Architecture-Driven Modernization: *Transforming the Enterprise*

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Authors' Note: This paper, which is presented in its original form, was published in 2008. Since that time, the concept of business architecture has evolved, but the architecture perspective as laid out in this paper remains valid. Readers should take note that business architecture is comprised of value streams, capabilities, information, organizational, and other business domain mappings. [1]

For a number of years, systems modernization been has providing benefits to organizations seeking to analyze software architectures in support of tactical systems initiatives such as software maintenance. Modernization has also delivered benefits for project teams seeking to migrate from obsolete or aging languages and platforms to more modern environments.

While success stories abound for tactical modernization projects, they merely represent the "low hanging fruit" of what modernization can achieve. Modernization efforts are now reaching into more significant and far reaching domains, extending opportunities into the upper echelons of IT and business architectures. Achieving this goal requires a deeper understanding of the architectural impacts of systems modernization.

Architectural Domains & Modernization

While there are numerous types of modernization project scenarios, they can be summarized into three major categories (perspectives) based on the architectural domains those projects impact. Figure 1 depicts the business and IT architectural domains within an enterprise. In Figure 1, these perspectives (i.e. business architecture, application and data architectures, and technical architecture) are coded as B, A and T respectively.
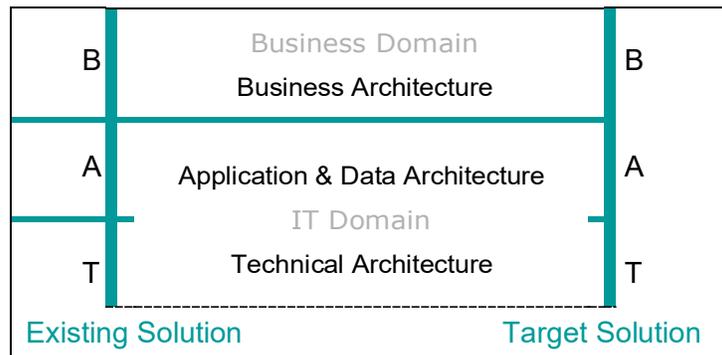

Figure 1: Business vs. IT Architecture Domains

The business domain in Figure 1 is represented by models and correspondent diagrammatic views of organizational governance, business semantics, business rules and business processes, which extend into value streams. The IT architectural domain, on the other hand, represents traditional data, application and technical architectures.

The business and IT architectural views on the left of Figure 1, including the data and systems themselves, represent the existing solution. The target solution, shown on the right side of Figure 1, is fluid and changes over time as incremental portions of the existing solution are migrated across to the target.

Architecture transformations occur as projects incrementally move portions of the existing solution across into the target solution. These projects can be business driven and / or IT driven. Figure 2 depicts the transformation of the existing solution to the target solution across business and IT domains.
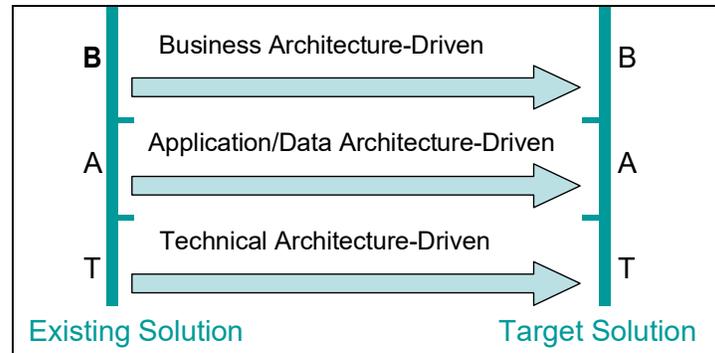

Figure 2: Modernization Drivers & Trajectories

The transformation processes depicted in Figure 2 are dramatically enhanced through the concept of "Architecture-Driven Modernization" or ADM, which can be used to incrementally evolve the existing solution into the target solution.

Historically, modernization projects have focused on transforming technical architectures. Now, as organizations realize the need and develop the means to transform higher level IT and business architectures, formal interoperability across these domains becomes much more critical. For organizations to successfully apply transformative concepts, modernization must be driven from multiple architectural perspectives. The "Horseshoe Model" explains these interoperability concepts.

