Executive Summary
Today’s competitive environment demands automation solutions that increase plant efficiency and profitability. Control system performance can significantly impact a manufacturer’s bottom line. Leveraging automation capabilities through simplified, cost-effective migration to a new technology, while optimizing current investments is a key to success.

In some cases, legacy control systems can no longer meet corporate objectives that include enterprise-wide sharing of business information. Nor are they a reliable and sustainable solution providing a high degree of diagnostic information to ensure the health of plant assets and keep the process running longer with proactive maintenance. Plants with outdated controls also face issues related to a retiring workforce and loss of intellectual property.

Industrial organizations require the latest automation solutions to enable increased throughput, lower costs and improved regulatory compliance while responding to customer demands for better product quality and faster delivery.

This paper highlights the requirements for safe and manageable control system migration, providing guidance for users who recognize the need to upgrade their automation platform while making the most of existing plant assets and intellectual property.

Identifying the benefits that a unified control architecture provides helps make the case for an easy migration path. As operators become more effective, assets work harder and businesses become more agile, process performance increases and overall operational effectiveness advances to new levels.
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Background

Improving the performance and business results of plants through control system migration has become an important strategic initiative. The typical drivers for migration projects include the impact of downtime of existing control platforms, the ever-increasing cost of maintaining obsolete equipment, and the need to acquire or supervise global business data.

The need to upgrade to newer automation capabilities means that industrial operations must select the best migration strategy and technology solutions based on various critical factors, including control reliability, data configurability, plant-wide architecture support and standardization and safety-instrumented systems (SIS) integration.

Consolidation of automation industry vendors has created some confusion for customers, especially when it came time to upgrade their process control systems. Some legacy systems were neglected or outright abandoned by their new vendor-owners. For process plants, the critical issue in control system migration is deciding when to jettison the old system in favor of the new. However, obsolescence does not happen on a specific date, but rather is a gradual process that starts when a vendor discontinues support. Spare parts become harder and harder to procure and more expensive to maintain. At some point, there is a line where migration is inevitable and migration must occur. But where do you go once you hit that point and how do you migrate your system?

Project Challenges

In most companies there are many projects vying for the same capital dollars. When migration projects do get funding approval, it is imperative that they are executed successfully to gain justification for other automation projects. For industrial plants, migration challenges include:

Selecting the right technology

The first task in any migration project is determining the process for selecting the future control system. This factor often determines customer satisfaction with the new automation solution. Faced with increasing performance demands, industrial facilities need a seamless platform that provides the foundation for integrating process control and safety systems, along with process knowledge for better decision-making. Additionally, plants seek collaborative software decision-support tools that help minimize disruptions and overcome abnormal situations.

With an open, yet tightly integrated automation solution, end-users can unify plant safety and control, providing increased safety, security and system dependability. They also gain a single facility-wide view of operations, plus the interfaces with industry-standard digital network protocols to optimize existing assets.

Many end-users are ready to leverage mobile computing capabilities through the adoption of wireless solutions that extend the reach of automation. New wireless field data collection systems enhance asset management by integrating field data with data from other sources, including production, process control and work management systems.

Ensuring operator acceptance

Operator acceptance is key and can determine migration project success. Because the control system is a direct operator interaction device, even if the new technology outperforms the legacy system, a lack of consideration for operational improvement or needs can lead to failure.
Replacing HMI

The Human Machine Interface (HMI) included in a Distributed Control System (DCS) can be most vulnerable to support issues. At many plants, multiple types of HMIs are installed. At some point, the HMI hardware will exceed its life expectancy or the cost of finding replacement parts will become prohibitive.

End-users need a solution that allows the new HMI to communicate with existing controllers on a continuous basis. Ideally, the new HMI would have the capability of using the old graphics or at least run in parallel with the current one for some period, giving operators a feeling of continuity during the transition while allowing for transfer of skills sets among experienced and new personnel.

