Image courtesy of Siemens

CIMdata eBook

Sponsored by Siemens Digital Industries Software

Creating a Flexible, Open, Lifecycle Value Chain

Siemens Xcelerator – A solution portfolio for the extended enterprise

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Takeaways

What you need to know

Takeaway #1
Evolution is necessary for survival—today's complex, smart, connected products require manufacturers to digitally evolve within the context of their extended enterprise ecosystem.

Takeaway #2
Successful enterprises will turn complexity management into a competitive advantage.

Takeaway #3
Companies need to establish an enterprise manufacturing platform that spans development, manufacturing, and service.

Takeaway #4
Siemens' Xcelerator™ portfolio delivers a comprehensive example of what CIMdata defines as a Manufacturing Enterprise Innovation Platform required by companies to enable a digital enterprise of the future, today.

Image courtesy of Siemens

Introduction

Manufacturers face increasing complexity at every level

Manufacturing enterprises in every industry are working in complex, fast changing times. They are being challenged to develop more personalized, complex, smarter, and more eco-friendly products in an increasingly difficult economic climate. They must compete for customers who want what they want and who demand more highly configurable products while meeting or exceeding government regulations.

Today's products continue to become more complex, smarter, more capable, and more connected. They often operate autonomously and are frequently part of a system of systems. Software and electronics increasingly drive product functionality and differentiation. This is also reflected beyond the product, with more intelligent production environments and connected in-service operations. With increased product configurability, due to demand for personalization and the need to serve markets of one, comes increased complexity in design, manufacturing, and service, often resulting in further added costs and inefficiencies.

Additionally, products are increasingly sold "as a service" and require actionable, robust digital twin bi-directional connectivity to the systems and/or parties responsible for their upkeep and operations.

To be successful, manufacturers must turn complexity into a competitive advantage. This requires them to:

- Find ways to quickly introduce new, personalized, complex products and variants.
- Continuously improve and innovate their manufacturing processes and associated supporting environments.
- Achieve the expected quality and operational efficiencies no matter where or at what volume their products are produced.
- Turn service into a business model, not just a maintenance and warranty activity.
- Quickly and effectively deal with change in product, production, and service as well as customer demands and expectations.

Competitive manufacturers need fully integrated information flows and processes that are highly flexible and can easily and quickly adapt to product and market changes. Implementing integrated extended enterprise value chains built on open ecosystems helps achieve faster ramp-up to production, reduced time to market, and better adaptation to changes in global and local markets. Companies also need improved collaboration in planning and scheduling that starts earlier during product engineering instead of later when the design is released and transferred to manufacturing. And they must leverage and re-use corporate IP, expertise, and lessons learned while complying with stricter company standards and all applicable regulations.

To successfully meet these challenges, many companies are implementing a Manufacturing Enterprise Innovation Platform (MEIP) that enables them to create an extended enterprise (value chain) lifecycle digital thread, as well as comprehensive and actionable digital twins.

Image courtesy of Siemens

Manufacturing Enterprise Innovation Platform

Solving the larger problems in manufacturing

A Manufacturing Enterprise Innovation Platform* is a specific configuration of domain-specific innovation platforms designed to enable and optimize an enterprise's end-to-end and complete set of lifecycle activities. It builds on the Product Innovation Platform as a foundation to deliver a suite of integrated business solutions and applications that support product development, sales and marketing, manufacturing operations, and product service and support in close concert. It makes technical knowledge available to the business domains of the enterprise and creates an actionable environment based on clear, concise, and valid data.

A MEIP requires deep integration and understanding of business, industry, and domain-specific processes to eliminate the boundaries between technical and administrative functions. With such a platform, individuals, organizations, and enterprises can harness and leverage the power of data across multiple innovation platforms.

A MEIP enables an enterprise's complete, end-to-end digital thread and a comprehensive set of appropriate digital twins. It helps manufacturers establish seamless integration and closed-loop feedback between the Product Innovation Platform** and the other domain-specific platforms that are part of the MEIP.

A **Product Innovation Platform** is a set of functional domains—process, lifecycle stages, and technical domains such as system ideation, profitability management, and quality and compliance, that support all product related disciplines and users through the complete lifecycle. These are orchestrated using a "system of systems" approach that, in essence, enables the innovation environment needed to develop, produce, and service products. An effective Product Innovation Platform enables optimization across the multiple lifecycle domains while ensuring configuration integrity from a product's conception throughout its entire life.

