



A Practical Guide to Legacy Sustenance Assessments for N-Tier Architectures Snagged in Business Silos

Executive Summary

Previous customer engagements have provided us with rich experience, upon which we have developed practical tips on how to approach legacy sustenance assessments with N-tier architectures in business silos. This white paper distills our knowledge on this topic and discusses the need for legacy sustenance assessment, analyzes key objectives and drivers, suggests a solutions approach, and concludes with the benefits of doing all of the above.

Legacy sustenance relates to the capability of existing systems to sustain for a given timeframe, while accommodating business growth. Legacy sustenance assessments entail the evaluation of selected assets against quality attributes for sustainability and result in a recommendation to fulfill the same. Generally, a legacy sustenance assessment is carried out to ascertain that an existing system can support the business until a replacement system comes into effect. The goal is to maintain reliable and acceptable performance levels, while accommodating business growth.

To carry out a legacy sustenance assessment, a traditional infrastructure assessment or performance engineering approach alone will not suffice. Hence, a blended approach that includes both architecture and infrastructure perspectives is recommended. As a result, the initiative would

typically require both an enterprise architect and an infrastructure architect.

The typical applications for which a legacy sustenance assessment is required include, for example, N-tier, distributed applications in business silos. By that, we mean older, distributed systems built on mainframes and minicomputers that may feed a network of PCs via a client/server architecture. Many of these applications were developed roughly seven to 15 years ago and, in some cases, may need to remain in production for three to five years longer before being replaced by either a COTS/third-party product or newer technologies. Although we have tried to generalize the approach to every possible extent, the scope of discussion is still limited to the type of applications mentioned above.

Considering the huge variety of applications and the array of technologies that have evolved over this period of time, we realize that legacy sustenance has an enormous scope. However, more often than not, standardization of legacy technologies is confined to the business silo/line of business (LOB) boundaries. Therefore, we think it would be prudent to keep the scope limited to these silos. Hence, this white paper does not attempt to completely generalize legacy sustenance assessment across all the assets in the enterprise.

This white paper will help readers understand the complexities and issues involved in legacy sustenance, thereby enabling them to draw some parallels to the technologies they are dealing with. The underlying assumption is that the technologies/architectures outlined above are very typical and could be potential candidates for sustenance assessment in the near future.

The Need for Legacy Sustenance Assessment

Consider the following scenario wherein the viewpoints of various stakeholders converge, making it imperative to carry out a legacy sustenance assessment.

- **CIO/CTO:**

“We have to defer the implementation of the third-party solution because it impacts so many applications across the line of business and the enterprise, and we just don’t have the budget and the bandwidth to accomplish it in the near term.”
- **Business Users:**

“We have been hoping that the long-awaited third-party solution is going to solve all the problems, but we can’t wait any longer for the implementation of the business-critical enhancements that are overdue. We would very much like for IT to support business growth in the meantime.”
- **IT Department:**

“We have some key legacy applications that impact most of the applications across the line of business and even some other applications in the enterprise, but they are complex, and their limitations make enhancements a high-risk proposition. In addition to that, the overdue upgrades and licensing and support issues with hardware and software put the systems at even higher risk. Moreover, we don’t have sufficient skilled resources in the legacy technologies to support it.”
- **Enterprise Architecture Group:**

“We need to carry out a legacy sustenance assessment to ascertain that the existing system can support the business until a replacement system comes into effect. The goals are to maintain reliable and acceptable performance levels, while accommodating business growth and providing business services to the external applications. We need a clear approach and a roadmap to fill any gaps in the architecture and infrastructure.”

Legacy Sustenance Assessment Objectives

The main objectives of the legacy sustenance assessment are:

- Provide architectural and technology recommendations to sustain and maintain one or more key applications in the near- to mid-term.
- Provide infrastructure recommendations based on current system performance and anticipated future growth.
- Provide recommendations on licensing and support issues.
- Provide recommendations on availability and backup issues.
- Provide significant ROI by making appropriate recommendations that alleviate the near- to mid-term costs.

Legacy Sustenance Assessment Drivers

The drivers have been implicitly described in the viewpoints of various stakeholders referenced above. A deeper dive into these factors reveals:

Business Drivers

Key issues here include:

- Accommodating expected business growth.
- Delay in implementation of better alternative solutions.
- Supporting enhancements that can’t wait until a replacement system is available.
- Budgetary constraints.

