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Contents

INTEGRATION'S PROMISE P4
ABB's Roy Tanner discusses the need for process automation architecture to facilitate easy, seamless integration among plant devices and systems, applications and individuals.

COLLABORATION ENABLED P6
From safety to power to visualization, a growing number of process manufacturers are realizing the operational benefits of integration even while saving on implementation costs.

CONTROL MADE SEAMLESS P10
Today's multi-function, multi-protocol controllers are making the seamless integration of plant functions a more achievable reality.

OPERATORS EQUIPPED FOR EFFECTIVE DECISION-MAKING P14
Single-click access to plant-wide sources of data together with integrated simulation and a dogged attention to human factors in the control room can elevate operators' performance.

ENGINEERS EMPOWERED FOR MAXIMUM PRODUCTIVITY. P18
From more effective change management to making state-based control manageable, object-oriented architecture can help streamline a range of engineering and integration tasks.

FLEXIBILITY FOR THE FUTURE P22
The central intent of ABB's lifecycle management programs is to preserve its users' engineering and technology investments while proactively managing costs and risks on the path forward.

Integration's Promise

Imagine that with one click a process operator can access any information required to make an informed decision—regardless of where the data resides. Or that a maintenance technician can access from her wireless tablet the commissioning displays, diagnostics and active work orders for the transmitter she is troubleshooting. Or that an advanced process control algorithm can tap energy costs, usage rates and production schedules to automatically optimize plant performance in real-time.

The potential and the power of integration lies in what can be achieved when information is made available, in context, to all of the devices, systems and individuals responsible for controlling, managing and maintaining production. Realizing this vision requires seamless, transparent access to data and information from all traditional hierarchical levels of plant information, from field devices to control system applications to business systems.

ABB, with its System 800xA object-oriented architecture, is uniquely positioned to make this vision an achievable reality, according to Roy Tanner, ABB systems marketing manager. Control recently caught up with Tanner to discuss how end users can leverage an "integration-ready" architecture to achieve substantial business benefits—both for today and into the future.

Q: WHY DO MANY AUTOMATION PLATFORMS FALL SHORT OF REALIZING THE PROMISE OF INTEGRATION?

A: With any integration using today's technology, the question isn't "can" it be done, but rather will it be seamless? How easily and economically can it be done? And how sustainable will the solution be over time?

For example, integrating a small software component may be relatively easy, but will multiple support contracts with multiple vendors be needed? And, when it doesn't work, is there anyone on staff that knows about it enough to troubleshoot problems, or must an outside source be called upon?

And can the automation platform accommodate new technologies and integration possibilities in the future?

"Where others promote 'rip-and-replace' migration strategies, we allow users to build on already strong foundations."

– ABB's Roy Tanner on the need for an open, integration-ready architecture to preserve users' investments in automation technology and infrastructure.

Q: WHAT TRENDS ARE DRIVING THE PROCESS INDUSTRIES TO SEEK MORE INTEGRATION-READY SYSTEMS?

A: In the past, optimizing process control defined excellent performance. But with changing market demands requiring faster turnarounds, greater customization and lower overall costs, production gains achieved through process control improvements have not been enough to guarantee success. In today's fast-paced global economy, competitive advantages result when a company can tap into its assets' unused productivity to meet changing demands.

Also, centralization of systems and resources is a key strategy for coping with retiring plant operators and reduced engineering resource pools. This means that having five to 10 different plant systems—each with its own domain experts—is unsustainable over the long term, whether we're talking about operations, maintenance or engineering.

And as manufacturing processes continue to become increasingly complex, a higher level of integration and coordinated control is required. Integrated systems must reach beyond the single unit or area to various plant entities, departments and people in order for them to be truly effective and to impact production in a positive way. What is needed is an automation platform with incredible connectivity capabilities--a platform that can make actionable information available to users in a variety of roles.

Q: HOW IS ABB'S SYSTEM 800XA ARCHITECTURE UNIQUELY SUITED FOR ACHIEVING THE BUSINESS BENEFITS OF INTEGRATION?

A: Collaboration among people and systems is fundamental to increasing engineering efficiency, operator effectiveness and asset utilization. In fact, the "xA" in System 800xA stands for "Extended Automation." System 800xA is the only automation platform that unifies the ability to engineer, commission, control and execute automation strategies for process, power, electrical and safety in the same redundant, reliable system.

The extent of integration offered by most automation suppliers extends only as far as a select set of fieldbus technologies and loosely integrated applications, which means that their solutions will be severely limited in functionality and business value delivery now and in the future. So, users need to ask questions, know their goals, and understand what is possible.

ABB's System 800xA is an automation platform that includes a full complement of integration capabilities. We have more than a dozen communications protocol Interfaces to our AC800M controller base as well as pre-integrated interfaces to multiple automation systems from ABB and other suppliers. And with integration hooks for a range of third-party software applications, System 800xA is ready now—and in the future—for any automation integration challenge

ABB's superior lifecycle policies, services and products also ensure the highest possible return over the entire life of the system. System 800xA has become the evolution platform for ABB's prior generation systems, encompassing an installed base of more than $21B USD of Advant Master, MOD 300, Harmony, DCI, Freelance, Melody and SATT systems. And where others promote "rip-and-replace" migration strategies, we deliver true system evolution, allowing users to build on already strong foundations. Removing the barriers of traditional distributed control systems, System 800xA provides the integrated environment that is required to increase productivity while reducing risk and total cost of ownership. ■

