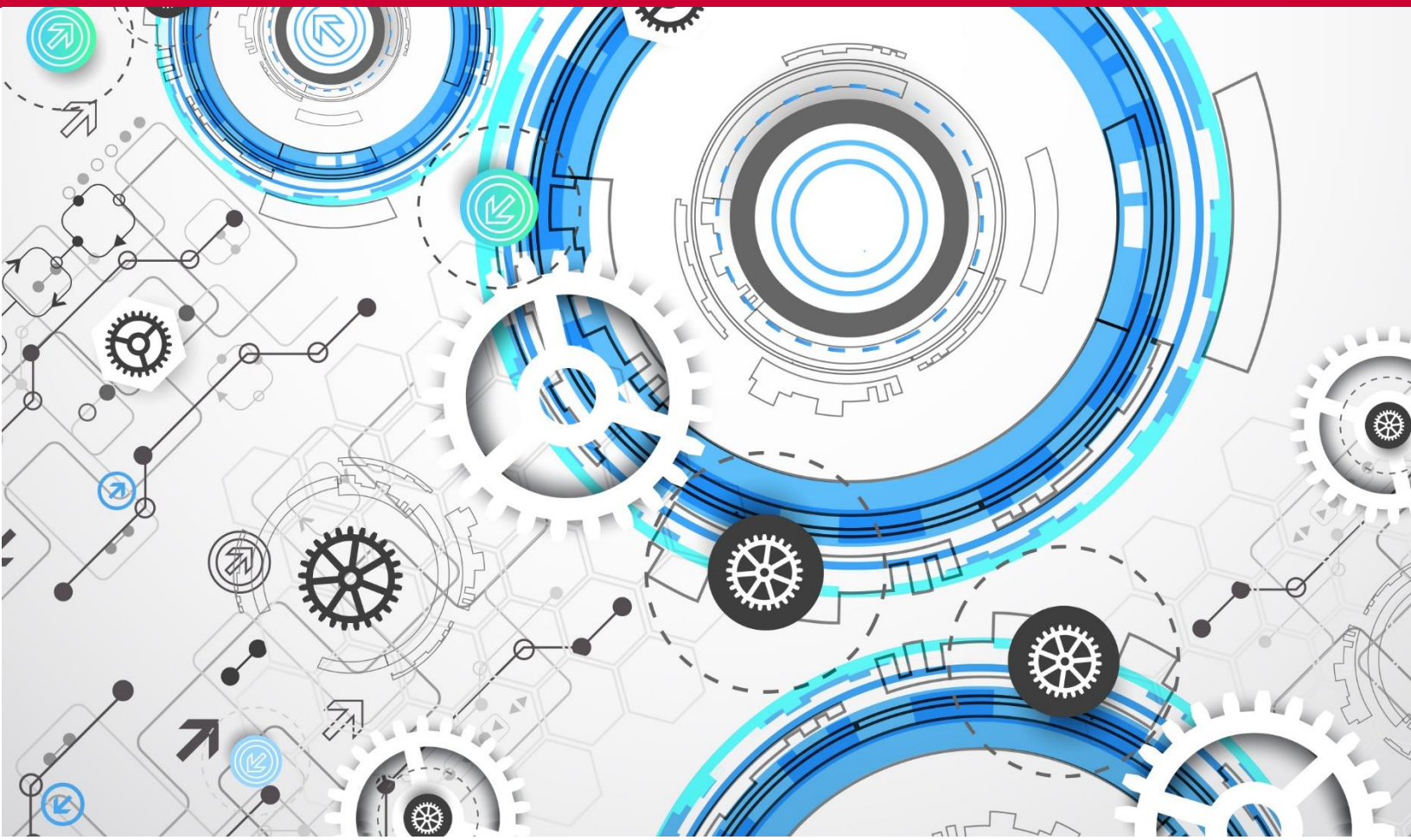

The Business of Engineering

How to Tackle Product Complexity

aras corp®

THE BUSINESS OF ENGINEERING

HOW TO TACKLE PRODUCT COMPLEXITY

As products get increasingly complex, interdisciplinary approaches that span the product lifecycle are a must. But legacy PLM systems are failing to meet evolving business needs—they are too focused on mechanical 3D CAD, simulation and digital mock-up –the Science of Engineering. In order to keep the pace and stay profitable, manufacturers must develop a broader vision- Business of Engineering - and implement a resilient PLM system that to tackle the challenges of today's volatile and fast paced industry.

