Building
Tomorrow's Enterprise

Perspective

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Logistics Legacy Modernization

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Abstract

Over the years, Logistics Service Providers (LSPs) have carried out business operations on systems which are largely home-grown or were acquired through mergers and acquisitions. Today's tighter operating margins,increased competition and rapidly evolving business environment requires improved agility, making it a business necessity to effectively modernize these legacy systems.

However, the legacy modernization process is riddled with challenges. One of the most important challenges is the answer to the question "What are we trying to migrate?" Even with a clear answer, the modernization process itself can be painstaking and costly, often without a well-defined business case.

This Infosys paper provides a well-defined legacy modernization methodology to help logistics service providers in their migration journey.

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Introduction

A modern logistics service provider (LSP) depends on information systems not only to support day-to-day business operations, but to also aid management in decision making. However, these information systems face the challenge of adapting to dynamic business needs and keeping costs down.

LSPs, over time, have made limited investments in technology and enhancements, which has resulted in large monolithic legacy systems. Further, consolidation in the LSP industry has contributed to an increase in the portfolio of applications to work with.

As today's dynamic business need for accessibility, integration, scalability, flexibility and maintainability grows, legacy systems struggle to keep pace. Organizations are struggling to make legacy applications integrate with new enterprise systems and making the legacy data available for management decision making. Meeting the challenge of seamless integrating across vendors, suppliers, distributors and customers, is also not easy. Thus the problems and costs associated with legacy systems is fast outweighing their value to the organization.

Realizing this, LSPs are trying to modernize legacy systems by migrating them to newer technologies, with minimum cost and time-to-market. However, in enabling this they face challenges around undocumented business knowledge, personnel change management and business continuity.

Why Modernize?

The decision to modernize legacy systems is influenced by five key factors.

Business agility – Customer driven demand in the areas of visibility, exception management, RFID-enabled services and other areas are driving LSPs to extract more out of their existing applications. However the cost of enabling this with existing systems is high.

Business necessities – Integration between various partners, vendors and customers in the supply chain is critical for seamless information flow. Process & IT integration between partners, if done successfully, can ensure real-time visibility to critical data and for faster response to exceptions in the supply chain. However legacy systems limit the possibilities of integration.

Impedance mismatch – As LSP customers began outsourcing large parts of the supply chain to logistics enterprises, new process areas like Warehouse Management, Purchase Order Management, Visibility management etc., driven by the customer, came into existence. These new process areas have seen products and solutions built on modern platforms as compared to the core processes of Booking, Documentation, Pricing & Contracts etc. which are legacy. The ability to deliver these new services from an awkward mix of technologies, legacy and modern, is not easy. With most of the applications talking to each other either via batch updates or data triggers, there is often the risk of the data integrity & timeliness impacting the service delivery. This co-existence has lead to higher cost and increased complexity.

IT support – There is a serious shortage of support personnel capable of supporting legacy technologies. This resource pool is constantly dwindling. Further, the operating costs of licenses and infrastructure to support legacy technologies are also significantly higher.

Environmental changes – Enabling existing legacy systems for the modern day information system environment of open web based is difficult and costly.

Most legacy systems were developed and maintained before well defined software engineering processes became a practice. Owing to this, these systems are in a state of entropy. System entropy has a telling effect on all the factors discussed above.

- Improved flexibility, with better design guidelines and software segmentation enabling separate presentation, business logic and data layers
- Improved support for automation of business processes
- Reduced costs for maintenance, licenses and system hardware
- Simpler connectivity and faster technology integration using current technologies
- Creation of a service-oriented architecture based on open standards
- Better support for prototype-driven, agile development methodologies due to modern developer productivity tools

Challenges in Legacy Modernization

Typical legacy systems have been in existence for more than two decades. Migrating is fraught with challenges:

Organizational change management – Users must be re-trained and equipped to use and understand the new applications and platforms effectively

Coexistence of legacy and new systems – Organizations with a large footprint of legacy systems cannot migrate at once. A phased modernization approach needs to be adopted. However, this brings its own set of challenges like providing complete business coverage with well understood and implemented overlapping functionality, data duplication; throw away systems to bridge legacy and new systems needed during the interim phases.

Cost – During modernization cost for the information system changes needs to be clubbed with cost incurred due to change management.