THE SCOPE OF ABB'S "EXTENDED AUTOMATION" ARCHITECTURE

- The 800xA **operations** suite provides a consistent method for accessing enterprise-wide data and for interacting with multiple applications from any connected workstation in the plant or office.
- An integrated **engineering** environment efficiently supports the complete lifecycle of automation projects, from planning through configuration and library management, to commissioning and operation to minimize system ownership costs.
- System 800xA provides a complete, scalable IEC 61508- and IEC 61511-compliant **safety** instrumented system (SIS) that spans the entire safety loop, including SIL-rated field devices, I/O modules, controllers and field actuators. Powerful system functions as well as operator and engineering tools reduce plant risk through management of the human factor.
- Powerful **knowledge management** software collects, stores, retrieves and presents current and historical process and business data to support reporting, KPI visualization and analysis.
- Enterprise-level planning coordinated with production system scheduling for **batch management** provides the agility, speed, and the quality control needed to respond to production demands.
- **Asset optimization** software exploits the wealth of plant-resident information to monitor, assess and report equipment conditions in real-time to reduce costly corrective and preventive maintenance and optimize maintenance and calibration work flows.
- A comprehensive suite of standards-based **controller and I/O** hardware and software meet the needs of total plant control, including a full line of industrial I/O interfaces suitable for all plant environments.
- Support of digital fieldbus standards and intelligent **device management** provides significant cost savings throughout the design, implementation and operational lifecycle of field equipment.

The Collaboration Enabler

The evolution of the traditional distributed control system (DCS) into today's more capable and more all-encompassing process automation architectures has been chronicled by the analysts at the ARC Advisory Group as the advent of the collaborative process automation system, or CPAS. In simplest terms, "collaboration" implies the need for systems to share the information needed to perform optimal control actions—and for people to make sound business decisions.

From a functional point of view, the CPAS model recognizes only two systems in a process plant: the business system and the CPAS, each with different classes of applications, writes Dave Woll of the ARC Advisory Group in Martin Hollender's 2010 book *Collaborative Process Automation Systems*. The CPAS vision leverages a single, non-hierarchical Ethernet/TCP-IP communications backbone such that field devices, controllers and applications "are able to exchange data and information without barriers," Woll notes. Indeed, the CPAS guiding principles of a common infrastructure that is "functionally transparent, logically concise and based on standards" go a long way toward describing the optimal automation architecture that makes possible the seamless integration of plant systems.

Practically speaking, true collaboration hinges on the integration of all data and information as well as functional plant silos into a single workflow environment. This allows plant resources, from operators to engineers to managers, to not have to deal with multiple systems in order to troubleshoot problems and perform routine tasks. This unified workflow environment helps individuals with different functional roles work together in the context of a bigger, more meaningful picture.

"Tighter integration has the potential to increase both efficiency and productivity."

– ABB's Peter Terwiesch on the opportunity presented by the integration of process automation, electrification and power management systems.

THE ABB APPROACH

At its core, ABB's System 800xA is designed to provide the collaborative environment necessary for the formation and execution of sound business decisions. Based on "Aspect Object" technology, ABB's integration architecture relates all plant data, the Aspects, to specific plant assets, or Objects.

The platform's client-server architecture streamlines controller communications, centralizes configuration and back-up tasks, and provides system-wide management of data for trend, history and audit trail purposes. System 800xA also provides hardware freedom of choice when it comes to the server and workstation computer hardware, even leveraging virtualization technology to streamline and simplify computer systems maintenance.

Engineering is done on a system level and provides significant time savings since configuration of each tag or object is done only once. Personalized workplaces can be configured so that each user has only the information necessary for their function. Licensing is done on a system level so all information and applications in the system are available at each workplace.

A central benefit to using the System 800xA architecture is that once all data and information are plugged into the architecture, a relatively simple, browser-based thin client can be used to seamlessly retrieve and display data from the control system itself as well as any connected third-party systems. Displays are available inside or outside of the plant facility, as long as a secure connection to the plant network exists.

In the case of ABB's System 800xA, this cpmPlus Smart Client provides intelligent data access and viewing functions to assist all levels of personnel in making quick, informed decisions to improve overall plant performance. Among the configurable dashboards that

can be easily deployed are trending and statistical process control charts, alarm and event notifications, and even an Excel interface for exporting plant data.

And while collaborative information sharing has broad-ranging benefits that carry into every corner of a process plant's performance, a closer look at the power of integration along two specific dimensions helps to illustrate integration's true potential: the integration of process automation with process safety and with electrical power systems.

SAFETY INTEGRATION FEATURES FLEXIBILITY

On the safety front, an integrated approach to safety and control is yielding more cost effective safety instrumented system (SIS) implementations while simultaneously delivering operational benefits. ABB's System 800xA architecture offers the flexibility of hosting both safety and process critical control applications in the same controller or on separate hardware if desired.

Either way, the user still gains many of the same integration benefits, including common operator interface and engineering tools, plant-wide sequence-of-events (SOE) lists for consolidated root cause analysis, as well as centralized historian and data archiving. A common, integrated platform also has the advantage of requiring fewer spare parts, less training and provides a comprehensive, integrated platform for asset management.

"Common safety and automation tools, such as for SOE or alarm management, reduce time to decision and action, while improving plant operations," says Luis Duran, safety business development manager for control systems in ABB's process automation division. "They reduce risk more quickly and allow safe start-up after shutdown because root causes can be quickly identified."

"Similarly," Duran continues, "having a common HMI increases operator familiarity with systems, and this reduces training needed. Seamless integration on all levels reduces complexity and simplifies system design, spare parts and maintenance procedures. Having one engineering environment reduces the engineering required, and this enables simplified application programming, upgrades and modifications to be managed through that one engineering environment. Also, having one supplier means users only need one support organization and lets them have a common life-cycle policy."

ABB's System 800xA SIS solutions comprise not only the 800xA HI (High Integrity) logic solver, but the entire safety

ELECTRICAL INTEGRATION PAYS FOR PETROBRAS

Faced with the need to expand and modernize the power substation infrastructure at its Repar refinery 400 km south of Sao Paulo, Brazilian oil giant Petrobras recently implemented ABB's integrated process and power architecture. The combination of the substation automation system with the System 800xA process automation system has brought benefits to Petrobras in many arenas—starting with project execution and continuing with daily operations and maintenance.