"Global organizations recognize that they must undergo a digital transformation of every aspect of their business. Manual processes have to be replaced and legacy systems retired to maintain and strengthen both competitive advantage and the power to innovate."

NO MORE SIMPLE PRODUCTS – COMPLEXITY INCREASES

A quick look at a typical automotive component illustrates that we live in complex times. Until a few years ago, the gearbox in an average car was a mechanical assembly, without any electrical parts or even software involved. However, with increasing product complexity and rapid development, the typical gearbox built into a modern car shows a completely different picture. Now, besides the gears, the gearbox is designed and developed with actuating drives, microcircuits and other electronic components. And of course software controls everything.

The complexity of a simple gearbox has increased exponentially, and this is true for most products when we look at the development during the last 20 years. Software has become an increasing factor and dominates almost every type of product today.

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SOFTWARE HAS BECOME AN INCREASING FACTOR AND DOMINATES ALMOST EVERY TYPE OF PRODUCT TODAY.

This development confronts manufacturers with a new range of challenges. Traditionally, only very few disciplines within the engineering departments were involved in the development of a given product. Today, mechanical, software and electronics or electrical engineers must work on the same product, in many cases not even in one location, but distributed around the globe. This means that all of these disciplines have to be coordinated, which makes projects and processes much more sophisticated than they used to be.

Complex products also contain subsystems of various kinds, which in most cases are provided by suppliers. Over time these suppliers have gained more authority for their own designs, and today, control many critical technologies. The impact on the production process is that these suppliers must be managed and orchestrated.

Product safety is also impacted. Manufacturers have to guarantee safety of their products at all times – in industries like automotive and healthcare the lives of end users can be at stake. Ensuring safety is tricky when the product is still in the making. But it can become even more tricky when field updates are necessary, especially for software. Recent news show the devastating effects that a relatively small flaw can have when it makes critical systems in a car or aircraft fail, for example.

And last but not least, products are not the only thing growing in complexity. Manufacturers today must literally negotiate their way through a maze of laws and regulations to stay in compliance and avoid business critical risks. There once seemed to be a solution for all these problems – a big vision that failed in many ways.

PLM OUT OF BALANCE

PLM systems started out with no smaller promise than to revolutionize industrial production. When Computer Aided Design (CAD) spread widely in companies during the 1980s, it gave rise to Product Data Management (PDM) solutions, as the mass of digital data created by engineering applications had to be managed. As a significant next step, PLM was meant to go further. It involved a broader approach in deployment and a much higher level of integration across every phase of the product lifecycle, cutting across all disciplines, national and international locations and the complete supply chain. The PLM process was meant to lower error rates and accelerate development, design and manufacturing. A single, common source of data for all processes and departments (including suppliers and other partners) was the goal wherein the complete lifecycle would be mapped. PLM was to centrally manage not only CAD data, but also track requirements, product specifications, project plans, BOMs – literally every department from design through procurement to field support was to become linked to the central information backbone. Faster time-to-market, reduced waste and more efficient use of budgets were the targeted benefits. This vision, however, has failed to materialize into reality.

TEN PERCENT OF THE PLANNED FUNCTIONALITY IS AVAILABLE, TEN PERCENT OF THE USERS HAVE ACCESS TO THE SYSTEM, BUT 100 PERCENT OF THE PLANNED BUDGETS ARE GONE.

Today the reality of many PLM projects can be best described with the 10-10-100 formula: Ten percent of the planned functionality is available, ten percent of the users have access to the system, but 100 percent of the planned budgets are gone. This is extremely frustrating for everyone involved. Many executives who have been involved in PLM projects see high risks and tend to shun PLM in general.

