

“Take Off’ to new heights in your legacy control systems migration programs

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Animals that live in habitats that are difficult to survive in year round, must evolve a way to cope with the difficult time of year, especially the extreme cold. Animals have evolved survival strategies for the hostile part of the year. These survival strategies are:

- Hibernation
- Resistance
- Migration

Though each of the strategy is an excellent adaptation by the animal to the environment for the survival, migration as a strategy has captured the interest of humans for centuries. Migration is a fascinating aspect of animal ecology.

In migration, the animals move across long distances. They survive by leaving the hostile environment for part of the year or part of their life, and move to habitats that are more hospitable.

And in the animal kingdom, Migration is synonymous to Birds. Birds have mastered this practice in terms of:

- Migration Cues - When to Migrate
- Migratory Route - The Migration Approach
- Navigation - Guidance and course correction

This paper describes a successful approach towards migration of legacy control systems and draws analogy from the above for the purpose of illustration.

In today’s world of economy of eroding margins, demanding customers, and increasing energy costs, manufacturers adopt various strategies to compete effectively. Process automation being a significant part of manufacturing systems; determine the effectiveness of these strategies. While leveraging today’s technology definitely helps, achieving manufacturing excellence in today’s global marketplace is not just about upgrading the control systems to the latest platforms. It is also about maximizing the value of the investment by addressing optimization and building flexibility for current and future operation requirements.

Migration Cues (When to Migrate?)

How do you know its time to migrate? Birds take their cues from seasons, seasonal conditions and the environment where they live. However the factor that triggers migration among birds is the number of daylight hours.

When to Migrate control systems?

Before we answer this question, we need to understand the alternative strategies available to the Plant Manager. Apart from Migration, the two other options available to the Plant Manager are:

- Upgrade – Replace the legacy Plant Automation with a new hardware and software environment from the same vendor. Care must be taken to ensure that the new environment is downward compatible to the legacy control applications. This is usually a run-time environment change.
- Revamp - Replace the legacy Plant Automation with a new hardware and software environment from a new vendor. For executing a revamp exercise, one needs to create specifications for the new system. A revamp exercise is like a fresh deployment except that you have legacy data for guidance.

Now we come back to the question – when does one migrate? Among many other reasons the five top drivers are:

- High Cost of Legacy System Operation and Upgrades
- The legacy or the upgraded environment does not facilitate flexibility and agility
- Long time to market for new products
- Difficulty in getting or retaining resources who can operate, maintain and enhance the system
- The vendors future strategic roadmap is not conducive to the manufacturers well-being

A detailed list of such cues and their probable causes is listed below for ready reference

Probable cause of the Cue	Cues
Age of the Installed Base	<ul style="list-style-type: none"> - Unpredictable performance - Un planned shutdown - Loss of production - Schedule slippage - Customer commitment
Performance Capability of old system	<ul style="list-style-type: none"> - Lower cycle time - Less scope for production expansion & product variety - Quality and product variants, more rejections and more rework - Impact on time to market
Up gradation/ Integration	<ul style="list-style-type: none"> - Do not support up gradation, not scalable to the future - Increase in GAP between plant layers to the ERP layer. - Planning, analysis , forecast
Reliability	<ul style="list-style-type: none"> - Frequent failures - Loss of production - Uncontrollable and unpredictable down time
Maintenance	<ul style="list-style-type: none"> - Huge maintenance cost - More cost of production per unit production
Technology	<ul style="list-style-type: none"> - Inability of legacy system to cope with rapid technological advances. - Problem with upward integration and openness of the system
Support	<ul style="list-style-type: none"> - Non availability of vendor for training and technical support - Non availability of trained resources for system support and enhancement - Non availability of spares / repairs - Problem with knowledge transfer and retention

Going beyond the cause of the **Cue**

Once a decision to migrate has been taken, there are many risks that need to be managed. The birds need to worry about the major risks like:

- Will I make it in time to the places where food is available?
- Will I survive the migration without dying of hunger or caught by predators?