For starters, simplification of the overall system design resulted in a 25 to 30% reduction in overall project execution time. Critical data is now shared between the DCS and the substation automation system via Ethernet instead of using hundreds of hard-wired signal cables. Operationally, the use of a common, integrated platform already has allowed Petrobras to reduce training costs by 20%. Next up is the integration of maintenance practices among instrumentation, motors, power devices, and IT systems to yield further productivity improvements. The ultimate goal is to reduce unscheduled downtime and increase availability through online monitoring of critical assets using both real-time and historical data collected via the integrated system.

Petrobras has a long-term vision for energy efficiency and is looking to improved visibility to help it deliver. The top areas of concern are motor systems, combined heat and power systems, steam systems, and energy recovery systems. Integrated process and power automation systems as well as high performance drives, advanced controls, emission controls and modernization are key elements of the company's efficiency improvement strategy moving forward.

loop of SIL-rated field instruments, controllers and I/O modules, valve positioners and actuators. Highly scalable, System 800xA SIS solutions provide the flexibility to match specific safety functions with actual plant needs. 800xA HI systems are delivered and supported in accordance with the strictest current standards. Among others, System 800xA HI complies with IEC 61508, IEC 61511, EN 954, NFPA 85 and NFPA 72 standards.

ELECTRICAL INTEGRATION BOOSTS PERFORMANCE

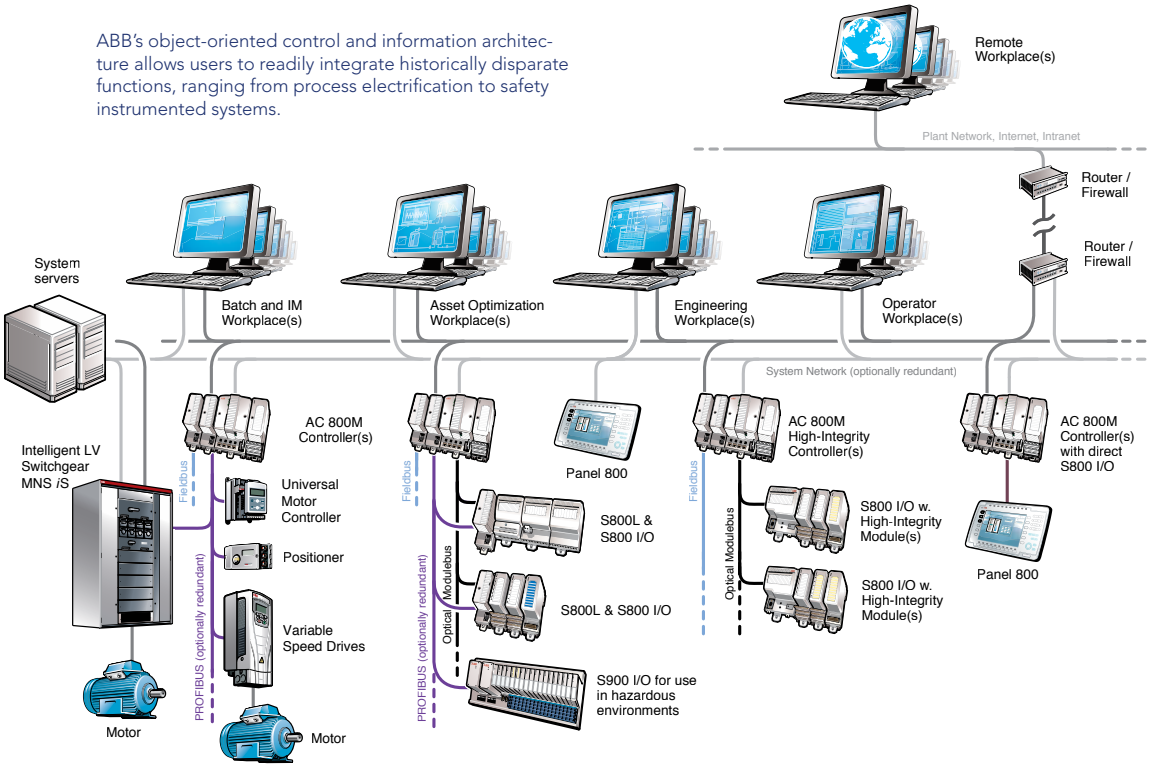
While the potential benefits of a unified approach to process automation and power management have long been recognized, past integration efforts often were made both painful and expensive by a hodgepodge of communication protocols as well as barriers among disparate plant departments and supplier organizations. The end result typically was two separate systems awkwardly tied together through complex, custom gateways or hard-wired signals used to bridge the gap for a few select parameters. This methodology had high integration costs, high project risks and high lifecycle costs as well.

Today, however, standardization of process electrification and power distribution systems around the IEC 61850 communication standard has opened the door to using an integrated, collaborative system to accomplish both process automation and power management tasks—and to do them both more effectively.

ABB, an innovator in both power and process worlds, is leading the way with its approach to what it calls "electrical integration." And a growing number of energy-intensive industries already are using this approach to improve plant uptime, increase energy efficiency and even lower capital project and lifecycle costs relative to separate, un-integrated systems.

"Electrical integration," explains Mats Pettersson, ABB product manager for electrical integration, "doesn't replace power distribution SCADA systems, but complements them on the plant site. It provides a common platform for unified operations and allows extended asset management and additional applications like power management to be included in the plant control system."

ABB's object-oriented control and information architecture allows users to readily integrate historically disparate functions, ranging from process electrification to safety instrumented systems.



"Electrical integration saves electrical and installation cost, reduces the possibility of blackouts and minimizes operational costs by non-duplication of systems and staff", Pettersson asserts. "It can reduce investments cost by as much as 20% over the non-integrated, two-control system approach," he adds.

