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Industrial Wireless Worries
Security and Standards Delay Adoption and User Affinity
BY IAN VERHAPPEN

Better-Connected Networks
Manufacturing Improves Performance Characteristics for Terminal Blocks, Connectors and Wire

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STOP ME IF YOU’VE HEARD THIS hallucination before. Oops, too late. It used to be that when I interviewed folks for a half dozen different articles, they would generally talk about different things. Motor experts would talk about motors and drives. Controls engineers would talk about PLCs. Software sources would talk about programming. Salespeople and CEOs would talk about nothing, I mean, excitement and synergy.

Freaky Integration

Sure, there was some talk about porous borders between the usual technological silos, breaking down a few barriers, and some topical overlap as a result. Still, most subjects retained their basic shape, and remained mostly distinct from each other. Not anymore.

The amount of technical overlap of control and automation topics is getting to the point where there is only overlap and little else. Each topic fits sloppily or neatly on top of the others like a stack of blasted pancakes!

In the past few weeks, for example, I’ve interviewed several dozen sources on network security, green and sustainable technology, recorders and data acquisition (DAQ) systems, motor technologies, machine safety, network integration and several others. However, as I asked my questions, I noticed that most of the people I interviewed were going off on tangents and speaking about the other topics I was covering, and not the one that I planned to discuss with them. Now, some asides and departures are normal in most interviews, but the sheer ratio was huge, and it’s become increasing lately. Amazingly, almost everyone I was talking to was speaking about every other story except the one I asked about.

It’s sort of like every control and automation story is merging into one big story. It’s been surreal and unnerving, but it also can be pretty annoying when you’re trying to report and write several different stories.

This latest experience also is a lot like my previous efforts to cover industrial computers, which now seem able to take on any form and almost any function. It also was similar to researching recorders and DAQ systems, whose data gathering, archiving and analyzing functions seem able to be done by almost any data processing module or chip. The question is: If anything can do these jobs, then how do I define them and make them distinct enough to write about them?

This time around, it seems like everyone is joining in the integration square dance. The security folks talk about safety, while the safety experts talk security. Several green sources describe the need for motor efficiency and the need to use variable speed drives (VSDs) to aid sustainability efforts. Meanwhile, the motors guys show how more pervasive networking and intelligence can improve efficiency beyond individual motors. Get the idea?

The only common thread was networking. Of course, everybody and their brothers are using Ethernet in some way, but even the networking folks can’t quite stay on topic. Just check out this issue’s “Search for a Single Spine” cover story (p10). They begin talking about fieldbuses, cables and wireless, but they too lapse into something else, such as I/O points, sensors and even motors and drives. From where I’m sitting, it’s like everybody is looking over everyone else’s shoulder, and they’re doing it all at the same time.

I suppose this should come as no surprise. Now that many networking translation functions are being handled by switches, gateways, programming and other devices both hard and soft, process engineers, system integrators, machine builders and end users can get back to the applications in which they’re truly interested.

Consequently, as spooky as it can be to watch formerly separate topics mash together, it’s actually good news for control and automation engineers, if they can overcome a little more technological and organizational upheaval. And given the number of engineers using tablet PCs, overachieving handhelds, Blackberry devices and cell phones on or near plant floors, it seems most won’t have much trouble adapting.

So, are there any new lessons here? Just more of the same—get ready for ongoing job description changes. Added exploration and education in new technologies won’t be a novelty or a hobby. Looking over other technical shoulders will be a core and expected necessity as networks continue to merge with their applications and users. I just hope I don’t run out of stories to write.

Jim Montague
Executive Editor
jmontague@putman.net
Three Variants Dominate Industrial Ethernet

ETHERNET/IP, PROFINET AND MODBUS TCP/IP comprise 80% of most used industrial Ethernet variants worldwide, according to a study from IMS Research (www imsresearch.com). EtherNet/IP accounts for 30% of market share, while Profinet has 28% and Modbus commands 22%, according to “The World Market for Industrial Ethernet—2009 Edition.”

Ethernet-Powerlink and EtherCat are estimated to have market shares of 11% and 4%, respectively. Among the top three, Profinet is forecasted to grow the most between 2008 and 2013, with an estimated increase of almost 9%. EtherNet/IP’s growth over the same period will be slightly more than 7%, and Modbus TCP/IP is expected to decline by 0.4%, according to IMS Research.

Europe Eyes Enhanced DCS, SCADA

IN RESPONSE TO RISING RAW MATERIAL COSTS AND INCREASED COMPETITION FROM low-cost manufacturing regions such as China, European manufacturers are paying greater attention to operational efficiency. As a result, providers of supervisory control and data acquisition (SCADA) and distributed control system (DCS) solutions are likely to see greater opportunities since these systems are crucial in achieving production synergies and eliminating costs in the manufacturing process, according to research from Frost & Sullivan (automation.frost.com).

An added factor aiding the uptake of SCADA and DCS systems is the enhanced value proposition derived from new product developments, the report indicated. Advances on the DCS front have seen the development focus widen from traditional process control to an extended range of applications such as production management, safety instrumented systems, information management and documentation, all handled in one single system. Likewise, advances in SCADA technologies have ensured improved IT compatibility along with the capability to support higher-level business systems such as manufacturing execution systems (MES) and enterprise resource planning (ERP).

As a result of these product advancements, differentiation between SCADA and DCS systems has blurred, and this also has changed the degree to which these systems compete against each other, noted Jonas Westlund, industry analyst at Frost & Sullivan. Further, with a growing share of the revenues being generated from system upgrades and retrofits, the general reluctance of end users to switch suppliers is restraining competition.

The report predicted the European SCADA and DCS markets across major end-user sectors such as oil and gas, pharmaceuticals, food and beverage, chemicals, power generation and pulp and paper could generate a revenue growth of $691 million between 2005 and 2011. With a projected increase of 37%, the food and beverage sector is likely to show the highest growth rate, and the power generation sector is poised to lead the growth in monetary terms, exceeding $300 million for growth of 28%, according to Frost’s research. Individually, SCADA system growth is likely to be $188 million, compared to DCS growth of $503 million.

“While future growth trends between SCADA and DCS do not show any significant changes, the lack of new system opportunities is expected to have a significant impact on future growth patterns,” said Westlund. “This is reflected by the expansion of the retrofit market, projected to generate growth of $476 million by 2011, as compared to new system growth of just $214 million over the same time period.”
Number of Security Incidents Continues to Increase


The analysis was conducted to determine where and when the 175 confirmed incidents have occurred. A significant shift has been observed in the incident rates by industry over the past five years. RISI has observed an overall decline in the incident rate in the petroleum and chemical industries (more than 80%), but an increase in the incident rate in the water/wastewater (more than 300%) and the power/utilities industries (30%).

Despite a decline in recent years, the vast majority of control system cybersecurity incidents (almost 50%) reported by RISI have been caused by malware, including viruses, worms and trojans.

However, incidents involving unauthorized access or sabotage perpetrated by internal sources, such as a disgruntled former employee or an independent contractor who uses inside knowledge or access privileges to cause disruption or harm to the company, are up considerably in the same time-period comparison. Also on the rise are incidents where network anomalies induced failures in control system equipment.

