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ALM and PLM interoperability: the time is now

In many companies product lifecycle management (PLM) and application lifecycle management (ALM) solutions exist in parallel silos in the product development world and are not well integrated. The convergence or interoperability of PLM and ALM environments represents the future generation of management control for systems-driven product development.

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Executive summary

Management of the product development process, governed by product lifecycle management (PLM) platforms, and management of the software development process, belonging in the domain of application lifecycle management (ALM) solutions, have long existed in parallel silos in the product development world and are not well integrated.

A previous whitepaper, "Why ALM and PLM Need Each Other," explored the reasons why ALM disciplines and solutions need to interoperate with PLM systems for better management of the entire product's lifecycle. This white paper examines the worlds of PLM and ALM, builds a business case for greater interoperability between the two systems, and outlines Siemens PLM Software's vision and strategy for achieving the interoperability needed for managing the development of software and hardware in the context of the entire product.

The convergence or interoperability of PLM and ALM environments represents the next generation of management control for a truly effective systems-driven product development process.

Software managing the product development process

The time for PLM and ALM interoperability is now. One of the key reasons is that software has quickly become a dominant part of technologically complex products and needs to be managed by a system specifically built to manage software. To add further fuel to the argument for interoperability between PLM and ALM, we can look to the fact that the product design process is increasingly computerized.

When PLM was first established as a discipline, the process of conceiving, designing, realizing and servicing a product involved physical models and prototypes. With the advent of digital product development (DPD), manufacturers replaced physical methods with computerized systems such as computer-aided manufacturing (CAM) and computer numerical control (CNC) machines, which reduced the need to produce physical prototypes. These computerized tools also enabled product engineers to evolve a product design more iteratively, and make more frequent changes.

The result of this computerization is that product engineering teams now behave and collaborate like their software engineering counterparts more than ever before, and have a new appreciation for the features and capabilities found in an ALM system. Since both PLM and ALM have their own strengths and weaknesses, to be effective the PLM and ALM environments must interoperate with one another so as to leverage each other's strengths.

"Virtual development environments will minimize the need for physical prototypes and accelerate the development time for new products while providing realistic verification against customer requirements. These environments will support a seamless flow of product information across all phases of the system lifecycle, including design, engineering, implementation, test and evaluation, and operational support. Workflow management tools will support the globally distributed, collaborative teams that will utilize these virtual development environments."

INCOSE Systems Engineering Vision 2020

ALM and PLM interoperability

ALM and PLM systems are vastly different and are designed to manage different things. PLM systems are designed to accelerate product development and move products to market faster. ALM systems are designed to create quality software.

If a manufacturer is building a product that includes a significant portion of software, that manufacturer requires an ALM system in addition to a PLM system in order to effectively manage the delivery of the whole product.

Finally, these systems need to interact in order to move software-intensive products to market effectively and ensure the quality of those products. Let's now explore those points of integration, and look at ways we can bring these two very different systems together.

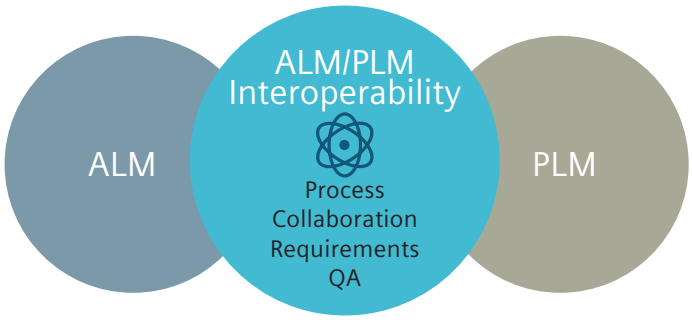
A common process layer to drive change

More mature vendors of ALM solutions have evolved their product offerings over the past several years to become integrated, process-centric solutions that enable the traceability and management of items across different development phases.

In such evolved platforms, ALM items exist with no replicas, are versioned, linked to each other, and guarantee consistency over time and changes. Such features allow a better separation of duties between developers and significantly increase their accountability. Last but not least, by means of these capabilities, modern ALM platforms dramatically simplify the assessment of compliancy during the diverse certification activities mandated by the increasing number of industry standards.

Leveraging linked data, this process layer forms an ideal "backbone" or common layer between PLM and ALM enabling ALM and PLM to share common processes for providing:

- Item uniqueness
- Workflow management
- Versioning
- Traceability
- Change management to any product- and software-related information



As discussed in the previous whitepaper of the series, "Why ALM and PLM Need Each Other," support for deep process integration provides a clear connection between Lean Manufacturing for product development and Agile methodologies for software development. Lean and Agile will naturally come together only if there is a process integration layer that will allow unique process management, including workflow, version and change management.