Important capabilities of a MEIP above-and-beyond those native to the Product Innovation Platform include the ability to:

- Create and validate digital product and process models across all relevant functional domains and disciplines.
- Provide fully managed information access across all relevant functional domains and disciplines—well beyond product development.
- Develop technology-based tactics to improve business operations.
- Manage and collaborate with suppliers and perform strategic sourcing activities.
- Forecast, plan, schedule, execute, track, and measure the resources, components, and equipment required to manufacture and/or service a part, component, or full product.
- Support a comprehensive portfolio and end-to-end lifecycle profitability management.
- Support customer management and interaction.

These capabilities contribute to creating the actionable, flexible, and agile environment needed by manufacturers to easily and rapidly adapt to changes in the market and their business. A key factor in establishing such an environment is establishing an open, adaptable ecosystem that integrates with different applications spanning the extended enterprise value chain.

* https://www.cimdata.com/en/news/item/13796-cimdata-publishes-an-enterprise-innovation-platform-for-manufacturers
**https://www.cimdata.com/en/resources/complimentary-reports-research/position-papers/item/8484-product-innovation-platforms-definition-their-role-in-the-enterprise-and-their-long-term-viability-position-paper

Delivering for the Enterprise

Siemens—Enabling digital transformation for manufacturers in all industries

Founded more than 170 years ago, Siemens AG is a global enterprise comprised of three operating companies focusing on the areas of electrification, automation, and digitalization. Siemens AG is a leading supplier of systems for power generation and transmission, as well as medical diagnosis, and has been a pioneer in the development of infrastructure and industry solutions. Siemens AG's vision is to enable, participate in, and in some cases orchestrate value chain ecosystems and enable their customers to successfully undergo the digital transformation critical to future success. They do so via industry specific approaches based on core technologies that enable open, interactive ecosystems with partners in the outside world delivering better integration of the industrial value chain. As a leading innovator, Siemens AG is averaging more than 33 inventions/patents per day.

Driving these digital transformation solutions is the Siemens Digital Industries Software (Siemens) business unit of the Siemens Digital Industries operating company. Initially built on Siemens AG's acquisition of UGS PLM Software in 2007, Siemens has grown significantly, augmented by over $14 billion in external acquisitions, significant internal R&D (from multiple Siemens AG operating companies), as well as corporate alignment of other Siemens AG business units, to be a leading player in the global PLM market. Siemens has been a leader in developing multi-domain solutions for many years with a commitment to both research and development tools, such as CAD, simulation and analysis, and manufacturing, including process planning, MOM, and digital manufacturing.

Complementing these solutions, Siemens AG developed MindSphere®, a leading industrial IoT-as-a-service solution. Siemens acquired the Mendix™ platform, a cloud-native, low-code application development and integration platform. They have invested in, and integrated with, solutions that span the mechanical, electrical/electronic, and software domains of products, as well as technologies and solutions for creating and connecting smarter products and systems. The use of Siemens solutions within the various Siemens AG business units is extensive—comprising a major in-house customer, if you will. These operating units are often beta users of Siemens solutions and provide excellent examples of how that software delivers value and results to a complex commercial business.

