Platform Architecture: A Core Digital Transformation Enabler

CIMdata Commentary

Key takeaways:

- *Managing the complete lifecycle of a product improves revenue opportunities and is a common digital transformation goal.*
- *Legacy or monolithic architectures require discontinuous innovation to extend and upgrade, which can be disruptive and expensive.*
- *A stable, future-proof product innovation platform architecture is required to efficiently manage the lifecycle to capture the complete business opportunity while mitigating risk.*
- *The Aras PLM Platform provides a resilient platform for digital transformation initiatives and is currently deployed at leading industrial companies such as General Motors, Airbus, and Microsoft.*

There are many new terms that have made their way into the product lifecycle management (PLM) lexicon recently. Digital transformation, digital twin/thread, and digitalization are all terms that get used to describe the next step in technology supported business evolution. Technology has evolved that it is now affordable to address common end-to-end business initiatives. The ability to manage products from concept through in-service operation and end of life gives product producers the ability to capture more revenue and improve both their and their customers' profitability by better cost control and innovation support.[1]

PLM solutions have been at the forefront of supporting companies in this transformation from analog, paper-based processes to digital ones. The solutions started in the 1980s as custom coded mainframe applications. During the 1980s and 1990s PLM systems evolved into commercial off-the-shelf solutions (although they were more toolkits than complete solutions) that commonly covered only the product design and engineering phases of the lifecycle. Today's product innovation platform approach leverages platforms within a system of systems architecture that can be adapted to changing business requirements using low-code technologies. Platform-based solutions are also more easily upgraded to take advantage of software, hardware, security, and other relevant technological advances.

Product Innovation Platform Enablement

The goal of a product innovation platform, as it is with all PLM solutions, is to connect all users and their information in a single logical environment to cultivate continuous creativity, yielding improvements in products and processes, plus inspiring new and better ones throughout full lifecycles and across generations of products. CIMdata believes that a product innovation platform more easily supports a broader scope when compared to traditional PLM solution implementations.

Figure 1 shows how the structure of a product evolves over its lifecycle and how objects are linked to enable traceability. Managing this data within a product innovation platform enables platform services to be configured to allow native platform applications to be tailored to business requirements while providing access to the full context and semantics of the data.

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[1] Research for this commentary was partially supported by Aras.

Non-native, integrated applications also have access to the same services so they can fully participate in product definition management.
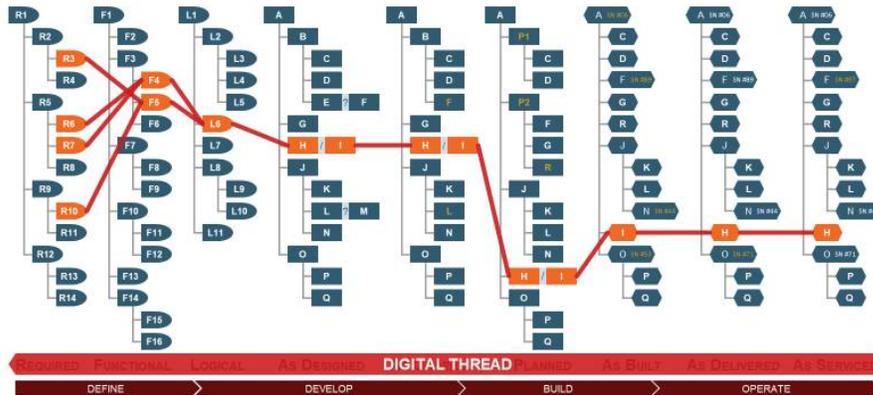

Figure 1—The Red Line Depicts Digital Traceability from Requirements Through the As-Maintained Condition
(Courtesy of Aras)

The result of clean and unencumbered access to data and processes enables a complete digital twin to be created and managed. The management of the data using platform services including structure management, workflow, and change management enables a configuration management environment that creates a digital thread capturing product evolution with guaranteed data traceability.

A complete configuration-managed digital twin provides many benefits that are derived from impact analysis and traceability. These allow companies to improve products and identify the causes of issues faster and with better confidence, driving top- and bottom-line improvements, as well as increased customer satisfaction.

Legacy & Monolithic Platforms: Why They Make Innovation Hard

PLM is complex because most product lifecycles are complex, even many of the stages within a product's lifecycle are complex. As much as solution providers want to meet ALL their customers' requirements there is no single solution available on the market that will do that and there won't be for the foreseeable future. This reality makes openness a critical platform enabler.

Most large enterprise solution providers in the ERP and PLM marketplace have grown through acquisition and often have to stitch their acquisitions together with integration technology. Each technology has its own architecture, often with differing technology stack elements (Oracle DB vs SQL Server, .NET vs. Java, etc.) It is difficult to re-engineer what wasn't engineered in the first place. Ultimately, grafting a web service interface onto a monolithic architecture does not make a platform.