Creating third-party interfaces

Communication and interfaces with third-party devices can be a major stumbling block to automation system upgrades. Control systems frequently communicate with legacy systems, such as Programmable Logic Controllers (PLCs), safety systems and advanced applications. Many modern systems can take advantage of newer technologies that enable a richer interface that enable tighter communications. Identifying these systems and determining a detailed interface plan is essential for an effective migration.

Scheduling migration work

When it comes to a control system migration strategy, careful lifecycle planning can reduce or eliminate risks. First and foremost, end-users should give thoughtful consideration to the scheduling of any migration. Long-term multi-year planning for multiple migration stages will help to ensure maximum ROI and minimal disruption.

Preparing for system cutover

System cutover requires careful planning to minimize risk. A comprehensive cutover plan is a critical requirement for seamless transition to a new control platform. Without proper preparation, migration projects can be affected by cutover delays and other unexpected issues that may cause downtime.

Figure 1: Industrial operations need an easy, low-risk transition path to a modern control system architecture.

Technology Solution

Today, industrial operations need an easy, low-risk transition path to a modern control system architecture. With an effective migration solution, companies can take advantage of existing automation investments while building a base for the latest digital technologies.
In the 1970s, the DCS revolutionized plant-wide operations, performance and asset utilization in the process industries. Three decades later, leading control system suppliers are once again redefining industrial automation with enterprise-wide solutions designed to unify people with process, business requirements and asset management.

Honeywell Process Solutions developed the Experion Process Knowledge System (PKS) to capture the knowledge of plant personnel and their workflows to deliver sustainable efficiencies to its customers’ businesses. The Experion solution is designed to merge traditionally disparate functions and systems across the manufacturing enterprise. This union streamlines information flow to the right place, at the right time — by the right people. It also eases configuration, visualization, maintenance and optimization of processes and critical plant equipment, enabling organizations to address key market drivers such as productivity, innovation, globalization and sustainability.

**Virtualization**

Experion PKS incorporates a complete portfolio of virtualization solutions for improved IT performance and reliability in the industrial domain. Virtualization technology drives down total cost of ownership through reduced PC hardware requirements, extended design freeze dates, a virtual Factory Acceptance Test (FAT) to validate configurations remotely, fewer disruptive operating system and hardware changes, reduced hardware refreshes, online hardware upgrades and replacements, and ensured availability and reliability of critical assets.

![Figure 2: Experion PKS offers a complete portfolio of virtualization solutions for the industrial domain.](image)

**Unified architecture**

Unifying people with process variables, business requirements and asset management allows industrial operations to transform process control beyond traditional DCS functionality. Competitive demands call for an automation system that focuses on plant personnel and makes the most of their knowledge.

By upgrading to a new-generation automation system like Experion, end-users can achieve improved operations, increased incident avoidance, better decision-making and enhanced workflows. Built on a secure DCS architecture, this solution encompasses the entire scope of production to equally address the needs of operations, maintenance, engineering and business. It provides a single platform for continuous, sequence and batch control, as well as safety, security, electrical, SCADA and asset management. Employing technologies such as Distributed System Architecture (DSA) and Fault-tolerant Ethernet (FTE), extended through an industry-standard wireless mesh network and unified advanced applications, Experion delivers a true open system approach but with greater, ongoing benefits and lower cost than point solutions tied together.

**Seamless integration**

Experion meets the need for a truly integrated safety and security solution, supporting complete operational integration through a single dashboard, utilizing a fully separated safety network for greater protection in addition to offering a single integrated network option. This
Control System Migration: Protect Investments, Improve Business Results and Reduce Risks

approach improves business performance by reducing the risk of incidents, faults and failures that can threaten people, assets and the environment, and disrupt normal operations.