Given the fact that today's business need to excel and not just compete, they need to manage the risks and maximize the investments

While the Cues help to determine when to migrate, for maximizing the investment of a migration a successful strategy needs to look beyond functional replacement.

Traditionally, a legacy system in any plant has an application built based on *yesterday's needs*. Added to that is the lack of flexibility required for *today's customer requirements*. Over the years, the product variability has increased and the lot sizes have decreased. This results in having to produce multiple products on the same line, with minimum line downtime and changeover time. This also has created a need for having an efficient recycle management facility to reduce waste.

Hence, an upgrade exercise focused as a "platform change" exercise limits an organization's ability to achieve the desired goal and does not provide a means to achieve optimization.

An external perspective coupled with an efficient approach helps in determining comprehensively the opportunities for improvement in a migration exercise. These opportunities determine as "*Where we want to go*".

Migratory Route (The Migration Approach)

Once we know where to go, the next step is to determine the best route to reach the destination.

How do birds know which route to take? That depends on the bird and where it is going. There is strong evidence that genetics plays a large role in migratory behavior and that birds inherit migratory routes from their parents genetically.

While the manufacturing organizations do not have genetics, it definitively has a legacy. This legacy is the general Industry trends and the knowledge accumulated by the manufacturing organizations. In addition they seek external help from consulting organizations like Tata Consultancy Services. Successful global services organizations have traveled the route many a times before. Their experience with several similar projects has given them the proper understanding of the best approach for successful migration.

This approach is not unique and is customized for each organization based on the genetic trait of the company. However, all approaches are designed to:

- Minimize the risk
- Minimize the impact on ongoing operations
- Assure the greatest opportunity for success

The factors that largely influence the design of the migration approach are:

- People Factor
- Technology Factor

People Factor

The legacy systems by its nature have limitations to address today's needs. Hence it depends on the users as how they have tuned the plant over the years. The legacy of knowledge base needs to be preserved and enhanced in the new system.

A migration exercise has two primary effects on an organization.

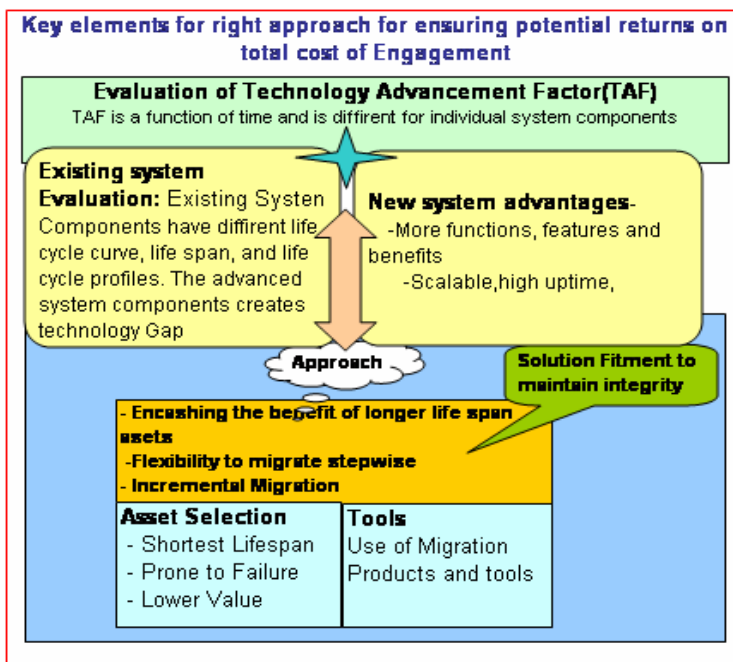
- Provides economic leverage to the manufacturing unit.
- Has an impact on the people handling the system in many ways

For factors mentioned above, the second impact may lead to adverse effects if the people factor is not managed efficiently.

The people at various levels like design, development, and maintenance and last but not the least the operators are used to the look and feel, the functionality and the features of the old system. These need to be factored in for a successful migration.

Technology Factor

Rapid changes in the technology, has created a technological gap between the components of the old automation system and the new automation system. A control system comprises of various components like the Field termination, Input/Output cards, Controller and the HMI/SCADA systems. Hence the gap is different for different components of the systems.