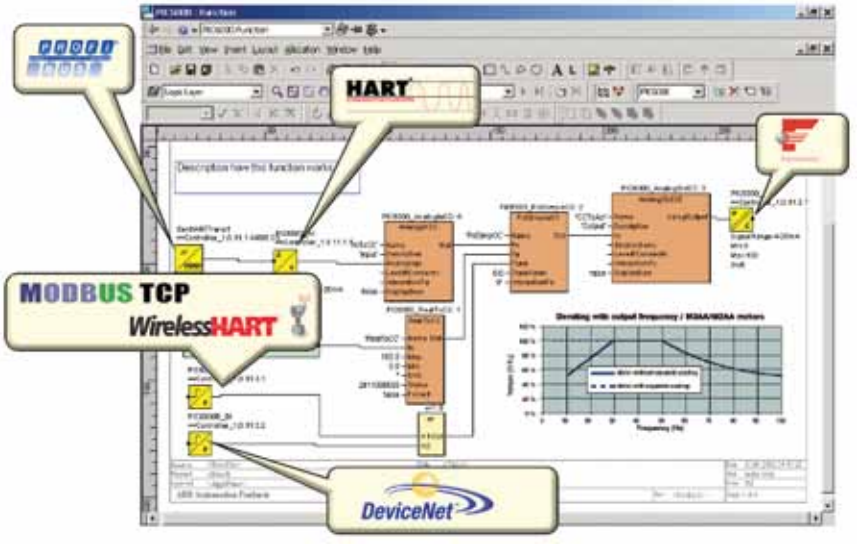
With an integrated approach, energy efficiency can be gained through improved visibility into power consumption as well as through faster plant start-ups. Shell Oil, for example, has reported a 20% productivity improvement through better operator visibility of plant assets. Plant upsets can be resolved more quickly with a plant-wide SOE list. And a smaller combined system footprint can reduce spare part inventories, lower training time, and make for a simpler overall system design with fewer wires but more connectivity.

New energy savings opportunities also can be explored, while existing energy reduction programs can be enhanced. For example, an increase in power consumption by a unit or in an area can indicate equipment malfunction or wear. A recent ARC Advisory Group report indicates that in many cases the potential energy savings attributable to increased visibility can equal 10% of total energy consumption.

"Tighter integration between power and process systems has the potential to increase both efficiency and productivity," adds Peter Terwiesch, ABB chief technology officer. And in this day and age, it's hard to imagine a process manufacturer that couldn't use a generous dose of both. ■

Control Made Seamless

Achieving seamless integration of the many different control disciplines required to run a modern processing facility has in many ways never been easier. If one is lucky enough to start from scratch, today's most capable controller platforms are both open and scalable, and can natively address a broad range of disciplines that traditionally required separate systems, often from different suppliers. And if legacy systems are a necessary part of the application mix, those same multi-functional controllers offer an unprecedented ability to seamlessly communicate over a broad range of digital protocols.



Seamless integration at the instrument network level requires the ability to seamless accommodate multiple fieldbus protocols.

In the case of ABB, the System 800xA's flagship controller, the AC 800M, provides the ability to integrate a broad range of networks, fieldbuses, serial protocols and input/output (I/O) subsystems. It provides seamless execution of advanced and process control strategies as well as safety, electrical, quality control and power management applications. The platform's extensive portfolio of communications modules also enables seamless integration of legacy controllers from ABB and other companies, as well as "non-traditional" automation devices, such as intelligent electrical devices (IEDs) via the IEC 61850 standard.

This flexible, unified field network architecture supports improved visibility and enhanced device diagnostics as well as distributed applications such as control in the field. Significant benefits can be achieved including improved process integrity, higher availability, and open and scalable information integration across the plant

TWELVE BUSES, ONE CONTROLLER

At the level of field instrumentation, a variety of standards-based fieldbus and, more recently, wireless networks provides an efficient means of gathering both process and diagnostic data from intelligent field devices. Once within the control system network, this data can be used for control and visualization as well as for condition monitoring, asset optimization or other non-control applications. From an architectural standpoint, it is important that one's control system offer the flexibility to communicate over any of the standard fieldbus and wireless protocols, allowing ultimate freedom of choice depending on a particular application's technical and business requirements.

From a practical standpoint, too, various instruments and field devices may communicate over a more limited range of standard protocols either because of their specialized nature or even country of origin. Further, there is an enormous opportunity today to integrate intelligent devices that have not traditionally been part of the process automation mix.

Setting the capabilities curve on this particular measure is ABB's System 800xA AC 800M controller, which can mix and match incoming information from any combination of up to 12 direct fieldbus connections. These module options include those for serial communications, Modbus TCP, Profibus DP, Profinet, Foundation Fieldbus, EtherNet/IP and IEC 61850 as well as ABB's own Masterbus 300, S100 I/O, Trio I/O, Satt I/O, INSUM and DriveBus protocols. Intrinsically safe I/O, SIL-rated I/O, and modular packaging options allow maximum flexibility in terms of I/O deployment.

Supporting this broad range of fieldbus options delivers significant value to the end users in the form of both capital expenditure savings (wiring, footprint and weight) and operational expenditure savings (heating and cooling, design flexibility and implementation of asset management and maintenance strategies). These protocols enable integration of data and devices from almost any compliant source. Further, the controller architecture is designed to allow individual controllers to see information from nearly anywhere on the entire network; there's no need for the individual controller-dedicated I/O structures of the past.

System 800xA also leverages the WirelessHART communication standard to wirelessly capture process variables and diagnostic data. WirelessHART data can be used within any System 800xA control or monitoring application, and for advanced asset optimization and maintenance strategies. System 800xA's WirelessHART integration, combined with ABB Instrumentation WirelessHART adapters and wireless consulting services offerings, delivers the complete package necessary to help users implement solutions tailored to their needs.

ABB's longer term vision of field networking acknowledges the convergence of field networks on the same Ethernet standards, including Foundation HSE, Profinet and IEC 61850. Since all of these protocols utilize the same Ethernet physical layer—whether copper, fiber or wireless–these different protocols can exist simultaneously on the same physical network infrastructure.