With integration of new and legacy systems, controller data has the same look and feel—regardless of where the data originates. Operator effectiveness is improved by merging multiple platforms. Plant personnel have seamless access to points, alarms, operator messages and history between servers. Moreover, they can access a single virtual database without duplicate configuration. Capabilities such as video event detection, comprehensive built-in alarm management, a large number of standard displays, and the ability to connect separate plants or units seamlessly together offer greater opportunities for collaboration and real-time decision-making.

Thanks to Experion’s integrated control infrastructure, alarms and events are detected automatically and operators have system-wide acknowledgement. Secure control access can be achieved using a variety of fit-for-purposes standards such as OLE for Process Control (OPC), IEC 61850, Profibus, etc. A truly unified system solution allows peer-to-peer communication between legacy systems and the application control environment. It also provides a common security model, as well as fault-tolerant communications with full redundancy.

Workforce mobility

Experion extends timely and accurate decision-making through direct access to real-time process information, history and alarms with a user interface optimized for the handheld. It offers secure and remote access to the control system from a handheld tablet or laptop, as well as secure access from a Web browser so that personnel have a range of options to view or control the process as well as make engineering changes at any time — from anywhere in the plant.

Continuous evolution

Effective control system migration does not end with a single modernization project. Industrial plants need a cost-effective approach for maintaining up-to-date process automation functionality and minimizing risks associated with system upgrades. Scalability is also key.

![Figure 3: End-users seek a cost-effective approach for maintaining up-to-date process automation functionality.](image)

Continuous control technology evolution is the goal of lifecycle management — accomplished by establishing a committed automation roadmap that leads to either electronic refresh or complete migration. Lifecycle support allows plants to start down the path to modernization today, and progress incrementally as needs and schedules dictate.

A lifecycle management solution should offer flexibility in how companies manage their plant assets and predictability in how their choices are financed, including the freedom to choose when to modernize and improve upon their control system, how to fund the transition and how long to maintain current capabilities. In this way, companies can effectively extend equipment life while providing a secure path forward to the latest advanced control technology and functionality.
End-users should partner with an automation vendor offering multiyear support agreements that guarantee parts availability and support until a modernization occurs according to site operating plans.

Such agreements result in predictability by providing:

- Predictable costs for spare parts, support contracts and migration/upgrade kits
- Reduced risk and increased reliability via guaranteed maintenance
- Long-term protection from equipment obsolescence

In addition, suppliers should provide easy-to-implement migration tools that are innovative and can save time and money. This includes tools assisting database migration and HMI integration, as well as wiring kit solutions to reduce downtime while migrating legacy systems.

**Migration Strategy**

Properly planned and implemented, control system migrations enable end-users to migrate legacy control platforms at their own pace, allowing new controllers to be added at any time and integrated with existing controllers. It also permits migration of subsystems and function blocks to new controllers whenever the user decides.

When a migration project is identified, several critical areas commonly define whether or not the work is successfully completed relative to scope, schedule and budget. First, end-users must take control of their existing system and clearly define upgrade goals and objectives. Then they must determine the optimal migration strategy. A structured, organized approach to system migration enhances the benefits of technology upgrades and preserves the rich intellectual property contained in legacy systems. Regardless of vendor support, end-users should play an integral part in the migration effort, reviewing its progress every step of the way.

**Do your homework**

As part of good engineering and project management practices, plants should take the following steps during migration planning:

1. Determine the best time to migrate
2. Determine the best migration path associated with clearly defined goals
3. Define the project through front-end engineering
4. Use a proven approach with comprehensive checklists
5. Develop detailed cutover plans
6. Define intermediate operability and training plans

As with any large, complex project, planning for control system migration is the key to success. The most important parts of a migration plan are the process definition and functional specification documents, defined at the start of the work. When detailed planning is not completed prior to beginning the project, everything takes longer than expected.

To ensure a successful technology migration, end-users should plan for the change, identify a critical timeline, conduct regular (perhaps daily) meetings, engage those who will be affected by the change, identify all available resources and plan for contingency resources or vendor staff, if needed.

