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A practical path

WITH ALL THE hype about Industrie 4.0, IIoT and other global advanced information initiatives, it's hardly surprising that suppliers are promoting products that highlight readiness for digitalizatian. Many solutions are available to take advantage of process automation field device information across the enterprise—from the plant floor to the cloud.

But end users tell me, "We are not planning to replace our field devices, rather employing solutions that work with them." So the HART and FOUNDATION Fieldbus devices sold today will still be in operation for the foreseeable future, and the challenge is how users can integrate everything in a standardized way.

This challenge expands our role from a traditional field protocol standards body to encompass system-wide data standards. On these pages, we provide guidance on solving the integration problem, starting on the shop floor where nearly 60% of the respondents to our annual Field Networks survey express a desire for Internet Protocol (IP). This means that the industry needs a lower-cost, safe physical layer to enable IP functionality. Ethernet to the Field, or Advanced Physical Layer (APL) is a two-wire, intrinsically safe solution, as described in our first article, "Advances in the physical layer" (page S-4).

To deliver on the promise of Industrie 4.0 and IIoT, field device information must be understood by many higher-level applications. It must be structured to allow comparisons and analytics independent of the supplier and protocol. So, consortiums like the Open Process Automation Forum (OPAF) and Europe's NAMUR organization are actively producing recommendations for next-generation open process automation system architectures. "Open systems unlock value" (page S-7) describes how FieldComm Group technologies support the OPAF and the NAMUR open architectures.

Some see OPC UA as a protocol, others think it's software, but we think of it as a framework offering the common methods needed to build domain-specific solutions. This year, FieldComm Group and the OPC Foundation have codeveloped the Process Automation Device Information Model (PA-DIM™). "Software eases integration" (page S-14) tells how OPC UA and PA-DIM® allow users to access information without any knowledge of the underlying communication protocol.

"Standards streamline information anywhere" (page S-20) describes a demonstration system installed at our Austin headquarters that, relying entirely on FieldComm Group standards, shows how information from a HART7 4-20 mA transmitter can be accessed through a Microsoft Azure-hosted web application.

The plant of the future will have many coexisting protocols and physical layers, and we already see that model beginning to deliver value. Our Plant of the Year (PotY), Mangalore Refining and Petrochemical Limited, is leveraging stranded data from HART field devices, adding new data through WirelessHART, and expanding its application of FOUNDATION Fieldbus. This has resulted in millions in savings by shifting unplanned maintenance to planned, avoiding failures and efficiency improvements in commissioning and maintenance. ●

Ted Masters
President and CEO
FieldComm Group

Innovations in the physical layer

Protocol independence, Ethernet speed, power and intrinsic safety, on a twisted pair

NETWORKING PROFESSIONALS LIKE to speak in terms of layers—application layer, transport layer, presentation layer, etc.—all of which can be rather abstract to the uninitiated. But one layer, the physical layer, actually seems tangible. The physical layer is where the rubber meets the road in automation and IT systems, or perhaps better stated, where the bits or waveforms meet the wire—or, in some cases, the air.

In process automation, we're all familiar with physical layers. A two-wire twisted pair that transports a 4-20 mA analog signal with a superimposed digital signal at 1,200 bps is the physical layer for HART. The wire pairs in an H1 cable carrying a 31.25 kbps bitstream is the physical layer for FOUNDATION Fieldbus.

In the IT world, we look at Ethernet cabling and think it's all the same. But if you need 10 Gbps Ethernet, you'd better use the Cat-6 cable, because Cat-5 or Cat-5e won't work, even if the cable jacks are the same. Note that these physical layers use four-wire communication. Twice the copper means more cost. And to get the highest speeds, cable lengths are limited to 100 meters, which means more switches, routers, extenders, infrastructure, etc., and more cost.

Advanced Physical Layer (APL)

- Ethernet-based, for any protocol or application
- Power and data over a shielded twisted pair line
- Any method of hazardous area protection especially intrinsic safety, including simple validation
- Transparent connection to any IT network
- Re-use of existing two-wire cable
- Supports the familiar trunk-and-spur topology
- Device access anytime and anywhere
- Fast and efficient communications for automation and other applications

STANDARD PATH TO IP

In the process industries, domain-specific concepts like the NAMUR Open Architecture (NOA) or Open Process Automation (OPA) by the Open Process Automation Forum (OPAF) are presently attempting to simplify the efficient construction, commissioning and operation of process plants. Broader use of wireless solutions, simplified field device integration and Ethernet to the field represent integral components of these concepts.

And certainly information and operations technology (IT/OT) integration, Industrie 4.0, and the Industrial Internet of Things (IIoT) are the buzzwords of the past few years. Embedded in all of those ideas is the belief that adopting Internet protocol (IP) networking technology is the way of the future.

FieldComm Group has been, and will remain, a leader in the development and support of standards for the process automation world. The foundation of a path to IP technology was laid in 2007 with the release of WirelessHART. The release of HART-IP in 2012 defined HART at the speed of Ethernet.

APL parameters and specs

Parameter	Specification
Standards	IEEE 802.3 (10BASE-T1L), IEC 60079
Power supply output (Ethernet APL power switch)	Up to 60 W
Switched network	Yes
Redundant cable and switches	Optional
Cable type for intrinsic safety	IEC 61158-2, Type A
Maximum trunk length	1000 m
Maximum spur length	200 m
Speed	10 Mbps, full-duplex
Hazardous area protection	For all zones and divisions, with intrinsic safety at the device

"IT protocols are already used at the I/O level. TCP/IP-based HART-IP is a good example. The next logical step is to do this in field devices directly," says Andreas Hennecke, product marketing manager at Pepperl+Fuchs. "This dramatically enhances functionality in field instruments and seamless integration in automation infrastructures. Such services can include browser-based diagnostics, FTP-based download of manuals or OPC/UA based cloud integration."

Now in 2018, FieldComm Group along with Profibus, ODVA and leading automation companies, including ABB, Endress+Hauser, Krohne, Pepperl+Fuchs, Phoenix Contact, Rockwell Automation, Samson, Siemens, Stahl, Vega and Yokogawa, are working together on an Ethernet-to-the-field project that uses a two-wire, powered, intrinsically safe (IS) physical layer for IP-enabled instruments and infrastructure. Currently referred to as Advanced Physical Layer (APL), the project focuses on an extension of 10BASE-T1L—an Ethernet physical layer for process automation and instrumentation, which can be deployed in hazardous areas (Zones 0 and 1, Division 1), allows long-reach connectivity, and includes an option for device powering over the line. Products are projected to be available in late 2021.

The realization of the APL vision began in 2011, when a group of solution suppliers at the urging of several end user groups began a technical investigation of a protocol-neutral, advanced physical layer that could solve the longtime problem of a long-reach Ethernet for use in hazardous locations. The results of this five-year investigation proved the feasibility of a solution for this problem, and also generated interest in an industry-wide solution based on IEEE's Ethernet standards.

"APL brings Ethernet into the field of process automation," explains Hennecke. "APL is in development, incorporating important lessons learned in cooperation with all stakeholders of the process automation lifecycle. It's based on the same two-wire cable as FOUNDATION Fieldbus H1, thus offering continuity to users."

WHERE WILL APL BE USED?

"Connectivity to IP-style internet is one purpose," says Ted Masters, president and CEO, FieldComm Group. "But there's a need in the field today for a faster solution. Higher-use devices such as drives and motors need higher data speeds. Valves need to send signatures, and analyzers also can use more bandwidth. We need to move more data during operations, and especially during startups, configurations and commissioning. Will everything become high-speed Ethernet? Will it be all wireless? No, we'll see different things—Ethernet, HART, 4-20 mA, even different protocols. The key is at the integration layer, where different physical layers and protocols are integrated. FDI and information models become important. Users want a standard way to reliably bring things together and display data."

Seiichiro Takahashi, general manager, marketing at Yokogawa, and member of the System Integration and Maintenance Working Group at

FieldComm Group, adds that, "At the early stages, four-wire devices such as magnetic or Coriolis flowmeters will be released, because upgrading from existing Ethernet-type flowmeters is not difficult. However, the majority of devices in process automation are two-wire devices, such as pressure/temperature transmitters. To disseminate APL technology, it is mandatory to adopt two-wire, intrinsically safe and powered field devices."

Hennecke adds, "For simple signals, such as NAMUR-switches or pilot valves, an IP-layer may not be reasonable or necessary for functionality. Here, data concentrator devices can act as process interfaces to multiple, simple analog, or discrete signals to Ethernet while offering an IP-stack for higher-level services."

This new Ethernet physical layer, together with the automation protocols that define the structure and meaning of information being transmitted to and from field devices, are the enabling factors of the IIoT. It will provide the prerequisite to extend the digitized world to process automation and instrumentation.

The leading standards development organizations participating in the project are working to ensure that all technologies and standards will be compatible to their respective protocols, such as EtherNet/IP, HART-IP and Profinet. They will also contribute to protocol-neutral conformance standards for their respective industrial Ethernet networks.

"No one is ripping out field devices. Fifty million HART devices are not going away," adds Masters. "We're not going to replace everything with Ethernet, but as suppliers make devices with Ethernet, it will come along. People want devices to fit the plant network."