LEVERAGE OPC FOR CONTROLLER INTEGRATION

One step up from the field, at the application level, consider an architecture that leverages the full suite of OPC standards—from OPC DA (Data Acquisition) to AE (Alarms & Events) to HDA (History Data Access) as well as the up and coming OPC UA (Unified Architecture)—to provide a consistent means of integrating third-party process controllers, including programmable logic controllers (PLCs) and other devices. This approach allows production facilities to gain the benefits of integration while evolving their control platform over time, avoiding the need to rip-and-replace older yet still functional systems.

The OPC connectivity that is part of System 800xA's integration platform enables connection of third -party DCS controllers and PLCs. And, once connected, the data becomes part of the system in the same way as other integrated ABB hardware and software components.

The operator can then view and interact with all of the equipment that he is responsible for without having to look at multiple screens or log into multiple systems. This makes the

ETHERNET COMMUNICATIONS OPTIONS FOR THE SYSTEM 800XA

IEC 61850 – System 800xA's IEC 61850 communications module is a key addition to AC 800M communications that enables users to finally optimize the use of their electrical subsystems within a facility relative to the power utilization required by the process manufacturing needs in real-time.

Foundation HSE - System 800xA's support for Foundation Fieldbus (FF) includes both HSE and H1 networks. Foundation Fieldbus offers the unique capability to fully distribute control into the field devices with the use of function blocks similar to those used in most distributed control systems (DCSs) today. System 800xA is the only DCS that offers a full implementation of FF HSE and FF H1, providing significant benefits to the user unmatched by an "H1 only" solution.

Profibus/Profinet - Profibus DP and PA are used for many applications, including remote I/O with ABB's S800 and S900 products, connectivity to devices like transmitters and valves, and solutions with AC and DC drives. Available in the latest System 800xA release, Profinet now provides many of the features of Profibus DP on an Ethernet backbone using the same tools and seamless connectivity features users of Profibus networks already know.

EtherNetIP/DeviceNet - Also included in the latest release of System 800xA are EtherNet/IP and DeviceNet communications modules. EtherNet/IP is the TCP/IP Ethernet extension of DeviceNet (and ControlNet). In addition to the speed increases achievable with Ethernet, the protocol includes standard object and device models to simplify communication message structures. A primary application of EtherNet/IP within System 800xA is to provide high speed connections to programmable logic controllers (PLCs) and Motor Control Centers (MCCs) that use this protocol.

At the Shell Ormen Lange site in Norway, the largest System 800xA Asset Optimization application in the world is monitoring some 2,300 HART instruments, 40 Metso valve positioners, and 400 Emerson valve positioners as well as a range of IT assets, including 30 servers, 20 clients, and 200 switches. For critical rotating assets, for example, a compressor curve application compares expected performance against actual process measurements.

operator much more efficient and provides him a complete view of the unit or plant. Further, it provides a migration path for older systems, enabling a longer useful life, and reduces training requirements.

At the applications level, System 800xA includes a common engineering information and visualization environment—an information "bus" of sorts—that facilitates seamless integration of third-party applications such as for integrated document management, electronic logbooks and laboratory systems that traditionally have not been integrated into the process automation architecture. With these and other integrated solutions, common visualization across plant areas delivers savings in engineering as well facilitating the right operational and business decisions and actions to maximize productivity.

One key aspect of the seamless integration of process and diagnostic data in the System 800xA environment is the ability to facilitate comprehensive device management and asset optimization strategies. ABB offers native solutions supporting a broad range of asset management tools and strategies, including condition-based monitoring, predictive maintenance. instrumentation health, process optimization, energy management and other "green" initiatives, alarm management, health/safety/environmental and other compliance issues, asset management benchmarking services, remote diagnostic services, and IT security.

System 800xA Asset Optimization (AO) is unique in the marketplace in that it brings together, in one user interface, a composite view of the health and performance of each plant asset. Transparently maintaining all the richness of information, advantages and capabilities of each specialized system, AO eliminates the need for the user to switch between several systems, workplaces, application environments and navigation schemes. ■

Operators Equipped for Effective Decision-making

The same scenarios play out every day in control rooms around the world. From the start, little thought has been given to human factors in the design of the operator stations, and even less to the user interface design. Operators are well oriented to "normal," steady-state plant operations, but are untrained and ill-prepared to deal with abnormal situations when they arise. This even includes scheduled shutdowns and start-ups that today happen at increasingly infrequent intervals. And, all too often, the information operators need to make quick, intelligent decisions does not exist within the operations environment—requiring operators to juggle other system interfaces at the precise moment the process itself demands their undivided attention.

Is it any wonder that operators' inability to deal with abnormal situations is responsible for enormous losses of productivity, money, and even life and limb across industry? Indeed, research indicates that nearly 80% of production downtime is preventable. And half of this is due to operator error. The monetary costs of this failure in the petrochemical industry alone are estimated at $20 billion per year. And with the financial impact of an unplanned production outage averaging $250,000 per hour, the incentive to improve operator effectiveness is not to be ignored.

Meanwhile, across industry, satellite control rooms are giving way to central operations centers as companies struggle to improve financial performance through more effective utilization of operations staff. In the end, fewer operators are responsible for more functional areas and increasingly complex processes. So, what's an operator to do?

FOUR PILLARS OF OPERATOR EFFECTIVENESS

Together with the design of more intuitive user interfaces and more ergonomic operator stations, the integration of disparate plant systems within the System 800xA Operations environment is central to ABB's approach to helping the process industries improve its operators' effectiveness. These three pillars—high performance human-machine interface (HMI), attention to human factors/ergonomics and plant system integration—are complemented by a fourth: the assurance of operator competency and confidence through training on integrated simulation environments.

The key deliverables of this integrated approach to operator effectiveness include:

- *Increased asset utilization:* Equipment utilization and overall equipment effectiveness (OEE) can be improved through efficient alarm management strategies, which can help to reduce nuisance alarms, rationalize existing alarms, handle alarms dynamically, design alarm sounds properly, and provide a means to monitor the alarm management strategy itself. An alarm management system designed with integrity allows operators to truly operate instead of just reacting.
- *Improved performance:* Control room ergonomics and design have a big impact on operator effectiveness. The

Operators at the Collahuasi copper mine, high in the Chilean mountains, rely on ABB System 800xA Operations consoles to monitor and optimize mining operations.

planning of areas adjacent to the control room needs to take personnel movements and workflows in consideration. Also, with control loops tuned and running in a consistent, automatic mode, the process will perform better which increases output and quality.