A formal migration plan identifies migration and support strategies for existing control system nodes, such as controllers, HMs, supervisory computing nodes, etc. It also includes proposals for consolidating existing control systems in order to reduce costs and enhance safety. Additionally, the plan provides recommendations for ensuring the reliability, robustness, security, expandability and ease of diagnosis of process control networks.
Major control system suppliers employ knowledgeable migration experts who can optimize the number of steps required to execute a long-term automation migration plan. These migration specialists help leverage investments in critical legacy components and maximize the retention of intellectual property.

Automation suppliers like Honeywell offer hardware assemblies and project services that enable the simple and easy transfer of existing DCS I/O connections so end-users can take advantage of the full performance benefits of a new automation platform. By having a Universal I/O, suppliers can help better match up the control architecture, I/O channels and portioning of legacy systems to provide a better front end and move customers forward. This also enables a reduction in the number of cabinets and footprint — ensuring an easier and smoother migration with a cleaner hot cutover. Collapsing operator stations and protecting them also helps minimize disruption and make the move from old to new a seamless one.

**Assess your current system**

A system assessment is essential for determining installed assets, as well as identifying current maintenance costs. The assessment outlines areas for improvement and the anticipated value of those activities, and specifies actions that will achieve improvements.

The system assessment typically includes:

- Audit of the current system and process
- Recommendations for HMI migration and effective operator displays
- Recommendations for base regulatory and advanced control improvements
- Recommendations for overall system improvements in maintenance and performance
- Strategies for migrating hardware and software, and protecting current installation investments
- Plans for personnel training and implementation
- Recommendations for optimization and integration

**Perform front-end engineering**

Migration projects can be more complex than they appear at first glance. Such issues as space allocation, HVAC and power considerations can have significant impact when not identified early in the project. Upfront engineering defines the detailed migration work scope and estimates the overall cost of upgrades. Front End Loading (FEL) can identify potential difficulties with a migration project and provide plans to mitigate risks. An FEL study analyzes all aspects of the project, including mechanical, civil/structural, instrument, electrical and controls. The result of FEL is an overall design specification, outlining the strategy and schedule for migration activities.

**Optional Methodologies**

Industrial facilities should take care to choose the migration methodology best suited to their specific needs. No single approach is appropriate for all operations. Typical migration options include:

- **Phased migration** – Allows system modernization in gradual steps, replacing the HMI or a particular unit first. Once this is completed, the end-user can take advantage of solutions improving operations and safety. The rest of the system can be replaced over several years.

- **Complete replacement** – Allows the entire system to be replaced all at once during a planned outage. In some cases, hot cutover can be used to minimize system downtime and ensure seamless integration of current control assets.

- **System upgrade** – Allows an upgrade of critical system components at the end-user’s own pace. The main automation contractor must be committed to retaining the value of existing systems and continuing to offer parts and support for the legacy platform.
HMI migration is key

HMI migration is one of the most important aspects of control system modernization. Upgrading legacy DCS operator stations to the latest HMI technology allows plants to provide a common user interface to the integrated control architecture, reducing training and maintenance requirements by keeping existing graphics, networks, controllers and I/O in place. It also provides direct access to the control network with read/write data access and integrated alarms and events.

Controller migration

Frequently, when a control system requires change, replacing existing controllers also makes economic sense. For migration, two key functions are required — the existing field signals must be easily and quickly moved to the new control system and the existing control schemes must be migrated (and preferably improved).

Phased migration

For a large-scale retrofit, it is often best to use a phased migration. This approach eliminates risk by incrementally narrowing the focus, while providing a fallback position to the old system. It requires communication with the existing system for interim phase-in, physical coexistence with the old equipment to enable a hot cutover, and the ability to switch quickly and easily between old and new signals for testing/tuning purposes.

Phased migration does have its drawbacks in terms of cost and time, but it is a lower risk approach with less downtime. Further risk and downtime reduction can be achieved by simulating the new system prior to installation.

