

CIMdata®

CLOVER

An Advanced Digital Thread Platform

Key Takeaways

Digital transformation initiatives are driving manufacturers to create robust digital threads throughout their organizations.

Effective integration of product data requires a rare blend of skills in business and technology. Challenges include the high cost in technical expertise to configure and maintain integrations, the expansion of new systems, and adapting to internal processes.

Razorleaf has deep expertise in PLM and MES and offers the next generation of CLOVER—a complete solution for product data integration, enabling manufacturers to enhance their digital thread and maximize their business performance.

CLOVER is a low-code/no-code integration platform built on cloud-native technologies that make it scalable, adaptable, and secure.

Introduction

In today's rapidly changing product lifecycle landscape, companies face unprecedented challenges. Modern products are increasingly complex, integrating mechanical, electronic, and software components, significantly heightening challenges in design, production, supply chain management, and service. In this environment, the seamless exchange of product data is no longer optional, it's vital to success.¹

The Need for a Seamless Digital Thread

To navigate the complexities of the modern end-to-end product lifecycle, companies must foster better collaboration among engineering, manufacturing, supply chain, and service teams. Product Lifecycle Management (PLM) environments enable this coordination, promoting efficient creation and management of product data across all domains. However, to fully realize the benefits of PLM, a seamless digital thread—an integrated flow of data across the entire product lifecycle—is essential.

Deploying a digital thread, however, is no simple task. Companies often struggle with disconnected systems and processes that lead to manual data entry, resulting in errors and inefficiencies. Disparate systems across different domains, each with unique data models, complicate integration efforts. Legacy

¹ Research for this paper was partially supported by Razorleaf.

systems, which may lack modern APIs or have been heavily customized, further hinder connectivity and require costly integration work. Fragmented data silos across functions and geographies make it difficult to create a unified flow of information. Maintenance of these integrations also poses challenges as systems evolve, with poor architecture choices, causing delays, cascading dependencies, and security risks. Without a flexible and well-executed digital thread strategy, outdated processes hinder data sharing and collaboration, driving up costs, impacting quality, slowing time-to-market, and stifling innovation.

Critical Success Factors for Integrating Solutions

Through our extensive work with PLM and Digital Transformation strategies, CIMdata has identified critical success factors that industrial customers can use to evaluate and select the most appropriate integration service providers. Key factors include a focus on PLM and the digital transformation it enables; digital thread creation and sustainment; working with providers that have demonstrated PLM expertise; and seeking solutions that are cost-effective and fast to implement.

PLM and Digital Transformation

While many data integration tools are available, their focus is typically on managing simple pieces of information. These tools often lack the capabilities and expertise to manage the complex data structures and processes associated with product data without extensive coding and development. Industrial companies should prioritize solution providers that specialize in product data to deliver effective solutions within realistic timeframes.

Successful providers not only understand PLM but also the digital transformation it enables. They recognize the limitations of current approaches—such as reliance on spreadsheets, simple collaboration tools, and legacy systems—and they know how to transform these processes using PLM solutions.

Providers must employ an implementation methodology built on flexible, adaptable solutions that can evolve with changing business needs. In contrast, poorly executed approaches often lead to rigid, outdated systems that are challenging to maintain and update post-deployment.

Digital Thread Enablement

CIMdata recommends that as part of an enterprise PLM roadmap, companies define a digital thread strategy that includes resilient system integrations, which is essential for creating a connected enterprise. Comprehensive system integrations are critical to this strategy, enabling real-time decision-making, fostering innovation, and ensuring traceability, compliance, and efficiency across the product lifecycle.

Modern businesses must embrace the digital thread to remain competitive, innovative, and adaptive in an increasingly digital and data-centric environment. Seamlessly connecting systems, processes, and data has become essential for driving operational excellence and business growth.

Demonstrated PLM Expertise

The ability of a PLM integration provider to succeed often hinges on their technical understanding of PLM solutions. A small number of PLM solutions, such as Siemens Teamcenter, Dassault Systèmes ENOVIA, PTC Windchill, and Aras Innovator dominate the market. Providers must have deep expertise in these platforms, including their data models, configurability, and architectures. The providers with established relationships—formal or informal—with PLM solution providers benefit from advantages like specialized training, support, and direct insights. This expertise enables them to handle complex product data more effectively, ensuring seamless integrations tailored to meet the requirements of their industrial customers.