- *Improved safety:* With more effective operations strategies in place—including alarm management, operator training and loops running in correct mode—the overall safety of plant personnel will improve.
- *Improved collaboration:* With systems seamlessly connected and transparent to operations, relevant information and data can be shared, encouraging a collaborative and productive environment.

Swedish papermaker Södra Cell Mörrum is among those companies using ABB's object-oriented architecture to access mission-critical data while preserving their existing control system infrastructure investments.

INTEGRATION IS FUNDAMENTAL

ABB's approach to integrated operations is founded on the inherent integration capabilities of the System 800xA, where the operator works in a seamless environment with vertical, horizontal as well as functional integration. Vertical integration gives the operator access to all information relevant to plant operation such as production orders, production reports and financial performance. Horizontal integration gives the operator detailed access to all types of devices and all types of control systems, independent of brand. Functional integration makes functions located in separate systems, normally not related to automation, available in the seamless operator environment. Examples include live video, maintenance management, laboratory systems and document management systems.

From an operations perspective, the 800xA Operations applications extend the reach of ABB's Process Portal to provide a single, consistent and intuitive window into all the applications encompassed within the Extended Automation environment. It allows users of all disciplines that impact production to organize information and navigate throughout the system in the context of their job function. The system, by virtue of the ability to associate all aspects of information available from the various applications within the system to the appropriate process object, allows for quick and intuitive analysis. The Extended Automation system environment also streamlines work processes and communication among various functional disciplines.

Personalized workplaces ensure that operators and other personnel are presented only with the information needed, in the proper context. The design of the environment provides intuitive and easy access to all integrated information through a simple right mouse-click on each object. Navigation is simple and independent of where the information is located. Information displays can mix-and-match any combination of data sources that are part of the 800xA environment. The operator can be presented with consolidated alarm and event lists, for example, without needing to know what application or controller supplied the information. Since it is all available in one place, troubleshooting becomes much easier.

Implementation of standards in the areas of display design (such as from the ASM Consortium, EEMUA and the ISA's S88 working group), enable operators to perform effectively no matter what is happening in the

Operators work in a seamless environment with vertical, horizontal and functional integration.

plant. Workplace layouts are adjusted and optimized to users' preferences and needs with individualized menus, toolbar contents and display locations. Windows management functions such as safe areas and the pinning and stacking of priorities minimize operation errors by prioritizing the presentation of material.

ERGONOMIC FACTORS BOOST ALERTNESS

Instead of being designed with operator performance in mind, many control centers, control rooms and operator stations are designed without respect to human factors or simply to impress visitors. Incorrectly planned environments intended for 24x7 use often are depressing, unwelcoming and uncomfortable at best—and at worst create fatigue and boredom.

ABB's Extended Operator Workplace (EOW) is intended to create an ideal work environment for the operator, including the operator station functionality within the control system as well as the surrounding environment.

ABB has been focusing on human factors for many years, and works closely together with CGM, specialists in control room design and ergonomic work environments. Together, ABB and CGM have turned fatigue and distraction into operator alertness and pro-activity with an offering called the Extended Operator Workplace (EOW), which aims to create the best work environment for the operator, including the operator station functionality within the control system as well as the surrounding environment. Exclusive to ABB, the EOW provides a modern control room or control center that promotes more alert, less stressed, happier and much safer operators.

The high-end EOW-x contains the latest flexible motorized console technology adjustable to individuals at the touch of a button. Included is the Advanced Operator Keyboard that includes hotkeys for easily switching between different System 800xA screens. In the motorized, large overview unit, a directional sound system as well as a high frequency dimmable lighting system is integrated. The console also has a live video camera system with speaker system for public announcement. "Micro ventilation" capabilities even allow each operator to personally adjust ambient temperature conditions.

A COMPETENT OPERATOR IS A CONFIDENT ONE

Finally, the assurance of operator competence through proper training also is affected by integration factors. A closely integrated training environment, for example, makes it possible to train operators on simulators that behave essentially identically to actual plant systems, instilling confidence that operators can respond correctly to abnormal situations when they arise. ABB provides custom simulator solutions to most types of plants using the System 800xA Simulator, a simulator version of the standard System 800xA.

For a new plant, use of an operator training simulator can contribute to shorter initial start-up, enhanced operator performance as well as trip and incidence avoidance. It also allows the testing of operational procedures and the tweaking of display and control strategies before initial start-up, when changes are less risky to make.

Operator training simulators also are important to the effective operation of existing plants. Many high-reliability plants are having difficulty maintaining performance during turnarounds because workers deal with these procedures only infrequently. And the ongoing retirement of experienced operators has only made this situation worse.

While the direct benefit of using a simulator is difficult to quantify, a recent survey by the Electric Power Research Institute (EPRI) indicated an average yearly saving of about $4,500 per megawatt of generating capacity. These savings are attributed to reduced training costs, improvements in plant availability, fewer environmental excursions and reduced damage to equipment. A little bit of math indicates a three-month payback for the typical power generation facility and begs the question: In what scenario would you *not* invest in a training simulator? ■

Engineers Empowered for Maximum Productivity

The ability of one's automation architecture to readily enable seamless integration rests in no small part on making the necessary engineering tasks easier to do. Rather than custom-coding an interface between two applications, why not drag-and-drop the needed data point from one window to another in the engineering console—and let the underlying architecture take care of the rest?

Perhaps more than any other underlying technology, the use of object-oriented architectures is helping to make this streamlining of integration effort a reality. Object architecture makes it possible to implement the common engineering, information and visualization environment that effectively abstract implementation details from the configuration and day-to-day management of seamlessly integrated production systems.

