats.

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Weidmüller’s u-mation embraces the digitally connected world

Weidmüller’s u-mation system is more than just automation, it’s a connected digital solution for a diverse range of businesses. That is because u-mation is a hardware and software solution that embraces the IIoT philosophy in an increasingly digitally connected world.

In South Africa, Phambili Interface is the distributor of Weidmüller’s quality connectivity and interface products. The u-mation system is one of the available cutting-edge automation solutions designed to make the leap to the Smart Factory by intelligently networking hardware, software and data.

According to Weidmüller, the digital transformation of industrial manufacturing is making great strides. Already, many production processes are no longer just automated, but connected to each other via a digital infrastructure, thus becoming a cyber-physical system.

Digitally savvy solutions

With the rise in complexity of machines and systems, there are increasing demands being placed on modern automation technology. Consequently, branched subsystems need to be precisely integrated into complex topologies. A rapid and reliable transmission of signals and data is critical for smooth operation, however, small and adaptable components that can be integrated in an application-specific manner are needed. Weidmüller’s remote I/O systems for protection degrees IP20 and IP67 offer flexibility in the design and cabling of systems, reliability in the transmission of signals and data, and compact offerings in an array of digitally savvy solutions.

“You need an I/O system that allows you to work quickly and flexibly,” notes Phambili Interface’s Peter Mc Donald, “a system that won’t leave you in the lurch as facilities become increasingly decentralised. The compact u-remote system consisting of IP20 and IP67 components offers maximum benefits and flexible use in automation.”

The overall u-mation system can be adaptable and flexible according to a business’ needs. Components of the system include u-control, u-view and u-remote units, and there is a helpful u-remote news section, where one can discover the latest innovations in Weidmüller’s automation portfolio.

“The u-mation system combines high-end hardware with innovative engineering and visualisation tools for future orientated services,” adds Mc Donald. “It also offers maximum freedom for the individual design of scalable automation solutions and corresponding services.”

The key components of the u-mation system are explained below:

- u-control – platform independent system programming via a browser or conventional Windows-based.
- u-view – visualisation for the monitoring and control of systems.
- u-remote – modular I/O system for lean planning, simple installation and quick commissioning.

In addition to the open and scalable u-control system, u-mation’s complementing u-view and u-remote products cater for businesses of different sizes and diverse operations. For instance, the u-view multi-touch panels that resemble an iPad/tablet come in basic, advanced and IPC/ panel PC lines. The u-mation system also has an array of safety features, which include:

- Profisafe modules for the Profibus-DP and Profinet fieldbuses.
- Fail safe over EtherCAT (FSoE).

In addition to the hardware side, the u-mation system has a software bouquet that includes u-create web, u-create studio and u-create visu that bring the system to life visually on screen.

- u-create web – platform-independent PLC and IoT system-programming.
- u-create studio – all-in-one engineering tool.
- u-create visu – visualisation for monitoring and control of the system.

Phambili Interface exhibited a coordinated IoT u-mation portfolio at the recent Africa Automation Fair. The combination of modular automation hardware, innovative engineering tools, sophisticated digitalisation solutions and intelligent machine learning modes demonstrated the connection of all levels of a process – from the sensors to the cloud.

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German company, Otto Boge (Boge), develops compressed air systems for which it offers an extensive portfolio of components, machines and complete plants. To increase the efficiency of its production, Boge has digitalised all its processes end-to-end with software solutions from Siemens PLM Software. This has enabled it to reduce its requirement for costly prototypes, simplified its quality control and release procedures and opened up whole new business models. Using new cooperation methods, digitalisation has allowed Boge to supply its customers with compressed air in the role of a service provider. It is used in the foam canons deployed by the fire department, ventilation systems for patients in hospitals and in offshore refineries.

Founded in 1907, Boge develops and builds the compressed air systems needed to supply this important resource in its own factories. The plants come in a variety of forms, such as complete compressed air units built into maritime containers, can encompass as many as 45 000 parts, and are exported to 120 countries. The company has been using CAD systems for its design work since the 1980s, and since the early 2000s, its design engineers have added Solid Edge from Siemens PLM Software to their design armoury.

The modules at a glance

Today, Solid Edge is not only used to design Boge’s own piping system (AIRFicient) as a method of measuring the air tightness and efficiency of important components. Boge also calls on the modular Solid Edge ‘construction kit’, comprising around 65 000 CAD components, when planning large-scale assemblies: Standard components can be added from libraries, and data from suppliers can be imported using the STEP (Standard for the Exchange of Product model data) format. As plant construction entails using a particularly high proportion of parts from subcontractors, Boge makes increasing use of synchronous technology from Solid Edge, which enables third-party geometries to be processed with ease, and then inserted into an assembly. All team members involved in the project who are not necessarily based in the same office are able to access the big picture of an assembly at any time as they work on the different components. This reduces the likelihood of errors during the initial assembly.

Direct link to the ERP system

Using the integrated FEM (Finite Element Method) module Solid Edge Simulation, it is immediately possible to check the correct dimensioning of components. This not only increases accuracy but also reduces the need for costly and time-consuming prototype production. Viewing models along the process chain simplifies many of the production steps such as quality inspection and final release. Through the direct integration of solid edge into the ERP system via the Engineering Control Centre, all relevant data, documents and processes can be managed and controlled over the entire product life cycle. To ensure that the software functions reliably, Siemens partner Solid System Team (SST) implemented the Smap3D PLM interface, which allows all processes taking place between development, purchasing, sales and production to be digitalised.

Focus on service

The advance of digitalisation has prompted Boge to explore new avenues in terms of its business models. The company is now offering its customers compressed air supplies in the role of a service provider. The cooperation between SST and Boge is based on a similar footing. “Instead of being a reseller, we see ourselves as a provider of complete solutions and services along the value chain,” said Torsten Hartinger, project manager at SST.

“Because of our master services agreement with SST, we no longer have to have many competencies available in their entirety,” added Boge IT manager, Torsten Spork. “Instead we can concentrate on strategic alignment in the direction of digitalisation and innovation.”

The latest Boge innovation takes the form of the new S-4 models. Thanks to the new digital design tools, this fourth generation of the S series is easy to maintain and also highly economical in terms of energy consumption.

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In 2017, Gartner predicted that more than 20 billion IoT devices would be connected by the end of 2020. Of these, about 7.5 billion will be business related. This begs the question: What impact is this new level of interconnectedness expected to have on traditional control platforms? In search of an answer, we got together with local scada developer and expert, Dave Wibberley.

“I believe we are entering an age of hybrid solutions,” he begins. “Scada architecture has its strengths and weaknesses as do the technologies of the IIoT. But, if we combine the two intelligently, we can solve problems that were simply not viable using traditional scada platforms by themselves.”

Strengths and weaknesses discussed
The strengths of conventional scada architecture are tied to the proprietary nature of ownership by the end user. The system is installed locally (on the site), which eliminates the risks of trying to control a large plant from a remote (cloud-based) application. Since the hardware is application specified, control and data retrieval are both fast, due to the very low latency intervals incurred on the local network. Also, any proprietary information, in terms of process improvement amongst others, belongs to the owners alone.

“In the context of weakness, scada systems have grown increasingly complex in order to provide all the data-intensive functionality that plant owners require nowadays,” stresses Wibberley.

What he is alluding to is that as scada has become increasingly ‘IT complex’, so too have the associated communication networks and security requirements. Put into context, around 80% of Adroit’s current support calls are network related. The OT vs IT riddle in action: OT personnel do not have the necessary IT skills, and IT personnel do not have the necessary time to maintain the control system networks. Patches and updates to operating systems are other areas of concern. It’s a vicious cycle because the problems grow almost exponentially in relation to the level of interconnectedness.

The neat thing about the cloud-based technologies of the IIoT is that they offer solutions to many of these problems. “The cloud brings a known, scalable infrastructure to the party,” explains Wibberley. “Moreover, it comes pretty much maintenance free as far as the scada vendors and end users are concerned. All the problems, along with expensive machine upgrades and hot-standby alternatives, become the cloud operators’ challenges – and they are very well equipped to handle them. Ditto when it comes to having the skills and resources to keep everything running acceptably.”

The disadvantage of course is communications and latency. You don’t want your fast control loops or critical safety processes running in the cloud – at least not yet. 5G potentially offers a solution, but even if it were ubiquitously available, Wibberley believes...
“In my view scada will rise to new heights.”

there is just too much data associated with such processes to make it economically viable. And he is in a position to know.

The value in the cloud

Suddenly it all becomes clear. The twists and turns of our discussion reveal the mother lode. The cloud offers access to resources on a scale that was simply unimaginable before.

“Think about a mining operation in the middle of nowhere that wants to implement a data-mining project designed to improve its yields,” says Wibberley, animated now. “In the past it would have cost a fortune to bring in consultants with the skills necessary to develop such a system. Now, thanks to the cloud, they have the option to access the type of knowledge-workers that very few companies can afford to employ full time. Software as a Service (SaaS) and the new global connected and outsourced workforce makes this a viable and affordable option.”

The cloud’s fabric (infrastructure) is designed to make it easy for organisations to share data through apps. This makes it affordable for companies to communicate whichever of their data they please with whoever they like, anywhere in the world. Something that was laborious and expensive before just became cost-effective and real-time.