Many integration solutions began as toolkits that required significant customization by consultants. However, fully productized solutions now provide a better alternative. These solutions offer scalability, configurability, and upgradeability without requiring excessive reliance on the software provider or a third-party service provider for custom development and/or ongoing support. A productized solution typically includes comprehensive documentation, training materials, and proactive support that all have been designed to help companies maintain and extend the solution as needed. Extensibility is also critical, allowing customers to build niche solutions specifically to enable their digital thread without needing a provider to make changes. CIMdata recommends solutions built on native cloud low-code platforms, which offer the scalability, flexibility, and resilience required to meet the needs of today's modern enterprises. Productized solutions implemented by experienced consultants provide the predictability and robustness industrial organizations require.

Fast to Implement and Cost-Effective

Customers expect fast, cost-effective integration solutions, resulting in timely implementation at a competitive cost, both essential for satisfaction and a strong return on investment (ROI). Successful integration providers leverage their experience to scope projects accurately, streamline implementations, and deliver value-driven results. Striking the right balance between speed, cost, and capability is key to unlocking the benefits of a robust digital thread implementation.

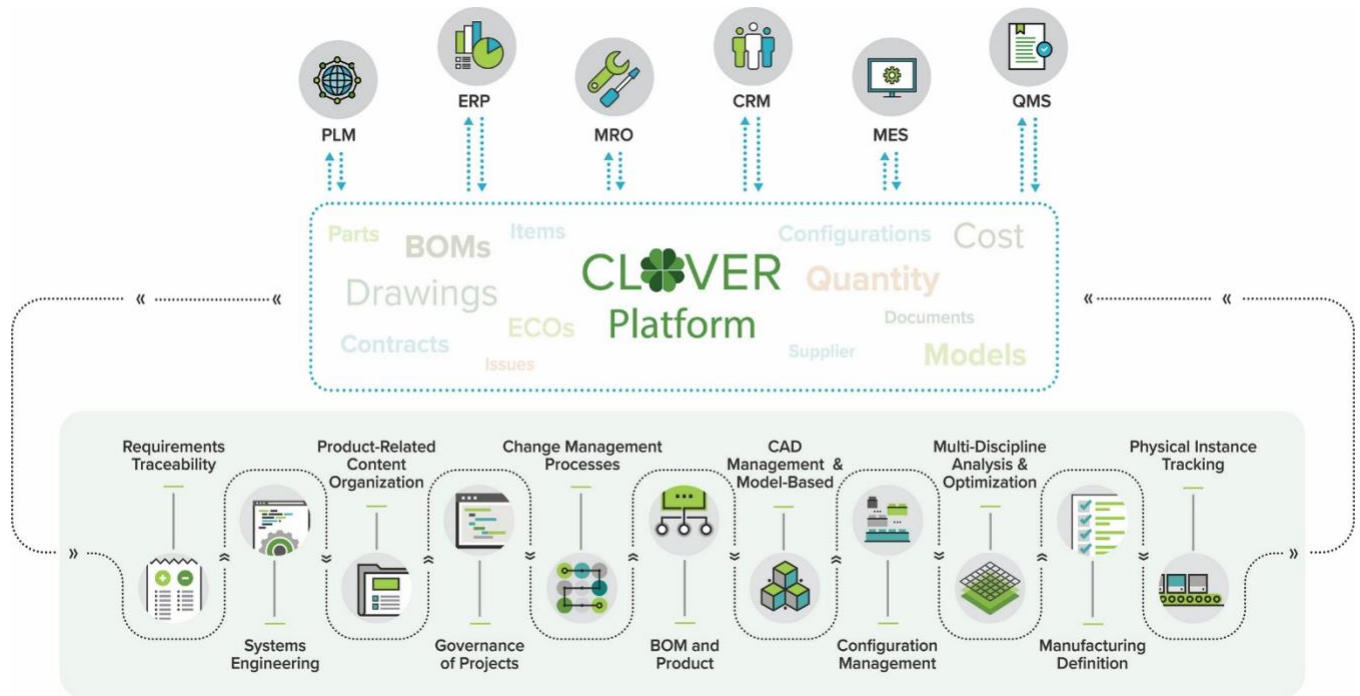
Razorleaf CLOVER: Integrating PLM Data Across a Digital Thread