The state of PLM can be partly attributed to the notoriously long time it takes to customize and deploy legacy PLM systems. According to industry analysts CIMdata, more than one-third of PLM installations surveyed in a recent study* still have more than three years of development time remaining. In today's fast-paced product world, that is a lifetime. Due to their inherently rigid structure, customizing these systems always means hardcoding changes and individual features. Already difficult to adjust to individual needs in the first place, these systems establish themselves in companies as behemoths that are too complex to be updated. And, we haven't even scraped the surface and discussed the need for fast and flexible reactions to evolving market trends.

The need to respond fast leads another PLM dead end: should a version upgrade of the PLM software cease to support customizations or individual features, everything done to the system to date becomes lost, along with all the investments made until that point. This makes companies extremely wary when considering upgrades. That's why CIMdata also found* that one-third of all PLM installations they reviewed haven't been upgraded in more than five years.

*Aerospace and Defense Industry PLM Value Gap Survey, published by CIMdata, Inc., March 2013

But the major reason why the whole concept of PLM has failed to achieve the original vision is that legacy PLM systems are too focused on 3D mechanical CAD, simulation and digital mock-up – which we call the science of engineering. Because the legacy providers come from the mechanical CAD world, their PLM systems were never optimized for the other processes critical to developing, manufacturing and supporting profitable products – which we call the business of engineering – leaving them disconnected and underserved. With the 10-10-100 rule in mind, this creates a huge gap in availability – 90 percent of the "users" don't even have access to their PLM solution. This leaves a gaping hole in processes that usually get filled with a patchwork of sub-par tools like Excel spreadsheets, shared drives, e-mail or Dropbox. None of these connect to the PLM system or each other, leaving critical processes poorly supported.

To reiterate: legacy PLM systems are overly focused on the science of engineering, making them little more than PDM systems for mechanical CAD data, neglecting the bigger picture, namely the business of engineering. The world of PLM is out of balance.

PREPARING FOR THE INTERNET OF THINGS

Such PLM imbalance is a major inconvenience for the majority of users within a company. The executive level should also be aware of these limitations for several reasons. First, as different departments are not properly connected, poor communication between hardware engineers and software developers becomes a constant source for errors and can easily result in a variety of safety problems. This opens companies up to liability risk – looking into the recent past, this is not a theoretical possibility and can directly harm business results. What's more, it can put real people in real danger. Who would have thought that a firmware flaw could result in unintended acceleration? It can and did in one leading manufacturer's cars, with fatal consequences. Another car manufacturer had to recall 142,000 cars over software issues – at enormous cost to both the company's balance sheet and brand image.

The lack of an integrated product configuration causes problems at the hand-offs between engineering, manufacturing, suppliers and field support. Wrong information gets shared, while different versions of bills of materials (BOMs) and documentation circulate. Simply put, processes do not access a single, common source of data, resulting in delays, cost overruns and safety issues due to faulty products. This again can have severe consequences. Something seemingly small, such as an error in software configuration, can have disastrous results. In times where companies are being held increasingly responsible for the full life of their products, the consequences of allowing key parts of the product development and production processes to be only loosely connected is risky at best. Suffice to say that the negative consequences are many and very costly. Moreover, fragmented data and processes bring negative consequences beyond existing products. They affect the ability of companies to react to upcoming trends and new business needs. Consider connected devices. The Internet of Things will leave hardly any technical device unconnected, rendering everything 'smart.' While companies are busy solving yesterday's problems, they are not able to tackle tomorrow's challenges with legacy PDM.

All these issues directly impact companies' ability to compete – the ultimate risk in highly competitive global markets, especially for those who run large enterprises and have to explain their results to shareholders.

DIGITAL TRANSFORMATION AS IT SHOULD BE

MANUAL PROCESSES HAVE TO BE REPLACED AND LEGACY SYSTEMS RETIRED TO MAINTAIN AND STRENGTHEN BOTH COMPETITIVE ADVANTAGE AND THE POWER TO INNOVATE.

In light of all these PLM problems, companies see a pressing need for change. Global organizations recognize that they must undergo a digital transformation of every aspect of their business. Manual processes have to be replaced and legacy systems retired to maintain and strengthen both competitive advantage and the power to innovate.

