Newsletter

São Paulo Section ISA

Março / 2011

Editorial

Esta é a segunda edição de 2011 do newsletter bimestral da ISA Seção São Paulo. Nesta edição, são apresentados três artigos técnicos, sendo dois deles dois artigos internacionais, além de um convite para um evento da National.

Apresentamos também um resumo do nosso último ETM (Encontro Técnico Mensal), realizado em São Paulo em 17 de fevereiro, na ABM, cujo tema foi "Tecnologia Wireless & Norma ISA100".

Confira também o calendário de eventos de 2011 atualizado.

A. Tomé Guerra – ISA Seção SP – Comitê de Publicações
B. Carlos Gury – ISA Seção SP – Comitê de Publicações

Visitem também o nosso site: www.isasp.org.br

Nesta Edição!

EVENTO SOBRE WIRELESS NA ABM - 17-02-2011

Aconteceu no ultimo dia 17 de fevereiro de 2011, nas dependências da ABM em São Paulo, mais um dos Eventos Técnicos promovidos pela ISA Seção SP. O referido Evento contou com o tema “Tecnologia Wireless & Norma ISA100” e reuniu mais de 70 pessoas, entre usuários, empresas de engenharia, fornecedores e consultores autônomos.

A empresa SHEVAT, através do Sr. Marcílio Pongitori, fez um tutorial sobre a tecnologia Wireless, desde a evolução inicial na transmissão de sinais e no uso de wireless patenteado em 1952, até as diferentes tecnologias hoje utilizadas em wireless, tais como Wireless HART, ISA100-11A, ZigBee, Bluetooth, etc,., e suas diferentes faixas e métodos de transmissão. Foi também comentado sobre segurança nessas transmissões, envolvendo criptografia, autenticação, verificação, anti-jamming, senhas, etc., e requisitos de projeto dependendo do tipo de instalação e aplicação.

Já a empresa SMAR, por intermédio de seu colaborador, Sr. Leonardo Oliveira, abordou o tema “Integração de Equipamentos Wireless via Backhaul”, enfatizando os segmentos de aplicação, os itens a serem avaliados na instalação tais como atendimento às normas, requisitos de disponibilidade, segurança, vida útil de baterias, custos e integração. As estatísticas apresentadas demonstraram ainda que a maior parte das aplicações é em monitoramento, telemetria e controles mais simples, apesar de que já existem algumas poucas aplicações em controles críticos. Foi também alertado sobre a evolução da tecnologia e conseqüente necessidade de interoperabilidade e integração entre sistemas e as diferentes tecnologias. Alguns dos desafios do ISA100.15 é integrar os vários protocolos tais como ISA100.11a, Wireless HART, HSE, etc. O FIC (Fieldbus and ISA Cooperation Group) está estudando usar o HSE como base para integração dos equipamentos via backhaul.

Já a Empresa YOKOGAWA, através do seu colaborador, Sr. Cassius Barros, abordou o tema “ISA100.11a: A Verdadeira Solução Wireless” apresentando o padrão ISA100.11a-2009 e trabalhos desenvolvidos pelo comitê. Enfatizou a necessidade de padronização, e mostrou o que as principais empresas do setor estão adotando e/ou desenvolvendo em relação aos diversos padrões de wireless, comparando, por exemplo, o ISA100 com o WirelessHART. Foi demostrado também a quantidade de dispositivos recomendada numa rede, versus o tempo de atualização e as diferentes topologias possíveis (estrela, mesh, anel, etc).

A última palestra foi ministrada pela PEPPERL&FUCHS, através do seu colaborador, Sr. Daniel Marques, abordando as topologias de rede e flexibilidade para alterar roteamento de informações, quando de falha num dos dispositivos através de rede mesh, redundâncias, etc. Foram apresentados exemplos de aplicação para monitoração e controle de temperatura, nível e corrosão, tipos de baterias, gateways, além dos tipos de obstruções existentes à passagem do sinal (visada, veículos móveis em trânsito, estruturas metálicas, pedestres, etc.), devendo ser estudada a localização dos dispositivos (instrumentos) e antenas quando da execução do estudo e do projeto final.

Ao termino do Evento, os participantes foram convidados a participarem de um Brunch de confraternização que foi servido nas dependências da ABM, que acabou aproximando a todos e servindo de um excelente canal de networking.

Os artigos acima, na sua versão completa, estão disponíveis no nosso site para consulta no endereço: http://www.isasp.org.br/site/index.php?p=32.

Fotos:





FOR IMMEDIATE RELEASE

CONTATOS

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Invensys Lança Software de Simulação SimSci-Esscor PRO II 9.0

-- A nova interface gráfica do software maximiza a efetividade do simulador, reduz a curva do tempo de aprendizado e direciona para a excelência em produtividade --