Open systems unlock value

Standards deliver the interoperability promised by OPAF and NAMUR

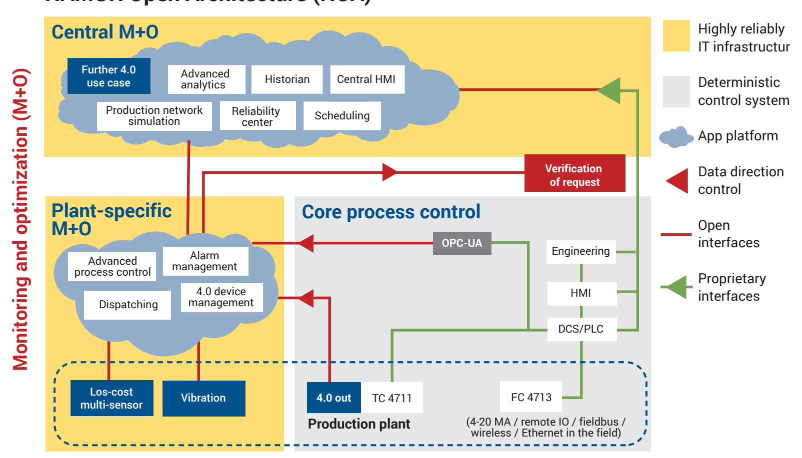
THE WELL-KNOWN "BUILDING block" metaphor may be slightly overused by now, but it's never been more true than illustrating how the FieldComm Group's protocols and technologies form the base of the two latest openness and interoperability efforts in the process industries. This is because the use of FDI, FOUNDATION Fieldbus, WirelessHART and HART can more easily provide long-sought, often-stranded information from field devices to systems across the enterprise, which is the ultimate goal of openness and interoperability.

MEET OPAF AND NAMUR

A revolutionary approach to openness is being developed by the Open Process Automation Forum (OPAF, www.opengroup.org/open-process-automation). It aims to develop an open, interoperable "standard-of-standards" specification. In the two years since it was launched, OPAF has grown to 116 members, including end users, system integrators, suppliers and supporting organizations. Over the past year, OPAF's Business Working Group drafted its 36-page "OPA Business Guide" (https://publications.opengroup.org/g182) that describes a value proposition and business cases for open process automation (OPA).

During the same period, OPAF's Technical Working Group developed the OPAF Technical Reference Model (TRM), Part 1—Technical Architecture that defines interfaces between devices, but doesn't dictate what's in those products or interfere with their intellectual property. The TRM covers regular DCSs and supporting PLCs, HMIs, I/O and Ethernet-based networks, as well as advanced controls and manufacturing execution systems (MES). TRM is expected to deliver openness and interoperability in three areas: On-Premise OT Data Center with real-time advanced computing (RTAC) and distributed control framework (DCF); OPA Connectivity Framework (OCF), which is a real-time, universal service bus like Ethernet using an OPA-standard communication protocol like OPC UA; and Distributed Control Nodes (DCN) that are configurable I/O for input/output processing, regu-

NAMUR Open Architecture (NOA)



Open monitoring and optimization with NOA

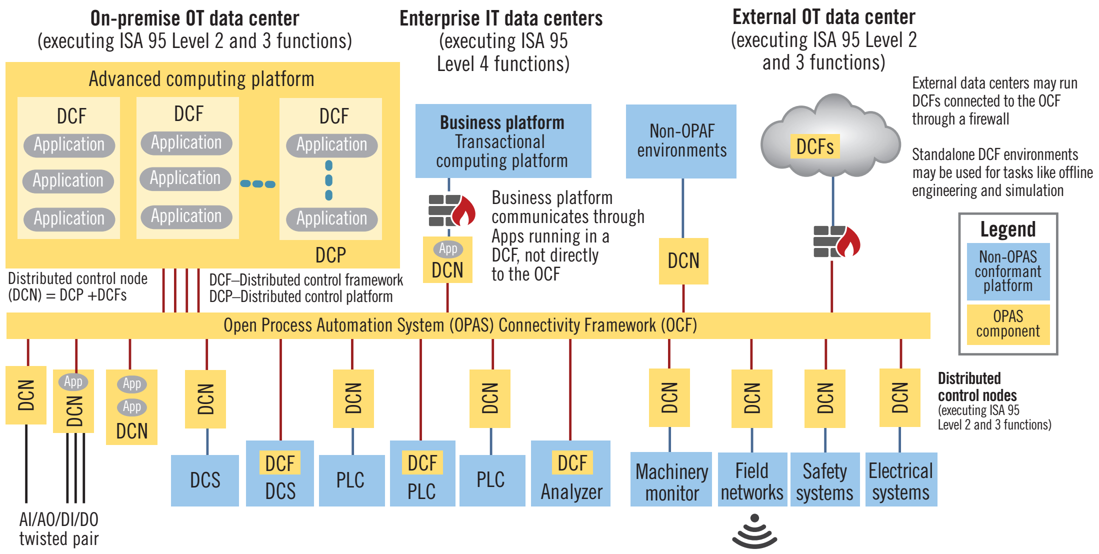
NAMUR Open Architecture (NOA) provides Industrie 4.0 monitoring and optimization by using a reliable IT infrastructure in centrally located plant areas, that does not impact core-process and deterministic controls or proprietary interfaces Source: NAMUR latory control, logic solving and application hosting. If successful, OPAF's architecture will result in radically different control systems.

The second major openness effort, NAMUR Open Architecture (NOA, www.namur.net) is scheduled to be released as an IEC standard in 2021-22. NOA addresses openness as an evolution, that is, without impacting what already works. NOA is trying to maintain the benefits of existing systems by layering NOA's monitoring and optimization (M+O) applications alongside existing field-level, basic automation, MES and ERP levels. These applications cover M+O functions like dispatching, alarm management, advanced process control (APC), and Industrie 4.0 device management, and essential M+O functions like advanced analytics, historian, central HMI, production network simulation, reliability center and scheduling.

FIELDCOMM GROUP BASE FOR OPENNESS

"FDI is the next step of device management. It provides a unified description, and allows for field communication standard independent device management using one tool. It separates device representation from the underlying communication technology, and lays the groundwork for digital twin representation of the devices," says Thoralf Schulz, board chair of the FieldComm Group and group vice president of R&D and technology in the Industrial Automation Control Technology division at ABB. "Making these device models available through OPC UA makes the device models available, not only to control systems, but also to further applications as formulated by NAMUR and OPAF. FieldComm Group is working actively with the OPC Foundation to make this a reality. The currently ongoing work in standardized semantic identifiers, as defined by international standard IEX or exl@ss, will further strengthen this. It enables not only the data access, but makes it possible to develop standardized applications."

Peter Zornio, FieldComm Group board member and CTO at Emerson Automation Solutions, adds that, "FieldComm Group technologies could and should play a major role in enabling OPA and NOA



Control, network and I/O with OPA

In a typical process application with Open Process Automation (OPA) standard devices, OPA's Technical Reference Model (TRM) includes On-Premise OT Data Center with real-time advanced computing (RTAC) platform and distributed control framework (DCF); OPA Connectivity Framework (OCF), which is a real-time, universal service bus like Ethernet running OPC UA; and Distributed Control Nodes (DCN), which are configurable I/O for input/output processing, regulatory control, logic solving and application hosting. Source: OPAF solutions. Regardless of whether OPA, NOA or other open architectures are adopted, users aren't planning to replace their installed and operating field and measurement devices, such as all the control valves running in their facilities today. The vast majority of these components are running some combination of HART or FOUNDATION Fieldbus, and that huge installed base isn't going away."

Zornio explains that whichever openness strategy is employed—OPAF's redefined, orchestrated control architecture or NAMUR's added digital transformation layer—both plan to build on the installed base of existing devices. "No one's talking about ripping and replacing existing field devices," he says. "Openness and interoperability will be achieved using established standards and easier connectivity."

STANDARDS UNLOCK DATA

Lukas Klausmann, senior marketing manager for industrial communication at Endress+Hauser, agrees that the FieldComm Group has spent years standardizing data in all kinds of field devices, which paves the way for NAMUR and OPAF efforts to also unlock data from field devices in a standardized way. "FieldComm Group enables suppliers like Endress+Hauser to launch new tools based on NOA that can cover a wide range of installed bases, and turn data into useful plant information," he says.

For example, Endress+Hauser recently launched an analytics app that shows a dashboard of the installed devices in a facility, and uses a new approach based on work by FieldComm Group to standardize device data. "Endress+Hauser Analytics app shows serial numbers, tags, manufacturer names, product code, and often asset type as well," he explains. "We're also about to launch the Endress+Hauser Health app that works in accordance with NOA to immediately display health status, performance history, root cause and remedy in case of diagnostic events on mobile devices. Both of these app tools are web-based, so dashboards can be displayed on tablet PCs and smart phones.

"In the same way, NAMUR and OPAF are seeking to increase device connectivity, so more field data can make its way to cloud services and mobile devices. All these capabilities are made possible by standardization, which makes sure each device shares its data in the same way. FOUNDATION Fieldbus is standardized on its H1 and High-Speed Ethernet protocols, as well as HART, and FieldComm Group compliance-tests devices to help ensure they can connect without issues to provide field data. In the future, FDI and OPC UA are going to have more standardized interfacing, which will make it easier to connect and access field devices. The potential here is huge because about 90% of Endress+Hauser field devices are already equipped with a communication protocol, such as HART, FOUNDATION Fieldbus, Profibus/ Profinet or EtherNet/IP. Standardizing their data will mean that ripping and replacing isn't necessary.

