Life Is On | Schneider Electric

The future-proof plant

How a modern process automation system eliminates obsolescence and meets the challenges posed by operational acceleration, evolving technology, and a changing workforce.

by Peter G. Martin

Executive summary

This is the first of a three-part series exploring how today's most advanced automation systems deliver new functionality to the process-driven business. This paper, "The future-proof plant," describes how the modern automation system has evolved to offer real solutions to three critical obsolescence challenges facing industrial process operations. The second paper in the series, "The protected plant," focuses on the process-connected aspects of a system that impact business continuity by mitigating risks to operational integrity. The third paper, "The enlightened plant," explains the new operational insight that can be delivered to plant operations once basic needs for reliable, secure performance are met.

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Introduction

The challenges facing industrial companies grow more daunting by the day. Globalization, energy markets that change in real time, variations in materials and prices, aging of the industrial workforce, inability to attract the next generation of talent, and difficult regulatory pressures have all contributed to an extremely stressful industrial business environment. Fortunately, the right automation system can now offer cutting-edge solutions for meeting at least three of these challenges: keeping pace with accelerating business and operational requirements, evolving with changing technologies, and attracting the right people, then supporting them with the required knowledge.

The speed challenge

The speed of operations and business continues to increase. Only a decade ago, basic manufacturing processes operated with satisfactory rapidity within storage boundaries. Storage capacity was viewed as a necessary aspect of production value chains, ensuring that materials and energy would be readily available when required. But storage-based value chains also added cost to the business and removed agility from the operation. Over the last decade, critical business variables associated with industrial production have begun to fluctuate with more frequency. For example, today the price of the electricity that an industrial operation consumes might change every 15 minutes. This increase in speed has also impacted the frequency in variation of the production value and material costs of an operation. Now the speed of business is so fast that industrial operations must be able to respond to market changes in real time. Unfortunately, the storage points in the storage-based value chains of a decade ago are becoming the limiting factor in these operations.

A number of industrial businesses are working to change their process designs to improve their agility. Automation systems must be designed from inception to be extremely agile, adapting to process changes quickly and easily. As these process changes are implemented, object-based industrial service-oriented architecture (SOA) can help industrial companies to adapt flexibly — essentially future-proofing the operation in this area while simultaneously maintaining the operational integrity of the plant.

As the speed of business continues to accelerate, many functions that industrial operations have traditionally performed in transactional business systems will require execution in real time. Therefore, these business functions will need to operate in a real-time system. To accomplish this, Schneider Electric, for example, has patented such business functions as real-time performance measures, real-time activity-based accounting, and profitable safety and asset performance management (to name just a few), and has incorporated them into its recently introduced Foxboro™ Evo process automation system.

The technology challenge

As well as helping companies meet business challenges by future-proofing their operations, modern process automation systems embody all the characteristics essential to staying ahead of ever-evolving technological developments — by future-proofing their technology. Control room components such as operator consoles and engineering tools have much shorter life cycles than process-connected components such as transmitters and control software. Process manufacturers need the flexibility to upgrade all components to meet emerging business requirements without having to upgrade everything at once.

A look at how Foxboro control technology has evolved over the past three decades can be valuable in understanding the fundamentals of future-proofing technology. During that time, clients who had invested in the company's I/A Series system, which embodied a unique "continuously current" approach, found they could continually evolve to the latest state-of-the-art technology while preserving existing hardware, software, and applications. This enabled clients to protect their engineering investments and, in many cases, to use emerging technology to drive more value from their automation solutions.

From an architectural perspective, Schneider Electric was able to implement a continuously current approach based on design decisions made at inception. Key decisions included developing a distributed software architecture that would operate in standard operating system environments such as UNIX and Windows® NT, utilizing industry standards where available, and building a distributed object-based communication infrastructure. In fact, the I/A Series object manager, a critical element of continuously current design, served as the basis for the international standard developed by the Object Management Group. From today's perspective, these design decisions may appear obvious. Yet Schneider Electric still provides the only automation system that offers this level of proven, continuously current design.

In recent years, Foxboro technology has brought the concept of continuously current technology to a new level by extending the basic system design to become an industrial SOA. The SOA design is incorporated in the new Foxboro Evo process automation system and is based on a two-layer set of services that wraps around the Microsoft® Windows NT kernel and utilizes open web technologies.

