

Enterprise ALM Accelerates the Pace of Innovation

Key Takeaways

Modern virtual engineering ecosystems keep regulations and safety standards visible ensuring compliance throughout the complete lifecycle.

Concurrent, end to end requirements traceability ensures regulatory compliance and speeds development and upgrades.

PTC's Application Lifecycle Management (ALM) solutions enable end users to capture system requirements to drive design, analysis, and verification of multi-disciplinary system models.

PTC's enterprise ALM solution portfolio (codebeamer, pure::variants, Modeler, and RV&S) powers Model Based Systems Engineering (MBSE), Requirements Management (RM), Product Line Engineering (PLE), Variant Management (VM), Test Management (TM), and more.

VW and BMW have recently selected PTC for their broad ALM capabilities.

Introduction

CIMdata's definition of Product Lifecycle Management (PLM) emphasizes the complete lifecycle of a product and all its related data and processes, from idea inception to requirements definition, to planning and development, with supply chains, and then mass production and in-service performance and product upgrades. The embedded software within a product and any server-based software that complements it are managed in Application Lifecycle Management solutions. A comprehensive PLM environment contains ALM capabilities that support the complete product and all its features—many of which are enabled by both software and hardware. Integrated ALM has improved PLM environments by bolstering traceability across design elements, test results, and regulatory requirements.¹

Products have more internal software as well as being integrated with IT enterprise software which communicates (even controlling operational aspects) with products as they are used. Developing and enabling systems with embedded software requires the capabilities shown in Figure 1. While many of these capabilities are managed well in PLM, others benefit from a functional and logical view rather than

¹ Research for this paper was partially sponsored by PTC.

a structured BoM view, which is where requirements management solutions from ALM providers have developed leading edge solutions.



Figure 1—ALM Capabilities that Should Be in a PLM Platform
(Courtesy of PTC)

There are competitive benefits of having techniques and processes that allow exploration of candidate features that can be implemented in alternative ways. This enables conducting performance and behavioral assessments without expensive, slow to construct electro-mechanical prototypes. Virtual engineering’s promise is that systems algorithmic development has fewer and fewer prototype learning cycles as virtual builds and performance assessments become more trusted. This accelerates product development while improving safety and sustainability compliance. Software developers rely on ALM solutions to manage their virtual engineering ecosystem. As software is co-developed with electrical and mechanical product elements, both ALM and Product Data Management (PDM) are integral to the best PLM platforms.

ALM Technology Differentiation

Competitive and product complexity pressures require faster decisions made well. Systems engineering driven with proven models, aka MBSE, is a skill today’s engineers must embrace, regardless of their domain of expertise. Product requirements are best managed in a repository containing the authoritative truth that enables different views and analyses as product lines are conceived and enhanced. Modern PLM ecosystems, like PTC’s Windchill, need to include ALM capabilities across a product’s lifecycle.