FDI AND OPC UA TO THE RESCUE

Zornio adds that two FieldComm Group technologies can enable any OPA and NOA strategy. "FDI is a tool that can configure any device as long as an FDI package is provided. It helps integrate existing and new field devices, which aids everything from configuration to data access and modeling. Meanwhile, WirelessHART is key to fulfilling NAMUR's vision because it provides easy installation for the incremental sensors that NAMUR talks about adding on top of the controls layer," he says.

Schulz explains, "Existing HART and FOUNDATION Fieldbus installations make the data from the devices available. FDI adds the system and communication standard that makes independent device management a reality, and available to all HART and FOUNDATION Fieldbus devices, as well as to other protocols like Profibus and Profinet. This is done without needing to replace existing devices, but is still expandable for advances in future devices. Adding OPC-UA and a standardized device representation, independent of the device standards, provides standardized access, and ensures that any advanced applications and capabilities are equally deployable for existing installations and newly evolved installations. This ensures the interoperability targeted by NAMUR and OPAF."

Scott Saunders, president and CEO of Moore Industries-International, says, "OPAF and NAMUR are attempting to do at higher data exchange levels what FieldComm Group technologies have been doing for years at the sensor, device and DCS levels, which are Layers 0, 1 and 2 of the ISA 95 control information hierarchy. FieldComm Group does a wonderful job of promoting and endorsing open industrial standards for measurement and data exchange at Layers 0, 1 and 2. OPA is the same concept, but it consists of platform-agnostic data exchange and analytics using open standards and off-the-shelf software components."

Saunders adds that FieldComm Group can help interoperability initiatives like OPA because its planned DCNs will serve as gateways between Layers 0, 1 and 2 and higher levels. This is where continued support for its open technologies like HART Internet Protocol (HART-IP), WirelessHART, FOUNDATION Fieldbus and FDI can be most beneficial. "The future of process control and automation is big data and analytics, but you can't take advantages of those without accessing data from Layers 0, 1 and 2, and getting it to the cloud and corporate wide area networks," explains Saunders. "OPAF has already outlined a number of requirements for its standards, and I understand that HART is going to be part of OPAF's physical platform requirements."

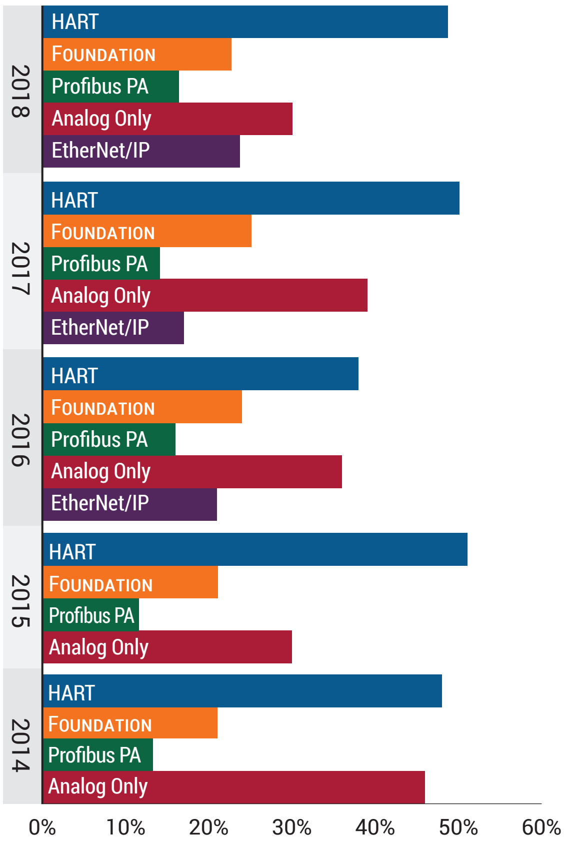
Moore has been developing a gateway that supports open protocols like HART-IP, Modbus TCP/IP and HTTP via Ethernet, which lets users take process data from field devices and more easily make it available to higher-level control and information systems. This HES HART-to-Ethernet gateway will communicate with up to 64 HART field devices, and allow immediate access to real-time HART variables and diagnostics over Ethernet.

Zornio concludes, "FOUNDATION Fieldbus, HART, WirelessHART and FDI are available today, but they're also set up to meet future needs. The best avenue for field instruments and devices to achieve openness and interoperability is FieldComm Group technologies." ●

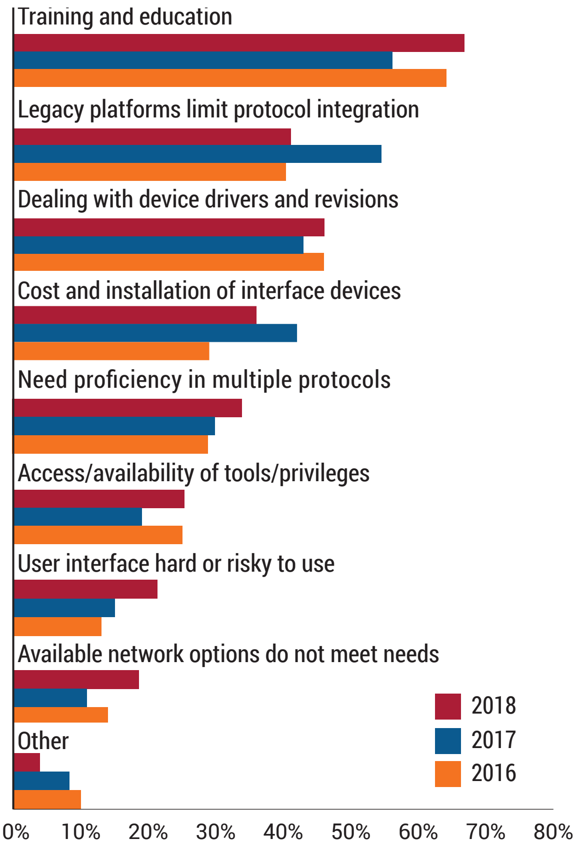
Users weigh in

This year's annual survey was completed by 136 members of *Control's* primarily North American subscriber list representing the process industries including Food, Chemicals, Pharmaceuticals, Primary metals, Petroleum, Utilities, etc.

Percent of installed wired devices by protocol



Major challenges to device integration



How connected are your digital protocols?

"Which of these statements describes your usage. (Please check all that apply.)"	HART			FOUNDATION		
	2016	2017	2018	2016	2017	2018
Permanently for real-time process systems	36%	44%	48%	50%	66%	52%
Occasional via handheld	59%	61%	57%	39%	37%	38%
Occasional via PC	41%	34%	34%	33%	23%	31%
Permanently for off-line activity	23%	17%	20%	15%	14%	20%
Permanently for real-time enterprise systems	10%	12%	9%	15%	9%	10%

Software eases integration

Information models and OPC UA power programmable paths to protocol independence and the installed base

FIELD DEVICES CAN provide a wealth of information to improve maintenance and operations of existing plants. Along with the opportunity to make intelligent decisions about how best to maintain equipment to avoid unplanned shutdowns, field device data can be analyzed to extract useful information and used to improve plant operations.

So, many companies are looking for opportunities to gather more data and add more field devices. But there are many challenges in existing plants, where it's difficult to get to the equipment, hard to extract information from smart devices, and a problem to integrate new devices to existing systems.

"We need to use data provided by field instrumentation to get information, use data analytics and artificial intelligence to process that information, and thereby generate customer benefits such us efficiency, productivity, flexibility, quality, etc.," says Thomas Hahn, chief expert, software for Siemens AG and vice-president, OPC Foundation (Siemens is a founding member of OPC Foundation).

"Much of the data available is currently not used, because control systems typically are the barrier to access the information," adds Achim Laubenstein, technology director, FieldComm Group. "Therefore, we need a solution that is much simpler, protocol-independent and non-proprietary."

Hahn explains, "A protocol- and system-independent software architecture is needed to secure the benefits of digitalization, Industrie 4.0, the Industrial Internet of Things (IIoT), Made in China 2025 and similar initiatives. These efforts require devices and systems that can cross-file and do other tasks, which in turn requires IoT interoperability and the ability to describe those devices and systems. We believe interoperable, scalable and secure OPC UA is a promising candidate for this job because it can work with companion specifications, and it networks with different partners, including FieldComm Group."

OPC UA PROVIDES THE FRAMEWORK

Software systems like FDI, based on OPC UA, support a new level of innovation with data modeling that allows disparate protocols to behave uniformly at the application software level. "FieldComm Group now maintains the tools and components for this very important FDI initiative, and OPC Foundation continues to work with them to extend and maintain the deliverables—both specifications and technology—for vendors to meet the needs of process automation," says Tom Burke, president and executive director, OPC Foundation.