ADM Horseshoe Model

ADM usually involves one or more components of various aspects of the IT architecture. Each component of an IT portfolio can have its own trajectory of evolution from the as-is state (i.e. an element of the existing solution) to the to-be state (i.e., an element of the target solution). Figure 3 depicts various trajectories as curves that reflect transformations across architectural paradigms.
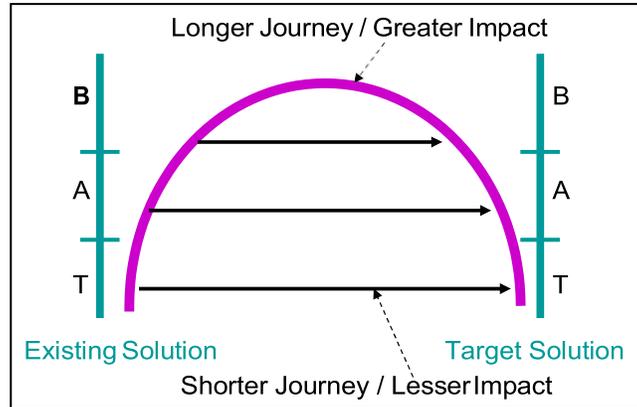
Figure 3: ADM Horseshoe Model

The diagram in the Figure 3 represents the *ADM Horseshoe Model* because the knowledge curve resembles an upside-down horseshoe. This paradigm is consistent with the SEI Reengineering horseshoe model [2] and earlier works of the authors of this paper [3 and 4].

A trajectory or *journey* represents the way knowledge from the existing solution is discovered, enhanced and reused in the target solution. Note that in Figure 3 there are shorter and longer paths to a target solution. Further, note that the shorter path may not yield the degree of value required, necessitating travel along the longer or more architecturally sophisticated path.

Also note that the same environment can travel many trajectories over time, starting with a shorter path and engaging in a longer journey later. There are three elements to every transformational path, regardless of the level of architectural impact. These are identified as follows.

1. Knowledge discovery of the existing solution. This can occur at many levels of abstraction across varying degrees of scope as appropriate to the projects involved.

2. Target architecture definition. In order to create a transformation approach, analysts must create a target solution that serves as a framework into which existing solutions can be mapped or transformed.

3. Transformative steps that move the as-is state to the to-be state. The approach can range from the physical (e.g. a language migration) to the more abstract (e.g. business rule mapping to a rules-based environment).

These architectural perspectives must be synchronized both vertically (business-to-physical implementation) and horizontally (existing-to-target). The ADM Horseshoe Model for a given enterprise modernization strategy is a collection of these journeys (made of horizontal and vertical transformations) that are combined based on business and IT requirements.

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ADM Horseshoe Model for Modernization Types

The ADM Horseshoe Model defines the entire range of architecture-driven modernization journeys available. This may include the vertical views (or modernizations of the specific portions of the portfolio) that begin within the business and move through data, application and technical architectures or ripple back up through the chain.

This is an important consideration for management. Many times, application or data architecture issues may be preventing an organization from implementing certain changes related to a merger, acquisition, new product deployment or other business issue. IT may wrongly believe that simply migrating to a new technology will fix the problem. So, it is important to place any type of modernization project into the proper perspective from an architectural standpoint.

The ADM Horseshoe includes a wide range of journeys from various as-is solutions to to-be solutions. The discussion of each of these journeys that follows relates the model to some practical project scenarios familiar to most organizations.

Technical Architecture-Driven Modernization

Technical architecture-driven modernization has historically been the most commonly applied type of modernization project. It may be driven by risk due to platform or language obsolescence, cost of ownership, system usability or other factors that can be addressed through a physical change. Figure 4 depicts the journey within the ADM Horseshoe Model for technical architecture transformation.
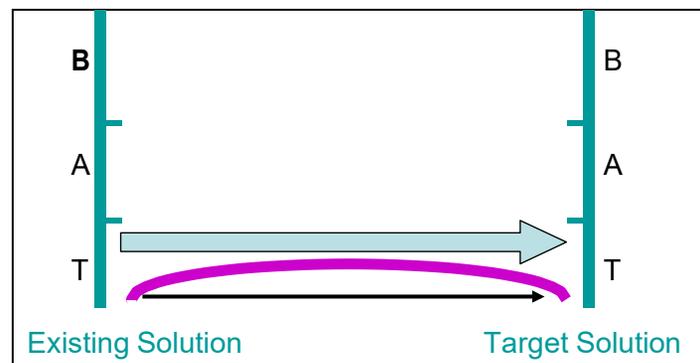

Figure 4: Technical Architecture Transformation

Organizations perform this type of work all the time. For example, IT may be moving from one platform to another and / or from one language to another. IT may alternatively be streamlining systems through various refactoring exercises such as restructuring, data definition rationalization re-modularization or user-interface replacement.

There is a fine line between a project that is only executed at the technical architecture level versus a project that crosses into an application / data architecture-driven project. That line is crossed when there is an impact on program-level, system-level or data design factors. For example, transforming from a procedural language to an object-oriented language, where application design changes are involved, implies changes to the

application architecture.

Application / Data Architecture-Driven Modernization

Application and / or data architecture-driven modernization moves up the scale of the modernization paradigm. The projects in this category vary, but generally span multiple applications.