“This is where I see the cloud adding value to a traditional scada solution,” continues Wibberley. “And it could happen in many ways. Since they now have access to a global resource pool, the company could subcontract a data expert in India, for arguments sake, to do the work for them. All the necessary information sharing would happen through the cloud using apps. Or, if there was a suitable cloud-based service already available, they could simply subscribe to that. The former gives them a more exclusive solution, while the latter is immediately available and probably the cheaper option.”

It’s a convincing argument, and scalable too. Exactly the same line of reasoning can be applied whether the work involved is custom report generation, dashboard development, or a more advanced AI related project. (It also creates an opportunity for knowledge-worker consumers to rank the quality of service from their various suppliers – but that’s another story.)

Putting the pieces together

The strength of the scada (system control and data acquisition) solution lies in its ability to control large plants and complex processes in real-time. The weakness is the increasing IT complexity associated with all the additional data processing and report generation functionality required for plant owners to squeeze that extra mile out of their assets.

How fortuitous then that this is exactly where the cloud offers strength.

“I don’t believe that we will see large plants moving the control side of their scada solutions to the cloud anytime soon,” elaborates Wibberley. “What I think we definitely will see though is a move to hybrid solutions that combine the strengths of scada with the strengths of the cloud to create a new generation of ever more powerful systems. The cloud offers us a way to process data that simply cannot be replicated in a single scada platform. The scada platform, on the other hand, spares the time critical safety and process control loops from the inherent latency and other risks associated with cloud-based applications.”

So will the IIoT kill scada?

“In my view it will raise it to new heights,” postulates Wibberley. “Even though it is technically possible to put scada platforms in the cloud, I find it unlikely that legacy systems will be moved there en masse, along with the intellectual property accumulated over decades. Large solutions will go hybrid, probably incorporating some edge computing functionality in addition to the cloud-based services.

“What we might very well start to see appear in the cloud though are cut-down, modular ‘scada-like’ platforms, for use in smaller applications that cannot justify the cost of a full-blown solution. A farmer maybe, who wants to monitor 20 or 30 parameters in order to manage their agricultural operation more efficiently. But this is hardly going to kill scada, it’s simply going to make it accessible to so many more applications. What it does imply though, is that scada vendors will need to stay on their toes if they hope to take advantage of these newly emerging opportunities.”

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Long range wireless communication for air instrumentation

Artic Driers in association with Suto iTEC of Germany have launched a long range wireless communication system for the comprehensive range of compressed air instrumentation marketed by Artic.

Wireless communication enhances the IIoT and simplifies the connection of sensors in industrial applications – sometimes it is the only viable solution to connect from one building to another. Wireless reduces cable connections resulting in installation cost and time savings. Suto offers solutions for a range of wireless sensor connectivity to local displays, as well as gateways to ISM servers.

The gateways communicate to the server through the integrated Ethernet or 4G modem. The Suto data acquisition and analysis software (S4M) collects the sensor data from the MQTT server, stores it in a database and offers various data analyses and reporting, thus providing a comprehensive IIoT solution.

For commissioning and network setup an ISM dongle can be used. This is connected to the USB port of a mobile phone and comes with an Android app for network testing. Sensor node features include:
- Can achieve up to 1000 m distance.
- Connectable to any Modbus/RTU sensor.
- 24 VDC power.
- Connects to either a ISM gateway or ISM transceiver: transmits sensor data in programmable intervals (1 minute to 1 hour).
- Economical and easy to use.

The ISM gateway can reach up to 1000 m distance and is connectable to any Modbus/RTU master, while having the capability to communicate with up to 16 ISM nodes.

The application software is either cloud or local based and provides powerful graphic analysis for multi-users for compressed air consumption and energy reporting.

The variety of sensors that can be connected includes dew point, flow, pressure, power, particle counters, and oil carry over monitoring devices. The new version of the S400 series thermal mass flow meters are set up via an android app for an easy to use solution.

Suto iTEC has a unique and broad-based range of compressed air measurement sensors and instruments, which are marketed internationally from offices in Hong Kong, China and Germany. All are specifically targeted at the compressed air industry for fixed and mobile auditing and monitoring applications.

Artic Driers is a level 2 BEE family operated specialist compressed air treatment company with a 29 year history in the local market.

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Rittal invests in new global smart factory

Investing in the future, Rittal’s new plant in Haiger embraces the principles of Industry 4.0. The company has made its largest single investment, totalling €250 million, to establish an advanced facility for its new compact and small enclosures. The highly automated manufacturing processes, in conjunction with the neighbouring distribution centre, enable seamless order fulfilment, guaranteeing rapid availability of standard products and accessories.

This bold investment ensures that all subsidiaries, including Africa, benefit, with managing director for South Africa, Adrian Buddingh, saying that by putting Industry 4.0 into practice globally, the company looks to advance smart manufacturing locally as well. “As the world’s leading provider of solutions for enclosures, power distribution, climate control and IT infrastructure, as well as corresponding software and services, we are creating a smart factory – the world’s most advanced production plant for compact and small enclosures,” he adds.

Owner and CEO of the Friedhelm Loh Group, Professor Friedhelm Loh elaborates: “The plant is to be fully aligned with highly efficient Industry 4.0 principles. The new manufacturing site will also safeguard future competitiveness for our customers and our own business. The investment is a positive statement in terms of the regional economy and the 290 jobs at our Haiger plant. We have quite consciously decided to shape the future with the people who made us what we are today.”

The new factory halls, with 24 000 square metres of floor space, will soon house more than 100 high-tech machines. Together they will manufacture some 9000 AX compact and KX small enclosures daily, processing approximately 35 000 metric tons of steel annually.

Manufacturing in a smart factory
The equipment in Haiger will be highly automated, producing individual work pieces and assemblies with exceptional efficiency. In the past, individual steps such as cutting to size, edging, welding and painting were transactional, sequential and independent of one another. In the new era, all workers, machines and materials will be integrated into the manufacturing execution system. At the end of the process, the individual assemblies are automatically merged and a QR code is applied. This enables identification as well as the further processing by the customer.

The machines and handling systems communicate with each other and also with higher-level control systems via modern industry 4.0-capable communication networks. Materials and components will be moved by means of 20 AGVs. Packaging, marking and transfer to the distribution centre are also performed automatically. Knowledge-based ‘learning’ systems will enable predictive maintenance, preventing faults from occurring and minimising downtime.

Automated order management and fulfilment will guarantee ongoing availability of standard products and accessories in the nearby global distribution centre, creating an end-to-end digital process chain, from configuration and engineering to final shipment of the end-product.

Digital value creation
Rittal will be manufacturing the new AX compact and KX small enclosures at the new plant. Digital transformation has created new challenges in terms of the products themselves, the operating environment, and its availability. The company has therefore rethought and redesigned this offering in line within the imperatives of Industry 4.0.

Rittal provides effective support for the entire value chain for the production of panels and switchgear, from engineering to ordering to automation. Its digital product twin delivers high-quality data for the entire design, configuration and manufacturing process. Following the successful launch of Blue e+ cooling units and VX25 large enclosures, the AX and KX products are now an integral part of this approach.

The Haiger facility is a showcase for the real-world implementation of Industry 4.0 and will act as a role model for Rittal’s international operations. It will also be a pioneer and reference for Rittal’s own products and services in terms of the IIoT. Blue e+ cooling units enhance the increase of energy efficiency and are integrated into the monitoring and energy management systems via the IIoT interface. The entire machine park permanently provides data from the control system and the current operating states. Production systems in the new factory are an ongoing source of actionable data on their operational status. In future, this information will be collected in an onsite edge data centre and analysed using powerful applications developed by sister company Innovo.

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Large systems are not normally maintained by just one person, but rather by changing maintenance personnel from various companies. For the system operators, coordinating these maintenance personnel and training them in the repair and maintenance tasks therefore involves great effort. If unique, clearly legible markings and a comprehensive WiFi network covering all areas are used for the digital, mobile activities, then the existing data can be better utilised, errors can be minimised, and time and money saved.

These days, most people can barely imagine locating an address in a foreign city, or even in a home town, without a smart device. This technology is also desirable for workers who maintain and operate systems in large plants. In such a scenario, a handheld device designed for industrial environments with explosion-risk zones would guide the worker through the facility to the exact device or machine that the employee needs to inspect.

Clear markings
Actually, such solutions do exist. But in reality, this digital approach still has a long way to go when it comes to supporting maintenance and inspection rounds in existing systems. In fact, sometimes even the ‘road signs’ are missing or they simply cannot be deciphered, to use the analogy of the address search again. For example, the old plastic signs used in brownfield systems are often weathered or have disintegrated, and metal plates are dirty or corroded, rendering the printed details illegible. This sort of situation does not pose many problems for employees who know the layout well. But new employees or third-party contractors tasked with performing maintenance and repairs will have difficulties. This wastes time and, in the worst case, can lead to errors. Operational safety is no longer guaranteed when a unit or pipeline cannot be clearly and quickly identified. Therefore, clearly legible, standardised markings are essential to efficient maintenance.

The most obvious solution is durable, easily decipherable signs, such as laser-engraved stainless steel markings. The plant operator can improve the occupational safety and the system availability by installing these markings on all components and equipment consistently throughout the plant. This alone ensures more targeted, error-free maintenance and repairs. Use of RFID markings is an additional step in achieving higher efficiency. These tags remain readable for a long time, even if a layer of dust forms on them over the years.