First and most importantly, the enterprise must become more resilient and adapt to change faster. That is the only way they can keep up with the rapid development merging products and technology. A crucial step is to integrate mechanical, electric and software components to establish truly cross-discipline processes. To get there it is necessary to connect the tools used for these different components – either directly or as an overlay to existing systems for PDM and ALM (software application lifecycle management). This is the basis for an integrated product configuration that provides sufficient context to understand how each product behaves in the field and to interpret data that smart, connected devices send within the Internet of Things. In other words, companies have to create a Digital Twin at the system level for each of their products.

It's important to recognize that the focus cannot be placed on only the product and its behavior. Organizations also need to extend configuration management from design through manufacturing to field support. The result is a Digital Thread that allows organizations to trace every decision made throughout the complete product lifecycle and connect this data back to the information the digital twin provides. Only then can an organization optimize processes, configurations and related cross-functional methods of working. Along those lines, connections beyond core design processes must be made. Teams must connect critical non-design processes, such as requirements capture, project management, quality management, process planning and technical documentation. All these processes are business-critical and contribute greatly to the success (or failure) of a product. Unfortunately, as we have seen, legacy PDM systems are largely failing to support these processes.

This effort must not stop at the enterprise's factory gates. With today's complex product development, suppliers play a crucial role and have taken on more responsibilities than ever before. So, it is key to connect and integrate them into the PLM environment. After all, products do not only have to function and fulfill their purpose – the manufacturer seeks profitability. The more insight that management has into the various processes involved, the better able they are to optimize the processes and make the business more profitable.

THE SOLUTION: RESILIENT PLM

Today, many organizations are learning the hard way that they can't tackle these challenges with their existing PDM installations. They have to take a new approach. What they need is a new, resilient PLM solution to make them successful in their enterprise-wide digital transformation. One that is Flexible, Scalable and Upgradable.

FLEXIBLE

Every business is different and evolves continuously so a flexible PLM solution is critical.

But the approach used in legacy PDM systems fails here – data model, business logic, services and database structures are firmly embedded in the source code. The result is a monolithic block of software that only an expert developer can access. So for any significant change or customization needed by the business, the code has to be rewritten. Aras takes a different approach, which we call model-based, providing the flexibility to fit your business now and in the future with adaptive data models, process models and business rules. This means that business needs can be met exactly: either by using out-of-the-box applications which can be easily adapted, or customer-specific applications which can be rapidly developed.

Remembering the 10-10-100 rule, enough budget dollars have already gone into legacy PDM projects. It would be extremely painful to lose those, so the new PLM solution would ideally be able to layer-over and make use of the existing systems. Not only does this avoid a high risk "rip and replace," it maintains support for existing tools that engineers desire to use, making implementation run far more smoothly. As a result, such a platform is far more sustainable and reduces both risk and cost. Aras is providing this option with the Aras solution, which can be either laid over existing deployments, providing exactly the connection organizations need, or as a stand-alone solution for a completely new deployment. This approach provides the flexibility to focus on your most critical needs and keep legacy PDM systems in place as long as needed.

For organizations to realize the true benefits of PLM, implementations must be completed quickly and be able to keep up with fast-changing business requirements. In other words, they must become agile. Yet, an agile-style implementation can only happen when the underlying PLM platform technology is as adaptable as the methodology itself. Legacy PDM systems simply cannot provide the flexibility required to do "agile" properly. The Aras architecture enables a flexible, agile implementation approach that demonstrates tangible business results quickly. Implementation cycle times are much shorter than they would be with a legacy PDM solution, lowering costs and risks.

CIOs are looking for the flexibility to deploy critical systems in the cloud, either today or in the near future. Legacy PDM solutions, with their outdated architectures, remain firmly locked in the data center. But Aras, with its modern web-based technology has the flexibility to be deployed on-site, in a public or private cloud, or in hybrid configurations.