According to the RISI database, incidents were rare in the 1980s and into the late ’90s, until the number of annual incidents climbed from two to eight over the span of 1996-2001.

The number skyrocketed to 30 in 2003, and then the number of recorded incidents gradually declined back to seven in ’07 before climbing to 10 in ’08 and then jumping to 18 in ’09.

“The spike around 2003 was primarily due to two major malware attacks in that timeframe that made their ways into industrial control systems,” explained John Cusimano, managing director at Security Incidents Organization. “The Slammer worm was particularly successful in infiltrating control systems, as it was built on Microsoft SQL, which is used in process historians as well as other database-driven applications. Also prevalent in that timeframe was the Sobig worm/trojan.”

The primary cause attributed to the decline of recorded incidents in the mid-2000s was a lull in tracking during a transition in ownership of the database, said Cusimano.

Prior to 2006, the database was operated by a university as a research project and then went idle for a few years before transitioning to private ownership and then to not-for-profit Security Incidents, where it is today, explained Cusimano.

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INTEGRATING CONTROLS, POWER, SECURITY, ENVIRONMENTAL AND ENTERPRISE SYSTEMS IS A PAIN. SOME NETWORK DESIGNERS ARE PURSUING A SINGLE BACKBONE APPROACH

IT’S NOT THE HOLY GRAIL, BUT IT’S CLOSE. EVER SINCE CONTROL and automation engineers began to move away from point-to-point, 4–20 mA hardwiring and toward twisted-pair fieldbuses, Ethernet and wireless, they’ve been approaching the means to create the one network that can do it all. This is logical because if you had to implement multiple separate networks for controls and automation, power, safety, physical security, administration and enterprise and other special functions, you’d no doubt prefer—if you had the chance—to install one network infrastructure that could handle all these jobs.

UNIFIED NETWORK FROM SCRATCH

Besides saving power and costs, the real benefit of a truly combined industrial network is that it can improve plant-floor control and help users run their applications more productively. For instance, pre-packaged food manufacturer CS Vacuum in Milan, Italy, recently needed a new control system that could bring together its modular production line for cooking, dosing, vacuum sealing, pasteurizing, storing and dispatching its meals and enable these steps and its operators to cooperate efficiently. The company reports that its old controller was inefficient because the line’s individual production plants didn’t have a network to communicate with each other. CS Vacuum also needed a two-part integrated system for controlling the production line and its complex air-conditioning system. The system also had to be as automated as possible to allow CS Vacuum’s operators to focus more time and effort on recipe preparation.

CS Vacuum sought assistance from system integrator Apollo Solutions (www.apollosolutions.it) in Pessano con Bornago, Italy, and its controls division, Saguaro Sistemi (www.saguarosistemi.it). To provide the controls and cooperative network that CS Vacuum needed, Apollo Solutions decided to implement a PC-based control system built around an embedded PC, panel PCs and other equipment from Beckhoff Automation.

“One superior, centralized control system is the best way to make all components play as an orchestra with excellent performance and reduced power consumption. Using standard communication lines such as LAN, CAN, Modbus and others permits the interconnection of several subsystems and lets us better manage subcomponents on the same machine,” says Marco Brunazzi, Saguaro Sistemi’s development engineer. “We also use advanced algorithms as the ideal way to make machines work in the best way possible, such that only the components that are needed are used at specified times and always at the top of the curve.”

In essence, the embedded PC controls the scales, cooking pot and the fryer via Modbus, as well as controlling the oven via Profibus. Another unit archives the resulting data, not only for a possible subsequent inspection by local health authorities, but also to verify production performance and efficiency. Also, production is controlled via the local server. Once a particular day’s program/recipe—such as spicy chicken—is entered, the specified program is adopted automatically by all plant modules, including the cooking pot, scales, oven, vacuum device, packaging and labeling machine and discharge conveyor (Figure 1).

The panel PCs, which are used for production preparation, are equipped with touchscreens and communicate wirelessly with a local access point. These touchscreen panels are mounted along the entire production line and allow CS Vacuum’s operators to monitor each production phase and make corrective interventions as needed.

Meanwhile, the second part of its integrated network controls the production process and the facility’s specialized air-conditioning system, which includes four air-treatment units, six fans, two cooling units, water heaters, pumps, overheat switches for the automatic or manual pumps and de-icers for the cold rooms. All consumers in the air-conditioning system are connected to an additional embedded computer.

“Because less consumption means a lower impact, our integrated system manages the various machines in the plant, making all of them work at the highest performance, wasting the least energy possible, all while delivering positive economic returns,” explains Brunazzi. “A first-class control system and network allows users to check machine status in real time, including the energy consumption, and view warnings when this consumption rises too much or too fast. This permits the reduction of overall power consumption and cuts energy use, especially in areas that are noncritical in that moment of the production cycle.”

Following the renovation and relaunch, CS Vacuum’s entire production cycle now is subjected to continuous checking. As requested and designed, the cooking and vacuum-sealing production line’s higher-level automation optimizes product quality and reduces demands on staff. Finally, Apollo Solutions also added power generation, building control, order management and traceability of production to CS Vacuum’s
integrated system. "We were able to implement the solution we developed without changing the basic principles stipulated by the plant designers," adds Brunazzi. "We see this as a big advantage alongside the impressive price-to-performance ratio. Also, the ease of operation of the system control, which only requires basic knowledge of the Microsoft Windows environment, also met with a positive response from our customer."

COMBINING NETWORKS 101
This emerging desire to unify networks begins with the basic need to get a job done fast and hopefully with less labor, materials and after-care than last time. "We recently worked on a power-monitoring project at a large Midwest airport, and we started with about 80 old Square D, Cutler-Hammer and GE power meters," says Brian Beaufeaux, PE, senior electrical controls engineer and co-owner of Industrial Automation Engineering (IAE, www.iae-online.com), a CSIA-certified system integrator in Ham Lake, Minnesota. "Some used Modbus, so we added protocol converters for Modbus or whatever proprietary protocols they used. These converters get meter data onto Ethernet, and we then put in an Ethernet backbone that allows meter data to be unwrapped at the end. This let all the meters send back data, log it into an historian and then help administrators analyze demand peaks and billing information and also schedule maintenance. On the other end, the plan is to tie in the HVAC system and lights and relate them to an SQL database."

Beaufeaux explains that the Cutler-Hammer power meters at the airport use Eaton's Eponi converters to translate its proprietary protocol to EtherNet/IP. The data is then secured by a Kepware data collection server and put into an historian like Wonderware’s SCADA software or an SQL database. In addition, this data can go to a secure website where users can employ Secured Reports System (SRS) and Microsoft’s SharePoint software to mine it and analyze it. "There are a lot of real savings here, but first we need the right pieces of information, and then they can go into a report to the finance department. For example, power-meter data could be used to run what-if scenarios and then negotiate off-peak, rate-structure savings for airfield lighting," says Beaufeaux.

