ARC WHITE PAPER

By ARC Advisory Group

Siemens Process Automation System Migration and Modernization Strategies

THOUGHT LEADERS FOR MANUFACTURING & SUPPLY CHAIN

■ Expansion projects ("Brownfield Plants")

■ New projects ("Greenfield Plants")

Process Automation System Marketplace Is Dominated by Brownfield Projects and Upgrades
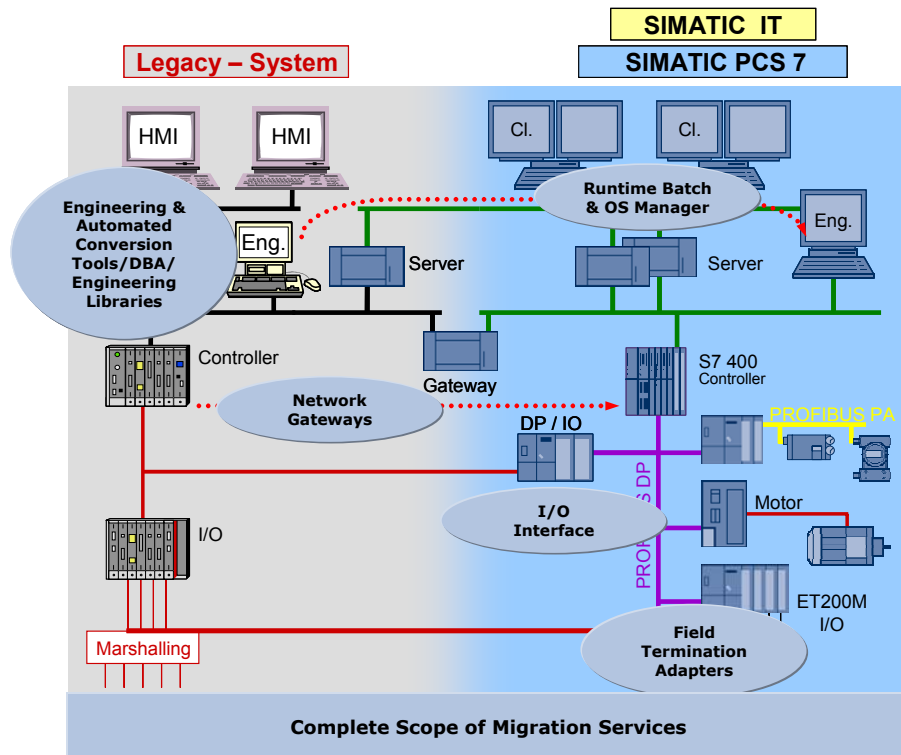
Siemens Offers a Stepwise Migration Approach for Its Own and Competitors' Systems

Executive Overview

Control system migration remains one of the top issues and challenges that end users face today. Worldwide, ARC estimates there is an ageing installed base of process automation systems reaching the end of their useful life that is valued at roughly $65 billion. This number gets bigger with each passing year as many manufacturers, particularly small to mid range manufacturers, are facing serious challenges as to how to deal with this installed base. With so many older systems installed and so many new system offerings emerging from the major suppliers, control system migration strategies are becoming important considerations for enabling increased plant performance and the adoption of new automation strategies. As with the initial acquisition of the legacy system, the new system will dictate the extent to which process automation end users can facilitate Operational Excellence (OpX) and create a sustainable competitive advantage in their manufacturing operations.

Siemens® has distinguished itself among process automation system (PAS) suppliers by developing a well thought out approach to control system migration, for both its own systems and those of its competitors. The company offers a stepwise migration plan that includes a full suite of products, services, applications, and a strong set of automated conversion tools that ease the process of migration for end users while allowing them to retain the functions and the look and feel of their legacy systems. Siemens' investment in conversion tools, for example, has been considerable. The company has spent significant resources on making it easy for users to convert legacy graphics and faceplates to the company's SIMATIC PCS 7 process automation system.

Siemens' approach to migration also incorporates a philosophy of continuous improvement and operational excellence in the form of SIMATIC PCS 7. Siemens realizes that in order to offer an effective migration solution there must also be a significant services and solutions offering to assist end users that are dealing with an ever-shrinking base of in-house resources. For this reason, Siemens is relying on both its own internal solutions capabilities as well as a growing number of strong relationships with third party systems integrators that have domain expertise in legacy systems from key suppliers. The following paper outlines Siemens capabil-

ities in control system migration and how these match ARC's views of migration strategies and best practices.

Siemens Strategic Focus on Migration

Siemens has made significant strides in growing its process business worldwide over the past few years both organically and through acquisition. While Siemens has traditionally had a strong installed base of systems in Europe, the company has made expansion of its installed base in North America a top strategic priority. With a large installed base of third party systems in North America, competitive migration offers a huge opportunity for Siemens in North America that cannot be ignored. Through the acquisition of Moore Products Company, Siemens has a significant installed base of APACS+® and Quadlog® systems that must be preserved and evolved. It is no surprise that Siemens has made migration a top strategic initiative.

The Business Case for Modernization

Justifying capital spending on automation is becoming more and more difficult as end users increasingly focus on getting the most out of their installed assets. As with any automation project, there must be a compelling business case and value proposition for migration, which poses the question, "When to migrate?" The possibility of an impending unplanned downtime event due to an unreliable control system is the most urgent criterion that ARC uses to determine when the time is right for control system migration. Other criteria include lack of support for the legacy system on the part of the supplier, limitations of the system preventing the user from taking advantage of an emerging business opportunity, or the old system cannot cost-effectively support the new generation of information and automation technologies that are available, such as open networks, plant asset management applications, and production management applications.