OPC Foundation is also working with FieldComm Group to develop a companion specification

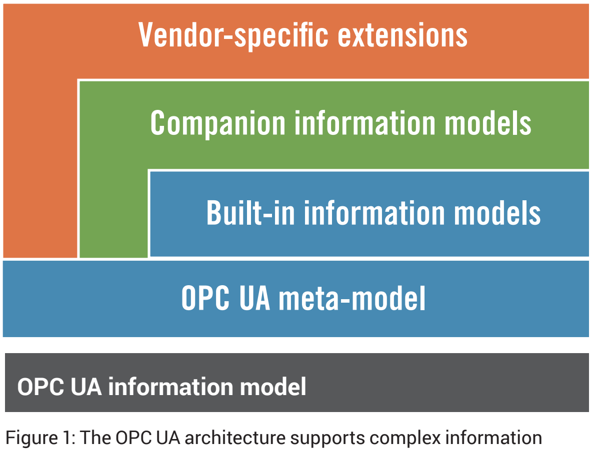
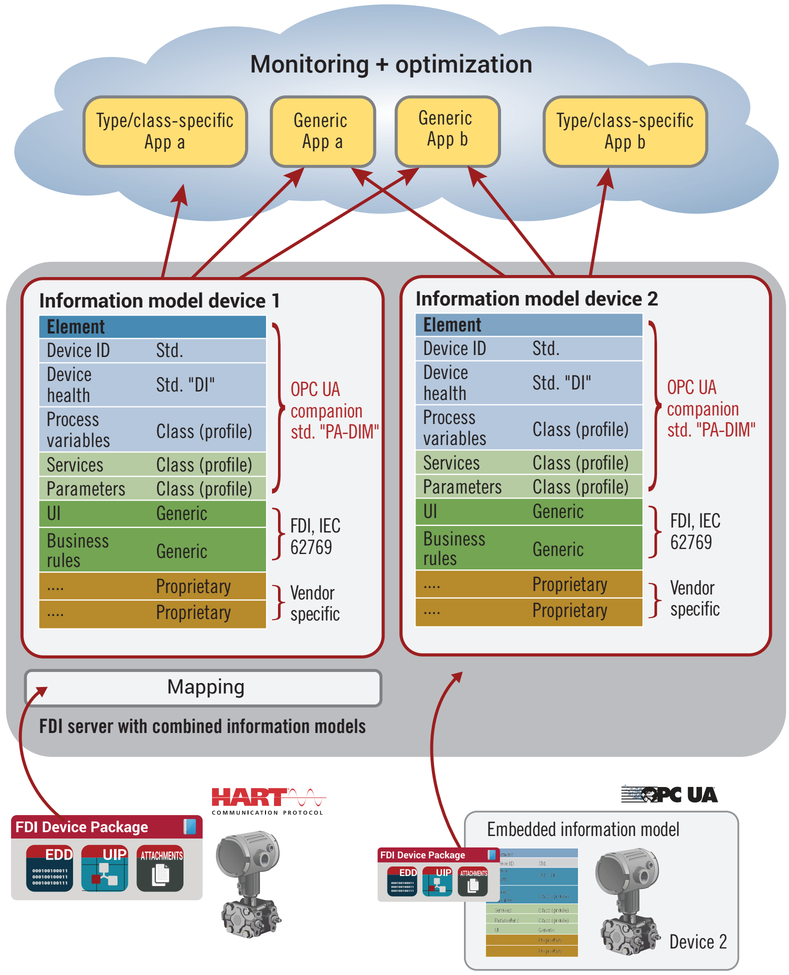


Figure 1: The OPC UA architecture supports complex information models from the OPC Foundation, its collaboration partners and non-members.



PA-DIM provides a path

Figure 2: When set up as part of the FDI information model through the device description (EDD), fieldbus-specific information will be mapped to the standard PA-DIM model by the FDI server.

that will allow OPC UA to consume data from all vendors' field devices, with the objective of making it available in the cloud. Along with NAMUR and Industrie 4.0, "We expect additional organizations will be part of this important initiative," Burke says. "All the rallying around the importance of standardization across process automation devices is really being driven by the end users, as illustrated by recent activities from OPA Forum and NAMUR."

The OPC UA information model architecture (Figure 1) is fairly simple, yet supports complex information models from the OPC Foundation, its collaboration partners and non-members. "What's most interesting about this architecture is that you don't have to be a member of the OPC Foundation to develop a companion specification and take advantage of the rich service-oriented architecture of OPC UA," Burke says.

OPC Foundation has a well-defined OPC UA meta-model that defines how data models are described from a syntax and syntactic perspective. The meta-model is the base architecture for OPC UA, describing all the native OPC UA datatypes, which themselves are structures that have both data and metadata.

Built on top of the OPC UA meta-model, the built-in OPC information models provide capabilities such as historical data access and standardization of devices, data access, alarms and conditions. Then the companion specifications, which are built by collaboration partners for their organizations' information models, build on top of the OPC UA meta-model but also have the ability to take advantage of the standard OPC built-in information models. Vendors can build vendor-specific extensions on top of the OPC UA meta-model and extend the capabilities of the companion information model specifications.

"Thanks to FieldComm Group's use of the OPC UA standard, Iconics' HMI/SCADA and IoT-enabled software can easily connect to the wide variety of devices that leverage FieldComm Group's technology," says Russ Agrusa, president and CEO of ICONICS. "Such connectivity to every 'thing' in the Industrial Internet of Things (IIoT) is critical for today's manufacturing, energy management, industrial and building automation systems."

FDI USES CDD AND SEMANTIC ID

Of course, OPC UA is aided by one of the FieldComm Group's three primary standards, namely FDI, which delivers specific device type information within a protocol-independent OPC UA information model. FDI provides device data by using standardized semantic identifiers (Semantic ID) that are part of Common Data Dictionary (CDD), which is based on international standards, such as IEC 61987 or even ecl@ss that defines protocol-independent semantics, according to Frank Fengler, head of Device Integration, Measurement and Analytics at ABB.

> "Semantic IDs are located on web pages and indexed, so they can be found in the CDD, just like database identifiers. By using semantic IDs, users know exactly what a parameter is doing, how it's behaving, and the meaning behind it."

"Semantic IDs are located on web pages and indexed, so they can be found in the CDD, just like database identifiers. This gives users a way to find parameters in their devices and applications, and determine how they're working," explains Fengler. "By using semantic IDs, users know exactly what a parameter is doing, how it's behaving, and the meaning behind it."

Without knowing any internal field device item names, Semantic ID provides generic access to data items and adds semantic contents to the raw data values read from and written to the field devices.

Fengler adds that Semantic IDs help to get data up from the physical layer to higher levels like cloud-computing services, but because they're protocol-independent, any protocol such as HART or Profibus can be used. "Once the data reaches the application layer or the cloud, its name and meaning is the same," he explains. "This provides benefits for the user interface, as well for machine-to-machine communication. IEC 61987 has been available for more than 10 years, and Semantic IDs are several years old, too, but now organizations like NAMUR are using them to put all the pieces in place for process automation."

PA-DIM BRINGS IT TOGETHER

"OPC Foundation participated in the FDI standard, and this was a significant achievement, as we developed the FDI specification with a multitude of DCS vendors funding the initiative for process automation," Hahn says. "OPC Foundation is now working on a very special initiative with FieldComm Group addressing process automation, which includes a

"We now have an ecosystem leveraging OPC UA and PA-DIM that allows field devices to integrate directly into higher-level applications, including IoT-aware applications, edge devices and cloud-based applications."

multitude of vendors working with organizations like NAMUR Open Architecture (NOA) and Industry 4.0 (RAMI 4.0) to achieve standardized process automation device normalization, allowing flexibility in a multivendor environment."

The initiative, by FieldComm Group, OPC Foundation and Profibus/Profinet International, will jointly standardize and specify the information model for process automation devices (PA-DIM). It's based on the NAMUR requirements on Open Architecture (under development), Self-Monitoring and Diagnosis of Field Devices (NE107), and NAMUR standard device—field devices for standard applications (NE 131). PA-DIM covers use cases like:

- Provide/receive information to/from HMIs, information apps, reporting apps, etc.
- Provide information for inventory management and remote monitoring applications
- Provide information that is used by real time control applications
- Device configuration and parameterization
- Provide interfaces for configuring device security and monitoring current hardening status
- Provide information for device dashboards

PA-DIM is protocol-independent, thus allowing development of software solutions that are independent of automation supplier systems. The protocol-agnostic unified information model will allow software applications to access device information without additional mapping or protocol-specific knowledge. "They just need to follow the standardized PA-DIM," says Laubenstein.

For existing devices, PA-DIM can be set up as part of the FDI information model server through the respective device description (EDD). Fieldbus-specific information will be mapped to the defined standard information model (PA-DIM) by the FDI server (Figure 2).

"OPC UA provides the possibility to describe and use in different domains—the 'how.' The 'what'—whether it be companion specifications for field devices, machines etc.—should and must be done as a responsibility of industries, industry association, etc.," says Hahn. PA-DIM is an example of industry associations taking that responsibility.

"Having a standard where all process automation devices of a certain class agree to the same syntax and semantics of data and metadata will facilitate complete system software solutions," says Burke. "Not only does it facilitate operations like training and preventive maintenance, we will now be able to have true plug-and-play interoperability in a multi-vendor environment, no matter what vendor a specific field device comes from. We'll have a standard for all field devices and will have total interchangeability across vendors."