Easy detection via RFID and barcodes
The marking type that is selected largely depends on the on-site conditions. If a high level of contamination occurs here, the operator should implement RFID technology. RFID HF is the short-range approach that is comparable to NFC (near-field communication) on a smartphone. RFID UHF can transmit over several metres. Thus, for example, transmitters mounted on a pipe bridge can be detected from below without scaffolding. A distinction is also made between active and passive RFID tags, which must be taken into account, especially when they are used in potentially explosive areas. The tags can be incorporated into plastic labels, cable ties or foil stickers. Furthermore, some field device and electronics manufacturers integrate them directly into their devices.

As a result, some RFID tags offer the option to be imprinted with text and some do not. When printing, the same framework conditions are to be observed as for signs without RFID. The power station marking system (KKS) is used in many large systems. In addition to the standardised key, barcodes
or QR codes that are detected by camera apps can also be used. In combination with software installed in an industrial tablet, the maintenance person is guided to all components to be inspected more efficiently than with any type of paper-based routing slip. If fully rolled out, routes can be automatically optimised using this approach, and documentation of the inspection round is simplified. The employee identifies himself using the handheld device and can confirm the maintenance procedures online as soon as they have been performed. This eliminates duplicate entries and the need to transfer paper entries to a maintenance tool.

**Consistent, centrally manageable WiFi network**

The prerequisite for all the described options is a reliable field WiFi network that connects the industrial tablets to a maintenance tool or the higher-level MES at any time. In the same way as for markings and RFID tags, the wireless network must be well planned, assuming the company has not yet set it up in the production area. Depending on whether the IT department or the production/maintenance team is responsible for installing and operating the network, a differentiation should be made when selecting the right solution. Two different setups specially designed for commissioning are available on the market.

Powerful office networks, which span across several hundred access points, are often based on a server system with client hotspots and can only be managed by experts. If such a concept is to be extended to production facilities, the IT department must be responsible for it. If the wireless network is to be installed and managed independently and flexibly by control/MCR technology team personnel, it should be ensured that the access points (as with the web-based cluster management system from Phoenix Contact) can still be managed centrally. Thus, for example, network and security settings can be transmitted easily to all devices simultaneously (Figure 1).

**Phoenix Contact adds the benefits of augmented reality**

Use of unique, clearly identifiable markings and a comprehensive WiFi network is the basic platform for Maintenance 4.0. In addition, early adopters are already beginning to explore the benefits of augmented reality (AR) applications. The tablet, which has identified a piece of equipment via NFC or RFID marker, then displays further information on the screen, such as a data sheet, the maintenance manual or a video of all the procedures involved. Measured values such as tank levels or the temperature of sensors can also be displayed.

Phoenix Contact is gathering additional experience itself by using AR to display the temperatures in the plastic injection molding machines at its in-house production centre. The status of pumps or motors can also be displayed on an explosion-proof tablet, smartphone or, in the future, directly on the operator’s smart glasses. The employee can now use gestures to open a maintenance sheet or an exploded diagram, and bring them into view in 3D. Virtual and augmented realities have lost their gamer associations. AR applications are now being developed to support operation and maintenance teams thanks to modern marking methods, and a reliable industrial-grade wireless network.

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**Festo IoT-Gateway**

The Festo CPX-IoT gateway is paving the way for a secure cloud solution which will enable machine, system builders and end customers to significantly improve their overall equipment effectiveness. The CPX-IoT gateway connects and collects information about Festo components and modules from the field level, such as the valve terminal CPX/MPA, the energy monitoring module MSE6-E2M or handling systems, to the Festo Cloud via an Ethernet connection and a standardised communication protocol such as OPC UA.

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Industrial cybersecurity risk assessment and management

By Cobus Pool, Proconics (on behalf of SAIMC Secunda Branch).

Since the acceptance of the various IEC62443 modules as national standards; SANS62443-2-1/4, SAT562443-1-1 and SATR62443-3-1, there has been confusion about the requirements, methodologies and implementation. In this we are not unique as similar confusion reigned when ISA99 (the precursor of the IEC standard) was introduced internationally.

Two aspects are causing particular concern:

- Implementation of a cybersecurity management system (CSMS).
- Risk assessment.

In the case of the CSMS, there are extensive application notes and papers available. This article addresses the second and arguably more frustrating aspect.

The rationale behind risk assessment
SANS62443-2-1:2016 indicates that the risk analysis should consist of two aspects. The first is the rationale that covers situation /risks specific to the business. The second is the risk identification, classification and assessment with section 4.2.3 detailing all the requirements, and this is exactly where most of the confusion arises. Once one analyses the requirements it can be condensed into the following key outcomes:

- A risk assessment methodology must be selected – it is not prescribed.
- A high level risk assessment is required.
- A detailed risk assessment is required after the high level assessment and prioritisation.
- The methodologies do not need to be the same.
- Periodic reassessment is required.

Unfortunately, in South Africa very few operators of industrial plants actually implement the risk assessment process for cybersecurity, and those that do, almost never go into the detailed assessment requirements. As will be explained, there are good reasons why both must be done.

The high level assessment establishes the baseline and should deliver the following outcomes:

- Establishing the ‘real estate’ – this means what equipment is being used/affected and having as much detail as possible.
- Get general information around vulnerabilities and support status of the equipment.
- Determine management/process gaps through an evaluation process. Addressing these gaps (policies, procedures training etc.) is not part of the risk assessment process and is typically handled by a separate team.
- Do preliminary system segregation (this is on a theoretical not actual implementation level).
- Determine the target SL (security level) per zone.
- Do preliminary prioritisation of zone security implementations.

There are numerous tools available to do this assessment and selection is very dependent on the type of industry. Both this and the detailed assessment require a comprehensive team to complete successfully. The SL determination is critical as it determines the minimum level of security controls that must be put in place. Since there are always limitations on security budgets, the prioritisation allows one to focus on the zones with the greatest impact.

A security zone will typically contain two or more systems. The detailed assessment allows for lower level prioritisation, specifically:

- System priority.
- Specific vulnerability priority.

Three steps to a structured approach
Unfortunately, unlike the high level assessment there is no single software tool to address the process and one needs to use a variety of tools and systems together, check and verify the information. It is also an iterative process where certain steps might have to be repeated multiple times as new information is uncovered. Much of the information gathered in the high level assessment will be reused. Detailed discussion of the process falls outside the scope of this article; however, Proconics uses a NIST800-82R2-based process that is shown below. It consists of three phases with sub steps in each.

Stage 1 – asset ID and characterisation:
- define business objectives (business rationale in SANS62443); system classification; asset ID; network topology and data flow; and risk pre-screening (optional).

Stage 2 – vulnerability and threat modelling:
- security policy review; standards audit and GAP analysis; industrial cyber vulnerability assessment; threat assessment; attack vector assessment; risk scenario creation; and scenario validation (optional).

Stage 3 – risk calculation and management:
- calculate quantitative (monetary/safety) risk; prioritise mitigation; and mitigation validation (optional).

In conclusion, it can be seen that while the SANS62443 suite can be daunting, if one follows a structured and complete approach it is possible to manage risks. The process described here is not perfect and will not guarantee a fully secured plant, but it does allow for continuous and incremental improvement in security deployment.

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Pressure sensors for Industry 4.0

Turck’s new pressure sensors of the PS+ series offer complete access to sensor parameters via IO-Link.

In the industrial environment, functionality justifiably counts more than appearance. All the better then, when products stand out both in terms of performance as well as looks. This is precisely the boast of the new PS+ series pressure sensors, which has been underlined by the winning of the iF Design Award. The plus sign in the name stands for two customer benefits: simplified commissioning and the guarantee of high plant availability.

Problem-free installation and fast familiarisation through the menu structure were key requirements in the development. The specifications also included the suitability for standard process connections and electrical outputs, as well as coverage of pressure ranges up to 600 bar. A large degree of flexibility for installation is provided, as the sensor head can be rotated freely around 340°, and the display can be inverted for overhead installation. The sensors automatically detect whether the controller or bus module expects PNP or NPN signals. This also goes for current and voltage when analog output signals have to be evaluated.

Another feature is a unique compatibility mode within IO-Link systems. The PS+ series not only supports the Turck data profile for integration, but can also emulate other commonly available profiles. This means that any sensor replacement goes unnoticed by the controller.

Operation with smartphone haptic technology

The sensor is operated in the same way as a smartphone. The touch-sensitive keypads can also be operated wearing various types of gloves without any force or even cumbersome gadgets, and guide the user intuitively through the plain text menu. The menu structure can be set up according to either the Turck or the VDMA standard. The absence of any mechanical operating elements is another benefit.

The design of sensor takes the reality of different application environments into account. This includes the ability to be commissioned quickly and the prevention of operating errors. The locking mechanism of the PS+ series therefore prevents unwanted actuation: the device can be enabled with a swipe and also a password if required. LEDs provide continuous indication of operating states and faults, and a programmable colour change from green to red (and vice versa) on the display makes it possible to indicate whether defined switch points have been overshot.

Heavy duty metal pressure cells

The operating concept illustrates how design and functionality are mutually interdependent. A high level of availability, however, has even greater importance than user friendliness, since pressure sensors are expected to perform measuring and monitoring functions over several years. The sealing concept of the PS+ series makes it robust to fully meet the requirements of IP6K6K, IP6K7 and IP6K9K. The materials used are also resistant to UV radiation and salt spray, enabling these devices to be used for outdoors applications.