The first layer comprises operating system services that extend Windows NT for secure and highly distributed industrial usage. These services include distributed object management, common name space, inter-process communications, and security services, among many others. Adding these extended operating system services to the Windows NT kernel means that users get the full benefit of the Windows NT system services as well as the industrial context provided by these extensions.

The second layer provides a set of application services that are common across all industrial systems (Figure 1). These services include common human-machine interfacing, historical data management, and a real-time workflow engine, among others. This application layer of services is based on the desire among industrial companies to have common approaches across their systems to simplify system design, implementation, and operation, as well as to offer operational insight and encourage collaboration across their operations. Over and above this multilayer software architecture, Schneider Electric has incorporated additional technologies that help to future-proof the system by increasing its agility.

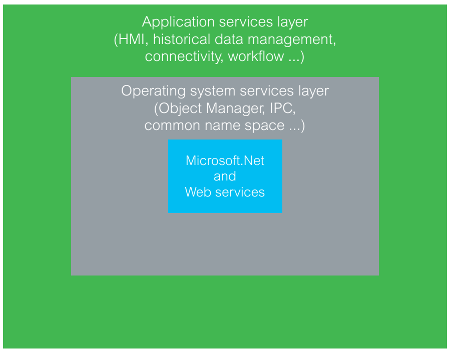

Figure 1

Industrial service oriented architecture — layered system design

The people challenge

A final important issue facing industrial companies over the next few decades will be the aging of the workforce with its resulting retirements. This will impact industrial companies in three key ways. First, much experience will be subtracted from the workforce. Second, new, younger workers must be readied to replace the talent that is leaving. Third, industrial companies will need to develop plant environments that attract younger talent.

Automation technology can help future-proof industrial operations within each of these three areas in a number of ways.

With respect to aging talent leaving the workforce, properly designed automation software can help capture the intellectual property of both engineers and operators before they depart. On the engineering side, applying an advanced object infrastructure and taking full advantage of the technology-independent characteristics of modern applications can enable these applications to migrate forward easily on new technology platforms, effectively preserving their design intelligence over time.

In addition, software workflow engines at the system platform layer allow intellectual property originating with engineering, operator, and maintenance veterans to be embedded into the system environment for call-up in event or on demand. Thus these workflows can offer new hires key operational insight from more experienced contributors who may have left the organization. Highly complex and error-prone operations such as plant and unit startup and shutdown can be directed down optimal operational paths. Also, operators and maintenance workers can be guided through unexpected and perhaps unsafe events via intellectual property embedded in automatically triggered workflows.

A properly designed automation system can also address bringing new and younger employees up to an acceptable level of effectiveness in the shortest time possible so they can replace retiring personnel. Tightly coupled, first-principle-based operator training simulators used in conjunction with contextualized virtual reality training systems can help new operators achieve certification levels in less than half the time of traditional methods.

Experience demonstrates that operators can become proficient in short order on the day-to-day, repeatable functions they are expected to perform. The challenge has been to train for infrequent and unexpected events. Now these can be programmed into simulation and virtual reality software, enabling operators to practice responding to these events in a repetitive manner and getting them to proficiency very quickly. But reaching proficiency is only the first step. Once operators reach certification levels, they must continue to build on their performance. The advanced automation answer: embedding lifetime training capability into the online environment through performance feedback mechanisms and performance prediction software. Since people learn by feedback control, providing these capabilities within the operational insight environment drives them to even higher levels of performance than that of their predecessors.

In the final component of the people challenge, potential employees from the X, Y, and millennial generations may not be attracted to industrial careers because they view them as “old and dirty.” But the industrial environment can be made much more appealing by system features such as visualization software that can run on a traditional CRT console, display wall, or smartphone, and that can be adapted to operate in new human-interfacing technologies as they are introduced. Coupling such user-friendly high-technology environments with advanced learning environments based on a deeper understanding of how people learn could be a major attractor of new talent into the operation.

The future-proof plant

Future-proofing automation technology is merely one of the issues industrial companies face as they move forward. Many critical challenges and changes that are expected to impact industrial operations will require similar efforts. Automation system technology cannot address every aspect of future-proofing industrial plants, but it can help in three critical areas: protecting the operational integrity of plants, enhancing the operational insight of people, and enabling them to adapt easily and affordably to change. Companies that deploy object-based industrial SOA such as that embodied in the Foxboro Evo system will gain significant capabilities for addressing all of those objectives.

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