"We now have a complete ecosystem leveraging OPC UA technology and PA-DIM that allows field devices to integrate directly into higher-level applications, including IOT-aware applications, edge devices and cloud-based applications," Burke concludes. "We're now able to truly break down the wall between OT and IT, with standardization of process automation devices that will facilitate this convergence with protocol and device independence." ●

For more about PA-DIM, see the whitepaper, "Process Automation Device Information Model" at go.fieldcommgroup.org/DeviceInformationModel.

Standards streamline information anywhere

FieldComm Group technologies let plant data breeze through gateways, servers and the cloud

AFTER JOURNEYING THROUGH any epic trilogy, there's always one obvious question—is there a happy ending? Well, if you just experienced the three prior articles in this year's Control FieldComm Group supplement—advances in the physical layer, Open Process Automation Forum (OPAF) and NAMUR's quest for interoperability, and OPC-UA and FDI's enabling software tools—you better believe there's a happy ending!

Just like the U.S. Postal Service delivering presents, FieldComm Group's standards and technologies are coalescing to produce protocol-independent data connectivity from legacy installed bases and APL on the physical plant floor, right on through standards-based FDI servers and software infrastructures, and up to cloud-computing services and all their data-hungry users and analytical tools.

"There will always be new protocols and physical layers to connect field devices to control and asset management systems," says Paul Sereiko, marketing director at the FieldComm Group. "However, the discussion lately is all about moving data from the plant to the cloud and Industrial Internet of Things (IIoT), so we're trying to promote a more standards-based approach."

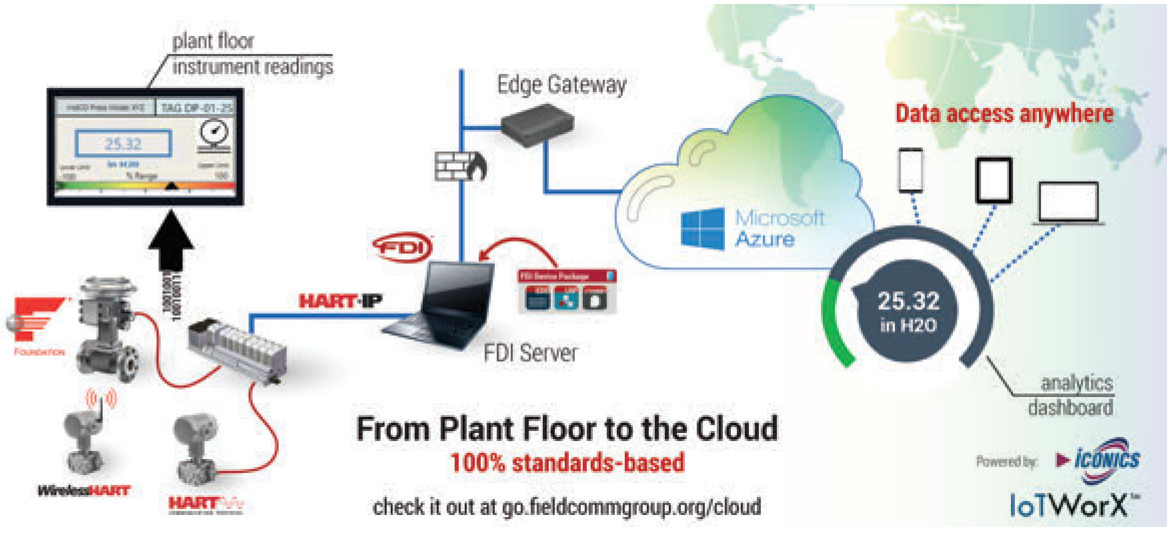
DEVELOPING THE DEMO

In fact, beyond mere text, FieldComm Group is showing how it's done in an interactive demonstration test bed that uses only FieldComm developer software, member components and a commercial off-the-shelf HMI presented at http://go.fieldcommgroup.org/cloud. The demo has a variety of features that visitors can explore.The demo's primary parts consist of:

- Three existing field devices, which include a 4-20 mA HART 7 pressure transmitter, FOUNDATION Fieldbus transmitter and a WirelessHART temperature device.
- Two types of software, including FieldComm Group FDI IDE and Reference Runtime Environment (Host) software, as well as Iconics IotWorx software. IotWorx is used to connect and display field device information via the Microsoft Azure cloud-computing service.
- Two emerging devices, namely a native HART-IP prototype pressure transmitter and an APL-enabled prototype temperature device, will be included in the demo before the end of 2018.

"We take the 4-20 mA HART transmitter, connect it to the HART-IP module, which encapsulates the plant-centric HART data in an IP package," explains Sereiko. "Next, the information goes to the FDI server, which serves as a hub where all data can flow in and be made available for other apps to grab it. To access the Azure cloud, we use what is known as an edge gateway. We are using a Windows 10 gateway installed with Iconics' IoTWorX OPC UA-enabled software. The gateway communicates with an FDI server that supports the Process Automation Device Information Model (PA-DIM). Then, the gateway receives data from the FDI server, and publishes it

> **"The cloud often means different things to different providers and users, so we have standardized data access from the plant floor to the cloud."**



Demo shows information flows

An FDI server makes transmitter data available for apps, including an edge gateway to the Azure cloud, where it is viewable anywhere via the.web.

using the AMQP protocol to the Azure cloud. Once in Azure, field device information is viewable via web applications from any Internet-connected device. In the future, FieldComm Group members will be able to add components to the demo."

DATA ACCESSED, CONTROLS UNAFFECTED

Sean Vincent, director of technical services at FieldComm Group, adds that, "Data access is allowed in this situation because it's standardized and uniform. The cloud often means different things to different providers and users, so we have standardized data access from the plant floor to the cloud, which enables people to understand it, perform metrics, and gain value from it using tools they already have and tools they can develop.

"We often hear that data is stranded and can't be pulled in, but this is a channel for delivering device information that doesn't affect the process control loop. As a result, users can interact and pull the data they need without slowing, bumping or jeopardizing the existing control system. This parallel access to field devices allows users to do data collection, modeling and analysis to find areas for improvement. In the cloud, you can apply software tools remotely. For instance, users can sit in their chairs, check available data for their plants worldwide, and quickly help individual units improve by what's been learned by other units."

Vincent adds that enabling corporate access to data without affecting control is accomplished with data diode functions performed by software. This is a very important feature as it protects process control security by removing the ability to remotely tamper with control. The demo also uses the publish-subscribe method, where the edge gateway subscribes to data published by the FDI server, and Azure subscribes to data published by the gateway.

"Just as APL deals with the physical layer, and FDI and OPC UA provide software in the middle, our demo shows how FieldComm Group standards and technologies can pull everything together to fulfill the openness and interoperability required by OPAF and NAMUR," adds Sereiko. "We hear from end users that they're not going to change out field devices just so they can use the latest software gadget. Most process devices are in place for more than a decade, and many users are still installing HART and FOUNDATION Fieldbus devices that will be in place 20 years from now. We're building a 21st century technology using global standards that allows information anywhere for devices that have been in place for 20 years, as well as those that will be in place 20 years from now." ●

MRPL wins Plant of the Year

Mangalore Refinery and Petrochemicals succeeds with a "do things better" culture and multiple adoptions of FieldComm Group technologies

BRAVE POKER PLAYERS go "all in" to show their confidence in their cards. Equally bold process engineers demonstrate similar commitment when they implement steadily increasing ratios of advanced digital communication protocols like HART, WirelessHART and FOUNDATION Fieldbus. However, only an elite few go on to claim the FieldComm Group's annual Plant of the Year Award, and earn the much-deserved recognition that goes with being a leading adopter of FieldComm protocols and technologies.

This year's winner, Mangalore Refinery and Petrochemicals Ltd. (https://mrpl.co.in), exhibits all these qualities, but it's also noteworthy because it's the first recipient from India, and represents the nation's burgeoning oil, gas and petrochemical sector that's been rapidly securing a preeminent place on the worldwide stage. MRPL's staff reports its "do things better" culture inspires it to be a pioneer and frontrunner in hydrocarbon processing, adopt digital communications for process control, and continuously strive for more effective utilization of its resources and facilities. MRPL jumps wholeheartedly into everything it does, including implementing FieldComm Group solutions.

Established in 1995, MRPL is a 15 million tonnes per annum (MMTPA) oil and gas refinery located on 1,550 acres in Mangalore, Karnataka state, on the west coast of India. It's part of India's state-owned Oil and Natural Gas Corp. (ONGC), a Navaratna (Nine Precious Gems) company, and its full range of products include liquid petroleum gas, Motor Spirit (gasoline), High Speed diesel gas and oil, kerosene, aviation turbine fuel, naphtha, coke, polypropylene, fuel oil, bitumen, sulfur and others. It also supplies raw materials such as naphtha and mixed xylenes to ONCG Mangalore Petrochemicals Ltd. (OMPL), which is a 0.9-MMTPA joint-venture petrochemical facility by ONGC and MRPL that started operations in 2014. OMPL is completely built on digital technology including FOUNDATION Fieldbus for process control, and HART for emergency shutdown (ESD) and fire and gas (F&G) systems.