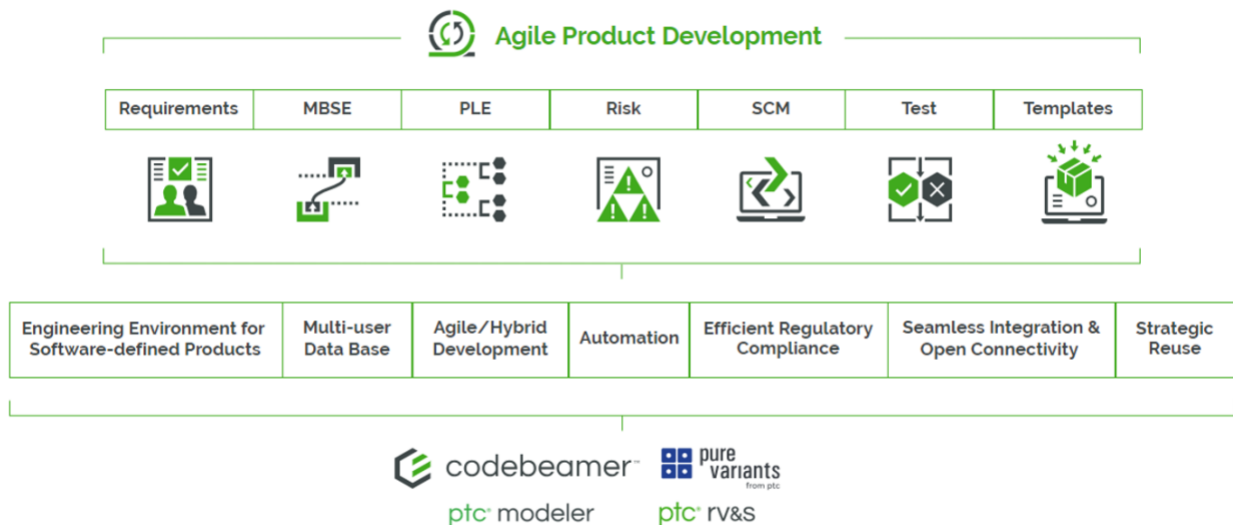


Figure 2—ALM Technology Differentiation
(Courtesy of PTC)

Agile development practices can apply to any engineering discipline, not just software. The techniques to manage feature requests and a backlog of work with wish-to-haves and mandatory requirements is typical of all product and component development. Strategy and efficiency come into play as engineers

plan a product line and reuse components across products. Figure 2 shows agile development capabilities, from requirements to MBSE to PLE to Risk Management to source code management (software’s PDM) to test management and templates. At the bottom of the image are tools that PTC has incorporated as they expand their ALM capabilities within their comprehensive PLM offerings to the marketplace.

PTC’s ALM Solution Suite

PTC has several ALM components, some developed and some acquired. Figure 3 lists them including a subtitle describing their purpose.

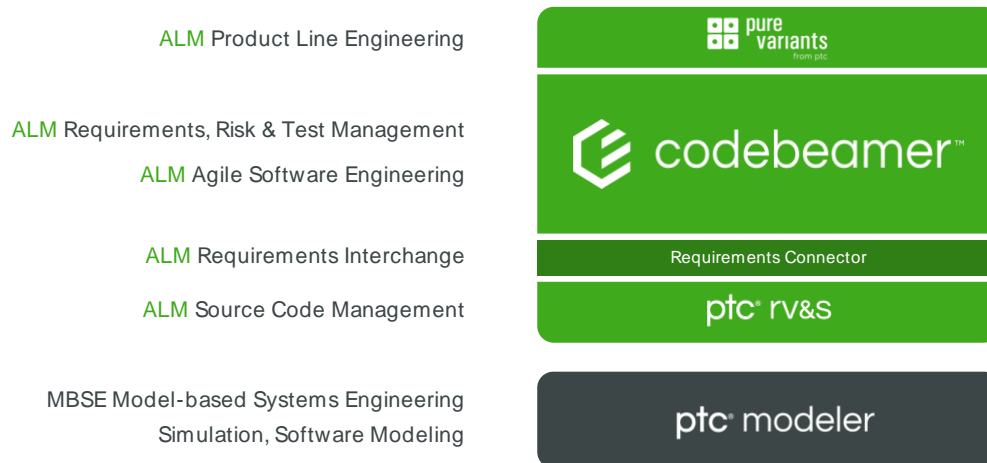


Figure 3—PTC ALM Solution Suite
(Courtesy of PTC)

Software developers like the ability of codebeamer to handle requirements and workflow with project management. Companies making large, complex products that include software need variant management for product planning (i.e., PLE) and test management (i.e., what tests to run as the feature set grows, enabling automated testing cycles). To meet these customer desires, PTC acquired MKS Integrity (in 2011), Atego (in 2013), Intland (in 2022), and pure-systems (in 2023).