HISTORY AND ETHERNET
Of course, most previous efforts to bring different industrial networks into this type of mix have been derailed by different cabling, connectors
and other hardware, as well as incompatible communication protocols, data rates, signal frequencies and power conditioning levels. This is logical, too, because they all have different technical histories, and many efforts to bring them together are only a few years old, even though the earliest efforts began 10-20 years ago. Plus, there remain many proprietary interests that might love to keep them apart and continue to make fearful users pay for their lack of interoperability.

On the other hand, the greatest enabler of network unification is Ethernet itself and its many cabling forms and communication protocol flavors. As it has emerged and gained momentum in recent years, Ethernet has come closest to delivering the one network that many of its supporters seek—or at least gathering data from several networks—while continuing to let specialized systems run separately and collect some data from them when available.

Likewise, many protocol conversion tools have grown up to handle translation tasks between different communication languages. These devices often accompany the increasingly intelligent switches and gateways that route data traffic between networks. Also, one of the biggest aids to Ethernet’s dominance is its use of Internet protocol (IP) addressing, which now seems to be used by every device from the largest facility or machine to the tiniest module or chip. Also, Ethernet’s ability to add new capabilities and pathways, such as wireless Ethernet or Wi-Fi and device power via power over Ethernet (PoE), have fueled its adoption even more.

HERDING AND MERGING NETWORKS

Though building new industrial networks always has been different than renovating old ones, there are more parallels between the two jobs when network unification is the goal. Perhaps it’s because industrial networks and their signals running separately can be accessed and linked together by an overarching network in much the same way as this uber-network reaches out and links the software running on hardware systems and individual components.

For instance, embedded systems designer and system integrator Saara Embedded Systems (www.saarasyss.com) in Bangalore, India, used National Instruments’ (NI) LabView software and single-board RIO platform to build a unified system user interface for its remote facility management system (RFMS) that can monitor and control an application or a facility’s or infrastructure’s total energy consumption (Figure 2).

NI’s RIO platform integrates an onboard, real-time processor, a field-programmable gate array (FPGA) and digital I/O with Ethernet and RS-232 ports and onboard storage for data logging. The RS-232 port communicates to energy meters, and remote systems data can be pushed to the central server over various communication protocols such as TCP/IP or over secure wireless modes including ZigBee, GPRS and CDMA.

“RFMS precisely monitors and controls a facility’s or an infrastructure’s total energy consumption,” says Siddarth Verma of Saara Embedded Systems. “It provides unconstrained real-time access to parameters from diesel generators, HVAC, signage boards, security systems, refrigeration equipment, lighting systems, uninterruptible power supplies, printers, beverage vending machines and even single-switch or valve-based devices. With the flexibility of the embedded remote terminal unit (RTU), our customers can monitor and control different points on their infrastructures, making RFMS an ideal system for effective energy consumption and optimization. For example,
RFMS reduced energy consumption by one of our customers by 15%. With RFMS, the frequency of fuel replenishments dropped because replenishments now are based on a proactive, on-demand system, fuel consumption accounting is accurate, and fuel-theft issues have been addressed. As the number of RTU-installed branches increases, so do power consumption savings. With the vast improvement in customer service quality due to uniform policies in its offices, our customer has gained a competitive edge as a pioneer in energy savings. Additionally, because of the performance of our RFMS, our customers are recovering the cost of our solution in six months through the energy savings."

In addition, pharmaceutical manufacturer Mantecorp Indústria Química e Farmacêutica (www.mantecorp.com.br) has spent $70 million in the past 15 years to modernize its 100-million-unit production facility in Rio de Janeiro, Brazil.

This ongoing effort recently included updating its controls with a CC-Link network, which allows simultaneous communication and control of the Rio facility’s major systems, including air conditioning and refrigeration for both process and environmental control; energy management, filtration and water handling, steam and air handling, and sterilization of air for process areas. CC-Link is also the pathway for system data to operator control panels and PC displays (Figure 3).

The combined CC-Link network consists of one Mitsubishi master and 10 of its slave stations. Each of the CPU slave stations has four CC-Link remote I/O racks containing analog and digital I/O modules connected to various field sensors and output devices. As a result, the reverse-osmosis process in Mantecorp’s facility that purifies water is controlled via CC-7890Link and its CPU stations, while more CPUs on the same network control air sterilization. With CC-Link, Mantecorp reports it can produce prescription pharmaceuticals that require a Class 10 environmental facility certification.

SECURING BACKBONE BUY-IN
Though having a combined and coordinated network might be admirable for its own sake, plant-floor personnel won’t use it until they can see how it improves production and their jobs. “We recently put in a holistic CMMS solution for a big grain-handling company that has 25 sites in the U.S. and trained the plant managers on it,” says IAE’s Beaufeaux. “However, only 5% of them were using it after six months. So, we redid it, but only 7% were using it a year later. Management wanted the CMMS to be used to avoid possible safety issues, but the...

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plant managers wanted to get their barges loaded in four hours, and weren’t as worried about dust buildup and overheating.”

Beaufeaux also notes each group wasn’t aware enough of the other’s priorities. “So, we grabbed more local data, added it to the corporate database and set up a 24/7 support service, Hazard Monitoring Reliability Program, to help resolve problems before they could escalate,” continues Beaufeaux. “This helped operations understand more about the reasons for not silencing alarms, and enabled them to show that when a barge didn’t get loaded quickly, it was being done to prevent a possible accident. This kind of communications isn’t available with stand-alone alarms and networks. In addition, it’s only possible to do this on a network that integrates many software packages, shows an overview of all plants and then allows reporting and interfacing on all levels.”
Industrial Wireless Worries

BY IAN VERHAPPEN, INDUSTRIAL AUTOMATION NETWORKS

INDUSTRIAL WIRELESS NETWORKS ARE THE “NEXT BIG THING” for industrial automation and industrial networking in particular. However as with all new technology, the adoption rate often lags both the level of coverage in the press and, of course, the number of purchase orders that companies developing the technology need to recover their investments, at least in the short term.

Experience has shown that any new technology in the industrial arena follows the traditional chasm model of early adopters and major companies that install small-scale pilot plants or test systems to see how they work and understand the technology. The results of these small-scale tests then form the basis of corporate standards and practices for larger-scale rollout and adoption of the new technology.

A recent study by ON World (www.ControlDesign.com/onworld) confirms that this trend is being repeated for industrial wireless. As a result, it is unlikely that large-scale adoption of industrial wireless will take place until the middle of this decade. If the challenges of security and standards are not addressed, this date likely will move further into the future.

All industrial protocols use the OSI seven-layer model as the basis for design, and the 802.15.4 radios on which the industrial wireless protocols are based use the lower two layers—physical and data link—of the model (Figure 1). This makes it possible for the various protocols to use the same basic radio while all being unique, based on how to define the network through user layers to meet the requirements of target vertical industries.

So let’s examine exactly what the current situation is for wireless security and standards.