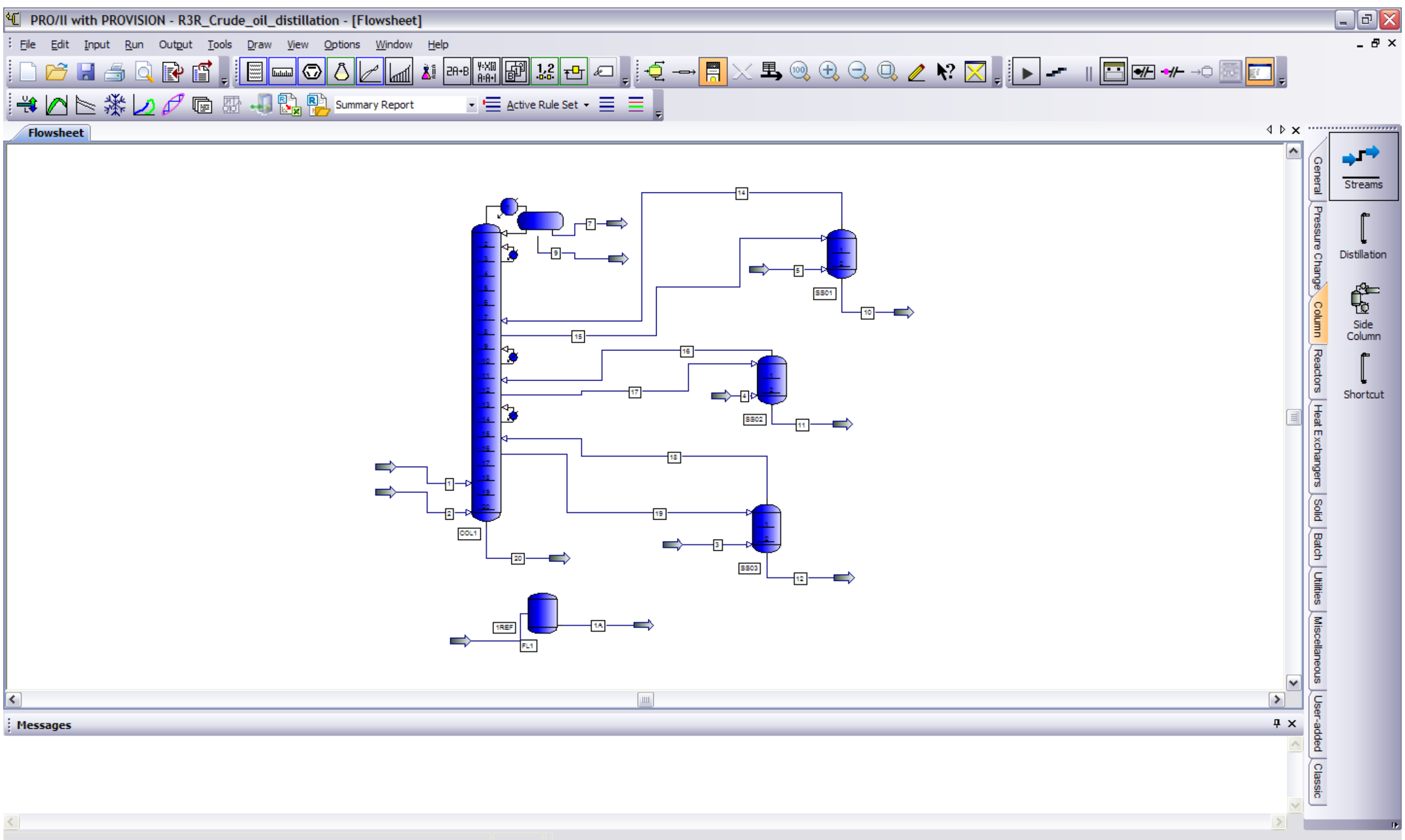
01 de Março de 2011 / PLANO, TEXAS - A Invensys Operations Management, fornecedora global de sistemas de tecnologia, software, soluções, serviços de consultoria para a indústria e operações de infra estrutura da indústria, lançou a mais nova versão do software SimSci-Esscor® PRO/II™, um simulador de processo em estado estacionário usado para design, análise e melhoria dos processos químicos; além de auxiliar os usuários da indústria a alcançar excelência em produtividade.

"Atualmente, os engenheiros de processo possuem mais e mais demanda de trabalho," disse Joseph McMullen, gerente de produto SimSci-Esscor PRO/II da Invensys Operations Management. "A versão 9.0 do nosso software PRO II inclui uma interface gráfica de usuário potente e um host de novos recursos desenhado para fazer as aplicações mais customizadas, as quais reduzem significantemente a curva de aprendizado de novos usuários, tornando-os mais efetivos. As melhorias de produtividade incluem a formatação para rapidamente identificar diferentes propriedades das correntes de processo; customizar os guias que permitem fácil classificação de operações unitárias divididas por segmento; novas janelas acopláveis; e barra de ferramentas aperfeiçoada, que fornecem acesso mais rápido para um vasto leque de escolhas e dados. A capacidade de simulação rigorosa do software se estende na funcionalidade do nosso InFusion Enterprise Control System, possibilitando uma tomada de decisão e colaboração em tempo real por todas as pessoas, processos e ativos."

A versão 9.0 do software SimSci-Esscor PRO/II também diminui o custo de quem o possui, sendo apoiado pelo Microsoft App-V para virtualização de aplicações, permitindo um melhor uso de recursos existentes do hardware do computador. As capacidades de simulação também foram aprimoradas através de uma atualização significativa das correlações termodinâmicas, incluindo um link para o National Institute of Standards e Technology's Reference Fluid e para a aplicação Transport Properties (REFPROP). A base de dados fornece valores de propriedades críticas necessários para avaliar os fluídos e otimizar os processos e equipamentos relacionados.

“Os usuários do software SimSci-Esscor PRO/II 9.0 serão beneficiados por muitas melhorias que fizemos,” adicionou McMullen. “Usuários mais experientes estarão aptos para customizar facilmente suas aplicações, obtendo uma melhor combinação para suas necessidades e também seus ambientes de computação; novos usuários se tornarão mais efetivos e rápidos. Atualmente, com uma economia desafiante, este tipo de software de simulação poderoso está ganhando muita importância, assegurando que as empresas otimizem suas operações e maximizem o retorno de seus ativos para alcançar a total excelência em operações.”

A nova interface gráfica do PRO II 9.0 facilita o manuseio da simulação.



Sobre a Invensys Operations Management

A Invensys Operations Management é uma divisão da Invensys, líder no fornecimento de automação e tecnologia da informação, sistemas, soluções de software, serviços e consultoria para a produção global e infra estrutura das indústrias. Com sua matriz em Plano, Texas, fornece soluções para mais de 40.000 clientes ao redor do mundo em mais de 200.000 plantas e instalações.