With their communication concept, the PS+ sensors are another addition to Turck’s set of building blocks for Industry 4.0. As specialists in the acquisition, transfer and conditioning of data, the consistency and transparency of sensor data are central requirements for Turck. This is why the company supports open standards like IO-Link, via which the devices can implement bidirectional communication with the controller. This enables the sensor to not only send digital process values, but also receive parameters such as switch points. The pressure sensors also offer different IO-Link process data profiles, which allow the flexible integration of a sensor into existing system landscapes with a 1:1 replacement of existing devices – even from third party manufacturers. This eliminates the need for complex adaptions to the controller setup.

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In this era of digital transformation, where companies are deploying digital technologies to improve their operations, deliver value to customers, and gain a competitive edge, IoT initiatives invariably form the backbone of those efforts. Huge amounts of data are generated by and collected from a wide variety of IoT devices. It is then analysed and actions taken, depending on the results of the analysis.

However, if you cannot trust the data and the devices that produce it, there is no point in undertaking the massive effort required to collect and analyse it in the first place, or even worse, make business decisions based on it. IoT security is all about enabling that trust, and that’s why it is such an important topic today.

Many IoT devices simply were not built with security in mind. The introduction of connectivity to legacy devices where it was never the original intention, or to newer devices whose designers lacked the expertise to develop for high-security networked environments, can result in the introduction of new and unanticipated vulnerabilities. And those vulnerabilities can be exploited by attackers to use an IoT device as a point of entry into a network, which they can then leverage to go after higher value systems and data.

The diversity of IoT devices and lack of standardisation pose challenges. However, proven time-tested security techniques – adapted to the IoT environment – are the key to addressing these. Digital certificates to uniquely identify devices and form a root of trust for IoT systems, firmware signing to ensure that devices can accept authentic and unaltered updates and security patches to eliminate discovered vulnerabilities, and encryption to protect sensitive data collected by IoT devices are three important technologies to enable a secure and scalable IoT.

Offering assurance
Securing the IoT is dependent on authenticating connected devices as an important part of ensuring that each one can be trusted to do what is expected of it. If organisations cannot trust the data and the devices producing it, why undertake the massive effort required to collect, analyse, and base decisions on it?

By providing each device with a unique identity that can be authenticated whenever it attempts to connect to a gateway or central server, it is possible to track its connection history and behaviour. Should a device behave in an unexpected way, an administrator can then quarantine it or revoke its network privileges.

Two thirds of the respondents to a recent survey, however, cited the poor authentication capabilities of IoT devices as...
one of their main security concerns – and with good reason. Strong authentication, based on a root of trust embedded at the time of device manufacture, is a linchpin to enable lifecycle security for medical devices.

In the case of medical IoT devices, assurance is required that the integrity of the device is maintained. It is crucial, for example, that a device receives the correct information to ensure it carries out the right action – such as delivering the correct dosage or recording the right measurements – at the right time. When a patient’s health is at stake, there should never be any doubt as to the integrity of the device and the data on which it relies.

Digital birth certificates
Providing this assurance, therefore, requires a solution that protects both the transfer and receipt of critical data, authenticates the addition of any new devices to the network to establish a root of trust and identity, and offers end-to-end encryption with strong key management. Only with such provisions in place can we be fully confident that our connected devices are secure.

Hardware security modules (HSMs) help IoT device manufacturers create a unique device identity or ‘digital birth certificate’ that can be authenticated when a device attempts to connect to a gateway or central server. With this unique ID in place, a device can be tracked throughout its lifecycle, and can be communicated with securely and prevented from executing harmful processes. If a device exhibits unexpected behaviour its privileges can simply be revoked.

IoT security is seen by many today as a barrier to their IoT projects, particularly when treated as an add-on as opposed to a core component that must be designed in from the beginning. Security getting a seat at the table from the inception of IoT projects will evolve from being the exception to being the rule. And rather than being the ‘no’ people, the security team must recognise its role as a key enabler in the IoT, navigating the vast ecosystem of connected products and platforms, and developing ways to ensure and maintain trust.

About nCipher Security
Today’s fast moving digital environment enhances customer satisfaction, gives competitive advantage and improves operational efficiency. It also multiplies the security risks.

nCipher Security, a leader in the general purpose hardware security module (HSM) market, empowers world-leading organisations by delivering trust, integrity and control to their business-critical information and applications.

Its cryptographic solutions secure emerging technologies – cloud, IoT, blockchain, digital payments – and help meet new compliance mandates, using the same proven technology that global organisations depend on today to protect against threats to their sensitive data, network communications and enterprise infrastructure www.ncipher.com.

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Endress+Hauser makes Process Industry 4.0 accessible through online services and apps that enable users to optimise and maintain their field devices. This way, they can unlock the potential of the field level in just a few steps and reduce plant shutdown.

As a complete provider for process sensory mechanisms, the company has accumulated decades of expertise with a strong range of solutions and services. The new online services enable it to link this expertise with relevant field data. This becomes particularly beneficial thanks to Heartbeat Technology, as it generates additional diagnostic and monitoring information about the sensor and process, for example, sensor wear and tear or deposits in the pipe. To unlock this potential, all that is missing is the data highway from the field devices to online services.

The technical implementation of the data highway is individually tailored customer infrastructure. The focus is on the NOA (NAMUR Open Architecture) concept, so that relevant field data can be supplied, in parallel to the control circuit, through a second communication channel. The data highway is certified by EuroCloud in accordance with the ‘StarAudit’ certificate, so that data is linked and used securely.

Since the digital range has been expanding since 1997, users are able to equip more than 90% of field devices with digital interfaces. With these digital field devices and retro-fit adapters, there are limitless possibilities for unlocking potential in the field. Early investments in technologies such as the Advanced Physical Layer (APL) will make linking the data to online services even simpler in future.

Paving the way towards Process Industry 4.0.

As an independent technology pioneer, Endress+Hauser wants to make the journey towards Process Industry 4.0 together with its customers. To do so, it has given its digitalisation portfolio a modular design. The portfolio consists of sensory mechanisms and connectivity components, as well as applications such as online services and apps, which allows users to choose the specific applications they require to manage and maintain. For instance, they can access online services in any area of the plant using the industrial tablet ‘FieldXpert’, which is suitable for use in hazardous areas. On trial are data glasses such as HoloLens that allow workers to follow instructions while leaving both your hands free. In short, the toolbox for Process Industry 4.0 enables users to make management and maintenance processes simpler and more efficient.

These efforts have already paid off through the German Innovation Award 2018 for Industry 4.0 flagship projects.
an impressive Industry 4.0 application for predictive maintenance of measuring points. The implementation of this type of digitalisation project requires skills and expertise spanning different domains, which makes constructive collaboration between industry parties indispensable.

Close collaboration as part of the flagship project also gave rise to a strategically important partnership between SAP and Endress+Hauser, which achieved integration of sensors and algorithms into SAP AIN in order to implement standardised solutions throughout the SAP workflow. After registering the sensor, all relevant information is automatically integrated in the form of a digital twin and kept up to date. Such embedded solutions eliminate the need for many manual and error-prone activities, allowing processes, including the maintenance, to be optimised.

Through these innovative technologies and partnerships, Endress+Hauser is paving the way towards Process Industry 4.0.

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With more and more companies implementing IIoT applications, the demand to connect hundreds or thousands of devices to industrial automation systems has increased dramatically. Moxa's DA-720, a high-performance industrial-grade x86 platform, is ideal for such applications. It is based on the Intel 6th Gen Skylake processor and provides a high density of gigabit-Ethernet and serial ports in a 48 cm2U rack-mountable case, making it an ideal choice for IIoT applications in power substations, railways, factories and building automation systems.

High flexibility for versatile applications
The DA-720 comes with high performance Intel Core i5 or i7 CPU options that allow system designers to install the mSATA, RAM, and operating system according to their application requirements. The computer is also provided with expandable serial and Ethernet interfaces to enable easy connectivity with a multitude of field devices that have various data processing needs.

High reliability to ensure 24/7 operation
Moxa’s DA-720 series rugged fanless computers are designed to operate reliably in harsh industrial environments. They have passed rigorous tests for adherence to safety standards, including continuous exposure to high voltage, power surges and shock.

Easy maintainability to reduce system downtime
Automation computers are often located at unmanned or remote sites. To ensure maximum uptime, the DA-720 supports Moxa’s Proactive Monitoring utility, which provides real-time information about the status of the computer hardware and triggers alerts based on user-defined criteria for predictive maintenance. The Smart Recovery utility allows engineers to automatically trigger OS recovery at remote locations to minimise system downtime.

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The implementation of Industry 4.0 is, among other things, about creating a digital silhouette of a plant, thus allowing for process optimisation. The essential information is provided by many sensors that are often already installed for machine control. Thanks to IO-Link, these sensors provide much more data than mere switching signals or analog values. Starrag Technology (Starrag) in Bielefeld is a company that produces machine tools and extensively equips them with IO-Link sensors from ifm electronic.

The FOGS-series portal machining centre from Starrag is a machine that has these features. It is used in mechanical engineering and in the aviation and automotive industries, for example, to manufacture body shell parts. These complex machine tools require sensors to monitor e.g. coolants and lubricants, hydraulics, and for machine temperature control. Tight tolerances are required for medium temperatures, pressure values and volumetric flow quantities to ensure that tools are used with optimum efficiency in fully automated production processes.

Sensors with a digital interface
IO-Link is a robust digital interface based on 24 V signal levels which, in addition to mere switching signals, enables bidirectional communication with the controller via the regular sensor cable. The sensors transmit digital measured values and diagnostic information via IO-Link to the IO-Link master, such as an IO module, gateway or a PLC equipped with IO-Link ports. Starrag Technology opts for fluid sensors from ifm electronic because of the extensive range of process sensors featuring IO-Link.