SECURITY

Fortunately, the engineers designing the industrial wireless communications protocols were aware of the concerns and impending regulations such as the North American Electric Reliability Council Critical Infrastructure Protection (NERC CIP) standards (www.ControlDesign.com/nerccip) that deal with security of the electrical grid and include cybersecurity as a key component of the nine published documents, and the ISA-99 standards themselves. In fact, part of the mandate for the ISA-100 committee is that it work with the ISA-99 committee on this aspect of the standard development and ISA-84 for safety-related parts of the documents, as well.

The developers of the industrial wireless standards incorporate a variety of security features in the protocols. Message encryption is a commonly used tool to maintain data integrity and prevent deliberate or inadvertent interception of the data between two nodes on a network. The process automation wireless protocols include industry-standard, 128-bit AES encryption, unique encryption keys for each message, and have the access point provide rotating encryption keys as part of its responsibilities when new devices attempt or request permission to join the network.

Other features incorporated into industrial wireless standards include data integrity—data is not corrupted—and device authentication—the device really is who it claims to be—two of the three pillars of cybersecurity, the third being authority—the device has sufficient security privileges to make the change being requested.

A channel-hopping feature makes it more difficult for a device that is not part of the network—to no access to the hopping key—to be able to know at which frequency the next transmission will take place.

Multiple levels of security keys for access by different individuals with different responsibilities are another important feature. This reinforces the concept of authority, that third pillar of security.

Adjustable transmit-power levels let the user manage signal spillage beyond the boundary of the plant environment. If the radio signals do not go beyond the edge of a facility, it becomes much more difficult for someone to either steal information or capture enough data packets to be able to decipher and compromise the data package format.

Wireless networks have security servers similar to RADIUS servers in the office environment, and the network manager records every attempt to join the network. By keeping track of the attempts,
indication of failed access attempts can provide a measure of how vigorously someone is attempting to compromise your network.

**ISA100**

The ISA100.11a protocol incorporates two important characteristics to help deal with coexistence. Slow hopping permits the radio to move from channel to channel, looking for one that is not busy. Unlike other protocols, ISA100.11a can return to a previously busy channel to determine if it might now be available.

Other approaches use “black listing,” whereby a channel is declared off limits, or not available, and is never revisited. However, ISA100.11a embraces “white listing” that indicates channels that have been found to be particularly good for the needs of the network. To enable white-listing, the ISA-100 standard modifies the 802.15.4 data link layer to increase the signal reliability in the industrial environment.

Any protocol compliant with the full specification of IEEE 802.15.4 must yield to IEEE 802.11 as a requirement of claiming compatibility with the standard. ISA100.11a is not fully IEEE 802.15.4-compliant. IEEE 802.15.4 radios are used since they are inexpensive and available, but the team has implemented a different media access control (MAC) protocol to improve the reliability and reduce the coexistence issues associated with the 802 family.

Profiles in ISA100.11a allow users to select the amount of protection desired. A key feature of ISA100.11a is the key distribution approach. ISA100.11a allows redistribution of keys in real time so the theft of a device does not give the thief access to a key that will be used forevermore in the plant. This redistribution is done over the air so the user maintenance staff is not troubled with touching every device being rekeyed. Other protocols in the marketplace use a key entered during manufacture so it can’t be changed or one that can only be changed with an out-of-band signal from a handheld unit that must touch every node in the network. The end users on the ISA100 committee were very vocal about this feature and agreed to the momentary risk of the over-the-air transmission as the best compromise available in this situation.

ISA100.11a uses three different approaches to optimize power use. Dust Network’s time synchronized mesh protocol (TSMP), under a standard access agreement, allows nodes in the mesh to wake up only when there are messages to be forwarded. Other mesh protocols require the intermediate nodes to be powered full-time.

ISA100.11a allows end nodes to be completely non-routing. This provides for the peel-and-stick wireless sensors envisioned for some simple installations. Since these nodes are non-routing, they don’t need to wake up to pass messages around the mesh, and they don’t have

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**FIGURE 1: OSI LAYERS & MESSAGE PASSING**

The OSI seven-layer model is the basis for design of all industrial protocols.
to maintain a complicated routing table, so they can be implemented with much simpler electronics and reduced memory.

The ISA100.11a specification allows for programmable power levels for the output radio. This approach can be used along with the received signal strength indicator (RSSI) to optimize radio transmission power for the instantaneous needs in the network. This feature also can have security implications since the range of the RF signal can be tailored with the power of the transmission.

**WIRELESSHART**

Techniques such as direct sequence spread spectrum (DSSS) technology (coding diversity) and adjustable transmission power (power diversity) also help WirelessHART provide reliable communication even in the midst of other wireless networks. WirelessHART also uses time-synchronized communication—time diversity—to minimize the potential for collisions by blacking out channels being used by other devices and networks. All WirelessHART device-to-device communication is done in a pre-scheduled time window, which enables collision-free messaging. In addition, each message has a defined priority to ensure appropriate quality-of-service (QoS) delivery. Fixed time slots also enable the network manager to create and manage the network for any application without user intervention.

**WIA-PA IN CHINA**

Wireless network for industrial automation—process automation (WIA-PA) based on IEEE 802.15.4 was presented by Shenyang Institute of Automation, Chinese Academy of Sciences. WIA-PA network supports a hierarchical network topology that is a hybrid of star and mesh. The first level of the network is a mesh topology where routing devices and gateway devices are deployed. The second level uses a star topology where routing devices and field/handheld devices are connected. Like other protocols, the WIA-PA protocol stack is based on the ISO/OSI seven-layer reference model and only defines the data link sub-layer (DLSL), network layer (NL) and application layer (AL). Network interconnections are made through the WIA-PA gateway where, in addition to the communications to the WIA-PA NM and SM, the WIA-PA gateway can communicate with other WIA-PA devices to exchange information between the devices. The WIA-PA gateway also is able to connect other networks such as wired fieldbus.

The WIA-PA standard specifies five types of devices including host computer, gateway device, routing device, field device and handheld device, which includes two functions—configuring network devices and monitoring network performance. A WIA-PA handheld device, like other network devices, connects to the WIA-PA network via the gateway device and routing device.

**STANDARDS**

Because we operate in a global environment and manufacturers want their equipment to be deployable anywhere in the world, it is important that the communications platform—radio—can be used in the target country. Since the 2.4 GHz frequency is the only practical option for global deployment, it is the ISM band being used for all three protocols being developed.

Unfortunately, many other devices such as cellular phones, wireless phones in your home and various other items including remote control cars and toys use the 2.4 GHz frequency. *Fortune* magazine recently predicted exponential growth of smart phones pushing data transfer into the exabytes (10^18 bytes or 1 billion gigabytes)/month range.

This growth in traffic will make the dropped-signal problem worse and will be a factor that standard developers will consider when they release the next version of the protocol. ISA100 with its white-list approach already has taken the first step in rechecking that a channel has become available for use again.

The range of wireless protocols using the ISM bands and associated typical applications reinforces how the demand for these bandwidths will continue to grow over time, thus putting more demands on the industrial network to provide the necessary real-time process data updates (Figure 2).

The three organizations developing industrial wireless standards all have
plans for adoption by the IEC, and each of them is in different stages in the process.