Os serviços e produtos da Invensys Operations Management são fornecidos para várias marcas de destaque na indústria, incluindo Action Instruments, ArchestrA, Avantis, Barber-Colman, Chessell, Continental, Eurotherm, Foxboro, IMServ, InFusion, SimSci-Esscor, Triconex e Wonderware. A empresa tem mais de 9.000 funcionários e seu ecossistema a nível de parceria global integra estes produtos e serviços para auxiliar e colaborar com seus clientes em vários sistemas e empresas em tempo real, extraindo dados críticos para tomada de decisões mais rápidas e melhores para sincronizar as operações desde o chão da planta, até os escritórios executivos, alinhando os objetivos de produção com os objetivos de negócios. Para saber mais sobre a Invensys Operations Management, visite www.invensys.com.

A Invensys plc (www.invensys.com) tem sua matriz em Londres e está listada no London Stock Exchange (ISYS.L), com aproximadamente 20.000 funcionários trabalhando em 50 países.

A postcard from the promised land of alarm management

We haven't seen a nuisance alarm or major alarm flood in months. The plant has never run so well. The weather is fine. Wish you were here.

Fast Forward

- The monitoring system generates key performance and diagnostic metrics.
- The benchmark documents the current state of alarm management, including performance metrics and practices.
- The philosophy documents the expectations for managing the alarm system, including definitions and performance targets.

By Nicholas Sands and Donald Dunn

Once you have achieved the benefits of a well-managed alarm system, you wonder how you ever ran the plant without it. It is a paradigm shift within the culture of an operating plant, similar to a major lifestyle change, like losing 50 pounds or quitting smoking. This fundamental shift in an organization's culture is not easy and is rarely embraced by everyone, but this shift is required as the work processes continue. The benefits are real, quantifiable, and achievable. The journey from chaos to the "promised land" has been made by others, and you can make it there, too.

The benefit is improved plant performance through improved operational discipline, which means doing the right thing at the right time, every time. A well-managed alarm system will notify the operator at the right time, and only the right time, for a specific action. A well-trained operator, or an operator assisted with some guidance from a well-designed alarm system, will know the right action to take in response to the alarm. An operator, not overloaded with alarms, will take the right action at the right time to correct the process condition. This was clearly and concisely stated by Campbell Brown in his "Horses for Courses – A Vision for Alarm Management" paper: "The fundamental goal is that Alarm Systems will be designed, procured, and managed so as to deliver the right information, in the right way, and at the right time for action by the Control Room Operator (where possible) to avoid, and if not, to minimize, plant upset, asset, or environmental damage, and to improve safety."

The fundamental conclusion made by alarm management pioneers M. L. Bransby and J. Jenkinson: "Poor performance costs money in lost production and plant damage and weakens a very important line of defense against hazards to people." Thus, improved operational discipline results in fewer incidents, increased plant reliability, reduced quality problems, reduced environmental excursions, and less equipment damage. To estimate the bottom-line benefits of improved alarm management, start with a list of these events in the last year and associate a cost for each event. Then, with input from different members of the plant, estimate how many of the events were preventable, or could at least have been mitigated if you made a significant step change in the ability to indicate and respond to abnormal conditions. The result is the quantifiable benefit at stake.

Often it takes only a few significant avoidable events to justify an alarm management improvement effort. It may be similar to a significant personal event, like a heart attack, that finally provides the motivation for a lifestyle change.

Before setting out on the journey, you should know it is not an easy path. Typically, it requires you to do things differently than you have in the past. Not everyone in the organization will embrace the changes. Some will want the results to change, but not want to change the practices that created the current chaos. This is insanity, according to Albert Einstein.

Here are a few things you might want for the journey:

- A leader – someone with the time and authority to organize the effort
- A GPS – a measurement system to tell you if you are on the right path
- A guidebook – a field guide to point out tricks and traps along the way
- A map – a guidance document, which you have to make yourself
- A guide – an experienced person that can help you get there more quickly

Leader

The leader is sometimes called an alarm management champion. He or she coordinates the effort and keeps the team moving forward. The leader should be appointed by management as an indication of its support. This is an important step. Management needs to provide the resources—time and money—to do the work. While an effort led from the plant floor can make an impact, successful efforts in changing the organization require management support. Management should review the progress and even take an active role at times.

GPS

The GPS is an alarm monitoring system that captures alarms as they are activated and generates the key performance metrics of the alarm system. The monitoring system will help you know your starting point and help show progress along the path of your alarm management journey. Some of the key performance metrics are:

- Average alarm rate per operator

- Percent time in alarm flood
- Number of out-of-service alarms

Average alarm rate is an important metric because it is related to the human factors considerations of how many alarms an operator can handle in a defined period of time. The rate is an indication of alarm load or overload. The average alarm rate, normalized per operator, is a good metric to track the progress in your journey. Often the starting point is very bad, perhaps thousands or tens of thousands of alarms per day. The recommended goal per ANSI/ISA-18.2-2009 is around 150 to 300 alarms per day, per operator.

Key alarm performance metrics with recommended targets

Alarm performance metrics	Metric target value
Average alarm rate	150-300
Percent time in alarm flood	<1%

Percent time in alarm flood is an important metric since average alarm rate does not tell the whole story. You may have long periods with few alarms and then overwhelm the operator with dozens of alarms at once, perhaps during a plant shutdown. In alarm floods, typically defined as periods with more than 10 alarms per operator in a 10-minute period, the operator is very likely to miss alarms. This was the case in the well-known incident at the Texaco refinery, Milford Haven, in 1994 where several hundred alarms were recorded in the last few minutes before the explosion. The recommended goal is less than 1% of the time in the alarm flood range.

The number of out-of-service alarms is an important metric that indicates the number of alarms that have been suppressed or hidden from the operator. The average alarm rate and percent time in flood would indicate perfect performance if all the alarms were placed out-of-service. A high number of out-of-service alarms indicates a potential problem, and possibly a safety culture problem.

Different control systems have different terms placing an alarm out-of-service, which means manually turning off an alarm. Common terms include *inhibit*, *disable*, and *hide*. These terms describe a function in the control system and not the process used to control the function. The terms are not used in ISA-18.2, which uses the term *suppression* for the general function of preventing an alarm from indicating an abnormal situation to the operator. The term *out-of-service* is used to describe alarms that have been manually suppressed.