> **When to Modernize/Migrate**
>
> - Impending threat of unscheduled downtime
> - New or emerging business opportunity impossible without new system
> - No longer cost effective to support old system/system dead ended or phased out
> - Old system cannot support new information technology

Migration Should Be Taken in Context with Supplier Selection

The migration process, itself, however, is not as important as the new system that is the target of the migration project. ARC advocates that end users should view control system migration in the same context as they would approach a supplier selection process. The new target system should provide a path toward continuous improvement and operational excellence (OpX), and should possess the characteristics of what ARC refers to as a collaborative process automation system (CPAS). These characteristics include providing information in context, to the right person at the right time, from any point in the system. CPAS also includes a common hardware layer with common controllers and I/O, a common user interface, and a common view into multiple applications across the scope of automation, from continuous process control to batch as well as discrete and logic applications, and safety.

SIMATIC PCS 7 Provides Path for Operational Excellence

For an end user, simply migrating to a system that replicates the functionality of the old system provides no value, and essentially puts the user back to square one. Siemens' target system for migration is the SIMATIC PCS 7
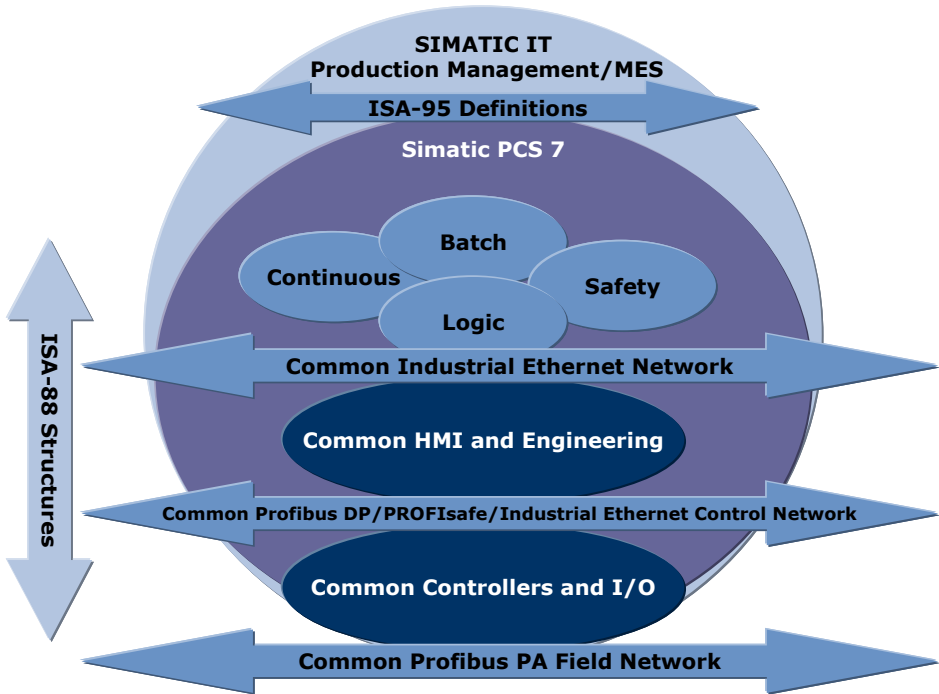
The SIMATIC PCS 7 Functional View Is Similar to ARC's CPAS Model

system, which is a full-scale PAS that possesses the critical requirements needed for the total scope of process automation applications. In ARC's view, there are many correlations between SIMATIC PCS 7 and the ARC vision for a Collaborative Process Automation System (CPAS).

Like CPAS, SIMATIC PCS 7 is based on international standards, possesses a common control and configuration environment, and has a common information infrastructure. SIMATIC PCS 7 also addresses the needs of process, hybrid, and discrete applications within the context of a single framework. The common hardware platform and common network infrastructure, as well as the unified 61131 and Sequential Function Chart (SFC)-based configuration environment, allow for seamless incorporation of discrete control capabilities, batch, and safety system applications along with process. In this way, SIMATIC PCS 7 allows end users to preserve the legacy system while adding functionality to it, providing a path to performance enhancement and upgrade that was not available in the legacy system.

Siemens Builds Migration Centers

As part of Siemens' strategic focus on migration, the company has developed multiple migration centers that provide technology, consulting, support, and educational resources for end users considering a migration project. The primary R&D center for migration is located in the company's Spring House, Pennsylvania location and has particular expertise in migrating the company's installed base of Moore APACS+ systems and Texas Instruments 505 systems, which were the product of the Siemens TI acquisition in the early 1990s.
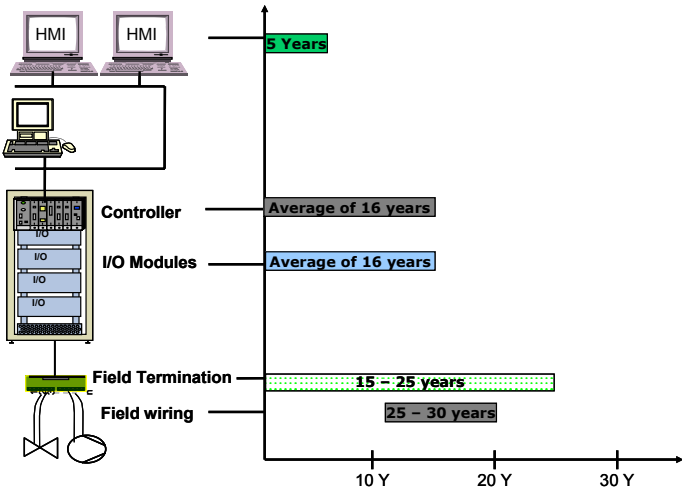
Siemens also has other migration centers. For example, in Cologne, Germany they have a migration center for Contronic systems from ABB/Hartmann & Braun. For Siemens TELEPERM M and other competitor systems, a migration center is located in Karlsruhe, Germany. While Siemens' migration centers exist to support the creation of standard migration products and services, the most important thing they provide for end users is assisting them in developing a real business case for migration and the training and education services that are necessary to realize the vision of the migration project.