STRIDING INTO FIELDBUS

MRPL started its journey into FieldComm Group technologies in 2005, when it installed all-digital communications on its isomerization unit. This project included implementing all process control loops with FOUNDATION Fieldbus with control in the field (CIF) functions, as well as HART transmitters used in its safety instrumented systems (SIS). On the strength of this success, MRPL raised the stakes in 2012 by also commissioning more than 10 process units, cogeneration plant and utilities at its 3-MMTPA refinery with FOUNDATION Fieldbus, HART and WirelessHART. They're also MRPL's default process control protocols for future upgrades and added capacity projects.

"We had experience with digital protocols such as DE, Brain and HART since MRPL's inception in 1995, and also used TRL/2 bus for tank gauging since then," says Basavarajappa Sudarshan, chief general manager for electrical and instrumentation at MRPL and project team leader. "We learned about FOUNDATION Fieldbus on the Internet and from suppliers. Its advantages included less cabling needed and a smaller footprint in the plant's Yokogawa DCS in terms of I/O, panels and rack space required.

"This led us to seek acceptance from MRPL management for an upgrade including interoperability of field devices. We visited with major DCS suppliers, and did many interoperability tests during four to six weeks in 2004 to resolve concerns and anxiety about such a new installation. This is how we introduced FOUNDATION Fieldbus in our new isomerization plant in 2005, which made MRPL the first company in India to construct a hydrocarbon process unit using entirely FOUNDATION Fieldbus for closed-loop process control."

CONVINCING COWORKERS

Beyond determining the technical advantages of FOUNDATION Fieldbus and other FieldComm Group technologies, Sudarshan reports that he and his team had to convince colleagues, including operators and managers at MRPL, that migrating to digital communications would be worthwhile and wouldn't hinder operations. Other core team members included: Suryanarayana, chief project manager; Ganesh Bhat, chief instrumentation manager; Allen John, senior instrumentation manager; Muralidhara Karanth, instrumentation manager, and Deepthi K.M., assistant instrumentation manager, who added to the discussion about MRPL's successful use of FieldComm Group technologies.

"We ensured participation of everyone concerned like C&I, projects and process operations in discussions and technical presentations," explains Sudarshan. "In 2005, technicians with experience with conventional DCS and field devices took some time to understand the new digital technology. However, with guidance from our field device and other suppliers, they were trained on the job, and quickly streamlined use of FOUNDATION Fieldbus, which was initiated during pre-commissioning. The team had no issues in adopting the technology."

Sudarshan also credits MRPL management with giving his team and other staffers the crucial support they needed to evaluate, design, test and implement HART, WirelessHART and FOUNDATION Fieldbus into their process applications. "Management gave us a lot of freedom, which enabled our excellent people on the forefront of these projects to be open to FOUNDATION Fieldbus," says Sudarshan. "Many were skeptical about these digital technologies, so they were first teased and tried on non-critical, open loops before being used on closed loops. Once users and managers got more confident, we were able to take everything forward."

BIG MOVES = BIG REWARDS

Consequently, MRPL reports that adopting FieldComm Group and other digital technologies on entire process units allowed its installed equipment to achieve versatility and performance gains faster than if it had implemented them in small increments. So far, the refinery has tested and installed digital devices and functions for almost all of its various applications, from simple DP measurement to complex analyzers and nucleonic level measurement. At present, digital device deployments at MRPL include:

- More than 3,000 FOUNDATION fieldbus segments using several concepts, including FISCO, FNICO, FISCO ic and HPT. Many applicable FOUNDATION Fieldbus interfaces, diagnostics components and junction boxes were supplied by Pepperl+Fuchs, which also furnishes temperature multiplexers.

- More than 35,000 total devices, including more than 9,000 FOUNDATION Fieldbus and 5,000 HART components.
- Developing its CIF potential, more than 75% of valve positioners at MRPL employ FOUNDATION Fieldbus. These include 1,500 with FOUNDATION Fieldbus and 450 with HART. Primary positioner suppliers are Metso and Emerson.
- Nearly 70% of the refinery's more than 10,000 other transmitters for pressure, radar level and Coriolis mass flow use FOUNDATION Fieldbus, while the rest use HART. Emerson, Honeywell, and Yokogawa are the primary suppliers of these devices.
- More than 215 motor-operated valves (MOV) and controls at MRPL's Phase 3 cogeneration power plant also employ FOUNDATION Fieldbus. They're supplied by Rotork, and deliver as many as seven parameters each, which reduced I/O, cabling and footprint requirements by 80% and saved $415,000.

Sudarshan reports that FieldComm Group technologies generate savings for MRPL in a variety of ways. "We achieved an average savings of 50% on I/O, cabling and installation costs for new projects," he says. "There's an average savings of 15 minutes per month per valve in terms of preventive maintenance, which results in an average savings of 55 man days per month in applications with digital valve positioners. In addition, we get early detection of failures in devices that had no preventive maintenance plans before diagnostic-enabled devices were available. Though these particular benefits can't be quantified in terms of cost savings, they've nonetheless improved refinery uptime. Thanks to all these gains, we've saved approximately $6.6 million compared to project costs that take into account added costs of conventional I/O and cabling compared to FOUNDATION Fieldbus."

A MORE MEASURED WORLD OF WATER

ABB's AquaMaster electromagnetic flowmeter has been designed to improve the management of potable water distribution networks. Its features are targeted to the industry's specific requirements, ranging from a total water management solution for revenue (billing) applications, district metering and water distribution to leakage management and irrigation. Flowrate information can be sent via GSM/SMS or GPRS/WITS, enabling operators to pinpoint difficult, small, slow leaks, virtually as they happen and providing the opportunity to rectify them quickly.

ABB, abb.com/measurement

HIGH-PRECISION DIGITAL POSITIONER

The Logix 3800 from Flowserve is the digital positioner choice for applications that require a balance between technological sophistication and long-lasting reliability in tough environments. This high-precision positioner simplifies installation as well as offering greater robustness and consistency.

Compatible with linear and rotary valves and actuators, the Logix 3800 includes quick calibration and advanced diagnostic capabilities. Command and control can be done with 4-20 mA or with Fieldbus or HART.

Flowserve, www.flowserve.com

LESS DOWNTIME, MORE EFFICIENCY

Muralidhara Karanth says there have been several other specific instances where FieldComm Group technology has improved operations, prevented downtime, or enabled other gains. These events include:

- Avoided shutting down a sour water stripping unit during a DCS upgrade in 2016 by using FOUNDATION Fieldbus, which allowed MPL to take the DCS controller offline while the unit continued running. Key parameters were monitored through local indicators, controllers were left in normal mode, and the unit ran normally without disturbances until the upgrade was done.
- Using HART pass-through I/O modules in DCS and safety systems delivers the added advantage of mapping critical secondary and tertiary parameters from HART devices to the DCS for better operation and maintenance. Critical inputs from HART devices like control valve position feedback from valve positioners, density from Coriolis mass flowmeters, and cell temperature from pressure transmitters can be mapped to the DCS.
- Wireless DP transmitters are cost-effectively achieving required backup tank level measurements and better process visibility in the shortest possible time by installing HART gateways and signal repeaters in the tank farm. This solution is also used for control valve leak detection via acoustic transmitters, and MRPL has made it mandatory to use WirelessHART in upcoming refinery units for applications like pump seal monitoring, control valve leak detection, etc.
- More intelligent field devices and the Yokogawa PRM asset management system (AMS) have redefined the preventive maintenance techniques and enabled advanced diagnostics. For example, critical control valves are monitored regularly by the AMS, valve signatures are captured during turnarounds and corrective actions are taken. In addition, valve position feedback is integrated to valve control function blocks, which allows better tuning of control loops and diagnostics. FOUNDATION Fieldbus physical layer health is tested regularly with DTM-based diagnostic tools and corrections are performed. Also, MRPL is in the process of making a preventive maintenance template based on the NAMUR NE107 standard.
- Because FCC reactor instrument nozzles in slurry service are prone to choking with catalyst, critical delta pressure transmitters are used for actuating shutdown on low pressure. To better detect plugged impulse lines, Emerson supplied 3051S transmitters with Advanced Diagnostics Suite software. MRPL tested this solution in sample applications, and is in the process of extending them throughout the unit.
- Available valve position feedback indication improved unit operation. In 2017, a failing actuator in a PSA purge gas valve was identified by valve positioner diagnostics, which averted a potential hydrogen unit shutdown. Breakdown of this valve would have brought down MRPL's diesel hydrotreater unit for 72 hours. Fuel and energy loss for startup and

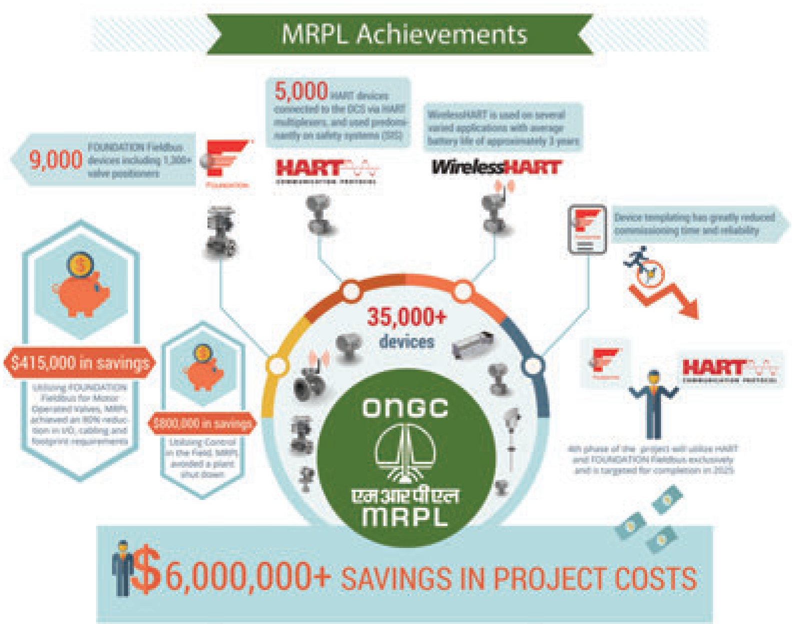
shutdown of the hydrogen unit alone would have cost $60,000.