Guidebook

The guidebook is a book on alarm management that explains how to get through the various steps of the journey. ISA-18.2 is not a guidebook. It provides a common language for alarm management and describes important activities and requirements. It describes what should be done, but not how to go about doing it. A guidebook is much more useful for figuring out how to do things. There are several books available that are worth adding to your library, for example, *Alarm Management: A Comprehensive Guide, 2nd Edition*. In addition, it is always a good idea to get formal training.

Map

With a leader, a monitoring tool, and a guidebook, you are ready to begin. An important step is to understand where you are starting from and where you want to go. By itself, the monitoring system cannot pinpoint your starting point. There is much more to alarm management than performance metrics. A benchmark, or initial audit, is a good way to identify the practices in place and working well, and the practices that might be missing or are not being followed. Some key areas to audit are how changes to the alarm system are managed, how operators are trained, and how temporarily placing alarms out-of-service is controlled.

The map is the alarm philosophy that documents where you want to go and some steps on how to get there. It defines how a site will address alarm management. While there are many common components, it is specific to a site and should address the elements of the current state that need to be changed. It includes key definitions, provides practices and procedures, and documents roles and responsibilities. It contains guidelines on how to classify and prioritize alarms, and how changes to alarms will be managed. It also establishes targets for key performance metrics, like the acceptable alarm load for the operator as measured by average alarm rate.

Guide

In developing the alarm philosophy, and in other steps of the journey, it may be useful to have a guide, a person who has taken the journey before. A consultant or an experienced internal resource might help you complete the journey more quickly and with fewer missteps. (Disclaimer: The authors are not alarm management consultants and are employed in the process industries. Note: We are not selling anything.) Choose your guide with care.

Now it is time to set off on the journey, and it can be a long haul. There are several tasks to complete, but they can be broken down many different ways according to site needs and resources. All alarms will need to be rationalized and documented. Problem alarms will need to be modified. Advanced alarming will likely be needed in certain cases. And all the changes will need to be managed and include operator training.

Rationalization involves reviewing and justifying potential alarms to ensure they meet the criteria for being an alarm as defined in the philosophy. It also involves defining the attributes of each alarm (such as limit, priority, classification, and type), as well as documenting the consequence, response time, and operator action. Although safety alarms generally tend to be some of the most critical in a plant, they still must go through the rationalization process. The product of rationalization is a list of configuration requirements recorded in the Master Alarm Database. Alarm classification and prioritization are extremely important parts of rationalization. They are not mutually exclusive or redundant. Classification is a tool for managing requirements. Prioritization is exclusively for the benefit of the operator.

Classification identifies groups of alarms with similar characteristics (e.g., environmental or safety) and common requirements for training, testing, documentation, or data retention. Aggregating alarms by requirements helps the organization more adequately allocate resources to ensure they are addressing the hazards within the facilities. It should be emphasized that the use of classification and or classes is to be defined in the philosophy and is not for the benefit of the operator. Classification is done during rationalization using the consequences and how the need for the alarm was identified—for example, during a Layer of Protection Analysis (LOPA).

Alarm priority is typically determined based on the severity of the potential consequences and the time to respond. Most companies have a risk matrix that may be used for risk assessments, typically established by a corporate risk management group. If possible, the information in this risk matrix, consequence descriptions, and categories should be used as a basis for an alarm severity matrix. Three or four alarm priorities are recommended. Grouping alarms based on priority helps an operator adequately allocate their time or ensure they are addressing the hazards within the facilities.

Monitoring can be enhanced by using alarm class and alarm priority as filters. Reporting frequent alarms by alarm class, such as safety or LOPA listed alarm, can identify potential hazards or poorly designed alarms. Frequent high priority alarms indicate either a problem in alarm design or a frequent potential hazard usually not desirable. Using class and priority in monitoring reports can help drive significant improvements very quickly.

The monitoring system can identify problem alarms with diagnostic metrics. Unlike performance metrics, which indicate the overall performance of the alarm system, diagnostic metrics point to specific alarms with specific issues. The most frequent alarms, stale alarms, and chattering alarms are just some of the diagnostics available. The diagnostic metrics are very powerful for making dramatic improvements in alarm system performance. If you have a monitoring system, it can be very tempting to start with making quick improvements before you have completed your benchmark. Resist the temptation. Document the current state before you begin making improvements.

Sometimes it takes advanced alarming—additional logic that modifies alarm attributes—to resolve alarm issues. In fact, it is almost always needed to reach the goal. A typical example is state-based alarming that automatically suppresses alarms on equipment when the equipment is not running. Advanced alarming logic should be designed with care so as not to introduce hazards.

Over time, each alarm can be rationalized, each problem alarm can be addressed, and advanced alarming can be added. The steps take time. Each change should be managed to keep documentation and training up to date. These steps lead to improved alarm system performance and improved operational discipline, which results in improved plant performance.

The journey from alarm system chaos to the promised land of alarm system performance is not only possible, but it has been accomplished by many sites. The journey is not easy and takes preparation and work. There are some key steps in preparing for the journey: getting an alarm management leader, a measurement system, a reference book, an alarm philosophy, and perhaps a consultant. There is no quick fix to the problem of alarm management. D.V. Reising and T. Montgomery in their paper, “Achieving Effective Alarm System Performance,” note: “There is no ‘silver bullet’ or ‘one shot wonder’ for good alarm management. The most successful sites will likely approach alarm management as an ongoing, continuous improvement activity, not unlike preventive maintenance or total quality management programs.”

As part of the continuing development of ANSI/ISA-18.2-2009, a series of ISA18 technical reports (TRs) is being developed to help alarm management practitioners put the requirements and recommendations of ISA-18.2 into practice. If you are interested in contributing your knowledge and experience to the TR development effort, please contact ISA18 co-chairs Nicholas Sands or Donald Dunn.