Migration Solutions Delivery

Siemens has dedicated Project Engineering Teams comprised of experts that already have a record of accomplishment in delivering successful migration projects. These teams are chartered with conducting front-end engineering and design (FEED) studies and providing consulting services to customers to help them determine the breadth and scope of their migration project. As part of the Solution Partner Program, Siemens has also developed strong relationships with local third party systems integrators, which have been selected, trained, and certified by Siemens specifically for migration projects, particularly in the North American market. Finally, the center for migration R&D in Spring House is responsible for testing and developing all migration products. This is consistent with Siemens' overall approach to the PAS market.

Siemens Modernization Program Offers Stepwise Migration Approach

Siemens provides options for modernization that span from a simple component replacement to a total solution. Services are complemented by a series of standard products and applications that are all tested and compatible with Siemens' TOTALLY INTEGRATED AUTOMATION® (TIA) framework. By limiting the need for custom engineering, it drives down significantly the cost of engineering, which can account for as much as 75 percent of a typical project. Because Siemens' migration technologies and tools are standard Siemens/TIA products, they also evolve in lock step with the evolution of the SIMATIC PCS 7 system and are continuously upgraded.

The Average Lifecycle of Control System Components Varies Greatly at Different Points in the System and Migration Strategies Should Reflect This

Migration with a View toward Return on Assets (ROA)

Control system migration projects need to be approached with the philosophy that the end user should preserve all of the existing assets in the control system that are maintainable and continue to offer value. The life cycle of control system components and applications varies among the different levels that exist in the system and depends on the rate of technology innovation. HMI software, for example, typically has upgrade cycles of 18 months. HMI Personal Computers themselves may not be able to run the latest OS in only a few years. Controllers, however, typically have a lifespan of up to 15 years, while I/O and associated wiring could have a lifespan of over 20 years.

End users must evaluate the components of their legacy system and determine which components of the system make sense to replace and which make sense to preserve to avoid making an unnecessary investment and achieve maximum return on assets (ROA). Siemens builds on its focus on ROA, a path toward CPAS and OpX, by also looking at other criteria such as downtime avoidance, accommodation of advanced applications, effective graphics and controller data conversion capabilities, training solutions, minimal re-wiring, and the ability to provide strong references. This philosophy also mirrors the way Siemens goes to market. In a given migration project, Siemens will identify key customer criteria such as the need to keep the existing HMI operating in parallel with the new system, preserving intellectual assets such as control strategies and graphics, peer-to-peer communication between new controllers and legacy controllers, and preservation of field wiring.

Siemens' product and application offerings for migration mirror the functional layers of the automation system and their corresponding value as an automation asset. Users can upgrade at the HMI layer first or do a more comprehensive project that involves field terminations, control network gateways, application conversion, or any other aspects of the system that need to be upgraded based on the needs of the user.

Armed with this menu of options, Siemens works with the customer to identify the market drivers and business case scenario for the modernization of the system, specific end user requirements for the target system functionality, and the products and systems that Siemens can offer to meet those criteria. These products are combined with Siemens services and solutions capabilities, whether they are Siemens own capabilities or those of

third party system integrator partners. Key value added services offered by Siemens are offered on top of their standard tools and products, such as graphics conversion and controller conversion.

A Stepwise Approach

Based on direct feedback from end users and their understanding of the market, DCS architectures, and the evolution of technology, Siemens has established 10 possible approaches to migration. The I/O Replacement option has been deemed unacceptable to Siemens and many of their users because older backplanes are supporting limited run hardware. Ten approaches address each major layer of the control system architecture. These ten layers include HMI Connectivity, HMI Conversion, Enhanced Batch Management, Engineering Library Conversion, Application Conversion, Control Network Gateways, I/O Gateways, I/O Replacement, I/O Interfaces, and Field Termination Assemblies (FTA).

Level I (HMI)
HMI Connectivity
HMI Conversion
Enhanced Batch Management
Level II (Control)
Engineering Library
Application Conversion
Control Network Gateways
Level III (Field)
I/O Gateways
I/O Replacement
I/O Interfaces
Field Termination Assemblies

Siemens 10 Layered, Three Level Definition of Migration Options

These ten layers are grouped into three primary areas of migration that address the three typical areas of a migration project. Level I deals with the HMI and supervisory layer, and includes HMI connectivity, HMI Conversion, an Enhanced Batch Management or other supervisory applications. Level II includes the creation and conversion of engineering libraries, application conversion, and control network gateways. Level III includes I/O Gateways, I/O Replacement, I/O Interfaces, and Field Termination Assemblies. The stepwise approach allows combining some or all of the 10 options and implementing them at the users' own pace.

Siemens Systems Versus Competitors': A Consistent Approach for Both

Siemens' approach is to apply its migration technology equally across its own systems as well those from its competitors. The company's migration technology was originally developed to address the migration from its APACS+, TELEPERM® M, TI505, and Open PMC systems to SIMATIC PCS 7 and TIA. TELEPERM M is the farthest along in terms of migration with

about 80 percent of all installed TELEPERM M HMI systems migrated to SIMATIC PCS 7.

Siemens also recently formed a partnership with Fuji for process automation systems. The two companies announced a formal alliance in November of 2003, under which Fuji will brand label SIMATIC PCS 7 as its primary PAS offering. Fuji will also act as a Siemens integrator partner. The Fuji agreement will add to an already rapidly growing process business for Siemens. To address the installed base of Micrex systems, a corresponding migration solution for Fuji Micrex systems is also in development. The same technologies, tools, and services used to address migration projects for Siemens' own systems are used for competitor systems including ABB Infi 90, Freelance, and Contronic P systems, Emerson Provox systems, Honeywell TDC 3000 and 2000 systems, and Rockwell Automation PLCs, with even more competitor systems to be added to the list in the future.

