The Power of Integration

Choose an Automation Infrastructure That Will Boost Performance Today and Readily Adapt to Tomorrow’s Demands

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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, maintaining and managing production.

Imagine that with one click an 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.

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. And one’s choice of process automation architecture can play a major role in just how easy—or impractical—realizing the power of integration can be.

A Brief History of Integration
In the context of process automation, the pursuit of “integration” has a long and storied history. Indeed, ever since the first digital networks and microprocessors were used for process control, establishing meaningful communication links among field devices, controllers and software applications has been a central task of project work.

But integration often was a big and complex job—disparate systems and applications from multiple solution providers made connections both time-consuming and expensive to build. Further, since each link was typically a point-to-point, custom-coded solution, they proved inflexible, fragile and a maintenance headache: Change or upgrade one system and break the links between them. As a result, realizing the full promise of robust, seamlessly integrated systems—and the collaboration and informed decision-making they would allow—remained more impractical aspiration than achievable reality.

Fast forward to today, and a growing number of process manufacturers are finding that their choice of automation architecture can dramatically streamline integration tasks, in turn enabling new levels of business benefits in the form of increased levels of collaboration and productivity, improved operator effectiveness, as well as streamlined system engineering effort and lower lifecycle costs. Further, because the proper 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.
From DCS toward CPAS
The evolution of the traditional distributed control system (DCS) into today’s more capable and more all-encompassing process automation architecture has been chronicled by the analysts at the ARC Advisory Group as the advent of the collaborative process automation system, or CPAS.

From a functional point of view, CPAS 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.

**Industry Trends and Control System Implications**

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From Instruments to Applications
At the level of field instrumentation, a variety of standards-based fieldbus and, more recently, wireless networks provide an efficient and transparent 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, notably intelligent electrical devices, the integration of which via the IEC61850 communication standard enables advanced automation strategies such as integrated power management.
At the controller 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 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 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, today’s most advanced automation architectures include 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.

Finally, at the business systems level, ensure that integration already has been demonstrated between your choice of process automation architecture and your company’s business system platform. Meaningful, real-time connectivity between your plants’ process automation systems and enterprise resource planning (ERP) systems is an increasingly essential requirement of today’s more agile process manufacturing companies. A verified integration solution will reduce maintenance costs and provide a configurable and consistent way to share data between the two environments.

**Toward More Effective Operators**

One key consequence of the proper choice of automation architecture is improved operator effectiveness, which in turn can yield enhanced production performance. Integration implications of one’s architecture choices include the ability (or inability) to provide context by pulling together information regardless of source or location, as well as the ability to filter out irrelevant information. Personalized, role-dependent workstations and effective alarm management are examples of this advanced integration functionality at work.

Across industry, satellite control rooms are giving way to central operations centers as companies find that this approach can yield improvements in both operational excellence and financial performance through more effective utilization of operations staff and improved collaboration. The proper automation architecture can aid in integration of these multiple plant areas and functions, providing both field and control room operations personnel with a quick and easy-to-use decision support environment for analyzing and troubleshooting both routine and upset conditions across the plant.
Operators’ effectiveness in these often expanded roles also is enhanced by optimal ergonomic and presentation technologies, including advanced keyboards with hotkeys, directional sound systems, integrated and adjustable lighting, and motorized/adjustable workstation configurations. In addition to better decision-making by operators, this attention to human factors in the control room can result in reduced turn-over among these highly trained personnel, attraction and retention of new staff, and a reduction in workplace health issues.

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. An integrated simulation environment also provides a platform for optimization studies and knowledge capture.

**Objects and States: Empowering Engineers**

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 increasing use of object-oriented architectures is making this streamlining of integration effort a reality. 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.

Object architectures allow for all of the similar pumps in a process plant, for example, to be treated as “instances” of a more generic pump “object.” These pump objects in turn can in turn be aggregated into larger objects such as distillation columns, and so on. This underlying object architecture is what makes it possible to implement the common engineering, information and visualization environment that effectively abstracts implementation details from the configuration and day-to-day management of seamlessly integrated production systems.
Agility 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 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.

Ultimately, the promise and the power of integration lie in enabling process manufacturers to achieve their business objectives. And today more than ever, architectural considerations—and the extent to which they enable seamless integration and effortless collaboration—have implications for realizing those objectives, and for sustaining them into the future.

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