Business continuity – Thorough planning is needed to ensure that business activities do not suffer during the migration phases, production releases as well as during piloting of the new systems.

Requirement gathering – Software development lifecycles typically go through phases of requirements gathering, design, development and deployment. In legacy modernization, requirement gathering is a challenge due to:

- Lack of documentation about business use cases
- Lack of mature automation tools which extract business rules from code
- Non-availability of usage information for applications
- Spaghetti information exchange mechanisms across different legacy applications
- Business logic and rules being embedded in code; there is no external documentation which can be used for defining business requirements
- Incremental changes in the code of legacy systems not being documented. Most of the additions are exceptions which don't comply with the generic business rules
- High risk of business rules being missed at the time of gathering requirements afresh through business user interviews

Re-engineering approach to modernization

There are many techniques and options for legacy modernization. The interested reader should refer to [1] to understand the various options and techniques. Re-engineering is a widely adopted modernization technique. This technique along with a twin pronged approach of reverse engineering followed by forward engineering addresses all the challenges in modernization with minimal risk.

Infosys' Legacy Modernization Framework

Infosys' approaches modernization from two angles

1. Reverse engineering followed by forward engineering being the driving design
2. Well defined phases in the modernization cycle

Reverse Engineering

Reverse engineering entails assessing the legacy system with two approaches -

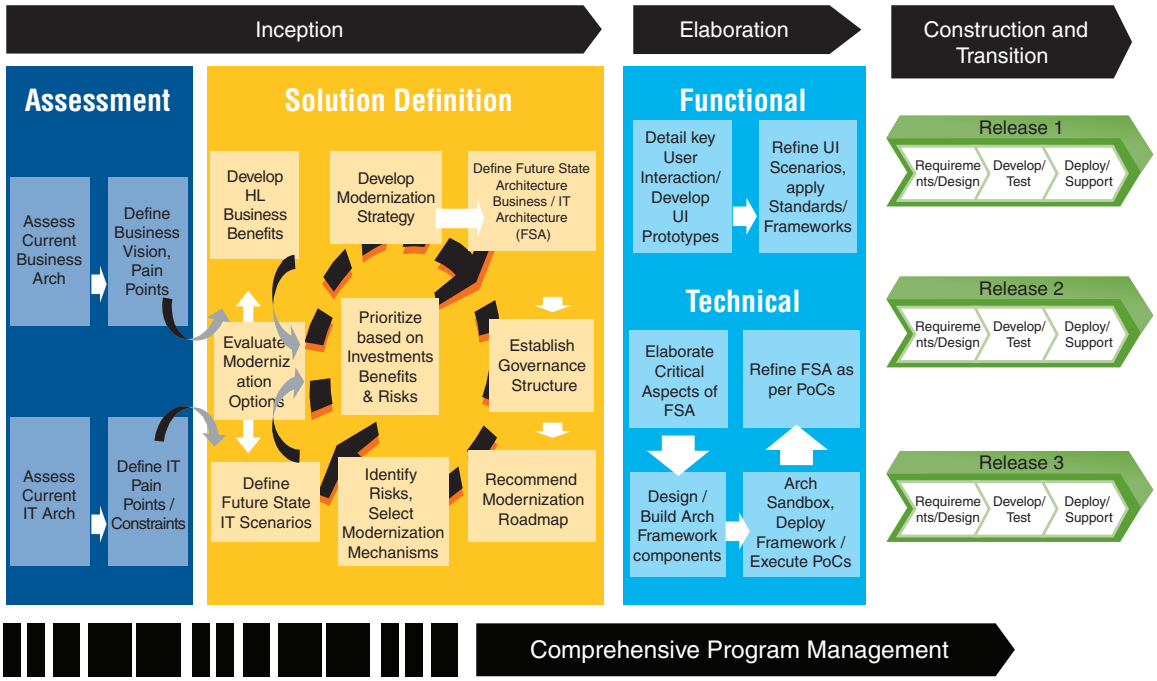
Business Process Analysis - Legacy systems cannot be understood only by sifting through codes and screens. A lot of information can be collected through interviews with business and application subject matter experts. A top-down business process analysis of the legacy systems, through a systematic divide-and-conquer strategy, is essential to requirements gathering. First, the value chain of the business is analyzed and documented. This takes into account all value-adding systems that exist in the organization, the flow of information through these systems, and the scope of the legacy modernization across these systems. The core systems which need to be migrated are identified along with the interfaces with other systems. The system context and business process flows within the core systems are documented. External third party systems which need to be interfaced and peripheral hardware which needs to be integrated are identified. The top down business process analysis defines the current system context in the business. This is refined to create the new system context and enterprise architecture. Legacy systems might have similar functionality in disparate business process functionality. Such common functionality is culled out to create support systems.