Siemens Systems
APACS+ / Quadlog
TELEPERM M
TI 505
Open PMC
Competitor Systems
Bailey (ABB) INFI 90
Honeywell TDC 2000 / TDC 3000
Fisher (Emerson) PROVOX
Hartmann & Braun (ABB) Freelance 2000
Hartmann & Braun CONTRONIC
Other Systems
PLCs (Allen Bradley, Modicon, Yokogawa)

Installed Base of Systems Addressed by Siemens Migration Program

The reason Siemens migration technology can be applied to so many different systems is due to Siemens' approach to these technologies as standard products, not as customized offerings. The fact that Siemens started its migration efforts with the APACS+ system was a bonus, since APACS+ itself was a very flexible system with a high degree of functionality that posed a demanding migration task. The significant development effort that went into the conversion of APACS+ graphics, for example, can also be used to the same advantage for a customer with a Bailey INFI 90 console or Provox workstation. The APACS+ migration effort also allowed Siemens to develop other competitor migration offerings more quickly and at a reduced development cost. APACS+, however, is still an active system. Siemens is still selling and supporting APACS+ and will continue to support APACS+ through 2010 and beyond.

Some elements of the 10-layered approaches are not available yet for all system platforms, but are still in the planning or development phase. Based on feedback from users, the I/O Replacement option relies on old technology and therefore has been ruled out as a viable migration approach

by Siemens. Naturally, Siemens offers the broadest scope of these technologies for its own systems. Siemens has taken an open approach to discussing its planning and development schedule, and there are already many pilot projects in place for solutions under development now. Once a user chooses one of the 10 migration options to move to SIMATIC PCS 7 they can use the many support organizations with Siemens to maintain their system and enjoy other lifecycle management capabilities that Siemens offers. These include 10-year hardware support and 5-year software support after the products are retired, multi-year service agreements, and software upgrade plans.

Connectivity, Conversion, & Batch

In Siemens' stepwise model for migration execution, HMI is usually the primary concern for end users when it comes to migration projects, and typically has the shortest lifecycle of all system components, and it involves the least overall risk. Many end users want to keep their existing HMI consoles as long as possible, and this requires a planned transition where the new SIMATIC PCS 7 OS HMI consoles and workstations can run in parallel with those of the legacy system in order to help the transition for operators. Aside from HMI connectivity, Level I of Siemens' migration solution also includes HMI conversion (Moving tag databases and graphics from one HMI platform to another), and enhanced batch management.

### HMI Connectivity with Zero Downtime

The HMI upgrade involves no downtime while preserving the end user's intellectual assets, such as graphics and control strategies. HMI Connectivity enables a common operations environment for Siemens' own legacy systems as well as competitor systems. SIMATIC PCS 7 OS HMI can be placed on top of the legacy system with an OS server connecting to the legacy system control network. Siemens offers a runtime migration plug-in that provides an interface to the legacy system communication channel. Siemens also offers OPC interfaces.

Siemens Offers a Unique Set of Tools for HMI and Application Conversion

One of Siemens' core strengths is its ability to provide automated graphics conversion capabilities for its own as well as competitors' systems. This is another area where Siemens was able to take advantage of its significant investment in migrating its own APACS+ system and apply it to competitor platforms. Siemens translates graphics, tag lists, faceplates, symbols, and other aspects of the system into SIMATICS PCS 7 OS, and fully integrates the system into the PCS 7 Alarm Sub-system to support alarm synchronization and persistence. All of this can be accomplished using automated technologies as part of standard products.

Taking the Work Out of Graphics and HMI Conversion

Siemens' capabilities for HMI and application conversion correspond to the various software layers in the process automation system, starting at the HMI layer. Siemens has invested considerably in the automated graphics conversion capability that is currently available for both Siemens' and competitor systems. ARC believes that Siemens' automated graphics conversion capabilities are unique in the industry, and Siemens views graphics conversion as a technology enabler. Reading and interpretation of existing graphics is done automatically, as is the drawing of the new graph-
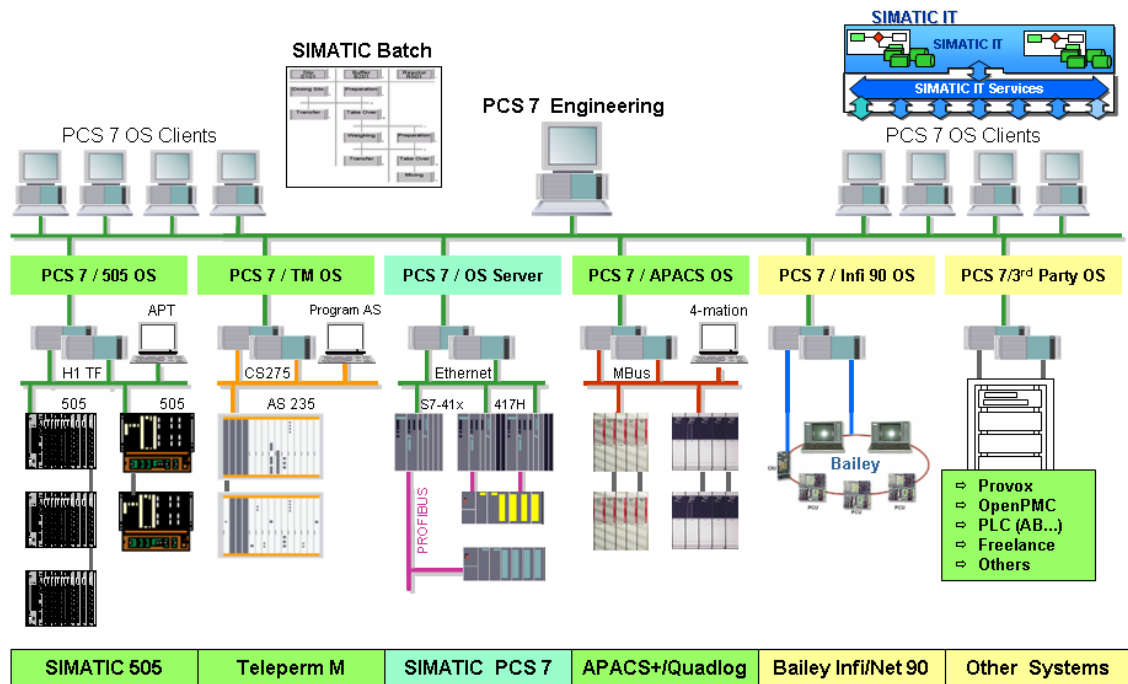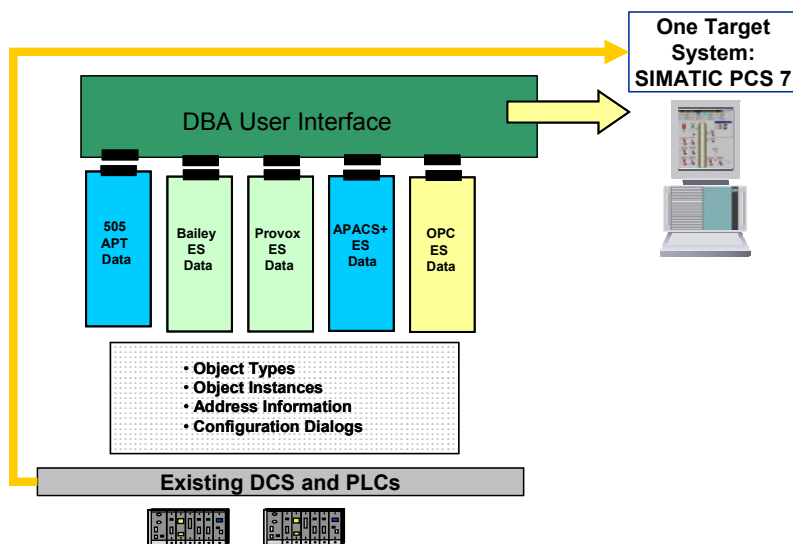