*WirelessHART*—The International Electrotechnical Commission (IEC) approved the WirelessHART communication specification (HART 7.1) as a publicly available specification (IEC/PAS 62591, Ed. 1) in 2008. The national committees of 29 countries participate in the approval ballot which is presently at the committee draft for vote (CDV) stage and therefore the furthest along the approval process of the three industrial wireless standards planned for consideration by the IEC.

*WIA-PA*—Its working group started standardization work in 2006, with input gathered from more than 20 companies, institutes and universities in China. On Oct. 31, 2008, WIA-PA passed voting of IEC/SC65C and was published as IEC/PAS 62601 and passed the committee draft (CD) stage on March 5, 2010.

In parallel, this standard has been submitted to the Standardization Administration of China (SAC) and, when approved, it will become a Chinese national standard.

*ISA-100*—ISA-100.11a-2009 is a published ISA standard approved by the ISA Standards & Practices Board on Sept. 8, 2009. During a further review of the approved document, a use case study indicated that some corrections were needed to ISA-100.11a-2009. A motion to that end successfully passed March 31, 2010, and therefore it does not make sense to submit ISA-100.11a-2009 for ANSI approval when it’s clear it needs some corrections. ISA will wait and submit the revision, which will be ISA-100.11a-2010 (or -2011) to ANSI for approval as an American national standard. For now, ISA-100.11a-2009 is an approved ISA standard and will continue to be until the revision now underway is completed. Until such time as the ISA-100 standard is accepted as an ANSI standard, it will not be submitted to the IEC for approval.

Like any installation, wireless is not without its worries. However, the good news is that many of the items of concern are being addressed through the standards development process on which the products being released to market will be based. Industrial wireless might not yet be ready for the mainstream, but it is certainly headed in that direction.

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MANUFACTURING IMPROVES PERFORMANCE CHARACTERISTICS FOR TERMINAL BLOCKS, CONNECTORS AND WIRE

Better-Connected Networks

BETTER MANUFACTURING HAS IMPROVED THE PERFORMANCE of terminal blocks, wire and connectors. "More precise and tighter fabrication tolerances of all components ensure increased reliability of conductor secureness, especially small gauge conductors," says Mike Roknich, design engineer, c3controls (www.c3controls.com). "Advanced thermoplastic injection molding processes and capabilities enable the design and production of smaller components with thinner cross-sections to maximize device current carrying, operating voltage and insulation voltage ratings."

Materials such as polyamide, zinc plating, stainless steel and electrolytic copper and the ability to process those materials reliably ensures component durability to withstand the electrical, mechanical and environmental demands of industrial applications over years of continuous service, adds Roknich.

"More precise manufacturing has led to smaller housing requirements for electronics utilizing surface-mount components," explains Brian Traczyk, product manager—fieldbus & remote I/O, Pepperl+Fuchs (www.pepperl-fuchs.us). "Cabling for bus networks improved with the introduction of exposed run cable that meets crush testing of armored cable without actually being armored. This cable is manufactured from high-quality PVC to withstand mechanical hazards."

I/O FOR THE OUTDOORS
Outdoor PushPull I/O connector family is an IP67 solution for fiber, power and copper signal connections in telecom installations. The I/O design eliminates the need to inventory costly cable assemblies and can be used for WiMAX and LTE base stations.
Harting North America; 847/717-9316; www.harting-usa.com

SOCKETS AND BLOCKS
Dinnector terminal blocks and accessories include supplementary circuit breaker terminal blocks and sockets. The blocks are available in sizes ranging ¼–10 A and terminal block sockets in 12 V and 24 V models with or without LED indicators. A new series of single and double level plug-in style terminal blocks are sold in packages with 32 blocks and four pin protectors.
AutomationDirect; 770/289-2858; www.automationdirect.com/terminal-blocks

ADAPT AND TERMINATE
DB9F-to-5-screw terminal-block adapter connects field wiring to DB9 connectors on USB serial adapters, Ethernet serial servers and other Sealevel RS-485 products with a DB9M connector. With standard-size DB9 connector, the adapter works with two- and four-wire RS-485 networks and can be secured to the serial port with thumbscrews to prevent accidental disconnection. The adapter is RoHS compliant.
Sealevel Systems; 864/843-4343; www.sealevel.com

CABLES AND CONNECTORS
Mur power cables with connector sizes ranging ⅞–1⅛ in. and pole arrangements from two to 19 pins have a standard PVC jacket and cable lengths to 30 ft. Field-wirable connections and panel receptacles take connectivity needs from the device through the wire-way and to the control panel.
Murrelektronik; 770/497-9292; www.murrinc.com

SMART I/O SLICE
SmartSlice GRT1 remote I/O terminals have a CompoNet interface and ac input modules. The ac input modules reduce space and have 110 Vac or 240 Vac inputs by offering four inputs. SmartSlice uses building-block style I/O terminals that allow connection of up to 64 remote I/O units. Pin terminal blocks enable screwless wiring.
Omron Electronics; 800/85-omron; www.omron247.com
SEGMENT PROTECTORS

R2 FieldConnex segment protectors are UL-listed for Div. 2 and FM/cFM-approved for Div. 2/Zone 2. T-Connector technology allows the segment protector to be disconnected while leaving trunk communications uninterrupted. R2 segment protectors provide IP20 protection with DIN-rail mounting, in 4, 6, 8, 10 and 12 spur configurations. They have removable terminals with retaining screws and LEDs for power, communication and short-circuit status indication.

Pepperl+Fuchs; 330/425-4607; www.pepperl-fuchs.us

M12 CABLES

Sensor/actuator cables are designed to provide high-density I/O connection and shielding from EMI. M12 cables feature 360° shielding in 12- and 17-pole versions. Cordsets are available in male and female, angled or straight versions with SpeedCon plug-and-turn technology. The cables meet IP65/IP68/IP69K requirements and have a PUR/PVC jacket.

Phoenix Contact; 800/322-3225; www.phoenixcontact.com

SNAP TO IT

Snap Tex mounting and wiring accessories include terminal extender cables, breakout boards, wiring harnesses, DIN-rail kits, jumper straps, rack adapters and other components for mounting and wiring Opto 22’s automation, control and I/O systems.

Opto 22; 800/321-6786; www.opto22.com

QUICK LINKS

Bulletin 1485P KwikLink Lite is ODVA-approved for wiring DeviceNet networks and designed to extend the network into light-duty, IP20-rated applications. Drop-lines for connecting nodes can be added using two-piece connectors. The cable system supports intermixing of DeviceNet cable types. All KwikLink Lite connectors have insulation displacement technology (IDT).

Rockwell Automation; 800/223-5354; www.rockwellautomation.com

POWERFAST

D-Size (1-⅜ in.) Powerfast modular wiring system is designed to handle high-current for machine power distribution and motor control. The system includes three- and four-pin cordsets, receptacles and tees for up to 600 V and 30 A. It complies with NFPA 79 standards and connectors carry IEC IP67, 68 and 69K environmental protection ratings, with NEMA 1, 3, 4 and 6P protection.