There is a far-ranging discussion in the systems engineering domain about the need for mature and coherent processes. On the other hand, a significant consequence of defining more and more formal process templates is that engineers are more and more under the impression that their talent is used in maintaining processes and in ensuring compliance, instead of in creating innovation.

A perfect tradeoff is represented by the capability provided by most advanced ALM systems to embed process knowledge in the toolset. This ability allows engineers to concentrate on their jobs, while the tool drives them through the process. Therefore, a common process layer embedding process knowledge is the perfect solution.

The need for a common process layer providing a single workflow and unified version and configuration management is not limited to the discussion about ALM and PLM convergence: another practice referred to as DevOps looks for the same information.

In DevOps, the focus is on communication, collaboration, and integration between software developers and IT professionals involved in operations.

Collaboration

In both software and product development, engineers collaborate with each other and with internal and external stakeholders by means of specifications, diagrams and comments. They collaborate over unstructured content. This content must be shared, accessed, protected, edited and, later on, re-used.

Collaboration between engineers happens today through common workplace tools such as emails, chats, phone calls, meetings and finally through the sharing of Microsoft® Word documents where content is often read and quickly forgotten. The problem with this kind of collaboration is that these workplace tools are normally quite disconnected from both ALM and PLM systems and processes.

Furthermore, much collaboration today takes place online and through mobile devices, so it is necessary for ALM/PLM interoperability to provide both browser-based and mobile-based access to project content. Many older ALM platforms and PLM systems are far from achieving this kind of capability.

Collaboration layers providing a modern, fully-integrated ALM/PLM platform such as Siemens PLM Software's Polarion and Teamcenter solutions solve this communication dilemma by providing web-based and mobile access to project content along with features for real-time collaboration between users. Such layers should be specific and dedicated to ALM and PLM users, to prevent the risk of lost or duplicated data due to collaboration outside of these systems.

Requirements management

In the requirements phase, requirements driving ALM deliverables (code or PLM deliverables/parts) co-exist within a single, common logical repository. These requirements may remain separate over their lifetimes, or they may come together (for instance when an ALM code deliverable becomes a part for PLM when installed on a PLM component). It is also possible that a requirement for ALM code may be leveraged multiple times as the same code becomes different "parts" on different hardware, or hardware with unique parameters.

Traceability

Finally, PLM must be able to leverage its definition of traceability (link and navigate product object's relationships and dependencies), and to incorporate ALM-style traceability showing linkages between files/items and hardware components, and the impact of change at any level to hardware- and software-related objects, as well as the system as a whole.

Some PLM vendors argue that they provide traceability within their current systems through integration with open-source versioning or software configuration management tools such as Subversion or Perforce. This form of integration provides links to embedded software code from models within the PLM system. While this initial level of integration is a step in the right direction, it does not approach the level of maturity being proposed with Siemens PLM Software's Teamcenter and Polarion interoperability, which will go beyond the simple ability to link model to code, enabling real-time collaboration from everywhere, with any device, and delivering impact analysis across different items belonging to different process phases (from requirements to tasks, from test cases to bugs, from change requests to test plans, from activities to code).

ALM and PLM interoperability: a single, logical data repository

Some ALM and PLM vendors are working on standardization initiatives such as Open Services for Lifecycle Collaboration (OSLC)[1] to establish a specification that defines a common integration and data-sharing approach for ALM and PLM integration, needed to integrate their standalone ALM and PLM solutions.

This initiative, however, does not address all the different use cases or levels of integration. OSLC addresses the physical data linking issues of the integration, which is good and noteworthy, but not enough: ALM and PLM can't just be integrated – they must become a single ecosystem driven by a wide variety of use cases, something that standardization efforts in the past have shown to be fairly difficult. As discussed earlier, to achieve good ALM/PLM interoperability requires a process layer supporting collaboration, common workflow, version, change, traceability and test management.

Modern ALM systems, such as Polarion ALM, do not rely upon data replication, nor do they leverage proprietary storage methods. This means that any item, such as a document, statement or piece of software code can conceivably be retrieved, linked, changed, analyzed, reported upon, re-used, maintained, disposed of, compiled and debugged within a single location, and accessed by users of either an ALM or a PLM system.

The linking of federated data to represent a single logical repository approach provides the key to PLM/ALM interoperability. From anywhere in the world, and at any time, product and software engineers can access, share and collaborate on product-related information. Creating this level of integration takes time and effort. Siemens PLM software's approach is to start with a focused set of features and use cases to support integrated requirements management, change management and closed-loop embedded systems software traceability, and then to continually expand the set of capabilities and use cases.

The ALM/PLM interoperability approach discussed in this paper simply requires good, modern, robust ALM and PLM systems and a common layer of shared information (devoted to collaboration, version and change management, workflow support, traceability, requirements management, testing and QA) to create an innovative and unique collaboration environment devoted to the overall improvement of system and product quality.