Siemens Offers a Series of SIMATIC PCS 7 OS HMI Plug-in Clients for a Wide Range of Systems

ics in SIMATIC PCS 7. Graphics from legacy systems are converted to XML and are then imported into SIMATIC PCS 7. The ability to automatically convert graphics with no user intervention is a significant benefit when you consider the fact that the average cost of a page of graphics in a DCS is roughly $1,500, including designing, building, and linking the dynamic elements.

Database Automation (DBA) Provides "Universal Interpreter" for Controller Databases

Perhaps the most interesting and differentiating factor in Siemens' strategy for automated conversion is called Database Automation (DBA), an offline engineering tool that provides a common user interface for engineering applications in legacy systems regardless of their characteristics. DBA allows users to not only preserve legacy assets but also enhance their functionality.

One Target System: SIMATIC PCS 7

DBA User Interface

505 APT Data | Bailey ES Data | Provox ES Data | APACS+ ES Data | OPC ES Data

• Object Types
• Object Instances
• Address Information
• Configuration Dialogs

Existing DCS and PLCs

DBA Automatically Extracts Database Tag Information from Legacy Controllers and Places Them in a Common SIMATIC PCS 7 Environment

In the SIMATIC PCS 7 Operator Station (OS), the HMI database tags are formatted in a certain structure. In a competitor system or Siemens system, DBA autogenerates HMI tags directly from the legacy controller configuration so they have the same look and feel as OS database tags and can reside in the SIMATIC PCS 7 OS. DBA also adds tags that may be necessary for SIMATIC PCS 7, but are missing from the legacy system. As with Siemens' graphics conversion capabilities, DBA extracts data from legacy system database files automatically. Incremental changes (delta changes) is also accomplished using DBA. This allows small changes in the existing system to be converted to PCS 7 HMI.

By allowing users to easily create HMI tags for legacy controllers directly in PCS 7, DBA allows end users to take full advantage of the functionality of PCS 7 in the context of the legacy controllers. Process operation changes (operator actions) are logged for any migrated system. Full integration of

legacy alarm schema into PCS 7 alarm schema is also a standard benefit when migrating to PCS 7. More importantly, however, DBA allows for the creation of S88 hierarchies within SIMATIC PCS 7 for the legacy system.
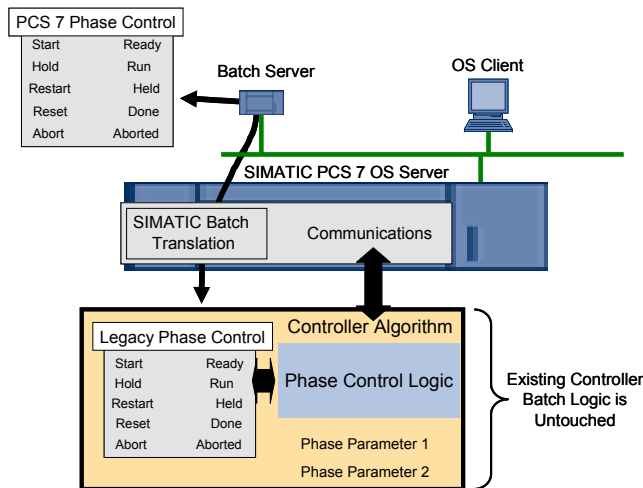
Run Time Framework (RTF) Provides Single Environment for Alarms and Events

While DBA reads the database tag information and puts it into a SIMATIC PCS 7 format, the runtime Framework (RTF) adapts to different characteristics from different systems and provides an abstraction layer for all legacy systems to run under SIMATIC PCS 7. It is a real-time framework for common functionality. RTF provides a single environment for managing alarms and events from legacy systems, and provides batch runtime translation. In line with Siemens' overall migration philosophy, RTF allows end users to take advantage of the intellectual property they have built into their existing systems, enabling them to preserve this functionality for as long as it is feasible to do so. Connections into the legacy system are available either through a native channel (provided there is access to the API), or an OPC server. Not all OPC Servers are created equally. Siemens chooses and then tests the OPC Server to ensure that the performance and robustness will meet the needs of DCS users.