Various components of automation system has different life span and aging factor e.g. the expected life span of the input/output (I/O) and wiring is two to three decades and for HMI & workstations typically 5 to 10 years which means that the HMI /work stations are more eligible entities to be considered for migration on priority basis where as more efforts to be given to maintain the existing I/Os and wiring.

The *Technology Advancement Factor* (TAF) hence plays a major factor in determining the Migration Approach.

The evaluation of the TAF will show that it has different impact on different components of automation. Figure 1 summarizes the approach based on the TAF and hence finalization of the approach.

The technology GAP analysis, selection of the right asset at right time for migration, focus on reuse and migration tools are the key element which contribute in the successful migration. The figure explains the factors influencing the Migration approach

Navigation (Guidance and Course Correction)

Birds use a variety of different information and senses to navigate. It is discovered that they find their way through a combination of:

- Sighting (they don't call it a "bird's eye view" for nothing) features like rivers, coastlines, and mountain ranges.
- Monitoring Earth's magnetic field, apparently with their visual system and with tiny grains of a mineral called magnetite in their heads
- Observing the stars
- Using the sun for guidance
- Smell
- And probably following their neighbors (many birds migrate in large flocks)

Starlings, for instance, orient themselves using the sun, compensating for how the sun moves across the sky throughout the day. Mallard ducks can find north using the stars of the night sky. Animals as diverse as migratory birds, salamanders, salmon, or hamsters use the geomagnetic field for orientation

The migration approach is influenced largely by the People factor and the Technology factor. And it is these two factors that provide navigational cues that are translated into strategies that facilitate successful migration.

Strategy for People Factor

Project execution methodology plays a critical part in determining the success of such programs. Capturing the requirements comprehensively from all people at various levels forms a major part of the strategy. The methodology adopted needs to provide means to extract “years of knowledge base” present in the user community. Having captured these requirements, these need to be presented in a way that is easy to understand and validate by the plant. This document (generally documented as Functional Design or Requirement specifications) many a times turns out to be a living document when the value of documentation is realized by the plant.

Another important stage is during Factory Acceptance Test (FAT), when the users need to be part of the complete simulation and testing before shipment of the system. A well laid out FAT procedure in conjunction with the users becomes part of a successful project execution methodology. Training before the shutdown for the users makes sure that they are accustomed to the new system even before they are operational.

Strategy for Technology Factor

The TAF has different effects on different layers of the system. This shall decide the Migration Points (MPs) required for a migration program. The migration points of the control systems need to address various factors. Given below is a list of factors for each of the Migration Points (MPs)

Migration Point (MP)	Factors
MP1: Visualization layer	<ul style="list-style-type: none">• Types / makes of HMI installed currently and future state• Communication requirements• Data migration requirements• Migration of Graphics – Rip out and build or Conversion• Access to historical data• Special applications like batch management, recipe management etc if any
MP2: Controller Layer	<ul style="list-style-type: none">• Conversion methodology• Conversion tools and engineering library available from the automation OEM• Communication gateway requirements
MP3: Field Layer	<ul style="list-style-type: none">• I/O communication network protocol• Ability to retain the existing I/O termination• Ability of the automation OEM to provide new modules to fit into the existing I/O racks• Ability to retain legacy I/O if required and provide I/O interface
MP4: Termination Layer	<ul style="list-style-type: none">• Ability to provide 1:1 replacement of existing terminations and connections to new I/O modules via new Field Termination Assembly (FTA)

Summary: In summary the following can be summarized for a successful migration initiative:

- Identification of the time to migrate (Watch for the Cues) is critical
- A migration initiative needs to be structured to get the maximum from the investment. As an example, extracting process intelligence can be taken up as an important objective. The goldmine lies within the data where a plant can build manufacturing intelligence to measure and manage operational performance. Distributed control systems (DCSs) and programmable logic controllers (PLCs), both generate volumes of data at fast rates. By accessing this data, a plant can have the visibility needed to tighten production processes, ensure compliance, reduce upsets, smooth operations, and increase profits.
- An external perspective helps in access to the best practices

Let us now see an example of a successful control systems migration for FiberVisions.