ABOUT THE AUTHORS

Nicholas Sands (Nicholas.P.Sands@USA.dupont.com) is a process control engineer at DuPont. He has co-chaired the ISA18 committee since 2003 and currently serves as the vice president of the ISA Professional Development Department. **Donald G. Dunn** (Donald.Dunn@aramcoservices.com) leads a Consulting Engineering group at Aramco Services Company, which is a subsidiary of Saudi Aramco. He has co-chaired ISA18 since 2003 and will be vice president of the ISA Standards & Practices Department in 2011-2012.

Wireless standards in action

A closer look at ISA-100.11a

Fast Forward

- Some of the unique elements in ISA-100.11a include backbone routers, standard interface for backbone routers, and duocast.
- ISA-100.11a includes the concept of shared timeslots in addition to dedicated timeslots for communication.
- Duocast benefits include data availability, latency, scalability, and battery life.

By Soroush Amidi

The term “wireless standard” may seem like an oxymoron to observers of the process manufacturing industries. After all, standard implies “the norm.” And while a small handful of wireless protocols have clearly emerged as front runners, there is still quite a way to go before a single standard can truly lay claim as the preferred.

While specific vendors and standards-making bodies will understandably continue to promote their products as the standards of choice, the reality is plants will make their wireless decisions based on their knowledge of how technologies can address their unique needs.

So what actually makes a standard, and how does it work? This article provides a snapshot of one of the current standards, ISA-100.11a, and boils down the key elements that make it unique in addressing those needs.

The basic anatomy of ISA-100.11a

ISA-100.11a resulted from requirements defined years ago by more than 500 end users and vendors in standardization activity supported by the U.S. Department of Energy. The group wanted to ensure the standard would meet, and in some instances surpass, wired system performance. They also agreed wireless sensor systems needed to offer reliability and security required to satisfy non-critical monitoring, alerting, supervisory control, and open- and closed-loop control. They wanted a wireless sensor system to address performance needs of applications such as critical monitoring and process control, where latencies on the order of 100 ms can be tolerated, with optional behavior for shorter latency.

In short, the standard needed a rich set of elements that enabled field instrument and automation vendors to build products that could satisfy evolving needs of various industries—a future-proof standard. The committee determined certain elements best met these requirements and would enable plants to transition from a monitoring system to more critical applications as their comfort levels with wireless sensor systems increased.

The resulting infrastructure includes these components:

Gateway: An interface between the wireless and plant networks, or directly to an end application on a plant network. It marks the transition between communications compliant to the standard and other communications, and acts as a translator between ISA-100.11a and other protocols (Modbus, HART, Foundation Fieldbus, etc.).

The **security manager** supports provisioning devices, authenticating devices that attempt to join the wireless industrial sensor network, managing the master security keys for each device and administrating security policy for each key.

The **system manager** governs the wireless industrial sensor network, including devices and communications. It performs policy-based control of the network runtime configuration, monitors and reports on communication configuration, performance, and operational status, and provides time-related services.

Backbone router: A field device, which has a field network interface and a backbone interface. Backbone routers enable external backbone to carry native ISA-100.11a protocol by encapsulating the protocol data unit for transport. A backbone is a data network (preferably high data rate) that could be an industrial Ethernet, IEEE 802.11 based wireless mesh network, Wi-MAX network, or any other network within the facility interfacing to the plant's networks.

I/O device: An input or output field instrument with the minimum characteristics required to participate in the network. The I/O role provides no mechanism for forwarding messages or routing any other device. This enables the construction of the least-complex devices and the potential for low energy consumption.

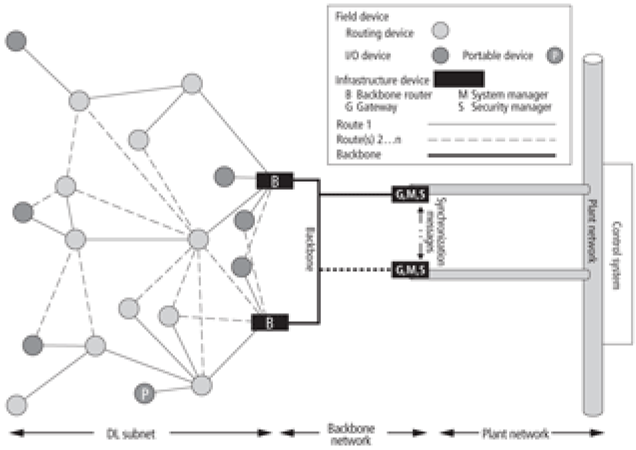
Router device: These devices can provide range extension for a network and path redundancy by routing ISA-100.11a devices received from other ISA-100.11a I/O devices. The router device can also be an I/O device, in which case it routes its own data in addition to data received from other I/O devices.

Provisioning or portable device: Used to provision ISA-100.11a devices, that is, inserting the required configuration data including security key into a device to allow the device to join a specific wireless industrial sensor network.

Unique characteristics

In addition to all traditional elements found in the WirelessHART specification, ISA-100.11a's unique elements include:

- Backbone routers
- Standard interface for backbone routers
- Duocast
- Shared and dedicated time slots
- Multiple DLL sub-network
- Over-the-air provisioning
- Network layer based on IPv6 over Low Power WPAN (6LoWPAN)



One of the many wireless industrial sensor network architectures supported by ISA100.11a and defined components.

Backbone routers

Backbone routers act as a transit link between the wireless field instrument network and the backbone. ISA-100.11a allows multiple backbone routers to be connected to a single backbone. Designing a wireless industrial network with multiple backbone routers provides several benefits:

- Increased network reliability by offering the spatial and temporal diversity required to handle errors caused by radio interference and obstacles
- Improved data latency by reducing the number of hops between the device I/O and gateway by taking advantage of a high-speed backbone
- Eliminated single points of failure

Being able to install multiple backbone routers has been critical for plants using ISA-100.11a field instruments for critical monitoring, regulatory, or control applications.