Legacy Asset Analysis - Not all information regarding legacy systems can be gathered by top down analysis. A bottom up analysis of legacy assets is necessary to complement the top down business process analysis. Use case lists with use case elaboration of the core systems are needed to understand legacy functionality as well as to define new functionality. Existing code inventory and complexity metrics are captured. This is one of the main inputs for effort estimation. Complex metrics which are captured span across lines of code, product quality metrics like cyclomatic complexity and Halstead measures, number of database calls per unit of code, number of business rules, and number of interfaces in the existing system context. Existing code is analyzed to extract business rules. Use cases are enriched to capture the business rules. An important result of legacy asset analysis is elimination of duplicate functionality in the form of duplicate use cases and duplicate business rules. Use cases should be distributed across the new systems to optimize functionality and have minimal duplications.

Finally, mapping of business process to legacy assets is done. This ensures that there are no gaps between the information collected through interviews and the information as existing in code.

Phased Modernization Cycle

The phases in modernization and the activities in each phase are illustrated below:



Inception phase: Assessment

A top-down and bottom-up analysis to understand existing business. An analysis of current pain points and future business needs is required to ensure that the future state architecture (FSA) addresses them. All this analysis helps in tailoring the modernization strategy and assessing downstream implementation costs.

Inception phase: Solution Definition

Define the future state business scenarios / IT requirements and decide on the modernization options. A future state IT architecture (Application, Information, Technology, Products and Infrastructure) is defined based on optimization of the current system landscape taking into account business and IT imperatives. Analyze and define capacity and infrastructure needs. Identify database migration strategy, product evaluations and proof of concepts (if required). Dependencies are analyzed and individual projects/solutions are sequenced. The modernization roadmap is defined inclusive of cost, schedules, releases, risks and skills required. It's important to establish a governance model to ensure overall program success.

Various principles guide the solution and architecture. The systems in the new environment should be mutually exclusive and collectively exhaustive. A system should have logically coherent functionality. Data should be separately mapped with the logically coherent applications. Data ownership should reside within one source system. Applications which are rarely used should be merged with other applications or retired. No system should stand in isolation. These interfaces should be well defined. Interfacing and data flow across mechanisms should be standardized. Existing data integrity issues due to multiple existences should be analyzed and removed. Relational models and well defined data ownership will ensure that duplicate data is removed to ensure integrity.

Legacy code has both logic as well as hard-coded data which define the logic. An attempt to externalize this hard- coded data is useful in enabling a flexible system. An analysis reports portfolio will ensure that only reports which are results driven and meet business needs are migrated. A business might already have invested in new platforms. Existing systems on these new platforms, if any, should be taken into account while defining the solution and architecture.

Elaboration phase: Functional

Detailed key user interactions are identified and use case lists drawn up. Use case lists are mapped to existing code inventory to ensure that all the business rules in existing systems are traceable to the implementation in the new platform. Use cases are elaborated to capture and organize the business rules. User Interface (UI) prototypes are drawn up to help users envisage the new system.

Elaboration phase: Technical

Future state architecture is designed and certain key frameworks developed. These are don to validate viability and make course corrections before deploying the architecture for the entire program. Common components in the architecture framework are established in conjunction with functional elaboration to ensure reuse across functional modules. The developed framework components are deployed in an architecture sandbox and refinements are made, if required.

Construction and Transition phase

The project construction is performed over multiple releases through Infosys' time-boxed iterative construction methodology. Each release has design, build, testing, deployment and post-implementation support phases. Each release comprises of logical grouping of applications. The number of releases and the grouping will be determined during elaboration phase.