For example, a project to abstract, redesign and redeploy existing applications in a model driven architecture (MDA) falls into this category. Figure 5 provides an example of the ADM Horseshoe Model showing application and / or data architecture modernization paths.
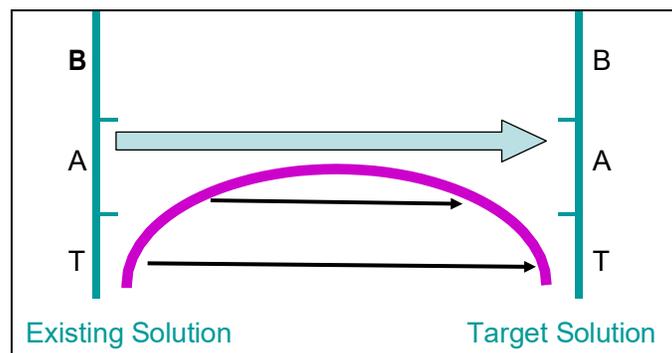
Figure 5: Application & Data Architecture Transformation

Application / data architecture-driven modernization may be motivated by a variety of factors. For example, an application architecture modernization project may involve multiple applications that can no longer serve the needs of the business through incremental maintenance activity. It may alternatively involve a data architecture that is out of synch with strategic information requirements due to being aligned around an outdated application model.

Another example involves multiple applications that require redesign and transformation into a common application that uses a redesigned data model coupled with a platform migration. Such a project moves through an application, data and technical architecture trajectory on the way to the ideal target solution.

Projects like this are being undertaken by IT organizations, but have not always applied the formal disciplines required in a modernization project. In addition, the interoperability models with MDA and other standards are still evolving. In each of these cases, there is analysis and design work involved, but the IT architecture is not being aligned to a revised business architecture.

Business Architecture-Driven Modernization

Business architecture-driven modernization involves the most comprehensive solution and incorporates business architecture models, application and data models and technical architectures. Figure 6 depicts the ADM Horseshoe Model for business architecture-
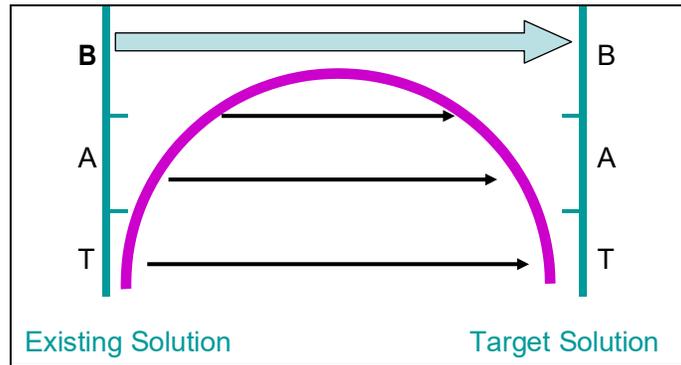
driven modernization.

Figure 6: Business / IT Architecture Transformation

Business architecture-driven modernization formally aligns application and data architectures with business models that can include a combination of governance, business semantics, business rules and business processes. Very little modernization work in this area has been effectively deployed because the mapping paradigms between business and IT lack standardization.

Standards Involved in Modernization

In 2003, the OMG Architecture-Driven Modernization (ADM) Task Force issued a 7- stage ADM Roadmap to establish a series of modernization standards.[5] Four of those standards, all of which deal with variations of modernization analysis, are either in place or underway.

Additionally, the Software Assurance (SwA) Task Force is developing a SwA Evidence Metamodel. These standards are plotted to the ADM Horseshoe in Figure 7 below.
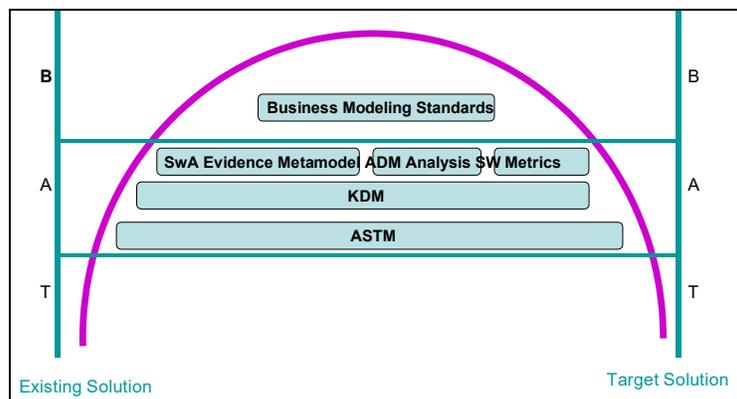

Figure 7: OMG ADM Standards and the ADM Horseshoe

The remaining portions of the ADM Roadmap deal largely with refactoring and transformation.

What is missing?

The missing links in the ADM Horseshoe include formal mappings between ADM models and MDA models, transformation standards to support these mappings, formal mappings between ADM models and the spectrum of business models, and interoperability across business models. This work is underway within various OMG task forces and working groups. Hopefully, this white paper will clarify the interoperability requirements across business and IT architectures.

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