Turck; 800/544-7769; www.turck.us

FOLD-BACK TECHNIQUE

MooreHawke TG200 TrunkGuard Series fieldbus device couplers use a fold-back technique that detects a short in an instrument, disconnects that spur from the segment and illuminates an LED. The couplers have four, eight or 10 fieldbus spurs and work with Foundation fieldbus H1 and Profbus-PA. Couplers can be DIN-rail mounted or enclosed in IP66-rated glass-reinforced polyester (GRP) or stainless steel enclosures.

Moore Industries-Int’l; 818/894-7111; www.miinet.com

FEEL THE TENSION

DIN-rail mountable, feed-through, tension-clamp-connection YBK series of terminal blocks for control panel and electrical panel wiring are available in gray, blue, red, yellow, beige, and green, including end plate, end bracket, cross connector and marking tag accessories.

Omega Engineering; 203/359-1660; www.omega.com

GO THE DISTANCE

X20 fiberoptic module increases the distance between decentralized, remote modules up to 2000 m. The system was developed for industrial Ethernet use. Different hub devices can be configured from a kit. Hub units with two RJ45 connections are available, which are simply lined up together or added to a bus controller.

B&R Industrial Automation; 770/772-0400; www.br-automation.com

TOP THIS

TopjobS 2002 terminal blocks include UL-listed fuse and disconnect blocks with two exclusive blocks: a four-conductor, mini-automotive fuse holder block and a four-conductor fuse disconnect block with a spare 5x20 mm fuse holder. The blocks have component plugs that add LED indication and use Cage ClampS spring-pressure connection technology and are DIN-rail mountable.

Wago; 800/din-rail; www.wago.us

BUS TERMINALS

HD bus terminals have 16 digital I/O channels in the housing of a 12 mm electronic terminal block. Using Beckhoff bus couplers or DIN-rail-mounted controllers, the terminals are compatible
with almost every major fieldbus. The terminals come in Beckhoff bus and EtherCat versions and have 16-channel terminals for digital inputs or outputs, as eight-channel terminals for digital inputs or outputs with two-wire connection or as combination terminals with eight digital inputs and eight digital outputs.

Beckhoff Automation; 952/890-0000; www.beckhoff.com/hd-busterminal

TERMINAL BLOCKS
IEC terminal blocks have been tested to meet the specifications and requirements of applicable UL, CSA, and IEC standards and are rated for Code 1, factory wiring only, and Code 2, both factory and field wiring. Screw clamp is available 20–232 A, and spring clamp 20–50 A. Miniature panel mount is available 20–35 A, in both spring and screw clamp.
c3controls; 724/775-7926; www.c3controls.com

NETWORK TERMINALS
NetBloc is 11 different networking terminal units that provide network connection and network cable management on 35-mm DIN-rails, and it gives engineers a method to organize, manage and label networking connections in much the same way they currently manage power and signal connections.
Weidmüller; 804/794-2877; www.weidmuller.com

ETHERNET CABLES
Category 6 DataTuff twisted-pair cable No. 7940A is Ethernet/IP-compliant and comes in a bonded-pair, round construction, which makes it suited for sealed industrial Ethernet connectivity applications. It can future proof mission-critical network and automation system backbones in processing and discrete industrial manufacturing plants and large industrial infrastructures.
Belden; 765/983-5200; www.belden.com

AUTOMATION CABLES
A family of industrial automation cables meets the stringent requirements of key industrial automation protocols. The line includes cables for ControlNet, RS485, DeviceNet, Fieldbus/Profibus and Industrial Twinax.
Alpha Wire; 908/587-4021; www.alphawire.com

CORDSETS
Ecolink M12 cordsets have a lock-in-place coupling nut that secures the cordset to quick-disconnect sensors and prevents the cordset from detaching in high shock and vibration environments. The product acts as a mechanical end-stop that prevents possible damage to the Viton O-ring from over-tightening.
ifm efector; 800/441-8246; www.ifm-electronic.com

PLUGS AND JACKS
RJ45 Ethernet plugs and jacks are designed for compact applications requiring high density and high protection levels. The IP67/IP20-rated connectors are built in accordance with the specification for Profinet-driven robotic devices. Supplied in tray packs, the plugs and jacks conform to IEC-60603-7.
Molex; 800/786-6539; www.molex.com

COMMUNICATIONS MODULES
Designated the EOTec 2C31 (single self-healing ring) and 2C32 (dual self-healing ring), the communication modules provide multiple communication paths between the various elements of the control system and utilize advanced downstream multicasting technology.
Ultra Electronics; 512/434-2850; www.ultra-nspi.com

MINI BLOCKS
ASIMT, ASIMTQuattro and ASIMTTB micro-miniature terminal blocks mount on a 15-mm DIN rail and are suited for limited enclosure space applications. They have a current rating to 15 A at 300 V and a wire capacity of 30 to 14 AWG in single level, multiple wire and dual-level designs.
Automation Systems Interconnect; 877/650-5160; www.asi-ez.com

CABLE CATALOG
Industrial Cable Catalog features more than 160 pages of portable cord, industrial power cables, instrumentation cables, tray cables and lead wire. In addition, this catalog contains the majority of standard industrial products, custom cable capabilities including the green energy and emerging markets, and an enhanced technical section.
Coleman Cable; 800/323-9355; www.colemancable.com
WHEN YOU MOVE DATA BETWEEN DIFFERING systems or networks, several factors influence the decision to use traditional hardware or additional software to convert protocols.

The choice between hardware-based protocol-converter appliances and using software is driven by a number of factors, says Roy Kok, vice president of sales and marketing, Kepware (www. kepware.com). "In the end, performance and cost used. An additional OPC product might be needed in order for OPC clients to share data amongst one another providing the protocol conversion."

Each OPC product must be purchased separately, says Harris, which could make this option costly. Within a PC-based platform, additional hardware and cost could be required if this solution is used to communicate with industrial networks beyond serial and Ethernet.

"ONE WAY TO AVOID EXPENSE AND HASSLE IS TO USE A SINGLE PROTOCOL CONVERTER CAPABLE OF COMMUNICATING WITH MULTIPLE PROTOCOLS. THIS TYPE OF CONVERTER COULD ALLOW SEVERAL PLANT FLOOR DEVICES TO CONNECT AND COMMUNICATE AT ONCE."

Don’t Get Lost in Data Translation

will be the two final factors," he says, "but if high performance is required, an appliance such as a gateway box might not be good enough as they are typically less powerful than their workstation or server counterparts. The application could require a PC-grade platform with extra processing power and memory and a gateway software product."

The computing platform that runs the communications can affect latency if underpowered for the task at hand. "One of my assignments at Rockwell Automation was to look at advantages and disadvantages of protocol conversion and the impact on performance and the overall latency of end-to-end message delivery," says Tom Burke, president and executive director, OPC Foundation (www.opcfoundation.org). When a packet is transferred over a network, a period addressed as latency is the time during which the sender is waiting for the receiver to acknowledge that the packet has been received. One critical effect on overall latency is the bandwidth and the available network connection speed.