Running SIMATIC BATCH on Siemens and Competitor Legacy Systems Provides Batch Extensibility

Siemens has always been a strong player in batch processing, and recently released its next generation batch package called SIMATIC BATCH. The successor to the previous Batch Flexible application, SIMATIC BATCH is a modular and scalable batch platform that is tightly integrated with the SIMATIC PCS 7 DCS. SIMATIC BATCH is capable of running on top of Siemens APACS+ and competitor systems, including Emerson Provox systems

SIMATIC BATCH Running on Legacy System through SIMATIC BATCH Runtime Translation

The enhanced batch management offering is similar to the HMI connectivity offering, and provides connectivity for the new batch manager to connect to the legacy controller's phase and recipe sequence log-

ic without the need for controller configuration changes. If the existing system has ISA-88 structures, SIMATIC BATCH can transfer those configurations from the legacy system and preserve the existing intellectual investment.

By installing SIMATIC BATCH on top of legacy systems, users also have an effective path toward compliance with the ISA-88 batch control standard, even if the legacy system is not built on ISA-88. Part 1 of ISA-88 defines standard terminology and a number of models for batch control. Siemens has adopted this standard terminology, and SIMATIC BATCH is designed with a modular set of functions and hierarchy based on the Control Activity Model. Part 2 of ISA-88 is in three parts: data models, information exchange tables, and procedure function charts.

Procedure Function Chart (PFC) notation addresses procedural control and execution, and is featured in SIMATIC BATCH. Part 3 defines General and Site Recipes and is also supported in SIMATIC BATCH. SIMATIC BATCH recipes can be "flat" according to the S88.01 collapsibility requirements. Batch related trends can be recorded at the recipe level, unit recipe level, or operation level and the operator can make changes to the recipe while the operation is taking place. Dynamic unit allocation is supported, allowing the operator to choose units based on criteria such as process parameters or longest out of use.

Siemens Migration Solution for Engineering, Applications, and Networks

The Applications, Engineering, and Networks level of Siemens' migration strategy encompasses the creation and conversion of engineering libraries, application conversion, and control network gateways. Application development is a significant expense in any project. The application cost typically equals or exceeds the sum of standard hardware and software in a given project. It is typically more on a batch project and somewhat less on a continuous project.

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Engineering Library Creation and Conversion Provides a Native Environment for Legacy Engineering

The engineering library for SIMATIC PCS 7 resides in the controllers and includes function blocks, structured text, and other languages specified under the IEC 1131 standard. Siemens also offers libraries that can emulate the functionality included in the legacy system controller library, specifically for the TELEPERM M, APACS+, TI505, and Contronic P systems. This essentially allows the user to program function blocks within SIMATIC PCS 7, which has the same look and feel as the legacy system if they wish, while preserving their ability to utilize the full functionality of IEC 1131 programming functionality. Engineering library emulation is either in the planning or development stages for all the other legacy systems addressed by Siemens, including competitor systems.

Controller Application Conversion Preserves Capital Investment

One of the services Siemens provides is the ability to migrate controller configuration from APACS+ to SIMATIC PCS 7. This option is available for some Siemens systems and is in development for other legacy systems. Since all controller databases consist of function blocks with input and outputs, Siemens is able to translate the legacy control configuration and place it in native PCS 7 control code. Since the old code is reproduced in SIMATIC PCS 7, it reduces training costs when migrating to the new system

Siemens also develops automated application conversion tools, which help users preserve control algorithms and applications. SIMATIC PCS 7 has
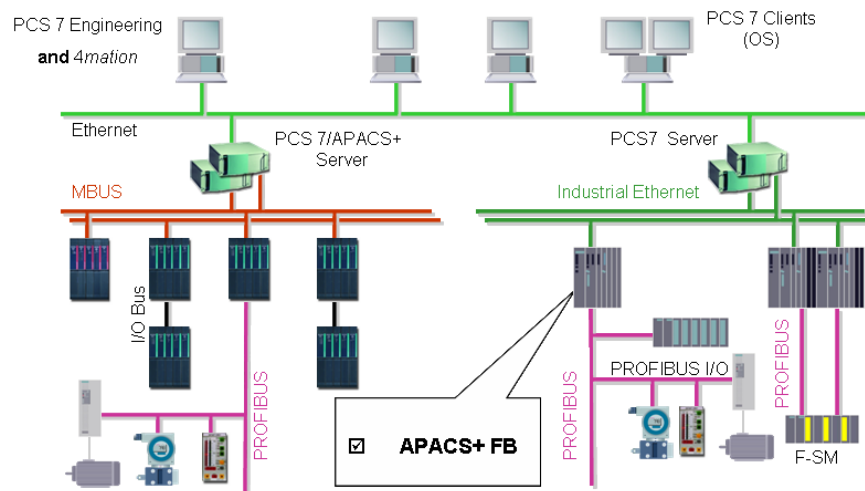
APACS+ Engineering Station Library for SIMATIC PCS 7 Provides APACS+ Style Function Blocks in a Native PCS 7 Environment

the ability to import and automatically build an S7 400 configuration from an import file. Aside from tool-based conversion, some things need to be manually converted. Siemens' goal is to convert 75-80 percent of all control strategies, although they will not convert ladder logic or legacy proprietary batch programming languages.