During this journey, Integrity Modeler became Windchill Modeler and is now branded PTC Modeler, **the first SysML 2.0 solution for systems engineers**. Appropriately, PTC has organized PTC Modeler within the ALM domain where systems trade-offs are studied, and an expansion of software-controlled products happens in product development and upgrade operations.

PTC Invests in ALM Expansion and Integration

PTC continues to invest in ALM capabilities by addressing key innovation themes as described to CIMdata by Mr. Christoph Brauchle, PTC’s ALM SVP. They include: a modern, integrated, connected ALM suite delivering risk and test management; software engineering support with key source code management and pervasive systems like GitHub;² end to end traceability; strong agile development at scale, across all disciplines; enterprise-wide collaborative solutions; sharing and managing best practice templates; and variability management enabling strategic reuse. These innovations address the industry challenges their clients are facing today, including application scalability. An expansion of the systems and software engineering ecosystems is yielding significant organic growth, summarized in PTC’s business overview

² <https://github.com/>

shared with CIMdata. ALM capabilities and the adoption of agile practices across engineering disciplines is a contributing growth factor.

Integration of ALM capabilities into PLM is necessary and PTC is delivering. As they acquired companies like Inland and MKS they got OSLC capabilities that are now being used within Windchill. These are the synergies that CIMdata expects when acquisitions are made by a PLM provider. PTC's progress towards ALM and PLM integrations includes multi-discipline use cases, a strong partner ecosystem, and a continuing commitment to openness across the PTC digital thread. Figure 4 shows the breadth and variety of solution integrations PTC provides, building on the technologies acquired with *codebeamer* and *pure::variants*.