The latency of communication between the sender and receiver really depends on the processing delay of the corresponding hardware and software, coupled with the protocol conversion complexity. The latencies in a typical industrial automation application typically can run anywhere between 10 ms and several seconds, says Burke.

In many cases, the hardware or software decision is made based upon the plant equipment currently in use. "Software protocol conversion involves one important piece of hardware, a PC, which can be located either remotely or on the factory floor," states David Harris, vice president of marketing, Red Lion Controls (www.redlion.net). "This PC often will use multiple OPC software products to facilitate communications with disparate plant floor devices, with one software product required for each protocol.

"However, if a PC is already in use in the factory, it might already use the necessary hardware, making a software solution more cost-effective for some applications," Harris adds.

Often, machine-to-machine (M2M) protocol conversion can be just an extra task on an existing server—no special hardware required. "Many protocol converters are very basic in operation and don't support the intricate nuances of a particular protocol; or they might not support the many forms of optimization that can be applied to communications," says Kok.

"With the new technology of the OPC Unified Architecture we've now successfully used traditional hardware in which the OPC technology is natively embedded, eliminating the need for complex protocol conversion," says Burke.

For many industrial network protocols, the protocol conversion to the OPC UA standard is fairly straightforward, because we're converting what is typically referred to as raw data in a very limited amount of information such as quality and timestamp, Burke says. "But as we have increased behavioral-type functionality that allows us to pass complex information, programs and commands from devices to applications, the amount of protocol conversion drastically increases."

Bernd Schuessler, business development manager, Pepperl+Fuchs (www.pepperl-fuchs. us) differentiates between transparent and non-transparent data and network conversions. "Profibus supports high-speed (up to 12 Mbaud), non-powered Profibus-DP as well as lower-speed (31.25 Kbaud), bus-powered Profibus-PA," says Schuessler. "The PLC or DCS can talk to both buses via a transparent segment coupler. The different physical layers are coupled via a DP/PA segment coupler, totally transparent to the host. The segment coupler automatically
takes care of the conversion between the different media and bus speeds. No additional human intervention or data mapping is required, which makes this a traditional hardware conversion.

When using traditional remote I/O systems, a hybrid—hardware plus software—conversion is typically implemented. “This involves the transparent conversion of analog and discrete process I/O signals to an internal digital bus, which communicates to a gateway,” says Schuessler. “The gateway is then connected to the external process bus system and the controller. In the controller, software is used to configure the physical I/O for process control. The configuration of the I/O in the controller requires minimal engineering and is typically standardized—that is, CSD, DD or DTM files.”

On the other hand, when converting two totally different networks and protocols—for example, Profibus to Modbus—I/O mapping definitely is required. “Important status and diagnostic information might even be lost, and users might not get the full functionality out of the system,” says Schuessler. “Manually mapping I/O data is time-consuming and adds to the overall project cost and complexity of a system. Sometimes there is simply no way around it.”

Jim Toepper, product manager, industrial Ethernet infrastructure, Moxa (www.moxa.com) and a member of the ODVA working group for EtherNet/IP infrastructure, says Rockwell Automation decided to partner with Schneider Electric as it relates to protocols. “Initiatives for making DF1, Modbus ASCII/RTU, Modbus TCP and EtherNet/IP all interoperate have been underway for some time now,” he says. “So now, more than before, we see Modbus devices and A-B devices operating smoothly side by side.” This doesn’t mean plant engineers can just go and connect devices willy-nilly, he adds. “There are many products out there that facilitate this conversion from a simple Modbus Serial to Modbus TCP to more complex cross-protocol conversions such as DF1 to Profinet,” says Toepper.

As with their software counterparts, many hardware protocol converters handle only a single protocol. One device can convert Modbus to DF1 and vice versa, but converting one of these protocols to or from MPI often will require an additional device. “Users that employ equipment made by many different manufacturers must maintain and configure several protocol converters to facilitate plant-floor communications, which can prove costly as well as time-consuming,” says Harris. “One way to avoid this expense and hassle is to employ a single protocol converter capable of communicating with multiple protocols—in some cases, more than 200. This type of converter could allow several plant floor devices to connect and communicate at once.”

PROSOFT PROFILES

When things get quiet, manufacturers lose money.

“This is going to cost us…”

That’s what the Maintenance Team Leader said when the roar from the 2000 metric ton transfer press suddenly went quiet. The giant press had eaten another cable. So, they put ProSoft radios in the middle. Problem solved. Now they just need better ear plugs.

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“WHEN IT COMES TO ROUTING, IT CAN BE A FAIRLY ADVANCED TASK TO SET UP THE APPROPRIATE TYPE OF CONNECTION.”

Gigabit Router Enhances Functionality

MOST INDUSTRIAL Routers ALLOW BASIC FUNCTIONALITY while operating in harsh environments. Users will tell you that temperature tolerance and form factor alone don’t determine whether a router is industrial-grade. Understanding which features an automation engineer might need is the key to a successful industrial router/firewall.

“Corporate IT and industrial engineers have different priorities,” says Nick Sandoval, technical support supervisor at Moxa Americas. The company introduced its new EDR-G903, designed to improve industrial automation, so engineers no longer are limited to IT-oriented tasks. “That is why this router has been designed, from the ground up, to be easy to use from an industrial engineer’s perspective,” claims Sandoval. “There are no archaic commands to learn or cryptic text to type. Instead, the router is configured by a simple Web interface that was designed for the industrial user that allows EDR-G903 to be configured in only a few mouse clicks.”

The gigabit, firewall secure router is designed to safeguard sensitive control networks and mission-critical industrial assets by forming a trusted intranet environment. “Having Gigabit ports and a faster processor can make a large difference in latency and throughput performance,” says Jim Toepper, Moxa product marketing manager.

The router supports three combination gigabit ports with built-in RJ45 ports and SFP slots for connecting to a WAN, a LAN and a WAN or demilitarized zone (DMZ) with rapid-transfer bandwidth. “The dual WAN feature is ideal for establishing a reliable Internet connection backup and for providing a secondary option for load-sharing two Internet service providers,” explains Toepper. “A wide operating range of -40 to 75 °C and smart firewall functions such as Quick Automation Profile for enabling common fieldbus protocols make EDR-G903 well-suited for harsh, industrial applications.”

EDR-G903 supports intelligent firewall functions to simplify security configuration. Other firewall services, such as PolicyCheck for policy debugging and SettingCheck for confirming the firewall rules, increase firewall accuracy.

“Many automation engineers are very technical within their realm,” explains Toepper. “But when it comes to routing, it can be a fairly advanced task to set up the appropriate type of connection. As it stands today, many routers have complex setup scenarios. During setup, if just one setting is misconfigured, it could mean that the engineer is locked out and has to access the device through the local serial console port. This can be a problem if the router is not nearby, as is often the case.”

In addition, one key reason to use a router/firewall is to keep unwanted traffic out of a network segment, says Toepper. “This would require the engineer to understand which port each protocol used and set it in the policy area of the router/firewall,” he explains. “As most of us know, there are many industrial protocols in use today, so having this type of information built in to a device just makes integration and setup that much easier.”