One of the greatest advantages of IO-Link is the possibility to transfer all necessary parameter data via the connection cable to the sensor. The parameter data (e.g. switch points, switching hysteresis and display colour) can be transferred from the controller either when the sensors are set up or later during operation, or to adjust them to a specific situation. If necessary, for example in case of small lot sizes, IO-Link makes it possible to store different parameter sets for different products separately, on the same sensor. All in all, one can say that IO-Link is a key technology for Industry 4.0 applications.

Error-free digital transmission of measured values
Up until now, analog sensor signals were digitised via A/D converters and scaled in the PLC, adding to inaccuracies of the actual measured value. IO-Link, however, provides the measured values from the sensor digitally to the controller. Transmission errors and conversion of analog signals are thus ruled out. The digitally transmitted measured values can be directly displayed in the control room. The transferred value is always identical with the measured value. There are no longer any deviations between the local display and the value that the PLC derives from the analog signal. Thanks to IO-Link, even interference with the analog signal, for example caused by electromagnetic fields, is a thing of the past.

Two measured values – one sensor
Modern process sensors from ifm often provide more than just one measured value. Dietmar Wallenstein, e-construction and commissioning department manager at Starrag explains: “Often, a sensor processes more than just one physical value. In addition to volumetric flow quantity or pressure, for example, it is also possible to read the medium temperature via the IO-Link interface. This saves money on hardware, wiring and mounting since, instead of two sensors you now only need one.”

Diagnostic data
Apart from the process data, the IO-Link sensor can also provide diagnostic data about the status of the device. For example: the level sensor detects critical deposits and signals them to the controller. Photoelectric sensors detect if a lens is soiled and signal it automatically. Pressure sensors store minimum pressure losses and maximum pressure peaks from the process and totalise the number of times those limit values are exceeded or not reached. This additional functionality supports the user decisively when it comes to condition-based maintenance as this extended information about condition minimises expensive downtime, while increasing process reliability.

Conclusion
Sensors offer a considerable additional value if they are equipped with IO-Link. Wallenstein summarises the advantages for Starrag: “Everyone is talking about Industry 4.0 and we at Starrag are not ignorant of this megatrend. When it comes to mechanical engineering, we think in particular about digital machine upgrading, which is why we opt for IO-Link. Thanks to low-cost robust interfaces, the sensors provide us with more information about the process that can then be more efficiently evaluated and optimised. This is one of the great advantages of IO-Link; it is a sensor feature contributing to the easy adoption of the principles of Industry 4.0.”

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Cisco IIoT solutions meet the needs of industrial organisations

Technology is constantly evolving, and so are the network infrastructures that support industrial entities.

Networking technologies are abundant in the industrial arena, but the nature of industrial networking deployments is vastly different to networking for consumers or corporates. The requirements from applications on industrial networks are incredibly diverse and can span a variety of industry sectors such as utilities, critical infrastructure, transportation, manufacturing and healthcare.

Technical requirements can vary, from light, to incredibly demanding, and at the same time, deployment scenarios are widely varied. For example, the physical conditions found in a mining operation are different to those found in healthcare. There are a host of operational factors that need to be taken into account, such as whether connected machinery will be static, or moving, such as with robots, or whether it might need configurability, such as found with adaptable manufacturing cells. In addition, the lifecycle of technology in industrial applications tends to be decades, rather than a few years, and has to be kept in mind when formulating an effective technology strategy.

Technology is constantly evolving, and so are the networking infrastructures that support industrial entities. As new technologies come to market, capabilities evolve too, and alongside this, new risks and threats are introduced into the mix. So the question is what can be done to manage and protect these systems?

Manageable secure networks
It is critical for administrators to have control of the systems and networks in industrial environments, and that includes an understanding of each and every device that is communicating within it. Successful IIoT protection strategies need to offer users a manageable, secure network that will let them deploy IoT at a massive scale.

Cisco, realising the need for secure industrial networking and IIoT, has developed a family of solutions that includes switches, software, developer tools and blueprints to combine industrial networking with intent-based networking and IT security. IIoT devices are driving new requirements on industrial control network infrastructure. These entities are dependent on high-speed connections and at the same time, low-latency application response. Industrial organisations require wired and wireless network infrastructure, which is both flexible and scalable, in order to deploy applications from the cloud all the way to the edge.

Cisco IIoT network connectivity solutions bring resilience at scale, combining reliability with simplicity to help industrial organisations quickly scale to meet the expansive networking needs of the IIoT without sacrificing any current infrastructure availability. The solutions also feature integrated security, with a network-as-a-sensor approach, to integrate cyber security throughout the network, vastly boosting visibility and control. Cisco networking solutions also support IT and operational technology standards and protocols, enabling a consistent solution to be deployed across the extended network. Moreover, convergence is at the heart of solution design, as the company understands that industrial entities must have IT and OT networks that can converge and offer seamless connectivity to support current and future business applications.

Platform solutions for all industries
Cisco IIoT network solutions were designed with the needs of industrial organisations in mind, across petrochemical, manufacturing, oil and gas, utilities, transportation, mining, and many other industries.

But it is not all about the technology. Any successful IIoT implementation starts with a good team that includes representatives from the IT, OT, security, production, logistics and finance departments. Finding the right partners is crucial, particularly when it comes to integration. Remember, the vast majority of industrial projects requires a networking partner that can work across the board and truly understands the integration that is required. Axiz has the specific expertise to meet the needs of customers in a slew of industries that are investing in IIoT solutions.

Axiz is about building ecosystems. The company identifies and delivers outcomes that its customers want. It believes in injecting real value and transcending the technology by bringing in complementary vendors and building diverse systems with them. It offers integrated products, software, services and capabilities to provide a wide range of platform services and solutions, which differ vastly from the traditional distribution approach.

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So, what’s left for us humans after the machines take over?

By Kieran Frost, research manager for software focused on sub-Saharan Africa, International Data Corporation.

One of the questions that we at the International Data Corporation are asked is what impact technologies like Artificial Intelligence (AI) will have on jobs. Where are there likely to be job opportunities in the future? Which jobs (or job functions) are most ripe for automation? What sectors are likely to be impacted first? The problem with these questions is that they misunderstand the size of the barriers in the way of system-wide automation. The question isn’t only about what is technically feasible; it is just as much a question of what is legally, ethically, financially and politically possible.

That said, there are some guidelines that can be put in place. An obvious career path exists in being ‘on the other side of the code’, as it were – being the one who writes the code, who trains the machine, who cleans the data. But no serious commentator can leave the discussion there as too many people are simply not able or have no desire to code. Put another way, where do the legal, financial, ethical, political and technical constraints on AI leave the most opportunity?

**AI is getting better but there are constraints**

Firstly, AI (driven by machine learning techniques) is getting better at accomplishing a whole range of things – from recognising (and even creating) images, to processing and communicating natural language, completing forms and automating processes, fighting parking tickets, being better than the best Dota 2 players in the world, and aiding in diagnosing diseases. Machines are exceptionally good at completing tasks in a repeatable manner, given enough data and/or enough training. Adding more tasks or attempting system-wide automation requires more data and more training. This creates two constraints on the ability of machines to perform work:

1. Machine learning requires large amounts of (quality) data.
2. Training machines requires time and effort (and therefore cost).

Let’s look at each of these in turn – and we’ll discuss how other considerations come into play along the way.

Speaking in the broadest possible terms, machines require large amounts of data to be trained to a level to meet or exceed human performance in a given task. This data enables the bot to learn how best to perform that task. Essentially, the data pool determines the output.

However, there are certain job categories which require knowledge of, and then subversion of, the data set – jobs where producing the same ‘best’ outcome would not be optimal. Particularly, these are jobs that are typically referred to as creative pursuits – design, brand, look and feel. To use a simple example: if pre-Apple, we trained a machine to design a computer, we would not have arrived at the iMac, and the look and feel of iOS would not have become the predominant mobile interface.

This is not to say that machines cannot create things. We’ve recently seen several ML-trained machines on the Internet that produce pictures of people (that don’t exist) – that is undoubtedly creation (of a particularly unnerving variety). The same is true of the AI that can produce music. But those models are trained to produce more of what we recognise as good. Because art is no science, a machine would likely have no better chance of producing a masterpiece than a human. And true innovation, in many instances, requires subverting the data set, not conforming to it.

Secondly, and perhaps more importantly, training AI requires time and money. Some actions are simply too expensive to automate. These tasks are either incredibly specialised, and therefore do not have enough data to support the development of a model, or very broad, which would require so much data that it will render the training of the machine economically unviable. There are also other challenges which may arise. At the IDC, we refer to the Scope of AI-Based Automation.
Within this scope:
- A task is the smallest possible unit of work performed on behalf of an activity.
- An activity is a collection of related tasks to be completed to achieve the objective.
- A process is a series of related activities that produce a specific output.
- A system (or an ecosystem) is a set of connected processes.

A practical example of constraints in action
As we move up the stack from task to system, we find different obstacles. Let’s use the medical industry as an example to show how these constraints interact. Medical image interpretation bots – powered by neural networks – exhibit exceptionally high levels of accuracy in interpreting medical images. This is used to inform decisions which are ultimately made by a human – an outcome that is dictated by regulation. Here, even if we removed the regulation, those machines cannot automate the entire process of treating the patient. Activity reminders (such as when a patient should return for a check-up, or reminders to follow a drug schedule) can in part be automated, with ML applications checking patient past adherence patterns, but with ultimate decision-making by a doctor. Diagnosis and treatment are processes that are ultimately still the purview of humans. Doctors are expected to synthesise information from a variety of sources – from image interpretation machines to the patient’s adherence to the drug schedule – in order to deliver a diagnosis. There are ethical, legal and trust reasons that dictate this outcome.