Standard interface for backbone routing

A standard interface allows users to route field instrument data through any backbone. Most backbone routers are used with Internet Protocol (IP) networks such as an IEEE 802.11 mesh network or Wi-MAX. The most common backbone routing implementation consists of encapsulated ISA-100.11a IPv6 packets inside IPv4 packets following RFC2529. As IPv6 becomes mainstream, the backbone router will be able to send ISA-100.11a IPv6 packets directly on an IpV6-enabled network.

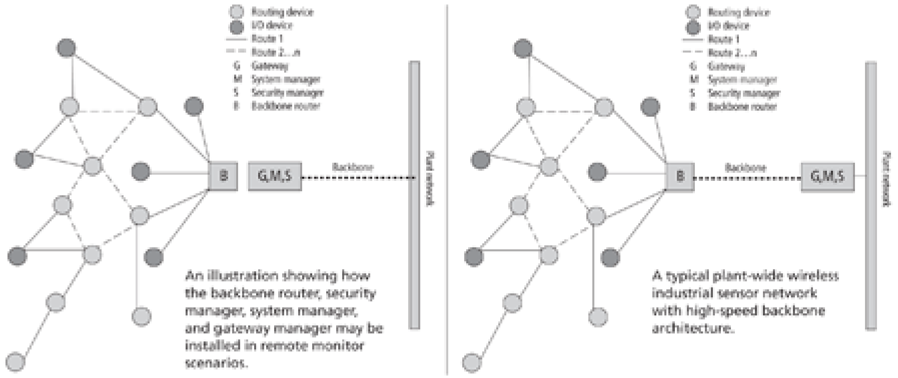
The standard interface for backbone router offers the flexibility required to use ISA-100.11a field instruments in remote monitoring, as well as plant-wide layouts.

In remote-monitor scenarios, the backbone router, security manager, system manager, and gateway manager may be installed.

This architecture allows the wireless industrial sensor network to remain functional in case the backbone, typically a point-to-point network, is slow or unreliable. The point-to-point network could be a modem-based or a shared network with unpredictable quality of service such as a satellite connection.

In a plant-wide layout with a high-speed backbone, users install the gateway, security, and system manager in a control room, while the backbone routers are in the field.

The standard interface allows users to connect the backbone routers to high-speed backbones and send their ISA100 data without the need to have any other protocol translator between the router and gateway. The system manager, security manager, and gateway, the heart of the sensor network, is then located in a controlled environment instead of an outdoor environment. Currently, most plant-wide implementations take advantage of this feature by connecting routers to high-speed IEEE 802.11 meshing access points.



An illustration showing how the backbone router, security manager, system manager, and gateway manager may be installed in remote monitor scenarios.

A typical plant-wide wireless industrial sensor network with high-speed backbone architecture.

Shared, dedicated timeslots

Some wireless standards require each device to use dedicated timeslots for communication. ISA-100.11a includes the concept of shared timeslots in addition to dedicated timeslots. A pool of shared timeslots can be used by a collection of devices depending on their needs.

This allows the network to meet the desired level of service expected by end users when, for instance, they are changing the device configuration or when the asset management application is querying data for troubleshooting.

The shared timeslot allows the network to quickly respond to additional queries from field devices and offer wired-like performance.

Multiple sub-networks

Multiple sub-networks allow ISA-100.11a users to design sensor systems that can span from a single, small, isolated network that might be found in the vicinity of a gas or oil well or small machine shop, to integrated systems of many thousands of devices and multiple networks that cover expansive plants. There is no technical limit on the number of subnets or devices that can participate in a network. A subnet, a group of devices sharing a specific data link layer configuration, may contain up to 30,000 devices (limitation of subnet addressing space). With multiple subnets, the number of devices in the network can scale linearly.

Practically, this allows a single ISA100 system manager to manage an ISA-100.11a network with slow subnets, with devices reporting once every hour that connect infrequently and report a value using a Carrier Sense Multiple Access scheme, and faster subnets with devices that would be used in Time Division Multiple Access fashion to reliably guarantee all devices have a dedicated timeslot to transmit their measurement data.

This provides the flexibility users expect from a wireless industrial sensor system—that is, a system that allows them to scale up and mix and match different types of topologies while managing all devices through a single system manager. (An array of supported network architectures and topologies is presented in the 700+ page ISA-100.11a standard.)

Duocast

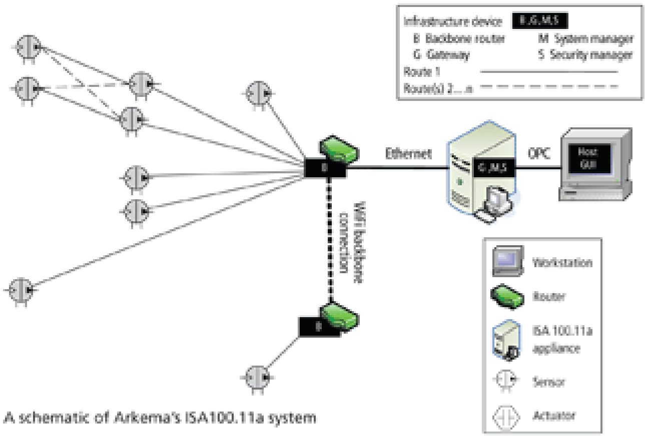
Duocast is one of the key elements that improves the “confidence in, integrity of, and availability of data sent by a wireless transmitter in an industrial environment.” Duocast allows two receivers to receive and acknowledge the data sent by I/O devices. Benefits include:

- **Data availability:** Duocast with backbone routers connected to a mesh backbone is the only way to obtain wall-to-wall redundancy, that is, from the field instrument to the host destination, which in most instances are redundant (redundant server, redundant controller).
- **Latency:** It provides better latency, especially when a router has more children, as the device does not have to wait until the next scheduled slot to attempt a second transmit if the first transmission fails.
- **Scalability:** Duocast allows for more sensor publications from a source node than the next best option, which is graph-based route redundancy with an automatic reroute feature also supported by ISA-100.11a.
- **Battery life:** Duocast provides better battery life in case of intermittent links for the dual casting node. It provides even better battery life if the receivers are also battery powered.