Razorleaf's CLOVER integration platform is an advanced solution designed to integrate PLM solutions with other enterprise applications, such as ERP, MES, CRM, IAM (Identity and Access Management), SIEM (Security Information and Event Management), and UBA (User Behavior Analytics). CLOVER is a cloud-native, low-code integration platform that enables companies to build and scale their digital thread by seamlessly connecting processes and their supporting systems and domains throughout the product lifecycle. Through standardized APIs and prebuilt workflows, CLOVER provides a flexible and robust framework for data exchange. It is fully extensible, allowing customers to create custom plugins for unique processes, business rules, and additional data sources.

Built on a cloud-native architecture with a microservices foundation, CLOVER delivers flexibility, scalability, and resilience. The platform's microservices architecture ensures that components can be independently developed, deployed, and scaled according to a company's changing business requirements. This modular approach also enables Razorleaf to release new features quickly with low disruption to existing implementations, improving time-to-market for customers. CLOVER is technology-agnostic and enhances reliability by isolating potential failures to specific services, minimizing system-wide disruptions. The platform is containerized using Docker, compatible with Windows and Linux environments, and can be deployed in the cloud, on-premises, within an air-gapped environment, as well as in hybrid configurations.

CLOVER offers a range of innovative features that simplify and enhance integration activities. See the figure for an overview of its capabilities. Unlike many traditional integration platforms, CLOVER is a low-code/no-code solution, enabling customers to implement customizations and configure endpoints without relying on external support. Its extensible data schema services and plugins reduce deployment times, while flexible job scheduling ensures that resource-intensive tasks can be run during off-hours to avoid disruptions. CLOVER includes job queuing and issue-handling capabilities, ensuring reliable job completion. Additionally, CLOVER integrates a modern security framework that encrypts all data in transit and at rest, ensuring a high level of data protection.

CLOVER’s capabilities extend to managing a wide variety of product data and processes, including parts, BOMs, documents, files, CAD data, product change management, quality management, project management, approved vendor lists, and inventory management. The platform’s extensive library of endpoint integration connectors and plugins further supports seamless integration with diverse enterprise systems, making it a comprehensive solution for digital thread enablement.



The Clover Platform and its Capabilities

The CLOVER platform offers a straightforward licensing model tailored to various customer needs. Available in Basic, Standard, Professional, and Enterprise tiers, each license includes help desk support, upgrades, and patches. The tiers also provide different levels of endpoint integration and come with pre-configured digital patterns for managing product data and processes. This approach ensures customers can start using CLOVER quickly and scale their usage as their requirements grow.

Razorleaf Background

Razorleaf is a PLM-focused systems integrator that helps companies leverage digital technologies to bring products to market faster and more effectively. By focusing on connecting products, data, and processes across the enterprise, Razorleaf enables clients to drive business value through digital transformation. Since its founding in 2000, Razorleaf has grown into a global organization with over 1,500 customers, Razorleaf specializes in implementing and integrating PLM solutions from leading providers such as Aras, Autodesk, Dassault Systèmes, PTC, and Siemens, as well as other enterprise software platforms.

Conclusion

Digital transformation initiatives are driving manufacturers to create robust digital threads enabling seamless data flow and collaboration throughout the end-to-end product lifecycle. Achieving this vision requires the effective integration of PLM data and the processes by which it is created, managed, and used—a process that demands a rare blend of business and technical expertise. Manufacturers often face significant challenges, including the high cost of maintaining integrations, adapting to evolving internal processes, and incorporating new systems into existing infrastructures.

Razorleaf offers a comprehensive solution to these challenges with the next generation of CLOVER—a robust platform for product data integration. With deep expertise in PLM, Razorleaf has designed CLOVER to empower manufacturers to enable and enhance their digital threads and maximize business performance. CLOVER provides a solution that integrates critical systems while maintaining the integrity and context of product data. CLOVER is a low-code/no-code integration platform built on cloud-native technologies.

CIMdata is impressed with CLOVER’s modern architecture that ensures scalability, adaptability, and robust security, making it a strong choice for manufacturers looking to support their digital transformation goals. CIMdata recommends that companies looking to overcome their integration challenges and unlock the full potential of their digital transformation initiatives, consider CLOVER in their evaluation.

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.