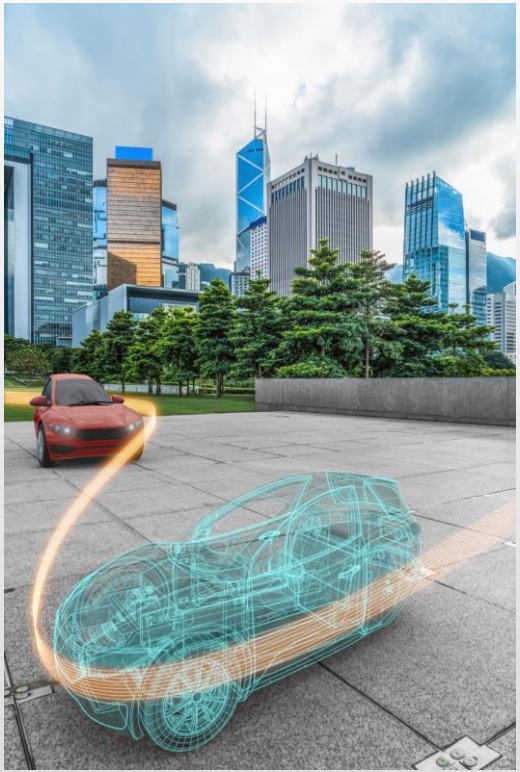

Image courtesy of Siemens

Protecting Customer Investments

Siemens works to future-proof its customers' PLM investments

Throughout the years, Siemens has focused on ensuring that their customers can move forward in technology and process enablement with minimum disruption and maximum leverage on their investments in Siemens solutions. Siemens is building their solutions on four technology-focused cornerstones that create a future-proof architecture designed to best support evolution while minimizing the total cost of ownership. These are:

- Open—Enterprise solutions need to use open standards and protocols so that information from any source can be shared and reused across the entire enterprise without losing fidelity.
- Scalable—Enterprise solutions must be scalable for all levels of product complexity and volume, and any size user base while also providing the performance needed for maximum user efficiency.
- Compatible—Enterprise solutions must be compatible with a broad range of technologies and support all types of IT platforms and operating environments.
- Configurable—Deployments need to be easily configured so that they can be adapted to both a dynamic business environment and changing enterprise needs.

Examples of Siemens' future-proof investment protection strategy are:

- CAD models created during the early 1980s on Siemens software will open successfully on the latest release of Siemens NX and preserve all knowledge embedded within the model.
- Teamcenter X, a fully featured cloud-native implementation of Teamcenter allows customers to migrate from on-premise Teamcenter to cloud-based Teamcenter X at any time, at any pace while maintaining their full Teamcenter capabilities.
- MindSphere is available on multiple cloud platforms – AWS, Azure, Alibaba Cloud – enabling customers to select and/or migrate to their infrastructure platform of choice.

Image courtesy of Siemens

Siemens Xcelerator Portfolio

Beyond data and process management

Xcelerator,* from Siemens Digital Industries Software, is a comprehensive, integrated portfolio of software solutions, services and a development/integration platform. Its application development platform provides a robust foundation for collaborative R&D, development, and manufacturing and acts as a catalyst to a manufacturing enterprise's digital transformation. Xcelerator provides solutions to:

- Collaborate in the design, manufacture, and operation of products and processes across discrete and process industries.
- Create and manage partner networks that span all of a value chain's participants.
- Connect smart devices and systems across operational and IT system environments.

Xcelerator is designed to help businesses leverage complexity as a competitive advantage and quickly transform themselves into digital enterprises. Key business imperatives supported by the portfolio include:

- Comprehensive digital twin comprising a network of information from product design, manufacturing, and in-field utilization data, enabling cross-domain engineering, virtual validation, and continuous product and process improvement through a closed-loop feedback system.
- Personalized and adaptable solutions that adapt to each manufacturers' digital roadmap and unique requirements. Personalization scales from the enterprise to the individual so each user can tailor solutions to optimize the functions they use to support their daily tasks.
- Open and modern ecosystem so manufacturers can adapt as technologies and business strategies evolve. Companies can access and incorporate best-of-breed solutions from Siemens and other solution and tool providers.

Key to the portfolio are three levels of application and device connectivity for IT flexibility and adaptability: cloud, on-premises, and edge. Xcelerator's authoring applications enable domain experts to make actionable, data-driven product and process decisions based on performance analytics and simulations independent of data source—creating a closed-loop data environment of sense-decide-act.

* https://sw.siemens.com/portfolio

Image courtesy of Siemens

Xcelerator Supports the Extended Enterprise

Solutions and integration tools enable full lifecycle management

Siemens continues to aggressively fill out their vision of providing a comprehensive, integrated portfolio of solutions (including third party partnerships) to address all aspects of the extended product lifecycle. Xcelerator provides the capabilities a business requires to configure and deploy a company-specific MEIP. In addition, the portfolio is designed to reduce barriers to innovation and enable manufacturing companies to become digital enterprises by leveraging today's, as well as tomorrow's anticipated transformational technologies and initiatives, such as generative engineering, additive manufacturing, Industry 4.0, and autonomous operation.