Conclusion

Organizations with vast legacy systems and a need to modernize them face a plethora of challenges and issues. These challenges and issues range across cost, time-to-market, lack of current system knowledge and most importantly, lack of a proven framework for modernization and experience in implementing the framework.

Legacy modernization requires meticulous planning and program management. While the effort and complexity involved in shifting workloads out of legacy systems should not be underestimated, significant benefits are available to those companies who are able to successfully make the transition. Each organization's legacy system evolution took them down slightly different paths, and different options may need to be chosen depending on that organization's objectives. The key parameters that affect the decision need to be evaluated and measured in a business case.

Infosys' Legacy Modernization framework enables modernization at a low cost and accelerated time-to-market. Our framework helps in requirements gathering and follows a phased approach through implementation. Our experience in legacy modernization within the Logistics industry is based on multiple client experiences, and helps facilitate Logistics organizations' transition towards a more agile information technology platform.

REFERENCES

1. Legacy Modernization, Karthik Venkatachalam, http://www.infosys.com/Technology/Legacy- Modernization.pdf, accessed 10-Apr-2007

Case Study

Bekins Van Lines "Moves" to modernize their Legacy Applications

Company Profile - Bekins Van Lines, founded in 1891, provides quality household goods and tradeshow relocation services for corporate accounts and private relocation customers. Bekins is one of the largest North American integrated networks that provides house hold and high value product services. The company operates through a network of 375 agents in more than 400 locations nationwide.

Context

Bekins' information systems comprised of COBOL applications executing on an IBM mainframe. IMS and DB2 were used for data storage. Bekins envisioned complete migration of mainframe systems to a Java and Unix based environment. The factors influencing this migration were:

- Existing infrastructure and software license costs
- Corporate re-structuring that had occurred. This lead to the creation of Bekins Van Lines and the sale of HomeDirect. These newly separated companies shared the same information systems
- Business agility and changing technology integration practices in their partner and customer community
- Extend the scope and reach of service offering by utilizing the web for marketing and lead generation

Bekins needed 100% of the functionality modernized and in an accelerated timeframe. The legacy systems have been in existence for 20+ years and have had extensive changes made to them. Business rules and logic were embedded in code, and there was no extensive documentation available on current systems. The documentation that did exist was often out of sync with the changes that the systems had undergone over time.

Bekins chose Infosys as their partner in this legacy modernization exercise.

Objectives

The objectives of the modernization exercise were not limited to migration of mainframe to J2EE. The main objectives in addition to the actual modernization exercise were:

- Assess current technical & business functionality of mainframe applications and their interfaces, addressed by the application portfolio in scope
- Document the existing business value chain, business process and technology landscape
- Provide the future technology landscape along with the modernization roadmap taking into consideration current shortcomings, pain points, data migration and business continuity

Infosys Solution

Infosys' Legacy Modernization framework was used to define the modernization and solution roadmap at Bekins. The framework helped to analyze the existing legacy applications and provide a solution which could be implemented in an accelerated timeframe. This was possible as a clear migration path with sequential as well as parallel phases was created. Infosys' Global Delivery Model ensured that the whole migration exercise could use an extended day with an on-site team conducting interviews and designing the solution. The off-shore team focused on analyzing existing code in order to document requirements and implement the solution.

Salient features of the solution:

- Defining logical application groupings considering functional and data coherence. For this system and technical landscape of existing applications were documented.
- COBOL code was analyzed to create business and system use cases. Business rules were extracted from legacy code reverse engineering. Around 2 million effective lines of COBOL code were analyzed. Mainframe logs were analyzed to extract non-functional performance requirements.
- Analyzed the feasibility of implementing a pure SOA model verses an evolutionary hybrid SOA model. A hybrid architectural option was chosen. Reference architecture for all the applications under the aegis of the modernization scope was created. This helped in standardization across multiple systems.
- Guidelines for categorizing logic related to data flow across applications and end-user reporting were created. This categorization ensured that report related offline jobs were converted to reports and not jobs. Infosys designed common shared components to optimize and ensure re-use of business rules across applications.

The Journey Ahead

Infosys has completed the overall solution definition, reverse engineering of requirements, architecture and design in the modernization roadmap. Over the next 15 months, Infosys will help Bekins realize its goal by developing new applications, integrating with existing applications and migrating applications to the new environment.

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