ASPECTS AND OBJECTS

In short, the concept of object orientation encompasses those software development and systems engineering principles such as instantiation, inheritance and encapsulation that help to make possible managing—and effectively integrating—the enormous number of details involved with the thousands of pieces of equipment and information in a typical process plant.

In its System 800xA control system and object-oriented architecture, ABB refers to the range of plant entities and the data that describe them as Objects and Aspects, respectively. Objects are the many physical and logical entities that exist in the plant (such as pumps and control loops). Aspects are the pieces of information that describe the particular instances of these objects (such as pump speed setpoints and control loop gains). Object-oriented engineering allows object types to be created, then instantiated throughout the control code with different aspects as necessary.

Each object, including associated aspects such as HMI graphics or control logic, can be developed once and deployed everywhere that same object type is used. The utility of this is that if a change needs to be made, it can be made once on the object type and automatically replicated to all the other "instances" of the object type. Object architectures also allow for smaller objects (pressure transmitters) to be aggregated into larger objects (distillation columns) and so on. This makes engineering and integration tasks easier to do, the results easier to maintain, and facilitates the implementation of standards throughout the organization.

THE INTEGRATED ENVIRONMENT

In short, the System 800xA Engineering environment allows engineers to engineer. They can spend their time focused on developing automation and integration strategies rather than writing code. The platform creates efficiency and boosts productivity, allows collaboration among on-site and off-site engineering groups, allows the development and re-use of intellectual assets and more readily supports the full system lifecycle.

Essential productivity-enhancing features of the System 800xA Engineering environment include graphical tools for the management of HART, Foundation fieldbus, and Profibus intelligent devices. Microsoft Excel add-ins can be used to automatically import and assign bulk data from external sources. Further, system data can be readily exported to support data validation and

Object-orinted architectures are what allow today's process automation systems to separately manage the thousands of physical and logical entities that make up a plant from the information that describes them.

The laborious, point-to-point integration methodologies of yesteryear can be replaced by an information architecture that great simplifies application integration.

modification needs. The system also includes extensive change management features to support the validation requirements of regulated industries. "Detailed difference" reports can pinpoint changes and reduce the time needed for verification procedures.

System 800xA also provides the ability to associate related documentation to equipment and applications. Documents based on Microsoft Word, AutoCAD and many other formats can be enhanced with live process values for easier diagnostic review.

PROCESS ENGINEERING TOOL INTEGRATION

Opportunities to drive engineering productivity improvement begin early in the project lifecycle, when key asset information is being created in core process design systems. Engineering tools integration improves plant communications, data management and decision support; increases engineering value by streamlining workflow and ensuring data quality and consistency; and allows use of the native engineering environment.

For example, information from Intergraph's SmartPlant Instrumentation® (SPI) solution can be bi-directionally integrated with the System 800xA engineering environment. Automation system structure, functionality and graphics within the System 800xA can be created directly from the Intergraph SPI design, and operational changes such as ranges, units and settings can be continually reflected back to SPI. Engineering firms and owner-operators have documented engineering savings of 40% and operational savings of 20% through the reduction of as-built cycles and automatic design synchronization.

A PLATFORM FOR STATE-BASED CONTROL

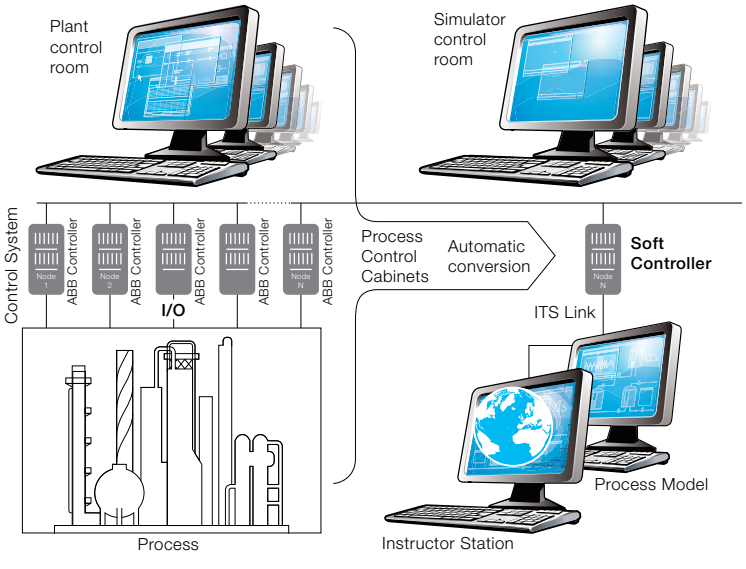
An object-oriented information and automation architecture such as System 800xA's is uniquely suited to supporting state-based control (SBC) methodologies and the improvements in engineering and operations productivity they can deliver throughout a plant's lifecycle. SBC has been shown to result in higher asset utilization rates for both people and equipment. Fur-

State-based control creates a way to standardize design methodologies across the organization.

ther, it provides an environment for ongoing knowledge capture directly into the system design.

In essence, state-based control is based on the principle that all process facilities operate in recognized, definable "process states" characterized by definable differences in processing conditions. Changes in rates, product grades or other factors influencing process performance dictate changes in automation and control parameters. Influences to be taken into account might include equipment operating conditions such as enabled/disabled alarm or safety interlock status.

Because it represents such a structured view of process conditions, direct management of many abnormal situations is possible with SBC. It can eliminate human errors and optimize processing conditions, even if conditions themselves are less than optimal. Traditional automation strategies, in contrast, rely on operator response and the multitude of sub-optimal outcomes that can—and do—occur. And when a situation arises that does require operator involvement, a SBC implementation often presents a less cluttered view and greater situational visibility to the operator.



With System 800xA, it is possible to create a simulator system with the identical layout, view and logic of the running plant. Optionally, operator panels' physical I/O can be integrated within the simulator for identical control room interactions.