There is also an economic reason. The investment required to train a bot to synthesise all the required data for proper diagnosis and treatment is considerable. On the other end of the spectrum, when a patient’s circumstance requires a largely new, highly specialised or experimental surgery, a bot will unlikely have the data required to be sufficiently trained to perform the operation and even then, it would certainly require human oversight.

The economic point is a particularly important one. To automate the activity in a mine, for example, would require massive investment into what would conceivably be an army of robots. While this may be technically feasible, the costs of such automation likely outweigh the benefits, with replacement costs of robots running into the billions. As such, these jobs are unlikely to disappear in the medium term.

Conclusion
Thus, based on technical feasibility alone, our medium-term jobs market seems to hold opportunity in the following areas: the hyper-specialised (for whom not enough data exists to automate), the jack-of-all-trades (for whom the data set is too large to economically automate), the true creative (who exists to subvert the data set) and finally, those whose job it is to use the data. However, it is not only technical feasibility that we should consider. Too often, the rhetoric would have you believe that the only thing stopping large scale automation is the sophistication of the models we have at our disposal, when in fact financial, regulatory, ethical, legal and political barriers are of equal, if not greater, importance. Understanding the interplay of each of these for a role in a company is the only way to divine the future of that role.

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The swelling middle class in India has created a growing market demand for petroleum products. An oil and gas producer, one of India’s largest petroleum product manufacturers and distributors, with a processing capacity of 6.5 million metric tonne per annum, must keep petroleum products pumping through the plant because any unplanned downtime could cause critical product shortages. A key contributor in the quest to reach zero unplanned downtime is healthy equipment – like pumps – achieved through monitoring and maintenance.

The company’s pipeline supplies the interior areas of India. Seven pumping stations along that pipeline have already used Rockwell Automation systems for several years, with almost no downtime. The goal was to maintain, and even improve, such performance.

**Challenge**

The biggest challenge for this customer is timely distribution and accurate pumping of products 24/7. Any disruption could increase refinery inventory and leave retail units without adequate supply.

To maintain continuous flow, each pumping station uses three pumps: two are at work at all times to maintain line pressure across the pipeline to the next terminal. The remaining pump is on standby, in case one of the others fails.

Oil pump operation is precise. Undetected Oil and gas reduces downtime through plant-wide visibility

“Rockwell Automation helped its customer reduce the risk of critical equipment failure by 20%”
or unreported wear and tear on the pump is not acceptable because even the slightest shift in pump operating parameters can cause damage. An ageing monitoring system, installed years ago, no longer functioned reliably, and there was no ability to communicate with the station PLC to identify and rectify system faults.

**Solution**

To reduce the number of systems it needed to maintain, the customer preferred a single system (and a single system supplier) for their control system, HMI and the machine monitoring system (MMS). Since continuous operation is required, this customer could not shut down the system for a switchover. The company requires seamless integration of this system, including the MMS, with existing systems.

Given the scope and complexity of the requirements, the customer wanted a supplier with proven skills, experience and support, and selected Rockwell Automation for its extensive experience in automation and global support.

With a local office and authorised distributor just five kilometres from the site, Rockwell Automation had the required expertise to manage the requirements of the project, from initial design through engineering, integration and implementation.

Effective solutions for the terminal included seamless integration on a single EtherNet/IP network with the flexibility to configure parameters using the existing graphic user interface. Separate training was not required to ensure the new systems were easily accepted by the operations team.

Rockwell Automation Global Solutions implemented a vibration monitoring solution that:

- Interfaces with existing systems to monitor vibration data of the pumps and alert operators of any abnormal situations.
- Allows operators/engineers to easily set parameters and provides trending, alarming, and exception handling.
- Works with existing equipment, including probes and sensors, by ensuring compatibility.
- Offers the plant manager complete and accurate information in real-time.

The solution is built on:

- Dynamix 1444 Condition Monitoring System using a common control system, ControlLogix L72, with a common development environment to provide high performance in an easy-to-use environment. The system’s tight integration between the programming software, controller, and I/O
modules reduced development time and cost at commissioning and during normal
operation.
• Logix5000 controllers and Add-on
Instructions (AOI) to increase productivity
and make troubleshooting easier.

Results
With this solution and the integration of
various OEM control systems to enable plant-
wide visibility and real-time monitoring,
Rockwell Automation helped its customer
reduce the risk of critical equipment failure.

At the same time, the solution improved the
ability of operators to monitor conditions and
immediately address concerns before problems
turn into downtime. The solution ensures that
any abnormalities in the process conditions
and deviation from the standard operating
parameters are immediately highlighted to
avoid problems and improve reliability.

As a result of implementing the Rockwell
Automation vibration monitoring system,
the customer reduced the risk of downtime
by 20%, and also reduced its dependency on
multiple vendors. The flexible graphic user
interface helped reduce operator training
time and expense. The next iteration of the
solution could include the ability to create
real-time dashboards for production and
utility data.

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SHEQ document reporting in real-time

While the manual compilation of a Safety,
Health, Environment and Quality (SHEQ)
documentation report can take up to 20 man
hours, Passport 360 can potentially slash this to
an astonishing three minutes.

This is thanks to the system’s built-in
Robotic Process Automation (RPA), which
allows for custom documentation to be
compiled fast. “It provides for a greater level
of real-time intelligence and insight into
SHEQ,” comments Passport 360 director and
co-founder, Siobahn Whitehead.

In addition, the dashboard view
feature consolidates all contractor SHEQ
documentation into a high-level dashboard
for real-time access of all data, which can then
easily be managed and interpreted accordingly.

This is an ungainly process in the case of paper-
based systems because these are very difficult
to audit and monitor in real-time.

Without consistent monitoring and review,
SHEQ information quickly becomes outdated,
thereby ramping up the risk considerably.
Digitising these records and then applying
Passport 360’s built-in RPA allows mining
operations, for example, to better pursue the
industry’s ultimate goal of zero harm.

“This also has significant implications for
clients in terms of transparency and security,”
highlights Whitehead, “as the Passport 360
platform allows contractors to access client
systems and information without any holdups
through internal bureaucracy.”

Passport 360 is well equipped to partner
with mining and resource companies in order
to on-board their contractors quickly and
efficiently, thereby ensuring that they can be
up and running in hardly any time at all.

“Our smart technology has a range of
significant benefits for our mining clients, from
real-time SHEQ monitoring and reporting to
advanced on-boarding features,” concludes
Whitehead. “It allows us to provide our mining
clients with a complete solution that slashes
their risk, allowing them to focus on the
profitability of their core business.”

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How the food and beverage industry could benefit from blockchain

Advances in blockchain technology could enable the food and beverage industry (F&B) to enhance traceability. In the US alone, food recalls and food-borne illnesses cost some $77 billion per annum, including discarded products, loss of revenue, damage to corporate reputations and healthcare costs. Better traceability could significantly reduce these.

“Blockchain comes into its own when the data needs to be highly secure, or if smart contracts are to be managed,” says Marc Ramsay, VP Industry Business Unit, Schneider Electric South Africa. “If an F&B manufacturer is handing off a finished product to a logistics company, which then delivers it to a retailer that stores it within a cold storage facility, the F&B stakeholders want to make sure that the logistics company does not damage the product and that it gets to its destination on time.

“Blockchain technology gives F&B organisations the ability to be much more precise in how they track their goods, and could simplify the execution (invoice/payment) of supply contracts. When an issue occurs, they can be more accurate about what needs to be removed and what can be kept in the food distribution pipeline.

“Verifications could all be dealt with within blockchain through smart contracts. At the IIoT level, sensors could be placed on transportation devices, such as pallets and packages, allowing variables like temperature and vibration levels to be monitored and the data stored in the blockchain.

“Stakeholders would then have real-time visibility into the stipulations of that contract and whether or not any of the agreed rules had been breached. This powerful tool provides traceability, security, transparency and real-time access to contracts that affect the upstream and downstream supply chain.”

Blockchain process unpacked

In a blockchain process, networks of computers use consensus mechanisms and cryptography to allow each participant on the network (or along the supply chain) to update a distributed ledger in a highly secure manner, without a central authority. (For a hacker to breach one of the blocks in the chain would be difficult; to breach all the links at the same time would be nearly impossible.)

In a private blockchain, this can be complemented by access rights rules, defined by each participant of the blockchain based solution, making it difficult to access the ledger data without the proper access rights. Moreover, some blockchain technologies have ‘smart contracts’ capability, which allows defined rules to be executed on the data in a secure way.

As a result, the level of trust built into such a system is high. When working within a trusted system, the time and cost associated with lengthy back and forth business processes is reduced. The ability to track movements across the various stages of a product lifecycle become much more acute, thereby improving the efficiency of the entire supply chain, i.e. defective products can be quickly traced and loss of revenue or damage to reputation limited.

More work to be done

“Although the use of blockchain in this type of application is still in the experimental and pilot stages, Schneider Electric is prototyping new ways to leverage its expertise in plant automation and process control to build and develop solutions that improve traceability across product life cycles,” concludes Ramsay. “By partnering with blockchain technology specialists, such as Microsoft and IBM, we are assessing its contribution to the development of blockchain-based solutions that will support a multitude of key manufacturing and process industry requirements.”