Controller Network Gateways Provide Peer-to-Peer Communication

Gateways are a long-established way of linking one control system to another. From a functional view, they can send process data values both from the legacy system to the target system and from the target system back to the legacy system. From a logical view, they perform protocol translation and throughput normalization. Siemens's control network gateways offer peer-to-peer communication between controllers in the legacy system and SIMATIC PCS 7 controllers. Siemens currently offers control network gateways for all of their systems and an increasing number of their targeted competitor systems.

Siemens Migration Solutions for I/O and Field Termination Layer

Many suppliers offer to migrate to a new system while preserving the user's existing I/O terminations and field wiring. Cabling solutions, for example, involve mapping I/O from the existing termination assemblies to the new system. While this preserves the user's investment in I/O terminations and infrastructure, installation can take a long time and often involves an increased footprint and possible problems in I/O mapping. Siemens has come up with several ways to ease the task of I/O level migration, while maintaining the same footprint, which correspondingly reduces the risk and cost to the end user.

## I/O Gateways Allow New I/O Modules to Connect to Legacy Controllers

Siemens offers a specialized I/O module, also called a Profibus Field Module (PFM), which allows new SIMATIC PCS 7 I/O modules to communicate with APACS+ controllers. The APACS+ I/O gateways of-

fered by Siemens, for example, extend APACS+ by providing standard Profibus connectivity.   I/O gateways are also available for TELEPERM M, TI505, OpenPMC systems, and Allen-Bradley PLCs.

I/O Interfaces and Field Termination Assemblies

Many end users also want to preserve their I/O as it represents a significant investment.   Siemens' I/O interface product is a module that is installed in the I/O rack that allows existing I/O to show up as remote I/O in the SIMATIC PCS 7 system. I/O interfaces are currently available for the APACS+ system, TI505, Allen-Bradley PLCs, and any Profibus-compatible I/O.

The cost of field wiring in any plant is significant, and this is normally the one asset in the control system that lasts the longest, and is typically the one
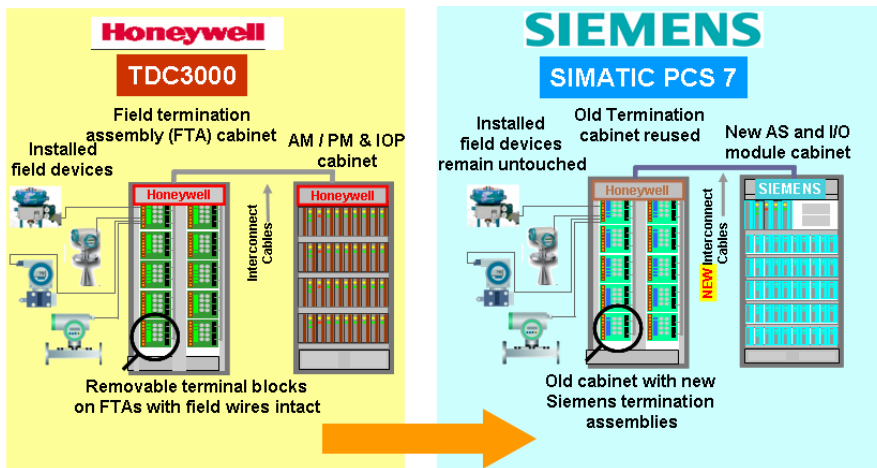
Siemens' Field Termination Assemblies Preserve Existing Wiring Investment

that end users wish to preserve the longest.   To address this layer of the plant, Siemens offers field termination assemblies, which are hardware-based solutions that provide a form fit functional replacement. The termination unit is essentially a board manufactured by Siemens that emulated the legacy system board, which allows the end user to preserve their investment in existing cabinets and boards ensuring that no additional cabinet space is required for terminations. This solution is currently available for the Honeywell TDC.

Siemens Builds Relationships with Solution Partners to Provide Value

Teaming up with solution partners is a key aspect of Siemens' global migration strategy, particularly in the North American marketplace where the company has a strategic initiative. Many systems integrators have deep

knowledge of legacy systems that is invaluable when conducting a migration project, and they can provide Siemens with access to these legacy installations. At the same time, these integrators often possess strengths in core geographic regions within countries, within specific industry segments, and for specific end user customers, all of which can work significantly to Siemens' advantage. Siemens has handpicked selected integrators to become official Siemens solution partners to ensure successful project execution.

In many ways, it is unrealistic for any automation supplier to have a full staff of experts dedicated to every competitor's automation system. The right partner will have dealt with all the idiosyncrasies of the legacy system many times at the specific customer site. In many cases, the Solution Partner could be a certified integrator for other suppliers' control systems. Siemens realizes this, and it can even be considered an advantage because the Solution Partner can continue to support the legacy system even as it is being migrated and upgraded to SIMATIC PCS 7. Siemens does not expect its partners to work solely with Siemens either, and they look for feedback for their own systems from the partners. Some partners also participate in product development activities.

Solution Partner Training and Certification

Siemens provides a standard Solution Partner training course for SIMATIC PCS 7 and for migration products. Some regions have created a Migration Certification program that is contingent not only upon the completion of the training course, but also includes execution and delivery of at least two successful migration projects. Currently, there are about 500 total Solution Partners for Siemens Automation and Drives worldwide, with about 60 in the United States. Not every Solution Partner can be a migration partner, and the final determination is reserved by Siemens based on the qualifications and expertise of the partner. Siemens requires that customer satisfaction ratings from their partners are equal to or higher than the response for Siemens' own projects.

Siemens Migration Successes

Siemens has successfully completed many migration projects for both its own and competitor legacy systems in a wide range of industries, including oil and gas, chemicals, pharmaceuticals, petrochemicals, and others. These projects were sold based both on Siemens' capability to migrate from the legacy system successfully and on the characteristics of the SIMATIC PCS 7 system. Projects have ranged in scale from both very small to very large. Norsk Hydro, for example, contracted Siemens to undertake migration and modernization of 3 offshore oil platforms accounting for 194 thousand barrels of oil per day and 5.9 million cubic meters of natural gas. Approximately 108 controllers were migrated along with 38,000 I/Os, 6 redundant OS Servers, 13 standard clients, and 4 engineering systems.