Over-the-air provisioning

ISA-100.11a allows users to provision a device wirelessly with different levels of security. This feature allows end users to provision devices remotely from the ISA-100.11a security manager using digital certificates or static security keys (less secure).

Regardless of commissioning method, users can configure and make changes to field instruments from the ISA-100.11a system manager or their favorite asset maintenance application, as the ISA100 gateway supports field protocols used by today's asset maintenance applications.



A schematic of Arkema's ISA100.11a system

Network layer based on IPv6 over Low Power WPAN (6LoWPAN)

Instead of re-creating the wheel, ISA100 adopted specifications developed by the 6LoWPAN IETF group. IETF has defined encapsulation and header compression mechanisms that allow IPv6 packets to be sent to and received from Low-Power Wireless Personal Area Networks (LoWPANs), which are defined as networks comprised of "devices that conform to the IEEE 802.15.4-2003 standard by the IEEE." These devices are characterized by low bit rate, low power, and low cost, with typically low computational power, memory, and energy availability.

The group has already resolved issues associated with enabling IP communication between 6LoWPAN devices. Adopting the established specifications enabled ISA100 to take advantage of IETF's work as well as any further enhancements resulting from the organization.

Crosby plant case

In 2009, Arkema's Crosby plant, located just north of Houston, Tex., agreed to be the beta site for the Wireless Compliance Institute (WCI) and vendors offering ISA-100.11a field instruments. The plant produces liquid organic peroxides used primarily to produce plastic resins, polystyrene, polyethylene, polypropylene, PVC and polyester reinforced fiberglass, and acrylic resins.

Within days of approval of the ISA-100.11a standard by the ISA Standards and Practices Board, the ISA100 WCI installed a multi-vendor user test system at the plant to demonstrate interoperability among multiple vendor devices.

Numerous applications for ISA-100.11a were identified, including temperature, pressure, contact closure, valve positioning, gas detection, corrosion detection, and others. Most of the sensing opportunities were outdoors, where cabling for sensors can be prohibitively expensive. Four applications were initially identified:

- **500,000 gallon water tank:** A firewater safety tank that must be full at all times previously relied on a simple mechanical sight gauge that “fails full,” and the cost of wiring to that location for a pressure sensor was prohibitive.
- **Cold storage:** Numerous cold storage warehouses operate at temperatures below 0°F. If these warehouses exceed the required temperature, product can potentially decompose and ultimately catch fire. Temperature was being reported to the control room by wire, with an audible remote alarm to indicate if a door was left open. Wireless temperature and door sensors were added to three of the warehouses, providing central reporting of exception conditions. This six-transmitter cluster provided a realistic demonstration of ISA-100.11a sensor meshing capabilities.
- **Wireless adaptor:** Values from a wired level sensor on a waste water tank were fed into a nearby satellite control room, but not the central control room. An ISA-100.11a adaptor connected in series to the 4–20 mA analog output of this sensor, reporting the result wirelessly to the central control room. This demonstrated the general notion of using ISA-100.11a to provide central visibility to existing sensors scattered across the plant.
- **Gas sensor:** The site included many gas sensing opportunities. A single wireless gas sensor was installed alongside an existing wired sensor. Following a successful pilot, wireless gas sensing can be expanded throughout the site when a fully certified wireless product is available.

Transmitters at Arkema

Application	Transmitter type	Count	Range	Reporting rate
Water tank 500,000 gallon	Differential pressure	1	0 – 400 in H_2O	30s
Waste water tank	Analog input	1	4 – 20 mA	1s
Cold storage	Temperature	3	-20 to 140 deg F	10s
Cold storage	Discrete input	3	Open/closed	10s
Gas monitoring	Sensor type and location confidential	1	0 – 30 ppm	30s

Suppliers who participated in the Arkema User Test

Supplier	Role/Components
Wilson-Mohr	Site specific project management, system installation, wireless system configuration/integration, host system configuration/integration, Arkema liaison
Nivis	System manager, OPC server, system integration
Honeywell	Host system, backbone routers, temperature transmitter, discrete input transmitter, analog input transmitter
Yokogawa	Water tank pressure transmitter
Gastronics	Gas sensor transmitter

An infrastructure was installed including two ISA-100.11a backbone routers providing necessary site coverage. A WiFi connection between the backbone routers simplified the installation, so the remote backbone router did not need a wired connection back to the host.

The test topology demonstrated the flexibility of ISA-100.11a standard where a backbone router would provide extensive outdoor wireless coverage, and sensor meshing would be used for uncovered areas.

Arkema was surprised by the backbone router coverage, as seven of the nine installed transmitters established strong connections directly to the backbone router. The remaining two transmitters were remotely located and connected by sensor meshing through other transmitters. All deployed transmitters had routing capability, enabling the site to add more transmitters without needing to implement additional backbone routers.

All transmitters installed at Arkema had been tested for ISA-100.11a compliance using a non-commercial version of the WCI's Device Interoperability Test Kit. This hardware/software tool uses XML scripts to emulate the operation of an ISA-100.11a system manager in a transparent and vendor-independent manner.

All transmitters were tested for ISA-100.11a compliance, and approved for use at Arkema.

To demonstrate the concept of plant-wide coverage from two access points, the initial transmitters were installed toward the periphery of the operation. The backbone routers were placed based on a visual inspection of the site, without a radio survey of any kind. Radio ranges of 100-200 meters were achieved, as expected.

ISA-100.11a was released as an ISA standard in September 2009. Since then, this standard for wireless field instruments was followed by another standard for field instruments – IEC 62591Ed 1.0, developed by HART Foundation. Additionally, an upcoming standard (IEC 62601), developed by a consortium of Chinese instrumentation companies, is expected to receive approval.