IT Drivers

Among the concerns for IT are:

- Legacy applications used for key business processes.
- Dependence of other enterprise systems on legacy applications.
- Maintaining reliable and acceptable performance and scalability levels to support future growth.
- Bottlenecks faced by key applications while integrating with external applications.
- Complexity and limitations that make enhancements a high-risk proposition.
- Licensing, support and upgrade compatibility issues.
- Availability, back-up, recovery and failover issues.
- Future implementation of COTS products.
- Providing business/data services to external applications.
- Ongoing IT initiatives.

Focus Areas for Legacy Sustenance Assessment

The suggested targets include:

- Workflows/Governance
- Integration/Interfaces
- Testing
- Key applications
- Infrastructure

Workflows/Governance

Closely study and review the workflows/governance aspects within the organization, such as the work/change request process, estimation process and communicating the change, as they could present ample scope for improvement.

Reviewing the work/change request process

Consider reviewing the following scenarios in which the work or change request process can be improved:

- Business users may not be capturing the requirements in their work requests in a way that helps the IT team clearly understand them.
- The project/program planning team does not have sufficient information to prioritize and bundle the requests in an efficient manner. This could be either due to the lack of clarity in the original work requests or due to the existing process guidelines and priorities.

Among the recommendations that could result from this kind of review are:

- Prioritizing the implementation based on the immediate needs of end users, as well as the consuming applications.
- Ensuring that certain requests are serviced within a stipulated timeframe.

Reviewing the estimation process

- Review the time taken to carry out a typical change to the existing system, the estimation process and models, as this could be contributing to an inaccurate interpretation of the actual effort needed to complete the necessary changes.

Communicating the change

More often than not, the impacts on various systems within an enterprise due to change requests are not communicated effectively to the

concerned groups. Each system, or a group of systems, may have different owners/stakeholders whose priorities could be entirely different. When a potential change or enhancement is communicated to the stakeholders of different external systems, they may not be exactly sure of how their systems are going to make use of it in the first place. Ideally, all the stakeholders should communicate effectively to decide on the required changes and their expectations of those changes.

Unfortunately, in many organizations, that does not happen. This becomes more of an issue in organizations using legacy systems that are tightly coupled, which presents unique challenges relative to applications sustainability. Therefore, it is recommended to look into the scope for streamlining the applicable process to facilitate better communication among the stakeholders.

Integration/Interfaces

Some of the organizations that predominantly rely on legacy/mainframe systems and N-tier, distributed applications might be utilizing various integration technologies, such as RPCs and messaging backbones (e.g., MQ Series/MQSI, TIBCO, etc.). Some of them may even be using Web services, but more from a tactical point of view.

The communication channels/interfaces and impact points, which include external applications or systems, organizations, roles or other processes, should be evaluated thoroughly. The mapping of the communication channels with various applications (producers and consumers of events) and the context of how other external applications use the key application(s) would be very helpful in the impact assessment. The study and analysis of data feeds received from the key application(s) and reports generated by the external applications might present adequate opportunities for simplification of the interfaces.

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The interfaces should be evaluated for alignment with the domain standards and best practices. In addition, the QoS aspects (performance, availability, scalability, security, etc.) of integration points or interfaces should be evaluated.

External third-party applications should be evaluated for the compatibility of interfaces and continuity of support. This is because the vendors that have developed them might be in the process of phasing out the existing protocols and related APIs over the next few years. So, it would be helpful to talk to the vendors to find out their plans and commitments to rolling out support for new and existing protocols or APIs. In the event the vendor plans to withdraw support for existing protocols or APIs, the resulting impact on the existing applications needs to be assessed.

Testing

The test plan and test case maintenance is critical in building a repeatable testing process. Hence, the current testing process (e.g., unit testing, QA testing, etc.) should be reviewed to identify any opportunities for improvement. The test environments, their setup and availability should be examined, as well.

Performing the following activities could help improve the overall testing process:

- Restructure the test plans to achieve some parallelism when possible.
- Evaluate the scope and impact of application changes on testing.
- Examine the logging, tracing and debugging aspects, as well as the documentation tools.
- Understand the current pain points in testing, test environments and testing tools.

The overall goal is to streamline the testing process and compress the turnaround times for implementing change requests, thereby reducing the lead times and overall costs to make the system sustainable in the near- to mid-term.

Key Applications

It is not uncommon to come across applications that are tightly coupled with other applications, within the landscape of an enterprise or an LOB. These applications have interfaces that, when changed, have a significant impact on external applications. These applications are complex, and their limitations make enhancements a high-risk and expensive proposition.