Overlapping policies can trip up industrial engineers, too. “The end result can be too strict or not strict enough on who or what has access,” says Toepper.

“Having an intelligent router/firewall that can check all policies during setup for accuracy can save a lot of time.”

Other features of the device include a high-performance gigabit copper and fiber combination port, firewall with Quick Automation Profile for common fieldbus protocols and network address translation (N-to-1, 1-to-1 and port forwarding). “EDR-G903’s Quick Automation Profile function supports most common fieldbus protocols, including EtherCat, EtherNet/IP, Foundation fieldbus, Modbus/TCP and Profinet,” says Sandoval. “This allows users to quickly forward protocols that are common in the industrial arena that IT may struggle to configure.”

The company says a VPN feature, available in Q4 2010, will be addable via a firmware upgrade.

For more information, call 888.669.2872, email jim.toepper@moxa.com or browse to www.moxa.com.
CONVERT THREE MEASUREMENTS
Universal input/output (I/O) transmitters for XYP 6000 series of OneWireless mesh network products can transmit signals from three different types of input, including high-level analog, temperature or millivolt or contact-closure switch input. The devices carry intrinsically safe approvals from FM Global and the CSA for use in hazardous areas.
Honeywell; 800/822-7673; www.honeywell.com/ps/wireless

MISSION-CRITICAL READY
RuggedRouter RX1500 industrially hardened, integrated layer 3 Ethernet switch and router with hot-swappable platform allows customers to select among DSL, cellular, T1/E1, DDS, serial and Ethernet options, while offering up to eight-port Gigabit Ethernet and dual redundant power supplies. RuggedRouter RX1501 offers a greater port density in 100Mbps line rates, with support for up to 24 optical ports and 36-port copper 10/100BaseTX.
RuggedCom; 888/264-0006; www.ruggedcom.com

VERSATILE PRO
IndustrialPro Wireless gateway provides 3G or 2G cellular connectivity, one Ethernet port, one serial port and support for either ac or dc power. Sixnet IndustrialPro Wireless router provides 3G or 2G cellular connectivity, one or five Ethernet ports, one serial port and support for either ac or dc power. It delivers full firewall and routing functionality, supporting IPSec or SSL VPN, port forwarding and support for network address translation (NAT), OSPF and RIP. It also offers a local Web-based management interface. Both are managed by SixView Manager software.
Sixnet; 518/877-5173; www.sixnet.com

HOT SPOT RADIO
Industrial Hotspot RLXIB-IHxN 802.11n radios for rugged industrial performance and easy deployment in the field use a single Web-page setup. Options include single (RLXIB-IHN), dual (RLXIB-IH2N) and watertight dual (RLXIB-IH2N-W) industrial hotspots. The radios use MIMO (multiple input, multiple output), enabling data rates up to 300 Mbps.
ProSoft Technology; 661/716-5100; www.prosoft-technology.com

WIRELESS ANALOG
SMS100-POX WIO wireless analog transmitter provides remote I/O capability to any Modbus system. WIO gateways provide connectivity on the receiver side. Battery-powered transmitter is designed for both 0-5 V input and 4-20 mA current loop powered sensors. Class I, Div. 1, intrinsically safe transmitter includes 24-bit analog-to-digital resolution, ultra-low-power sleep mode operation, and self-contained 3.6 V battery power.
OleumTech; 949/305-9009, x625; www.oleumtech.com/wireless-analog-transmitter.html
Users considering the prospect of running fiber optics in lieu of copper often faced obstacles in material costs, as well as the labor skills needed for installations. Installing RJ45 connectors on Cat. 5e (copper) cable isn’t for the bifocal-challenged, faint of heart—especially with cheap, brittle and faintly color-coded twisted-pair cable. But fiber terminations were once the exclusive domain of communications professionals who exercised their skills on a routine basis. If these hurdles ever caused you trepidation when choosing the ideal physical layer for your plant networks, you’ll be interested to learn the new solutions emerging and already on the market. They’ve made fiber a much easier choice, especially when it’s the solution that makes the most sense.

When extending one’s Cat. 5/Cat. 6 Ethernet network into the plant, the choice to run fiber optic cable was often a foregone conclusion—copper networks simply can’t function reliably or at the 10–100 Mb transmission rates we have come to expect when extended beyond 100 m, especially in noisy industrial environments. It might or might not have been plausible to install additional Ethernet switches or hubs at the extremes of the copper network, and in such instances, at least until recently, the vagaries of local power, environmental protection and area classification had to be considered. Despite its inherent challenges, fiber optic cable was still the logical choice. The issues of power, environment and area classification had to be addressed, but this could be done where the service was needed—vs. intermediate junction boxes—which in turn could be much farther away.

Terminations were once the biggest challenge for those of us aiming to apply fiber optics. The tried-and-true polish and epoxy methods use inexpensive hardware and remain the most versatile and robust technologies, but require more setup time and greater training and skills than normally maintained in the typical plant maintenance shop or even the local trade union hall. Even telephone company craftspersons who make these terminations routinely tend to have high error rates among less-experienced installers. When we need to install epoxy and polish ends, we contract with our telephone service provider to get the job done.

In recent years, however, improvements made by fiber optic suppliers have reduced the barriers to a trouble-free installation significantly. The most useful development is the introduction of easier termination tools, hardware and procedures. The Corning UniCam connector system was the first one we used in our plant. While the literature promises trouble-free terminations of various connectors in as little as a minute, it probably will take longer if your electricians are novices or haven’t done any in a while. It also will take longer when the fiber terminates in noisy, cold, wet or otherwise unfriendly environments. Our people had some experience with UniCam, but only got to practice about once a year. As a result, two ends of a six-fiber tray cable took the better part of a day to terminate, and the result was not as trouble-free as we would have liked. The kit for performing terminations is a little pricey—figure you will spend as much as or more than you would for a large tool box, depending on how many ends you need to terminate. A training video is provided, which is enough training for your typical experienced electrician, but you should budget a few hours to practice and review this video each time you plan a similar job.

Recently Belden introduced FiberExpress Brilliance field-installable connectors. With this new solution Belden promises a no-tools termination in as few as five seconds. “The connector’s patent-pending design not only eliminates the need for special tools, it also simplifies the installation steps typically associated with fiber terminations,” claims Richard Perron, FiberExpress product manager at Belden (www.belden.com). The barriers to the widespread application of fiber optics are much diminished, making it easier to heed the advice of Frank Madren, president of GarrettCom (www.garrettcom.com), who says, “Don’t settle for the false economy of copper cabling when fiber is necessary to do the job right.” Copper solutions will struggle to deliver the bandwidth, noise immunity, distance and security needed for production plant control networks. Thankfully, the increasing availability of improved tools and hardware continue to make industrial installations more accessible to end users.

John Rezabek is a process control specialist at ISP (www.ispcorp.com) in Lima, Ohio.
“Even with all of my experience in the industry, AutomationXchange provided opportunities for me to find solutions to advance my machines that I was not aware of before.”

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