Another element of SBC's secret sauce is that it creates a platform across which much of an organization's design methods and elements can be standardized, regardless of whether the processes at hand are continuous, batch or hybrid in nature. Better utilization of engineering resources—whether internal or external to the organization—is a key deliverable. Improvements in operator effectiveness, as measured by reductions in operator errors, increased attention to key performance indicators, and the consistent performance of true value-added activities also can be delivered with SBC.

And while using SBC may seem like a no-brainer, implementing it on a traditional DCS platform was anything but. The result often was an overly complex, monolithic beast that was difficult and costly to maintain. Until, that is, the development of object architectures and state-based control engines such as those in ABB's System 800xA.

Within the System 800xA architecture, objects can be applied from the lowest individual control element level (Control Modules) through increasing levels of complex objects (Equipment Modules and Unit Modules), creating a high degree of reuse and far-reaching corporate standards. State-engine control logic can be embedded directly inside these objects.

All of this makes delivering on the promise of SBC easier and more cost effective than ever before. ■

Flexibility for the Future

The choice of automation architecture has clear implications for the ability of end users to evolve their systems over time and to protect their intellectual property investments. An architecture that supports freedom of choice in standard communication protocols and integration methodologies provides the clearest path to facilitating integration at all levels of plant systems—from field devices to controllers to applications to business systems—into the overall control and visualization architecture.

Further, it's important that system suppliers provide continued investment and support, as well as an active path for porting their control code and graphics directly into the latest system controllers, thus reducing costs and risk. And because effective integration infrastructure architecture abstracts process data and information itself from the underlying communications, the benefits of integration can more readily be preserved in the face of inevitable changes in technology, control strategy and business processes.

AN EVOLUTIONARY PATH

In a word, "evolution" is ABB's guiding lifecycle principle and is embedded within the company's product offerings, policies, programs and processes, according to Roy Tanner, System 800xA product manager. "Evolution allows our customers to achieve their business goals by both sustaining their automation system and extending it with new features and technology," says Tanner. "Our customers need to better control lifecycle costs, budget for expenses, and eliminate unplanned production interruptions. ABB's Lifecycle Management policies fulfill all these needs."

The central intent of ABB's lifecycle management programs is to preserve its users' engineering and technology investments while proactively managing costs and risks on the path forward. For example, with ABB's evolutionary approach to system updates/upgrades, production interruption is minimal and many times non-existent. Consoles can be upgraded with little or no effect on the running production system. Controllers can be upgraded to the latest version and the only downtime required is installation and switchover—typically done in a single shift. And, in most evolutions, live cut-over methods can eliminate loss of production entirely.

Considering the time spent designing, implementing, validating and refining them, process control applications represent an enormous investment in end users' time and intellectual property. With ABB's evolutionary approach, upgrading to the latest controller technology protects all this effort; the same logic executes seamlessly in the new controller. System-specific control libraries for the System 800xA allow users to easily transfer their control code from older controllers to the newest AC 800M.This includes control and I/O compatibility for most installed systems from ABB, Bailey Controls, Hartmann & Braun, Taylor, Fischer & Porter and Alfa Laval Automation.

AUTOMATION SENTINEL WATCHES OVER YOUR SYSTEM INVESTMENT

A subscription to Automation Sentinel, ABB's program for system lifecycle management, includes:

- Licenses for new versions of system software
- Software maintenance updates
- Extended support for System 800xA software versions, up to seven years
- Technical phone support to assist in system problem troubleshooting
- On-line website access for downloads to assist in system maintenance, including software and firmware updates, user manuals, software release notes and product technical bulletins.
- Software security management, including Microsoft security patch validation status reports,and third-party virus scanner qualification
- PC hardware qualifications for compatible replacements
- Device library management updates for Profibus, Foundation fieldbus and HART-based instrumentation

End users with remote, difficult-to-reach systems and instrumentation, such as on this off-shore platform, rely on ABB's Service environment to help optimize production and maintain safe operating conditions—even from a distance.

Even more important are the operator knowledge and experience developed around existing consoles and graphical displays. By converting user graphics, workplace layout and navigation methods from older systems to the System 800xA platform, operators' look-and-feel can be preserved. This reduces training, startup time and improves the ability to interact with the process. If a plant upset occurs, for example, operator response is not encumbered by an unfamiliar HMI.

Upgrade projects can be long, complex, risky and expensive. But by providing incremental upgrades and investment protection, most of these risk factors, time and re-engineering expenses can be reduced or eliminated with the ABB approach. And not only are direct engineering/technician costs reduced, secondary costs are reduced as well, including project management and risk review as well as time to travel and meet with suppliers.

SUPPORT FOR THE LIFECYCLE

To facilitate this continuous evolution and to help users manage control system costs over the entire system life, ABB offers Automation Sentinel, a program designed to assist owners in actively managing their lifecycle system costs and investments. With this program, system owners can decide when to update to newer versions of system software based on their system lifecycle plan and business objectives. In addition, customers receive consistent support throughout the complete lifecycle of their system.

As one of the world's largest automation companies, ABB's capabilities include a broad portfolio of services—from spare parts management to process optimization—to ensure its users maximum return on their ABB automation equipment investment. Lifecycle services include a comprehensive selection of services to maximize productivity, minimize costs and extend the useful life of installed equipment. These services include tech support; maintenance and field services; parts, repair and refurbishment; evolution planning and implementation; training; engineering and consulting; and installation and commissioning. Help with advanced engineering methodologies such as to improve operator effectiveness or to implement asset management strategies is also available.

Ultimately, ABB's evolutionary philosophy also means support for integration needs throughout the plant's lifecycle, enabling process manufacturers to achieve business objectives today—and sustain them into the future. ■

System 800xA Extended Automation
The Power of Integration

Integrated Process and Power Automation. ABB reduces capital expenditure and lifecycle costs by bringing process control, process electrification, substation automation and power management together on a common System 800xA platform, eliminating the need for multiple systems for your plant. Also, in one powerful, integrated, plantwide system, operations and maintenance are unified, reducing downtime and increasing productivity. For more information visit **www.abb.com/controlsystems**

Power and productivity
for a better world™