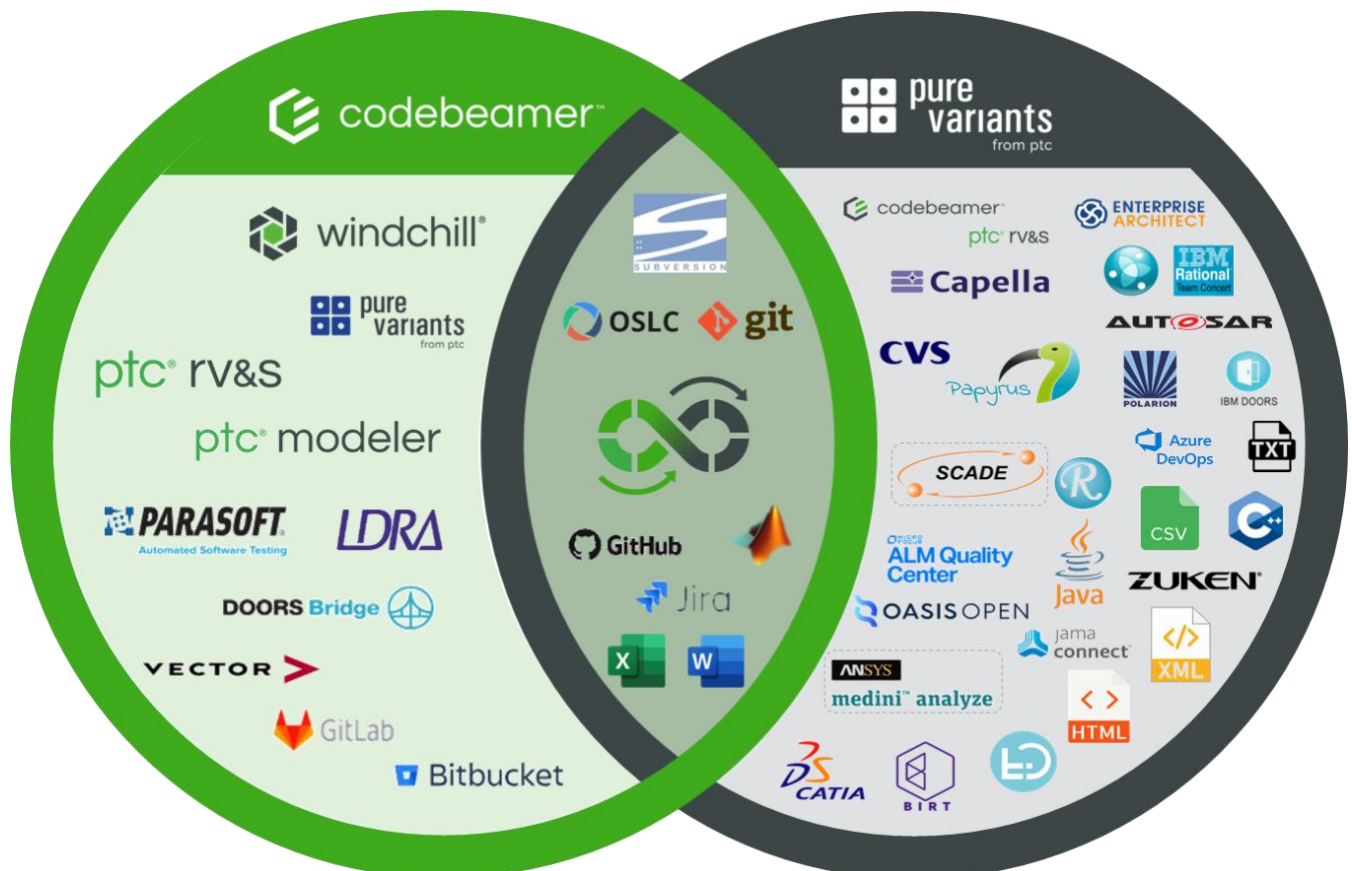


Figure 4—PTC ALM Acquisitions Bring Integrations Beyond Software and Architecture
(Courtesy of PTC)

At LiveWorks in May of 2023, PTC presented windchill+ and codebeamer cloud and SaaS roadmaps. PTC is enabling the digital thread across the enterprise and their products from inception (systems engineering) until end of useful life (upgrades and service). Using pure::variant to manage PLM platform configurations integrated with codebeamer as the ALM collaborative solution and their MBSE solution named PTC Modeler, PTC has the comprehensive engineering digital thread as OSLC³ is used to enable Windchill data exchanges. At the PLM Road Map & PDT 2023, held in Paris in late 2023, Mr. Hedley Apperly, PTC's ALM Product Leader, provided additional insights into the Windchill and codebeamer integration road map including for the first time the goals for pure::variants integration.

³ <https://open-services.net/>

Conclusion

As more and more product features are enabled by software elements, ALM capabilities like those provided by PTC solutions will be integral within the best PLM environments. In fact, ALM capabilities are one of the factors customers should be considering as they expand their PLM usage.

By combining the requirements and work management solution from codebeamer with a variants management solution, pure::variants, PTC has added the necessary ALM capabilities to their PLM ecosystem to help their clients enable complex product development and improve their pace of innovation.

Evidence of industry acceptance of PTC's strategy for ALM within PLM comes from [Volkswagen](#). They recently chose the PTC family of solutions for their systems and software organizations, as they compete in the growing software-defined vehicle market. By acquiring one of the fastest growing ALM ecosystems and integrating into their PLM platform, PTC continues to grow their business.

CIMdata recommends that companies include PTC in their evaluation and selection of ALM capabilities. PTC's are well integrated in the PLM ecosystem to address their multi-domain product and agile development needs.

About CIMdata

CIMdata, a global strategic management consulting firm, provides services designed to maximize an enterprise's ability to design, deliver, and support innovative products and services. For more than forty years, CIMdata has provided industrial organizations, providers of digital technologies and services, and investment firms with world-class insight, expertise, and best-practice methods on a broad set of product lifecycle management (PLM) topics and the digital transformation they enable. CIMdata also offers research, subscription services, publications, and education through certificate programs and international conferences. To learn more, visit www.CIMdata.com or email info@CIMdata.com.