Siemens PLM Software's approach to ALM/PLM interoperability

A leading provider of product lifecycle management software, Siemens PLM Software delivers an open, standards-based portfolio of PLM solutions that spans the entire product lifecycle, providing value by establishing a platform for product innovation. The addition of Polarion ALM and the other Polarion solutions to the portfolio enables us to better address manufacturers' needs for integrating software tools, data and processes into the product lifecycle.

Siemens PLM Software supports an open, standards-based approach to product development and integration with applications and platform environments. Both Teamcenter and Polarion ALM are open environments, built on a unified foundation providing collaboration and traceability. This capability has been widely recognized by customers, and led Siemens PLM Software's Polarion ALM to become the sole ALM solution to be certified as compliant with the ISO 26262 standard for functional safety of automotive electronic systems by TüV.

The interoperability of PLM and ALM is an integral component of Siemens PLM Software's vision for systems-driven product development, a holistic approach to the development and delivery of today's complex products. Siemens PLM Software has the vision, the strategy and the roadmap for the implementation and delivery of systems-driven product development, an approach that leverages true ALM/PLM convergence and interoperability.

"This is an excellent opportunity for Siemens PLM to bridge the worlds of ALM and PLM: embedded software is critical to product operation today and PLM needs the maturity that ALM can offer in managing those software elements."

Michael Azoff
Principal Analyst
Ovum

Together, Teamcenter and Polarion ALM interoperability will deliver greater value, benefit, and capability by enabling product teams to work in a familiar context, trace relationships across domains, share data, validate designs, assess and respond quickly to changes, and consistently configure and streamline operations.

"Our team was searching for an ALM solution that could be integrated with our PLM system. In Siemens PLM Software we found much more than that. It has become the orchestra director of our hardware/software product development."

Siemens PLM approach to ALM/PLM interoperability

1. Create an open communication layer to link ALM and PLM tools, data and processes
2. Unify process support, collaboration, requirements, design, model, build, test and delivery processes and disciplines to simultaneously cover software and hardware.
3. Introduce a broader definition of bidirectional traceability to better show the impact of changes on all objects managed in either system.
4. Establish and manage an efficient closed-loop "Define-Model-Develop-Build-Test-Release-Maintain" process for continuous multi-domain delivery of software-intensive products.

User benefits of ALM/PLM interoperability

- Improved team collaboration on product specifications, requirements definition, design implementation, test case creation, system validation and project progress through more universal web and mobile device access.
- Improved visibility to software and hardware specifications that are not fulfilled or validated through unified traceability for requirements, software and hardware objects and test cases.
- Greater ability to assess the impact of changes to software and hardware, reasons driving the changes, and their status through unified version and change management.
- The ALM and PLM environments for the software and hardware product lifecycle are treated as a single logical toolset and discipline that enables the user to work in the environment and processes most familiar to them.

Company benefits of ALM/PLM interoperability

- Increased productivity by enabling engineers to work in their native environments while providing cross-domain visibility of requirements, design objects and processes
- Improved quality by intelligently assessing the impact of software and hardware dependencies and changes across the entire product
- Accelerated delivery by establishing an efficient closed-loop "Define-Model-Develop-Build-Test-Release" process for continuous multi-domain delivery

Achieving ALM/PLM interoperability

To achieve ALM/PLM interoperability requires:

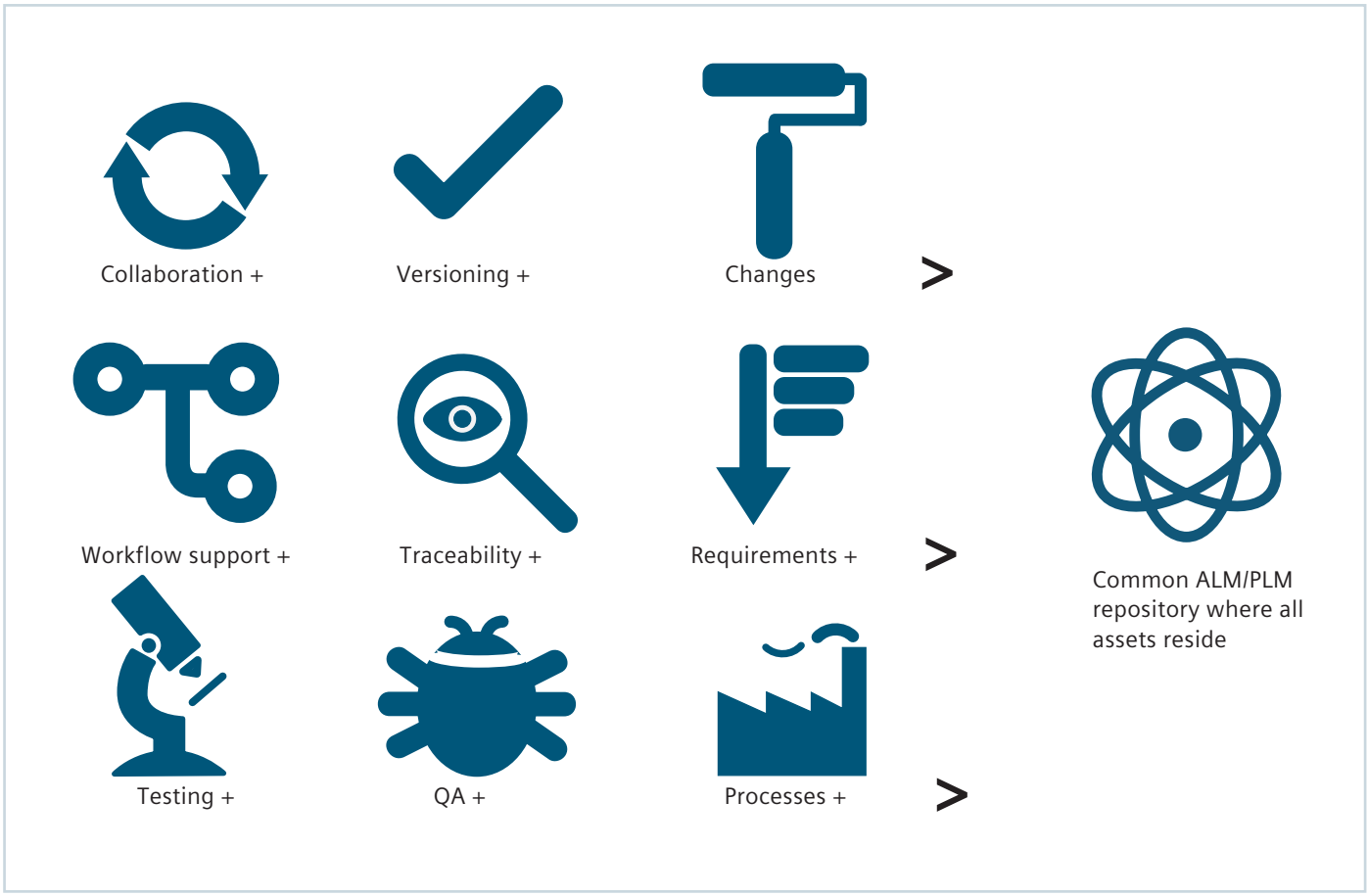
- A well-formulated roadmap that leads to the development of a single logical repository where PLM and ALM information can be accessed from either environment
- New communication mechanisms and common processes to manage product and software development, leveraging appropriate functionality for each discipline (that is, ALM work items, PLM parts/components)

The PLM environment:

- Leverage key practices such as traceability and change management processes supported within the ALM discipline
- Embrace iterative and Agile development processes to facilitate greater multidisciplinary engineering collaboration during various product design phases

The ALM environment:

- Employ industry standards to link PLM parts and components to ALM processes and work items
- Leverage open APIs to create integration points that bridge PLM and ALM functionality, creating a common logical repository



Summary

Software is increasingly overtaking hardware's traditional dominance in product development. This is particularly true for technologically sophisticated products (such as automotive vehicles, aircraft, medical devices and smartphones).

Product engineers need to actively seek out tools and product development methodologies that go beyond conventional approaches with standalone ALM or PLM systems. The answer will not be found in one overly complex solution that incorporates PLM and ALM functionality into one system. Just as software is a "component" of a product, ALM should be a domain "subsystem" of the PLM discipline. This connection will be achieved through true ALM/PLM interoperability creating an environment specifically designed to manage the development of software-intensive, technically complex products.

Engineers must seek out solutions such as Teamcenter and Polarion ALM that fully embrace a systems-driven approach to product development and leverage the interoperability of their ALM and PLM environments. They provide a solution that enables multidisciplinary collaboration – especially between hardware and software engineering counterparts – a solution that ensures end-to-end management of software components as well as hardware components.

The Teamcenter and Polarion ALM interoperability maintains reliable traceability across different product (hardware and software) versions, configurations and variants. In addition, as systems-driven product development is more widely embraced, the product development process becomes increasingly virtualized, and the entire process becomes increasingly iterative and incremental. Teamcenter and Polarion ALM's interoperability expands the definition of collaboration and traceability.

References

1. Open Services for Lifecycle Collaboration (OSLC), http://open-services.net/about/

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About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Digital Factory Division, is a leading global provider of product lifecycle management (PLM) and manufacturing operations management (MOM) software, systems and services with over 15 million licensed seats and more than 140,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with its customers to provide industry software solutions that help companies everywhere achieve a sustainable competitive advantage by making real the innovations that matter. For more information on Siemens PLM Software products and services, visit www.siemens.com/plm.

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