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MiX Telematics supplies fleet management solution

MiX Telematics, a leading global provider of fleet and mobile asset management solutions, has announced that its channel partner in East Africa, A&S Electronics, has been awarded a tender to supply a water services provider in Uganda with a comprehensive fleet management solution.

This customer operates an extensive fleet to fulfil its mandate of providing water for use in agriculture, rural industries and tourism, among others. It also coordinates the national development of water resources and provides effective planning and management for the water and sanitation sectors.

“The data provided by our telematics solution enables this service provider to optimise the utilisation of its fleet, manage drivers, reduce costs, and increase productivity,” says Gert Pretorius, managing director of MiX Telematics Africa. “The benefits derived from effective mobile asset management are tangible, and provide improvements which are sustainable.

“Our premium fleet solution provides real-time insight, allowing the fleet manager to make informed decisions with the aim of improving productivity and reducing operational expenses. This online platform processes data from multiple assets, creating customisable reports, graphs and dashboards that provide actionable intelligence.”

Given today’s demands, fleet management is essential for utility companies that undertake the critical task of delivering natural resources to consumers. MiX Telematics partners with various companies in the service and utility industry around the world in order to help them adhere to ever-changing government and customer compliance demands.

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As manufacturers accelerate digital transformation and workforce evolution, Emerson has unveiled significant enhancements to its Plantweb digital ecosystem, a comprehensive Industrial IoT automation platform.

“Manufacturing jobs are rapidly becoming data-centric roles, requiring immediately actionable information for experts across the enterprise,” said Peter Zornio, chief technology officer for Emerson Automation Solutions. “Through a deep understanding of customers’ vision for organisational effectiveness and business performance improvement, Emerson is innovating breakthrough products and services to accelerate that organisational transformation.”

Identify clear business objectives
A 2017 Industry Week survey of manufacturing leaders revealed more than 60 percent of those surveyed indicated active pilot projects in IIoT, but only five percent identified clear business objectives at the heart of their programmes. Of the 205 industry executive respondents, 34 percent stated that lack of clear technology strategy was a barrier while 61 percent confirmed that a scalable approach to investment is preferred.

“A clear message from the industry is that a one-size-fits-all, vendor-prescribed IIoT approach won’t work,” continued Zornio. “They want to identify specific business challenges, target technology to improve performance and then scale up their investment based on results achieved. That is why we have architected Plantweb to enable companies to get started where they can gain the greatest near-term impact.”

Plantweb offers scalable solutions
Built on the foundation of best-in-class process control and safety systems, Plantweb expands on existing automation infrastructure to make the promise of IIoT scalable and achievable, with a broad portfolio of pervasive sensing technologies, an extensive suite of analytical software tools, secure and robust data infrastructure devices and expert services.

During the 2017 Emerson Global Users Exchange event in Minneapolis, Emerson introduced extensive enhancements to the Plantweb digital ecosystem portfolio, including:

• Pervasive Sensing: Emerson’s Pervasive Sensing is the foundation of the Plantweb digital ecosystem, providing enhanced visibility into process performance and asset health, so experts have the information needed to drive operational improvements.
• Secure First Mile: As global adoption of the IIoT increases demand for robust cybersecurity strategies, Emerson’s Secure First Mile provides secure transfer of actionable data from OT systems to authorised Internet-based applications, services or mobile users.
• Plantweb Insight: Emerson’s Plantweb Insight is a scalable and lightweight, web-based software platform that helps users make sense of plant data by leveraging sensing technologies and prebuilt analytics to provide relevant-time monitoring and identification of abnormal situations for specific asset classes.
• Plantweb Advisor: Emerson’s Plantweb Advisor is a scalable set of software applications that utilise deeper analytics to provide reliability and energy specialists with critical information about equipment health and efficiency as well as energy consumption and emissions.
• Always Aware: Formerly known as Always Mobile, Emerson’s new Always Aware suite of solutions builds on previous mobility capabilities, expanding them to focus on delivering role-based, relevant-time information and alerts to plant personnel, regardless of locations, enabling more effective collaboration and driving actions to improve asset and process performance.
• Services: Emerson is expanding its role as a trusted industry partner with consulting and service offerings that complement its leading portfolio of automation and IIoT-based technologies.

To help customers understand the impact these new technologies can have on personnel productivity and organisational effectiveness, Emerson brought the next-generation digital workforce to life with the ‘Digital Workforce Experience’ during Emerson Exchange. The immersive, role-based simulation demonstrated first-hand how various manufacturing roles are evolving and the impact they have on business performance.

“The industry’s technology evolution over the past 30 years has delivered tremendous improvements in efficiency,” Zornio said. “Now it’s time to fuel the next-generation workforce with the actionable insights they need to become even more strategic assets in their companies.”

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The powerful Festo modular control system CPX-E

Designed as an EtherCAT master and motion controller with protection to IP20, the powerful automation system CPX-E for factory and process automation with NE21-specific certifications is becoming the central control system for handling technology. Several bus modules are available for the configuration as a compact and low-cost remote I/O.

Powerful control
In addition to comprehensive PLC functions, right up to multiple axis applications with interpolation, the CPX-E can easily be integrated into existing host systems. This is made possible by the EtherCAT master interface, the integrated Profinet device interface as well as the EtherNet/IP slave interface. The OPC UA client and server functions ensure easy integration and interoperability in Industry 4.0 host environments with cloud and digitalisation concepts.

Complete solution for many applications
The CPX-E features specific software functions tailored for products and solution packages from Festo, for example:

- Handling technology parts such as parts handling, assembly systems and palletising.
- Complete automation which includes packaging machines (flow wrappers), palletising systems, selective soldering systems and wafer handling systems.
- Automation system for factory and process automation system advantages
  - Standardised Codesys programming interface.
  - CPX-E provides a complete answer to customer tasks, whether universal or Festo system solutions.
  - Significantly reduced engineering workload: integrated data management in combination with the Automation Suite software.
  - Extended Software functions for seamless integration and easy actuation of electric drives from Festo.
  - Standardised, integrated platform for consistent combination of servo and stepper motor technology. Ideal for smooth mixed operation and an identical appearance for the customer interface.
  - All motion control functions are embedded into the controller.
  - High I/O component density.

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New KUNBUS range includes Raspberry Pi-based solutions for IIoT markets

The KUNBUS range of products includes 14 new lines including industrial computers, PLCs and data acquisition and human-machine interface (HMI) devices. A key series from KUNBUS is the Revolution Pi series of open-source and modular industrial PCs, based on the well-established Raspberry Pi platform.

This innovative and reliable modular system, which meets the EN61131-2 international standard for PLCs, offers a series of central processing units including the RevPi Connect, RevPi Core and RevPi Core 3. Installed in DIN-rail housings, all the products come with USB, Ethernet and HDMI connections and are based around the Raspberry Pi Compute module, making them highly compatible with the Raspberry Pi model 3 or Raspberry Pi B+. Depending on application requirements, these base modules can be expanded seamlessly using the appropriate digital or analogue I/O modules, as well as fieldbus gateways to connect them to an industrial network.

For example, due to its open platform concept, the RevPi Connect gateway provides users with maximum freedom when implementing IIoT projects, including full root rights. Implemented as a DIN-rail PC, or purely as a small control unit, the system uses a specially modified version of the Raspberry operating system with a real-time patch, as well as supporting common IIoT protocols such as MQTT and OPC UA. Individual applications can be programmed using a range of languages including Node-RED, Python, or directly in C.

For more information contact RS Components SA, +27 11 691 9300, sales.za@rs-components.com, www.rsonline.co.za
Bridging the gap to the Industrial Internet of Things

The Adroit Enterprise IIoT platform is a customisable software platform that enables users to deploy and integrate cloud-based sensor data with normal telemetry data using protocols such as MQTT, Sigfox and OPC UA, for monitoring and control purposes. The platform was created to make it easy for users to build their own monitoring and control applications. The data can be visualised, alarmed and put into databases for real-time operations or reporting purposes. It can also be used as an Edge device, where data can be pre-processed and only smart data sent to the cloud, to take advantage of other cloud-based Big Data services such as reporting, AI, machine learning etc.

When combined, the new Adroit Air App, the Adroit Performance Anywhere web client and the Secure Mobile Gateway allow mobility and boost responsive design technology, which allows access from desktop or mobile devices.

The unique selling feature is the speed with which users can build their own solutions. The Adroit IIoT Platform is ideally suited to markets such as remote asset management, smart cities, utilities and power, or any machines monitoring applications.

For more information contact Dave Wibberley, Adroit Technologies, +27 11 658 8100, info@adroit.co.za, www.adroit.co.za

Powerful multicode reader: as simple as a sensor

The new multicode reader from ifm electronic impresses with its 4 x higher resolution for reliable reading results, 10 x faster evaluation time and 10 x faster set-up.

Teach button: one of the sensor’s highlights is the simple teaching via one button. After pressing the teach button, the user aligns the multicode reader to the code by means of a laser marking. Focusing, exposure setting and detection of the code type are automatically carried out by the sensor. A few seconds later, the sensor is ready for use.

Configuration via smartphone app: a smartphone app (iOS, Android) is available for basic configuration of the device. The user can e.g. use it to define the trigger or IP address. Based on these settings, a Data Matrix code is generated on the smartphone’s display. When this code is held into the multicode reader’s field of view, the configuration is automatically adopted.