Systems upgraded included both Siemens TELEPERM M systems and competitor systems. The Norsk Hydro project was a stepwise migration that involved many of the aspects discussed in this paper, including add-on SIMATIC PCS 7 HMI and tool-based conversion of application software. All of this was accomplished while online with no interruption in the process.

108 Controllers (417F/HF) with 38.000 I/O

6 Redundant OS-Server

13 Standard Clients

3 Clients in Ex-Area

3 Clients with Large Screen Projectors

4 Engineering Systems

Stepwise Migration:
- Additional new HMI (PCS 7 OS)
- Replacement of TELEPERM M OS
- Stepwise changeover

Upgrade of the plant while in full production (no shutdown of plant)

Tool-based conversion of the application software (OS and AS)

Characteristics of Norsk Hydro Offshore Platform Migration Project

Making the Grade at Leading End User Companies

In addition to single projects, Siemens has also been placed on the approved vendor list at major end user companies in no small part due to its ability to provide migration and upgrade solutions. DuPont is probably the best example of this success. Migration was one of the key criteria for DuPont in the selection process. The requirement for online cutover with no interruption in the process was also of primary importance for DuPont. Siemens' engineering tools, high-speed control capabilities, and batch capabilities were also a major factor in the selection decision.

Air Products is another key Siemens alliance customer for automation systems that is taking advantage of the company's migration capabilities. Siemens was selected as a global alliance partner. The initial migration

project at Air Products started at an air separation unit with two single station OS licenses replacing a legacy Bailey Infi90 system, and option for OS redundancy, and an OS Engineering license including a DBA license.

Siemens Control System Migration Strengths and Challenges

In ARC's view, Siemens offers the most comprehensive set of migration products, tools, and services on the market for competitor systems and its own legacy systems to SIMATIC PCS 7. The primary challenge for Siemens lies in convincing customers of the value of the SIMATIC PCS 7 system and the Totally Integrated Automation framework.

Siemens' migration and modernization capabilities are unique in the automation industry. They have invested a large amount of development resources into their automated conversion tools not only for graphics, but also for databases through Database Automation (DBA), runtime applications such as alarming with Runtime Framework (RTF), application conversion, and engineering library conversion. The fact that Siemens universally applies this same suite of applications and technologies to both its own systems and competitor systems in the context of standard product offerings with regular version upgrades and maintenance is another key strength.

Selection Criteria for Migration Supplier

- Openness of the system for your specific needs
- Ability to preserve existing assets that still offer value
- Avoid replacing hardware assets that add no value
- Level of control functionality replacement should be equal to or greater than existing system
- Effective graphics conversion
- Accommodation of advanced applications
- Offer solutions for existing customized integration such as installed gateways
- Offers effective training solutions
- Offers solid path for the future
- Can provide references

Siemens meets the criteria that ARC lays out for successful selection of a migration supplier. As a target system, SIMATIC PCS 7 provides a high degree of openness, and in ARC's view can offer a solid path for the future. Siemens' stepwise approach to migration also reflects a focus for the value of installed assets and avoids replacement of assets that add no value. The company also has the training resources that are necessary to get up to speed on the new system, as well as a full curriculum of migration-related training services.

The challenge for Siemens is twofold. Siemens must continue to convince their customers that they know their own legacy systems better than anyone else does and that SIMATIC PCS 7 is the right platform for its installed base to upgrade to. Similarly, Siemens must also convince customers of their competitors' systems of the same thing. The company's long-term success rides on convincing users of Siemens own systems as well as competitors of the value of the migration and modernization solution as well as the value of SIMATIC PCS 7.

Two of Siemens' key differentiators in this regard are its ability to bring together process and discrete automation under a single control environment, as well as its philosophy for ownership of core system technologies. Siemens is not a PLC supplier entering the world of DCSs, nor is it a DCS supplier entering into the world of PLCs. It has decades of experience in the arenas of both process and discrete control, and its ability to bring both worlds together in a single environment under the TIA and SIMATIC® umbrella is unique. Building upon this are Siemens' offerings in batch and safety control, as well as its expertise in automation networks. From the perspective of technology direction, SIMATIC PCS 7 conforms closely to ARC's CPAS model, and has rapidly advanced its technology position in the marketplace.

Siemens' other big challenge lies in sticking to its ambitious development schedule. Some aspects of its migration and modernization solutions for additional legacy systems are still in development. They are extending DBA and RTF to other systems and extending current product abilities for legacy systems. The sooner these products are available, the sooner Siemens can more aggressively target additional competitor installations.

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Analyst: Larry O'Brien

Editor: Dave Woll

Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/C13/IndustryTerms/

API	Application Program Interface	**ERP**	Enterprise Resource Planning
CAGR	Compound Annual Growth Rate	**HMI**	Human Machine Interface
CAS	Collaborative Automation System	**IT**	Information Technology
CMM	Collaborative Manufacturing Management	**OpX**	Operational Excellence
		OEE	Operational Equipment Effectiveness
CNC	Computer Numeric Control		
CPG	Consumer Packaged Goods	**OLE**	Object Linking & Embedding
CPAS	Collaborative Process Automation System	**OPC**	OLE for Process Control
		PAS	Process Automation System
CPM	Collaborative Production Management	**PLC**	Programmable Logic Controller
		RFID	Radio Frequency Identification
CRM	Customer Relationship Management	**ROA**	Return on Assets
		RPM	Real-time Performance Management
DCS	Distributed Control System		
EAI	Enterprise Application Integration	**SCM**	Supply Chain Management
EAM	Enterprise Asset Management	**WMS**	Warehouse Management System

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