Real Life example of a successful migration of legacy control systems

The Covington, Georgia plant is the principal US manufacturing location for FiberVisions Corporation. It is the world leader in the manufacture of polypropylene staple fibers used in disposable hygiene products. FiberVisions also produces olefin fibers, filaments, and yarns for textile companies. FiberVisions differentiates its products by the processes and technologies that enable them to highly customize their finished products according to customer specifications. They are under rigid requirements to produce highly consistent product uniformity.

At the Athens, Georgia Plant, FiberVisions' production process requires many changeovers to accommodate specific customer requests for such features as color and size. Over the years, operators tried to minimize setup time. One line in the plant was using a MACO 8000 control panel that was coming to the end of its life cycle. A quick upgrade was needed to avoid unplanned downtime due to an inability to retrieve parts for panel maintenance. In addition, a Siemens Programmable Logic Controller (PLC) was used in the control room; a new control panel and operator station needed to be installed to increase performance on the line.

Scott Carey, Manager of Plant Engineering at the FiberVisions plant, was tasked with finding an engineering services company that could help his plant successfully integrate their Siemens PLC and help improve existing process control sequences. The way the current process worked, an operator had to enter data in two different places, such as for set points and alarms. Scott wanted to tie these systems together to make it easier to run the process and to minimize downtime. The project required technology expertise, as well as process design experience – and Carey wanted to find a vendor who knew their industry.

Carey called upon the Plant Automation Group of TCS and the first meeting was very productive and it was clear TCS understood the intricacies of FiberVisions' integration challenges. Carey was immediately impressed and put at ease with TCS' in-depth understanding of their business. TCS was entrusted with the project.

Capturing the requirements comprehensively and applying a standardized approach in all aspects (functionality, design, development, and technologies) led to business benefits both in the short-term and long-term.

Some of the examples relevant to the system were:

- Standardization of control objects and phase plates
- Providing unified recipe management and facility to change recipes in minimal time

- Merging two different systems into one – better screen management, easier use
- Adding new parameters to the recipe system (optimizing previously stand-alone loops based on product recipe)
- More intuitive – screen layout mimics production line
- Improving security of recipe system – prevent unauthorized recipe setpoint changes

Resulting in:

- ✓ Line downtime reduction, by way of online recipe management
- ✓ Ability to more easily produce 40 different products on one line
- ✓ Reduction in waste – addition of Waste/Recycle management
- ✓ 4 times more data – need to continue to train people to fully utilize it (but, it will be powerful)
- ✓ Lower costs (Up to 55% on the development costs) allowed the project to include a dedicated data historian server and the ability to share process data with 3rd party applications

“TCS really understood our current situation and helped us uncover all the scenarios and limitations that faced us,” said Carey. “After our first meeting, they assembled a team that knew the Siemens system, and put together a project plan to support our upgrade process. They were highly accountable right from the start of the project, and it made for a smooth process. Working with TCS didn’t feel any different than working with any other US-based vendor. In some ways, TCS was more efficient.”

TCS is selected for the next line and due to the above mentioned approach the next line is going to be completed in 40% less time and effort as compared to the first line.

A Closing thought

There is a significant difference when it comes to birds and control systems from a perspective of migration. While some of the birds migrate back to its original place after the seasonal change , the reasons of migration does not change!

About Tata Consultancy Services

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as the “Global Network Delivery Model,” this strategic services delivery concept has reshaped the IT services industry.

More than 95% of TCS customers reward the company’s reliability, passion, creativity, and unique ability to handle the broadest range of their IT needs by continually extending and deepening their partnerships with TCS. With over 70,000 of the world’s best trained IT consultants located in 35 countries, TCS is uniquely positioned to deliver its flexible world class services seamlessly to any location. TCS reported consolidated revenues of \$2.97 billion (U.S.) in the fiscal year 2005-2006. The company is listed on the National Stock Exchange and Bombay Stock Exchange in India. For more information:www.tcs.com

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