"Using open standards lets us integrate smart instruments throughout the entire plant, including extensive use of HART in our safety systems that enable capabilities like partial stroke testing, as well as CIF from FOUNDATION Fieldbus that lets us operate even with the loss of critical hardware—giving our team peace of mind," says Suryanarayana. "In 2016, we were able to keep the refinery process running during that DCS upgrade, which would have resulted in a production loss conservatively estimated at $800,000 without CIF."

Suryanarayana adds that MRPL benefited greatly from adopting digital technology during its early stage, and achieved considerable savings in commissioning time, improved process visibility, reduced DCS footprint, and simple, effective maintenance practices thanks to better utilization of device diagnostics. "FOUNDATION fieldbus physical layer diagnostic tools have simplified our diagnostic procedures and improved the uptime of the process units," he explains. "Innovative techniques, like carrying out FOUNDATION Fieldbus loop checking using device display, segment-wise device commissioning, etc., reduced pre-commissioning time and required resources." Likewise, availability of multiple parameters from single instruments and getting the values to the operators has improved quality of process operations and ease of maintenance.

Ganesh Bhat, who worked for OMPL from its conceptualization stage in 2007 until its construction stage in 2011 on deputation from MRPL, reports that OMPL's Aromatic complex that produces paraxylene and benzene has also completely adopted FieldComm Group technology. "This greenfield petrochemical (aromatics) complex of OMPL didn't face any difficulty in plant commissioning with FOUNDATION Fieldbus and HART," says Bhat. "They use all FOUNDATION Fieldbus and HART features for predictive and preventive maintenance, and these technologies also make their maintenance tasks easier and simpler."

Sudarshan adds, "Overall, there's been a paradigm shift in how instrumentation maintenance has been carried out ever since MRPL introduced FOUNDATION Fieldbus into its process units in 2005. For instance, breakdown maintenance calls are converted to predictive maintenance, and preventive maintenance activity has been shifted to the control room from former routine, manpower-intensive field visits. The biggest advantage of smart devices is the self diagnostics of the devices. They've been tapped to avert breakdowns due to instrumentation failure, and this increased on-stream availability of the whole refinery."



OTHER USERS CATCH ON

Sudarshan adds that many of India's other major industrial manufacturers have been observing and joining its digitalization initiative movement in increasing numbers.

"Once it became known that we'd implemented FOUNDATION Fieldbus, HART and WirelessHART, and were reaping considerable benefits, representatives from other Indian refineries approached us, and since then, many of them have started using FieldComm Group technologies, too," adds Sudarshan. "In fact, anyone who reads our story is welcome to visit MRPL for a detailed discussion on using FieldComm technologies." ●

NEW SMART ESD* DEVICE FOR SAFETY INSTRUMENTED SYSTEM

Azbil Corporation's Smart ESD Device 700 series (700SIS) is now available. Devices in this series act as the interface for an emergency shutdown valve in a safety instrumented system. They're compliant with the IEC61508 international standard for functional safety. The 700SIS has been certified for applications that require SIL (Safety Integrity Level) 3 according to IEC 61508.

*ESD: Emergency Shut Down

Azbil
www.azbil.com/products/bi/iap/products/hfbs/index.html

FIELDCOMM GROUP™ MEMBER

NCS-TT106X TEMPERATURE MODULE

Microcyber's NCS-TT106x temperature module has high reliability, high long-term stability and high measurement accuracy. It's a high performance fieldbus temperature transmitter with independent R&D communication controller. It supports multiple thermal resistances and thermocouples, 2/3/4-wire connection mode for thermal resistance, cold end compensation for thermocouple.

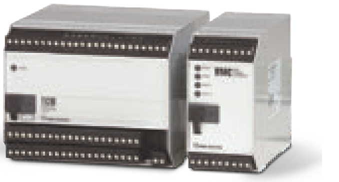
Microcyber Corporation
www.microcyber.cn/temperaturetransmitter2

NEXT-GENERATION MASS FLOWMETER WITH FIELDCOMM PROTOCOLS

The next-gen ST100 Series Flowmeter for air/gas flow measurement and plant communication from Fluid Components International (FCI) features the FieldComm protocols including both Foundation Fieldbus and HART. It is the first triple-variable instrument that measures mass flow, temperature and pressure. In addition to flow rate, totalized flow and temperature, pressure measurement up to 1,000 psi (70 bar) is available. An on-board data logger stores 21 million readings on a removable card.

Fluid Components Intl.,
www.fluidcomponents.com

HIGH DENSITY FIELD TEMPERATURE MEASUREMENT



The TCS Temperature Concentrator System with universal inputs substantially reduces the cost of transmitting multiple T/C, RTD, resistance, mV or potentiometer measurements in general purpose and hazardous areas by "concentrating" up to 32 signals onto one digital HART or MODBUS RTU network.

Moore Industries
www.miinet.com

YOKOGAWA YTA710 TEMPERATURE TRANSMITTER

YTA710 temperature transmitter is highly accurate. The sensor input can be choice of single or dual inputs. This input can accept thermocouple, RTD, ohms or DC millivolt inputs and converts it to 4-20 mA DC with HART 7 or Foundation Fieldbus signal for transmission. HART type is certified as complying with SIL 2 for safety requirements.

Yokogawa Electric Corporation
www.yokogawa.com/solutions/products-platforms/

CONNECT TO HART VIA USB

Phoenix Contact's new USB HART MODEM provides a simple way to commission, monitor, or evaluate a HART device. It is a cost-effective alternative to RS-232 Serial HART modems and expensive hand-held programming devices. To learn more, enter web code #1791 in the search bar at www.phoenix contact.com.

Phoenix Contact
www.phoenixcontact.com

NEW WIRELESS PRESSURE GAUGE APP

Emerson's new Plantweb™ Insight application for Rosemount™ wireless pressure gauges displays real-time field data in an easy-to-understand dashboard for increased convenience and safety. The application provides a streamlined view of networked wireless pressure gauges, allowing operators to monitor changing conditions remotely and reduce manual rounds.

Emerson Automation Solutions
www.emerson.com/rosemount-wireless-pressure-gauge

FEEL THE PULSE OF YOUR ASSETS WITH ENDRESS+HAUSER'S IIOT HEALTH APP

Endress+Hauser's Health application gives you access to health-relevant instrument information. There's nothing simpler: enter the error code displayed on your instrument and receive instructions on how to resolve the fault. Combined with an Edge Device, you get a real, hands-on connected solution! Start now, it's free.

Endress+Hauser
www.iiot.endress.com

Recently registered technology

These products were registered between August 30, 2017 and August 30, 2018. For a complete list of all registered hosts and devices, visit the Product Testing and Registration section at www.fieldcommgroup.org.