As mentioned, it is unrealistic and impractical (and incorrect) to assume today's industry as a whole has chosen one over the other. This makes it all the more crucial to understand the ins and outs of these standards so companies can effectively evaluate which ones can meet their needs now and in the future.

ABOUT THE AUTHOR

Soroush Amidi is the product marketing manager for Honeywell Process Solutions. He manages several wireless products including OneWireless network. His career spans a variety of engineering, general management and marketing roles within Honeywell. Soroush holds a Bachelor of Engineering Sciences in Chemical Engineering from the University of Western Ontario, London, Ontario, and a Masters of Business Administration from McGill University, Montreal.

National Instruments promove em 24 de Março o evento NI Days 2011 – Conferência Tecnológica sobre Projeto Gráfico de Sistemas

A National Instruments Brasil realizará no próximo dia 24 de Março o NI Days 2011 - Conferência tecnológica sobre Projeto Gráfico de Sistemas, o evento mais importante da indústria relacionado às áreas de Automação, Testes, Medições e Projetos Embarcados, e que deve reunir mais de 700 engenheiros, educadores e pesquisadores de todo o país. O evento será realizado no Centro de Convenções do Expo Center Norte, em SP. Na ocasião, serão realizados workshops, sessões técnicas, simpósios verticais, seminários práticos e exposições sobre as mais recentes tecnologias da National Instruments nas áreas de projetos, pesquisa, manufatura e testes.

Este ano, o evento contará com a presença do Sênior Vice-Presidente de Marketing e Vendas, Sr. Pete Zogas, que fará a apresentação de abertura com o tema:

"Tecnologias Inovadoras para aplicações de Automação, Teste e Medição**"**

A edição 2011 do NI Days contará com 4 sessões verticais, a saber:

- Sessão Automotiva, nesta sessão, serão abordadas as soluções para os grandes desafios na indústria automotiva como: Aquisição de Dados e Testes Embarcados, tecnologias para aplicações de Testes e Simulações com Hardware-In-the-Loop (HIL) e prototipagem rápida de sistemas de controle (ECU) utilizando hardware COTS (Commercial of the Shelf).
Para aplicações embarcadas, a NI apresentará plataformas compactas e robustas para solucionar aplicações de aquisição de dados, testes de durabilidade, testes em campo de provas e outras aplicações, até mesmo para desenvolvimento de produtos. Para as aplicações de testes e simulações com hardware-in-the-loop será apresentado o NI VeriStand, um ambiente flexível e amigável onde os usuários criam complexos sistemas de testes baseados em configurações, que são capazes de interagir com hardware da NI ou de terceiros e integrar modelos matemáticos e algoritmos já existentes (desenvolvidos em diversas ferramentas de mercado), acelerando o desenvolvimento e reduzindo custos.
- **Sessão Acadêmica** – apresentará as tecnologias National Instruments para projetos de pesquisa acadêmica, incluindo as vantagens de sua consolidada utilização pela indústria, como ferramentas de apoio ao ensino acadêmico em engenharia, ciências biomédicas, física, química e computação. Serão abordados temas de hardware e software, contemplando NI LabVIEW 2010, arquiteturas para aplicações em tempo real com PXI e CompactRIO, condicionamento e aquisição de sinais, instrumentação virtual com FPGAs. Também serão apresentados dispositivos plug-and-play para aquisição de dados e controle, CompactDAQ, CompactRIO, NI ELVIS e o mais novo lançamento da NI – o NI myDAQ.

- **Sessão Big Physics** - ao longo dos anos, o uso de soluções comerciais integradas, ou COTS (**C**ommercial **O**ff the **S**helf), tem possibilitado que cientistas e pesquisadores possam focar mais em seus experimentos do que em sua instrumentação. Esta sessão apresentará como as soluções COTS baseadas em tecnologia FPGA e multicore associadas à utilização de um sistema gráfico de desenvolvimento têm colaborado com o sucesso de vários laboratórios tais como CERN, Max Planck, Los Alamos e ESO. Também serão abordadas algumas plataformas de hardware voltadas para medição, diagnóstico e controle.

- Sessão de Energia: nesta sessão serão abordadas soluções National Instruments para aplicações em energia, petróleo e gás.
Para aplicações em energia, serão abordados alguns desafios em redes inteligentes, também conhecidas como Smart Grids, e apresentadas as soluções NI Smart Grid Analizer (SGA) e NI Phasor

Measurement Unit (PMU) para análise de qualidade de energia (IEC 61000), medição de flicker (EN 50160 / IEC 61000-5-15), fasores (IEEE C37.118), entre outras.

Tanto para aplicações em energia quanto para aplicações em petróleo e gás, será mostrado como as soluções COTS baseadas em tecnologia FPGA e multicore associadas à utilização de um sistema gráfico de desenvolvimento têm colaborado com o sucesso de vários projetos, reduzindo custos e tempo de desenvolvimento.

Além disso, os participantes podem aprender sobre novas tecnologias e ver demonstrações de produtos nos stands das empresas integradoras que estarão expondo durante o evento. Também haverá apresentações de Estudos de caso de usuários dos mais variados segmentos da indústria local.

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Taxas: **U$ 50 (profissional) e U$ 10 (Estudante)**

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JUNHO		
Utilização de Válvulas de Controle e/ou Inversores de Freqüência	Sorocaba/SP	23-06-2011
AGOSTO		
Soluções para Automação Predial & Segurança Patrimonial	Sao Paulo/SP	18-08-2011
SETEMBRO		
Gerenciamento de energia , Otimização e Smart Grid	Sao Paulo/SP	22-09-2011
OUTUBRO		
Instrumentação em Áreas Classificadas	Sao Paulo/SP	25-10-2011
NOVEMBRO		
FDT/ DTM , EDDL,FDI & Gerenciamento de Ativos	Maua/SP	17-11-2011