Once cloud-based PLM solutions mature beyond running in virtual machines, their software services or microservices become tied to the underlying platforms such as AWS, Azure, and Google. Cloud native solutions may already have this issue as CIMdata is unaware of cloud native solutions running on multiple cloud platforms. A well-defined abstraction layer is required to enable a solution to be portable across cloud platforms.

The problems CIMdata hears about most from its industrial clients are lack of flexibility, performance scalability, and costly maintenance and support. These issues often trace back

to fundamental architecture decisions made decades ago such as product code that dates back to when client-server architectures and single-threaded processors were state of the art.

This lack of future-proofing led many companies down a bad path that requires a significant investment with a low return, i.e., the stitched together products don't perform well and are difficult to maintain and improve. For customers to get capabilities they need, they end up customizing, which often creates a technical debt. This debt manifests itself in costly upgrades, performance issues, and ever-growing security vulnerabilities.

Product data has a long lifespan, often outliving the solutions in which it was created and managed. Many products in production today were designed on drafting boards or with CAD systems that haven't existed for decades. Reuse of this intellectual property to understand the decision path and justification for decisions is critical in many industries, especially for profitability and for regulatory reasons.

Assessing Solution Architectures

So far, the benefits of a future-proof architecture and the effects of an obsolete or poorly implemented architecture have been described. CIMdata is often asked how to identify whether a solution is worth investing in, and when it needs to be ripped and replaced. The following list are some of the key characteristics and techniques we use to evaluate solution architectures during assessments.

- Does the solution's use of new and modern software development approaches mean it has a future-proof architecture? Not necessarily, a good architecture can be poorly implemented, extended, or customized.
- Does the data model support necessary object types across the lifecycle? Do different applications have independent data models and user IDs? Can new object types be defined? How easy is it to create relationships between object types? How easy is it to trace data across the lifecycle?
- Does the solution use a common workflow engine across the lifecycle? Can impact analysis identify ALL items affected by a proposed change from requirements through the as-maintained lifecycle state?
- How easy is it to integrate with competitors' solutions or different authoring applications? Is additional software required? Is custom application code required?
- Is the solution portable to different infrastructure platforms? Has the solution run on other platforms such as different operating systems (e.g., Unix, Windows, and AWS), SQL and graph databases, different web browsers, mobile and desktop environments?
- How much recoding and testing are required to upgrade and is it cost prohibitive?

Ask a developer, they have the best understanding of the solution.

Aras' Industrial Application Platform

CIMdata has written much about Aras and the Aras Innovator solution. We have been impressed with the architecture and have seen it deliver what it promises. It is a modern architecture and supports our definition of a product innovation platform. CIMdata finds Aras' recent strategy of incorporating new technologies to be very interesting. Aras' "incorporation process" refers to how existing services are reused to support common application functions

such as workflow, security, and compound documents. Algorithms and functions are then coded as new platform services. This allows the new services to be easily leveraged in ways even Aras did not initially conceive.

CIMdata has seen other solution providers attempt to rewrite acquired technologies onto their native architecture, but most fall back to integration because rewriting software is time consuming, costly, and often difficult. Given their strategy, CIMdata is looking forward to the release of Aras' recently-acquired MRO and simulation related solutions based on incorporated capabilities.

Aras has done an excellent job of defining the services necessary to support the entire product lifecycle. Aras' technical documentation solution is a good example of this. It reuses existing object, workflow, and structure services, but required new services to support structured document data such as table of contents, image rendering, and document composition. The initial release was based on web services, but a fully incorporated application was later released.

According to Aras, the difficult part of defining and implementing new platform services is their validation. Coming up with comprehensive test cases that cover all the ways a service can be used is complex. Yet, when done well, the service can be effectively used to satisfy many seemingly disparate user requirements.

Aras' industrial application platform has been well received in the market. High profile wins at GM, Airbus, and Microsoft have disrupted the PLM market enough for CIMdata to include Aras in our PLM Mindshare Leaders category. All of these companies publicly described how they are using the Aras solution as a flexible platform both to replace legacy applications and in the case of Microsoft as the core product innovation platform. When CIMdata discusses why Aras was selected with customers, the elegance of the Aras architecture is often the first item the customers bring up.

Conclusion

To effectively execute a digital transformation, a resilient product lifecycle management platform is critical. Product data volume and complexity are growing exponentially, and therefore must be addressed to ensure long-term success. Legacy architectures were not designed to support end-to-end processes, most were designed to support silos, and have had extensions grafted on and will struggle to meet digital transformation requirements. A product innovation platform is a state-of-the-art way to create a resilient foundation that can support end-to-end product lifecycle requirements.

Customers recognize Aras for its architecture, which has been based on web services from its inception. CIMdata has been following Aras for a long time and continues to be impressed with their innovations. Industrial companies planning digital transformation initiatives need to perform an honest assessment of their current technologies and solution architectures before executing a digital transformation initiative. If these are lacking, the Aras PLM platform belongs on their short list.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM). CIMdata provides world-class knowledge, expertise, and best-practice methods on PLM. CIMdata also offers research,

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