End-user Benefits

A well-executed migration plan provides significant operational and business benefits through seamless integration of new and existing automation systems. By incorporating existing data, events and operator messages into the control architecture, and providing a common operator interface, the legacy system appears as an extension of the new system.

From managing existing parts or infrastructure to upgrading hardware and software, an effective migration solution can maximize the end-user's ROI while helping them maintain predictable year-over-year expenditures.

The specific benefits of control system migration include:

- Increased protection of asset investments
- Reduced modernization risk
- Increased plant reliability
• Improved process performance
• Improved operator effectiveness
• Fewer unscheduled shutdowns
• Greater productivity through a faster network
• Enhanced platform for advanced applications
• Improved human interface functionality
• Reduced engineering time
• Improved ease of communication with third-party systems, devices and software
• Increased wiring and I/O savings
• Reduced service and implementation costs
• Lower component costs as compared to legacy systems
• Maintenance improvements by using smart field networks

Case Study: Borregaard – World’s Most Advanced Biorefinery

Borregaard started on the route to gather operations from all its different process units into one centralized control room with a common HMI for all operators. At that time, the company purchased its first Honeywell PlantScape system to operate a new recovery boiler. The plan was to operate this boiler, together with oil/electrical boilers, an SO2 boiler, and water/wastewater treatment systems, from a common control room and operator interface. Experience gathered from this pilot project, together with the challenge of reducing operational costs, caused Borregaard to undertake a reorganization of all its operations. Based on pre-studies, a formal decision was made to proceed with a migration project.

The key project requirements included:

• Ability to standardize on a platform that afforded flexibility, and increased reliability and efficiency
• Centralized control room with common operator interface for improved effectiveness and operator confidence
• New, state-of-the-art automation system to reduce the number of required resources and provide more accurate information for faster decision-making
• Enhanced HMI to help operators perform their jobs more efficiently and effectively

Borregaard had to minimize cutover time and reduce risk through stepwise implementation of new control technology, since lost production would translate into lost profits. Most of the system migrations had to be completed during very short shutdown periods, which required reusing existing field termination as much as possible while replacing all controllers and I/O boards to gain the advantages provided by modern control technology.

Borregaard began the process of moving from a decentralized, multiple operations organization to one common, centralized operation running from a single control center. This included upgrading legacy Honeywell automation systems to the latest Honeywell Experion PKS technology, as well as migrating outdated, third-party DCS- and PLC-based systems to a common automation platform.

Borregaard has been able to solve its technical problems and meet its continuous need for the most updated process control technology without compromising initial investments. At the same time, network redesign and the adoption of best practices have improved system performance and stability. All of the automation upgrades have been completed, and the company has a solution
For More Information
Learn more about how Honeywell’s migration solutions can protect investments, improve business results and reduce risks, visit our website www.honeywellprocess.com or contact your Honeywell account manager.

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primed for the future. This includes a centralized control center that is more automated and, as a result, more efficient and informative to help operators make better decisions affecting operational performance. Best of all, management now regards automation as a strategic tool for future business improvements.

Conclusion

Control system migration projects, although challenging, have the potential to deliver great value to industrial plants. The process used to arrive at migration timing and scope has considerable influence on whether that value is actually achieved. The most critical consideration is planning. The more upfront detailed planning performed, the lower the risks in the execution phase of a project.

A well-planned and executed automation migration ensures seamless integration of new technology and continuous lifecycle support for legacy systems. It puts the end-user in control of the plant modernization strategy, allowing them to determine component investments and how much longer to maintain current capabilities.

Honeywell offers a wide range of migration options that include a packaged set of standard hardware, software and services and is the only vendor that continues to support its 30-year control systems. Whichever migration path you may choose, Honeywell’s world-class services organization stands ready to support customers’ systems throughout their entire lifecycle, helping sustain the benefits of investing in Honeywell technology.