Let's consider the N-tier, distributed applications for which a particular legacy sustenance assessment has been necessitated. These applications typically have presentation (UI), business logic and data access layers and use message-oriented middleware to enable interoperability. The presentation layer, business logic and data access layers, data flow and framework components need to be assessed along the following dimensions: usability, reusability, extensibility, maintainability, scalability and a future technology roadmap.

Application impacts

Consider the following implications of change requests while assessing the application impacts of a potential sustainability project:

- Assess various scenarios for key business processes and the steps to implement them.
- Assess the process to identify the impacts of typical changes.

The suggested impact assessment of applications could result in a recommendation on:

- Capturing the scenarios for key business processes and the steps to implement them.
- Streamlining the process to identify the impacts of typical changes and the time taken to carry out the changes using the following methods:
 - Capturing the mapping of application components and interfaces with the external applications, business events and the external systems consuming the events.
 - Developing a model for estimating the time taken to implement the individual changes.

Evaluating the technology options

To sustain key application(s) for a few more years, various options need to be evaluated, such as upgrade; upgrade and rewrite; upgrade and incremental rewrite; and a complete rewrite. Some of the factors that need to be considered during the evaluation include cost effectiveness, timeframe for cutover, platform support, compatibility, adoption to enterprise technology roadmap, usability, scalability, code reusability, extensibility, maintainability, availability of expertise, time to stabilize the system, impact to business continuity and any other implementation risk factors.

Figure 1 depicts a sample scorecard for evaluating these options. The options are evaluated based on various factors, such as cost, technology, user experience, skill set and so on. A score is assigned based on the interviews or workshops

Sample Technology Options Scorecard

Factors		Weightage	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
			Upgrade UI only	Upgrade UI & middle tier	Replace UI & upgrade middle tier	Upgrade UI & replace middle tier (incremental)	Replace UI & middle tier (one time)	Replace UI & middle tier (incremental)
Cost Effectiveness	Licensing and support cost	10%	6	8	5	4	9	9
	Migration / Re-engineering cost	10%	9	8	5	2	3	3
Technology	Platform support (3-5 years)	5%	6	10	9	7	8	6
	Compatibility	5%	2	8	6	8	8	8
	Aligned with the enterprise technology roadmap	15%	2	6	4	7	7	8
User Experience	Usability	10%	10	10	8	10	8	2
Non-Functional	Scalability	5%	8	8	8	10	10	10
Code	Reusability	5%	2	6	5	8	6	8
	Extensibility	5%	2	6	4	8	8	8
	Maintainability	5%	2	2	4	8	8	8
Skill Set	Availability of expertise	10%	4	6	6	8	8	10
Business Continuity	Time to stabilize	5%	9	5	5	8	2	8
Timeframe	Time to cutover	5%	9	8	6	2	4	2
Risk	Implementation risk	5%	9	9	6	8	2	8
Total Score		100%	5.65	7.78	6.11	7.17	6.85	7.36
Rating performed on a scale of 1 (low score) to 10 (high score). The total score is calculated based on the weighted average method.								

Figure 1

conducted with various stakeholders. However, the individual scores can be modified with further input from the stakeholders.

Based on the indicated cumulative score, option 2 (upgrade UI and middle-tier approach) is the preferred way to go.

Infrastructure Considerations

It is imperative to get an environmental snapshot and deployment architecture to help determine the right perspective of the system. Moreover, it is essential to assess the licensing and support and software upgradability issues to ensure the supportability of the system in the near- to mid-term. The middleware configuration details, com-

ponents and pain points, version compatibilities and upgrade impacts must be assessed. Hardware failover issues also need to be assessed to help in improving the availability of the system. The server OS details, operations and management inefficiencies must be captured to help streamline operations and plug any holes. Server utilization trends on memory, CPU and disk space must be collected to uncover any potential performance and scalability issues.

The database components' upgrade and recovery processes must be assessed to understand the availability and backup-related issues to arrive at possible solutions. The detailed incident history and QoS (performance, availability, scalability,

security, etc.) aspects should be studied thoroughly to assess the viability of the system for the sustainability timeframe. Moreover, it would help to verify if an application recovery strategy is in place, as well as whether the SLAs for time to recovery and recovery points are within the acceptable limits, and that the strategy has been validated recently.

Performing a single point of failure (SPOF) analysis would help in identifying availability issues.

Figure 2, below, depicts a sample SPOF analysis report.

Key Considerations

Legacy sustenance assessments are aimed at achieving sustainability of a key application or a portfolio of applications by aligning the solution with business challenges from three key dimensions, namely, people, process and technology.