Vision assistant: the multicode reader can be extensively configured using the Vision Assistant software. For example, the auto-find code function detects several different codes in one image. The user can easily assign these codes in the Vision Assistant. Thanks to different logic functions, the sensor can be programmed for sequential control, eliminating the need for an expensive evaluation unit. The live image and extensive visualisation of all settings provide an optimum overview.

Ifm mass storage device: the instrument has an exchangeable mass storage device. It can be used to save or load complete configurations of the multicode reader. This simplifies device replacement and the set-up of several units for the same application.

For more information contact ifm – South Africa, +27 12 450 0400, info.za@ifm.com, www.ifm.com

Sensirion’s latest humidity and temperature sensor

The new sensor builds upon Sensirion’s SHT3x series, which offers industry-proven CMOSens Technology that for more than 10 years has delivered highly accurate units with long-term stability. Adding to these capabilities, the SHT85 comes with a pin-type connector, which enables easy integration and replacement, and offers excellent thermal coupling to its surrounding environment as well as decoupling from potential heat sources on the main processing board.

Able to operate in harsh environmental conditions, the SHT85 also features a PTFE membrane that meets the IP67 rating. Designed to protect the sensor opening from water and dust, use of the membrane means the response time of the relative humidity (RH) signal is not affected.

Offering a fully calibrated, linearised and temperature-compensated digital output, other key features of the SHT85 include: final product level testing to deliver a typical accuracy of 1,5% (RH) and 0,1°C; an I2C interface with communication speeds up to 1 MHz; fast start-up and measurement time; low signal noise; and an operating voltage from 2,15-5,5 VDC.

For more information contact RS Components SA, +27 11 691 9300, sales.za@rs-components.com, www.rsonline.co.za
Big Data enabled by Omniflex IIoT solutions

Omniflex specialises in ‘out-of-the-box’ remote monitoring solutions based on years of industrial plant networking experience, from last mile connection to mainstream Ethernet backbones. The Teleterm range specifically addresses the remote outstation issue by providing a programmable platform of IEC61131 languages, for control and networking options from low grade cable to radio and GSM infrastructure. Wireless distributed PLCs with inherent data acquisition capability are an attractive proposition against cable-based systems.

HMI systems can link easily with SQL databases, Use MQTT and OPC UA to integrate into larger MES system with links to big data. Visualisation can be wireless also, through the use of WiFi and a tablet for a portable operator interface or management tool linking into the system without having to use fixed desktop computers. Remote site visualisation is achieved the same way, using a tablet and remote Teleterm devices and local routers integrating via the Internet.

What to look for in an IIoT solution

1. Security from hackers.
2. Interoperability with existing solutions.
3. Scalability: add to the solution easily.
4. Precision and accuracy: industrial grade measurements.
5. Programmability: process local data at front end.
6. Low latency response to system changes.
7. Reliability: industrially hardened products for harsh conditions.
9. Automation: function as a connected automation block, not just data acquisition.
10. Serviceability: plug-and-play replacement, service and support.

Features of the Omniflex solution

Wireless capabilities: licence free band radio RTUs and wireless PLCs; WiFi and HMI solutions; GSM IIoT RTUs and PLC units; repeater solutions; Internet-based monitoring; and email, SMS and data transmission.

Telterm Features: flexible mixed configurable I/O (analog and digital); Ethernet and wireless ports; programmable serial port; local logging on SD cards; DIN rail mounting: 9-30 VDC powered; and digital); Ethernet and wireless mixed configurable I/O (analog and digital); Ethernet and wireless.

Big data connectivity: MQTT capable; SQL database compatible; OPC UA compatible; and REST API interface.

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Open-source cloud IoT in a box

biTid has galvanised the IoT software sector by bringing to market a scalable, open-source IoT cloud platform, developed in South Africa. The platform source code is freely available for download from github and the company strives to keep up with the latest technologies, currently using node.js, angular, mongoDB and Kubernetes, all running on Linux.

Equipped with this platform, biTid offers its services as an out-sourced model based on customised service level agreements, as it becomes your trusted IoT advisor.

Cloud platform features

The architecture allows every aspect to be accessible via well documented Restful APIs, allowing for seamless integration. Data, reports, mimics and alert profiles are shared between users and apps via the OAUTH2 standard. All aspects of the platform make use of this sharing model and APIs are granted access. Firewalling and end to end encryption are also implemented.

The open-source platform provides dashboarding, web-based and traditional scada, Mapping (including geofencing), and Android and iOS Apps. Data is presented live on the web via webSockets, eliminating the need for continuous page refreshing. It integrates seamlessly into Google Big Query and Google Sheets, which have AI and machine learning capabilities. A reporting app allows users to easily wrap these data sources into your own branded interface.

Alerts and device management

Alerts are received via push notification to a smartphone app. The alerting module integrates with Slack.com allowing for easy management of alerting groups.

Being hardware agnostic, a variety of functionality has been implemented using Sigfox, LoRa, RF and GSM technologies. The Device Management app monitors hardware health, and manages scaling and naming of I/O, while the Genus app manages IoT installations using GPS coordinates and date stamp to locate devices.

Other features include:
- No licensing fees.
- White label platform and apps to promote your brand.
- Host on any cloud provider such as AWS, Google or on premise.
- One programming language – javascript.
- biTid undertakes to integrate legacy hardware/sensors into the platform at no cost.

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PoolSense: set to change the face of pool maintenance forever

The automatic pool cleaner changed the face of pool cleaning forever, but maintaining the quality of the water has remained a difficult and expensive task. PoolSense is about to change this. An unobtrusive device that floats in the pool and regularly samples and transmits the quality of the water now delivers simple dosing instructions to an app running on the user’s smartphone. It is a simple and effective solution to an age-old problem, designed to save pool owners both time and money.

The technology

The PoolSense device continuously measures temperature, pH and oxidation reduction potential (ORP), and regularly transmits this data to the cloud. From there, the data is continuously run through a self-learning algorithm that effectively understands how each pool responds to the addition of chemicals as requested by the app. This allows continuous refinement of the decisions around just how much acid and chlorine must be added to keep water condition optimal at all times.

Dave Wibberley, managing director of Adroit Technologies and a founding member of PoolSensse designer Pro Automation, explains: “The Internet of Things, combined with low power networks like Sigfox, has enabled this development. We could finally get to a price point that makes a device like PoolSense affordable to everyone who owns a pool. In the future, it will not be a ‘nice to have’ device for techies, but we believe every pool owner will have one. It pays for itself through the cost saving on chemicals, and takes away the hassle of manual measurements and the guesswork associated with the quantity of each chemical that must be added to maintain a perfect pool all year round.”

Pro Automation technical lead Heinrich Heesen adds: “The IoT and cloud computing allowed us to tackle the problem on a large scale and develop a better understanding of the chemistry and performance required for a cost-effective solution. A system like this requires a multi-disciplinary approach and the efficiency of the Sigfox network allowed us to add a global communication capability and still meet the design criteria for a 2-year (minimum) operating life for this innovative new instrument.”

The product has won accolades from the Innovation Hub and also made the finals of the 2018 MTN IoT Awards, which take place in September. For further reading please go to https://www.dataweek.co.za/62170n

Using IS phones or tablets for barcode scanning

Extech Safety Systems worked with Mobexx in the UK to develop the mobXscan mobile application for barcode scanning with mobile devices. The application (https://mobxscan.com) has been released for Windows 10 and Android offering 100 ms scanning times.

Barcode scanner: mobXscan adds the capability of barcode scanning to any Windows 10 tablet PC or Android device and uses the built-in camera to scan and capture the barcode. Easy to use, the interface makes it simple to add barcode reading functionality.

Easy integration: mobXscan is designed to be as easy to use as possible. Simply open the app and press the scan button to read the barcode and enter it into the device. Alternatively send a simple command from the application to trigger mobXscan.

Clever design: mobXscan makes the use of barcodes easy, but also powerful. It is fully compliant with Microsoft Windows 10 and Android 5.0 and above, but offers some clever features to make it really easy to add to the application, and really simple for the operator to use – the easier to use, the easier operators will accept a new process.

For almost 30 years, South Africa-based Extech has been providing instrumentation, especially intrinsic safety, for hazardous area operations in southern Africa. In recent years, it has signed with several leading communications companies with the view to offer a comprehensive solution for IoT/Industry 4.0 in hazardous areas.

“MobXscan opens up true 100 ms barcode scanning at a fraction of the cost of traditional IS barcode scanners,” explains Extech sales director, Gary Friend. “Extech can offer the AEGEx Windows 10 tablet and/or i.safe Mobile smartphone (IS520.1) or tablet (IS910.1) to allow this application to be used in all hazardous areas.”

As sole agents for MTL, Beka Associates, Extronics, MercuryHMI and authorised reseller for AEGEx, CorDEX, i.safe MOBILE and XPlore Technologies in southern Africa, listed are some of the areas where Extech Safety Systems can assist: IS zener barriers and galvanic isolators; HART interfaces; fieldbus; industrial Ethernet; industrial security; industrial wireless networks; visualisation; displays, indicators, sirens, beacons and lamps; iSafe and flameproof cameras (incl. infrared); rugged IS smartphones and tablets (Android and Windows); hazardous area Exd access points for zone 1; hazardous area CCTV cameras for Group I and II; hazardous area barcode scanners; RFID tracking; surge protection; process alarm equipment; and hazardous area access control systems.

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