Category	Protocol	Manufacturer	Model / Host Name	FDI Device Package	New Registration	Updated Registration	Updated EDD	New Physical Layer	Updated Physical Layer
Actuator	FOUNDATION Fieldbus	Emerson Automation Solutions	CAM228/CAM28 FF EHO Actuator		●				
Actuator	FOUNDATION Fieldbus	Noah Actuation Co., Ltd.	MA_ACTUATOR		●				
Actuator	HART	Flowserve	Logix 3820		●				
Flow	FOUNDATION Fieldbus	ABB	FSV/FSS 430/450		●				
Flow	FOUNDATION Fieldbus	Emerson Automation Solutions	MVD 5700		●				
Flow	FOUNDATION Fieldbus	Endress+Hauser	Promag 200 FF				●		
Flow	FOUNDATION Fieldbus	Endress+Hauser	Promass 200				●		
Flow	FOUNDATION Fieldbus	Endress+Hauser	Prowirl 200			●			
Flow	FOUNDATION Fieldbus	Krohne Messtechnik GmbH	M40 ESK-FF			●			
Flow	FOUNDATION Fieldbus	Krohne Messtechnik GmbH	OptiMASS MFC400				●		
Flow	FOUNDATION Fieldbus	Xi'an Dongfeng Machinery & Electronic Co.	DPT100		●				
Flow	HART	ABB	FCXxxx	●					
Flow	HART	ABB	FEW5xx_FEX6xx		●				
Flow	HART	Endress+Hauser	Promag 300/500			●			
Flow	HART	Endress+Hauser	Promass 300/500			●			
Flow	HART	Endress+Hauser	Prosonic Flow E100		●				
Flow	HART	Endress+Hauser	Prowirl 200			●			
Flow	HART	Microcyber Corporation	L-mag		●				
Flow	HART	Micro Motion	5700 Configurable I/O	●					
Flow	HART	Micro Motion	5700 with Intrinsically Safe Outputs		●				
Flow	HART	Micro Motion	MVD Series | Models: 1000/2000 Configurable I/O			●			
Flow	HART	Micro Motion	MVD Series | Models 1000 IS Output, 1000/2000 Analog Output	●					
Flow	HART	Micro Motion	2400S Mass flo			●			
Flow	HART	Nivus	NivuFlow		●				
Flow	HART	Rosemount	8800D			●			
Flow	HART	Rosemount	8712EM/8732EM HR7			●			
Flow	HART	SICK Engineering GmbH	FLOWSIC 30			●			
Flow	HART	Yokogawa Electric Corporation	ROTAMASS TI			●			
Level	FOUNDATION Fieldbus	ABB	LMT100/200/300		●				
Level	FOUNDATION Fieldbus	Honeywell International	SmartLine RM77		●				
Level	FOUNDATION Fieldbus	Schneider Electric	LG01		●				
Level	FOUNDATION Fieldbus	Schneider Electric	LR01		●				
Level	FOUNDATION Fieldbus	VEGA Grieshaber KG	VEGAFLEX 80 series						●
Level	FOUNDATION Fieldbus	VEGA Grieshaber KG	VEGAPULS | Models: 62, 63, 69						●
Level	HART	Endress+Hauser	DeltapilotS			●			
Level	HART	Endress+Hauser	Levelflex FMP5x			●			
Level	HART	Endress+Hauser	Micropilot 5x			●			
Level	HART	Endress+Hauser	Micropilot 6x			●			
Level	HART	Fisher Controls	DLC3011			●			
Level	HART	Fisher Controls	DLC3010			●			
Level	HART	Honeywell International	SLG700			●			
Level	HART	Rosemount	3308A Wireless Guided Wave Radar Level & Interface Transmitter			●			
Level	HART	Rosemount	2140 Level Detector			●			
Level	HART	VEGA Grieshaber KG	DeltabarS			●			
Level	HART	VEGA Grieshaber KG	VEGAFLEX 80 series			●			
Level	HART	VEGA Grieshaber KG	VEGAPULS | Models: 64, 69, SR 68, WL 61			●			
Multi-variable	FOUNDATION Fieldbus	Mettler-Toledo GmbH	M400 4-wire FF		●				
Multi-variable	HART	Honeywell International	SMV800			●			
Multi-variable	HART	Thermo Fisher Scientific	AutoXP		●				
Net-working	FOUNDATION Fieldbus	General Electric	IS420PFFAH1B			●			
Net-working	FOUNDATION Fieldbus	Measurement Technology Limited	937x/938x-FB(2) Series						●

Category	Protocol	Manufacturer	Model / Host Name	FDI Device Package	New Registration	Updated Registration	Updated EDD	New Physical Layer	Updated Physical Layer
Networking (continued)	FOUNDATION Fieldbus	Okonite	261-92-35xx and 264-92-35xx					●	
			261-92-49xx and 264-92-49xx					●	
		Phoenix Contact	2316360 GW PL FF/HART		●				
			2316363 GW PL FF/MODBUS			●			
			FB-6SP; FB-8SP; FB-12SP			●			
		Zhejiang Supcon Technology Co., Ltd.	AM712-P Module with MB734 Redundant Base					●	
			FSP100 Series					●	
Position	FOUNDATION Fieldbus	Flowserve	Logix 3400MD				●		
			Logix 3800		●		●		
	HART	ABB	EDP300			●			
			TZIDC	●					
		DVG Automation SpA	ITVC intelligent total valve control		●				
		Forbes Marshall	SmartPoz 8400S		●				
		Metso Flow Control Oy	NDX | Models: H6, H7			●			
		Samson AG	TROVIS 3730-3		●				
		TopWorx, Inc.	Position Xmtr		●				
Pressure	FOUNDATION Fieldbus	Schneider Electric	IGP, IAP, and IDP Series | Models: 50S-F Premium Performance, 10S-F Advanced Performance	●	●				
		VEGA Grieshaber KG	Vegabar 80 Series						●
			VEGADIF 85						●
	HART	ABB	2600T 266 Pressure	●					
		Autrol by Duon System CO., Ltd.	APT3500W		●				
			APT3800N		●				
		Barksdale Control Products	H455X		●				
		Elemer	AIR-20H		●				
		Endress+Hauser	CerabarS			●			
			DeltabarS			●			
			DeltapilotS			●			
			Levelflex FMP5x			●			
			Micropilot 5x			●			
		Honeywell International	ST 700			●			
		Krohne Messtechnik GmbH	OPTIBAR 5060		●				
		Rosemount	3051			●			
		Schneider Electric	Absolute, Gauge and Differential Pressure Transmitters	●	●				
		Shanghai RockSensor Automation Co.	RP1000		●				
		VEGA Grieshaber KG	VEGADIF series | Models: 80, 80 SIL		●				
Temperature	FOUNDATION Fieldbus	Elimko Electronic Production & Control Co.	KC-200-H		●				
		Pepperl+Fuchs	F2D0-TI-Ex8.FF				●		
	HART	Endress+Hauser	iTEMP TMT162		●				
			TrustSens TM371-TM372		●				
		Guangzhou City Xitai Auto-Control Facility Co.	XTH300i		●				
		Inor Process AB	IPAQ C530/R530 (X)	●	●				
		Jumo GmbH & Co. KG	JUMO dTRANS | Models: T08 37, T08 13		●				
		Krohne Messtechnik GmbH	TT53 C/R (Ex)	●	●				
		PR electronics A/S	PR5437		●	●			
		Siemens AG	SITRANS | Models: TH320, TH420, TR320, TR420		●				
		Yokogawa Electric Corporation	YTA610			●			
			YTA710			●			
Valve Controller	FOUNDATION Fieldbus	TopWorx, Inc.	TopWorx D2-FF			●			
	HART	Fisher Controls	DVC6xxx Series | Models: 6200, 6200 SIS, 6000 HW2			●			
		Metso Flow Control Oy	ND91000H			●			
Other	FOUNDATION Fieldbus	Brooks Instrument	Brooks SLA Series Fieldbus			●	●		
		Emerson Automation Solutions	MVD 2700			●			
	HART	FSUE SPA "Analitpribor"	DAH-M		●				
		Mistras Group, Inc.	CALIPERAY		●				
		MSA	FL500		●				
		Otis Instruments	OTIS 7543-6 W-HRT		●				
		Schneider Electric	876pH-S		●				
		Texas Instruments Inc.	DAC8740H		●				

Calendar

For up-to-date information, see "Events" on www.fieldcommgroup.org

FieldComm Day
Abu Dhabi
October 17, 2018

FieldComm Day
Saudi Arabia
October 22, 2018

Advanced principles of FOUNDATION Fieldbus
Dusseldorf, Germany
November 6-8, 2018

M&C Show
Osaka, Japan
November 7-9, 2018

Rockwell Automation Process Solutions User Group
Philadelphia. PA, USA
November 12-13, 2018

HART Fundamentals
Austin, TX, USA
November 12-13, 2018

Device Integration (EDD and FDI)
Austin, TX, USA
November 14-16, 2018

FieldComm Group Working Group Meeting
Singapore
December 3-7, 2018

Advanced principles of FOUNDATION Fieldbus
Austin, TX, USA
December 4-6, 2018

HART Fundamentals
Dusseldorf, Germany
December 10-11, 2018

Device Integration (EDD and FDI)
Dusseldorf, Germany
December 12-13, 2018

ARC Industry Forum
Orlando, FL, USA
February 4-7, 2019

FIELDCOMM GROUP CURRENT COURSE OFFERINGS

Introduction to HART Protocol

Available in the first half of 2019, this self-paced, e-learning workshop covers the basics of HART communication protocol, as well as an overview of the HART market and technology.

HART Fundamentals and QA Testing Workshop

This workshop is an intensive two-day course covering all aspects of HART communication protocol. You will gain the information needed to develop new HART-enabled products, support existing products and design systems that utilize HART technology.

Device Integration - Writing EDD and FDI Package Workshop

An intensive three-day course where developers learn the step-by-step process for building a Device Description for a HART- or FOUNDATION Fieldbus-enabled device based on Electronic Device Description Language (IEC 61804-3, EDDL) for use across all DD-enabled host platforms.

Introduction to FOUNDATION Fieldbus

This self-paced, e-learning course for developers, end users, marketing professionals and applications engineers assumes little or no prior knowledge of FOUNDATION Fieldbus, but students should be familiar with process control. Students will learn the basic concepts and terminology related to the FOUNDATION Fieldbus integrated architecture and gain a working knowledge of the technical foundation upon which the technology is built.

Advanced Principles of FOUNDATION Fieldbus

This workshop is an intensive three-day course covering all aspects of the FOUNDATION Fieldbus protocol. Students will learn the skills required to develop new FOUNDATION Fieldbus products, support existing products and design systems utilizing FOUNDATION Fieldbus technology.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