People

A dedicated team with experience and expertise in specialized technology areas can be very helpful. Skills in enterprise architecture, performance and scalability are essential to carrying out such an assessment.

Sample SPOF Analysis Report

As-Is Technology Observations			SPOF Analysis				
Technology Area	Technology	Component	Is it Critical to Business?	Is it Critical to the Application?	Is Failover Available?	Is Manual Switchover Required?	Overall Rating
Client/Presentation Tier	Delphi	Windows PC	Yes	No	NA	NA	NA
Middle Tier (Application/Business Logic)	Power RPC	IBM P5/AIX System (Server)	Yes	Yes	No	Failover not available	Not HA-ready
		PowerRPC Manager	Yes	Yes	No	Failover not available	Not HA-ready
Integration Tier (e.g., DB Connection, Message Brokers)	DB2 Connect	IBM P5/AIX System (Server)	Yes	Yes	No	Failover not available	Not HA-ready
		DB2 Connect Instance	Yes	Yes	No	Failover not available	Not HA-ready
	TIBCO	TIB/Message Broker	Yes	No	Yes	No	HA-Compliant
Data Tier (Mainframe DB)	DB2 z/OS	Mainframe (LPAR)	Yes	Yes	Yes	Yes	HA-Compliant
		DB2 database	Yes	Yes	Yes	No	HA-Compliant
Data Tier - Other DB Software (e.g., DB2 on LUW, Oracle, SQL Server)	Oracle	Oracle DB	Yes	Yes	No	Failover not available	Not HA-ready

Figure 2

Sample SPOF Analysis Rating Values

SPOF Analysis Rating Values	Explanation
HA-Compliant	Components are defined as critical with HA setup defined in place.
HA-Ready	The HA setup may or may not have been designed for these components for BCM (Business Continuity Management). However, in some cases the backup server is kept ready to support the business with manual switchover during the primary node down.
Not HA-Ready	Components are defined as critical and not made fault-tolerant/highly available (not fault tolerant).
NA	Failover is not necessary.

Figure 3

Recommended below are a few factors that can be considered to improve the people-related aspects for sustainability projects:

- Analyze the key issues, process owners, their roles and the resources that are needed to fix the problems and handle the knowledge management aspects.
- Identify teams or individual SMEs well-acquainted with the systems.
- Identify the teams that lack deep insight into the system due to both limited exposure to the system or the desired skill set.
- Identify the resource or skill limitations with respect to legacy technologies.
- Leverage the existing resources and plan appropriate training for the potential new resources.

Process

A simple, step-by-step, easy-to-understand approach, coupled with ready-to-use templates and other artifacts and relevant case studies can be very helpful when carrying out a legacy sustenance assessment.

Here are suggestions that improve the process and support future business growth:

- Identify the issues with the implementation of key business processes.
- Suggest technical and/or workflow-related enhancements.
- Suggest any possible improvements in the areas of workflow, process streams and governance for change management.
- Align people with the identified improvements to the processes.

Technology

A strategy that strikes a balance between aligning the technology roadmap and extending the life of key legacy applications is vital for sustainability.

The following three key dimensions should be considered to initiate the improvement of the technology strategy:

- Leverage the existing technology and plan for the right technology/infrastructure upgrades.

- Make the appropriate technology choices that facilitate leveraging the available resources/talent pool.
- Plan the technology roadmap toward building sustainable systems in the future.

Help for Customers

Although it is possible for an organization to draw from internal resources for conducting such an assessment, it's often a good idea to engage a consulting firm with documented expertise. Some have diverse groups that collaborate with each other to build expertise based on prior experience in carrying out such assessments.

Among the questions to ask the prospective partner:

- Does it have a comprehensive assessment methodology that views the problem from people, process and technology perspectives?
- Does the assessment focus on the workflows/governance, integration/interfaces, testing, key applications and infrastructure?
- Is the assessment end-to-end, from scoping and planning, to recommending an approach and, optionally, defining a detailed roadmap for migration, as well?
- Does the firm leverage enablers/accelerators, such as methodology, workflow, custom templates, worksheets, checklists, questionnaires, etc.?
- Do they have any case studies to support their credibility?

Conclusion

There are significant business and IT benefits to conducting a legacy sustenance assessment. The business benefits from leveraging the investments result in cost savings. IT can avoid expensive re-architecture in the short-term and identify operational efficiencies, system management improvements, process improvements and documentation, and align these results with the technology roadmap. Legacy sustenance assessments have great potential to increase the ROI for IT organizations that are trying to minimize risk and maximize their current investments.

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