TAKING A NEW APPROACH TO PLM

FLEXIBLE

Model-based technology lets you meet your unique business needs now and in the future

SCALABLE

Single platform architecture lets you scale your PLM implementation easily across processes, disciplines & functions

UPGRADEABLE

Included upgrade services let you continuously enhance your PLM environment

SCALABLE

A PLM solution that supports the business of engineering has to be able to grow in line with the needs of the business.

Legacy PDM system can be hard to scale as the applications are typically built on different platforms. This complicates support for collaborative business processes as individual applications may operate in a silo or be poorly integrated with one another. But with integrated applications running on a single platform, Aras makes it easy to scale your PLM implementation when adding support for new processes, disciplines and functions.

Scaling is further enhanced by the cross-application Visual Collaboration capability in the Aras solution which allows users to review, mark-up and comment on 3D models, documents and other kinds of data in a browser environment without requiring access to the original authoring tool. Seamless collaboration in a secure environment within a global context and across the supply chain is possible without any hurdles. So companies can finally go for the unconnected 90 percent.

Legacy PDM systems reliance on heavy customization and dependence on multiple platforms also raise performance issues when scaling to support large user loads. But the Aras architecture is optimized to scale easily and performance is proven at 250,000 concurrent users.

The business model of the PLM vendor can also be a significant obstacle to scaling. In the prevailing model for legacy PDM vendors, a customer has to pay the full cost of the licenses up-front before being able to see the full functionality of the system, raising risks significantly. Once the system is operational, support and maintenance charges must be added. And when the system needs to be upgraded, further significant costs are involved. Aras again changes the rules in order to truly support the business of engineering. Instead of a license system, user access to all applications and inclusive maintenance, support and software upgrades performed by Aras are covered by a single subscription, simplifying scaling your PLM implementation. This ensures that costs are distributed evenly over time and allows a true enterprise-wide deployment and beyond.

UPGRADABLE

Software upgrades can turn into a nightmare for organizations. The problem lies in the monolithic structure of legacy PDM systems, making it impossible to complete an upgrade without extensive updates to the custom code followed by testing and recertification. The Aras PLM solution can easily be upgraded without any downtime and risk of losing important features and changes made by the customer. Only the service layer, which is never changed during implementation, is impacted during an upgrade. Applications, whether from Aras or developed by the company, remain completely intact. What is more, upgrade services are included in the Aras subscription making it easy to stay on the latest version.

CONCLUSIONS: BRINGING THE BALANCE BACK TO PLM

Designing, manufacturing and supporting complex, connected products are major challenges for organizations today. And things are not going to be simpler any time soon. On the contrary: besides the Internet of Things and smart devices, there is a growing trend towards products as a service. This means that many products will not be sold anymore, but provided as a solution package, including support and services.

To enable this, even more disciplines beyond mechanical 3D CAD engineering will be involved throughout the lifecycle, and will have to work together in a much more integrated fashion than they currently do. Manufacturers will have to focus more on orchestrating their suppliers, as they provide parts or whole assemblies with all the technology in them. They will have to ensure they have sufficient insight into all of these parts and modules by connecting their suppliers to their PLM system. Being able to manage the Digital Twin and the Digital Thread are increasingly important and will be a must in future.

Many organizations have already realized these challenges and have taken the first steps to drive their digital transformation in product development. They realize that to achieve the long-sought, but yet unfulfilled PLM visions, their PLM deployments have to be fast and transparent, highly flexible and scalable, easy to upgrade and cost efficient. A resilient PLM platform like this will enable them to fully support the business of engineering.

About Aras

Aras® offers the best Product Lifecycle Management (PLM) software for global businesses with complex products and processes. Advanced PLM platform technology makes Aras more scalable, flexible and resilient for the world's largest organizations, and a full set of applications provide complete functionality for companies of all sizes.

By rethinking the way PLM is designed, Aras has taken a fundamentally different approach with a focus on the Business of Engineering. Aras solutions support processes for global product development, systems engineering, multi-site manufacturing, supply chain, quality and more.

Companies running Aras include Airbus, Boeing, Bombardier, GE, Hitachi, Honda, Kawasaki, Magna, Microsoft, Motorola, Nissan, TOSHIBA, Xerox, the US Army and hundreds of others worldwide.

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