Xcelerator's integration and application platform tools enable enterprises to blur the boundaries of traditional stand-alone domains of electrical engineering, mechanical design, and software development by integrating them within a single collaborative environment.

Xcelerator thus forms the software basis of a customer's fully connected digital enterprise by enabling and linking:

- Key enterprise intellectual and physical assets like intellectual property, factories and products, operations, and service resources.
- Relevant product lifecycle domains such as design, engineering, simulation, test, manufacturing, application development, and service.
- Previously siloed technical disciplines such as semiconductors, microelectronics, PCB, wire harness, mechanical, software, simulation and analysis, recipe and formulation, and systems engineering.
- Enterprise data and formerly siloed IT systems such as CAD, EDA, ERP, PLM, CRM, and MOM.

Siemens recognizes that it (and no single solution vendor) can provide every application or solution that a customer may need. While they continue to expand their solution portfolio and capabilities for all their target markets, they also provide excellent tools for integrating with non-Siemens solutions, license core technology such as Parasolid to third parties (including competitors), and are establishing partnerships with third parties (e.g., IBM, SAP) to address additional business-specific capabilities.

Image courtesy of Siemens

Diving into Xcelerator

A portfolio of broad and deep capabilities

Siemens strategy to preserve and enhance their customers' investments in data and technology has been the foundation for continuous innovation from one generation of their solutions to the next. Xcelerator is the latest evolution in Siemens' digital transformation portfolio and with its depth and breadth, represents a significant step forward in that journey.

Xcelerator solutions are adaptable to each company's needs and are designed to be personalized down to the individual user. This means that solutions such as Teamcenter and MindSphere apps can be rightsized for a company's requirements. Startups have very different requirements from established multi-national companies—the solution flexibility allows both simple and complex processes to be configured and performance scaled as the user population grows from an individual to large, global multi-disciplinary teams. Mendix enables personalization at all levels, apps can be easily built to support individuals, workgroups, and at the enterprise level. As an example of individual productivity support, Siemens uses artificial intelligence to enable the command-predictive adaptive user interface in the latest releases of NX and Teamcenter X.

A key example of this strategy is Teamcenter X, the latest evolution of the Teamcenter product suite. It is a modern, fully-functional, cloud-native, software-as-a-service implementation of Teamcenter. Teamcenter X is built using cloud native micro-services and leverages Mendix for application development, personalization, and integration. Being a cloud-native implementation, Teamcenter X enables instant-on deployment, the ability to grow on demand, and strong security for IP protection. Further, as a SaaS solution, it is maintained and kept current by Siemens SaaS Operations.

Teamcenter X cloud services are built to scale as needed, and are used for critical PLM components, including database and storage. This cloud-native service architecture enables Teamcenter X to scale to any required size while continuing to deliver the up-to-date and always-available fast performance demanded by today's users. It is important to note that Teamcenter X is Teamcenter—all the modern advancements made for Teamcenter X are made for all Teamcenter customers, on-premises and on-cloud.

Image courtesy of Siemens

Expanding Xcelerator

Enabling companies to easily integrate and connect their enterprise

Siemens is evolving many of their applications and solutions to be cloud-native/compatible and micro-service based. Recently announced microservices include visualization, sketcher, and configurator products. Each of these microservices is used in multiple products including NX, Teamcenter, and Capital.

Mendix is used to:

- Tie microservices together across the portfolio of solutions.
- Support rapid application development across enterprise and cloud solutions.
- Deliver solutions over multiple types of devices, e.g., smartphone, tablet, laptop, desktop, etc.

Adaptors exist for most enterprise software solutions and the entire Xcelerator portfolio designed so all its services can be consumed by Mendix apps. Mendix enables developers, business analysts, and power users to rapidly create and deploy company-unique multi-experience composite applications across their extended enterprise ecosystem.

MindSphere supports IoT, connected, smart devices, and the factory floor. It leverages Siemens AG's deep experience in factory automation to provide connectivity to data and analytics services needed to close the loop. MindSphere Analyze and Predict provides solutions that enable manufacturers to use integrated data sets and modern data analysis to derive deep, predictive insights about asset health and performance. It supports edge-thru-cloud model management and incorporates predictive learning.

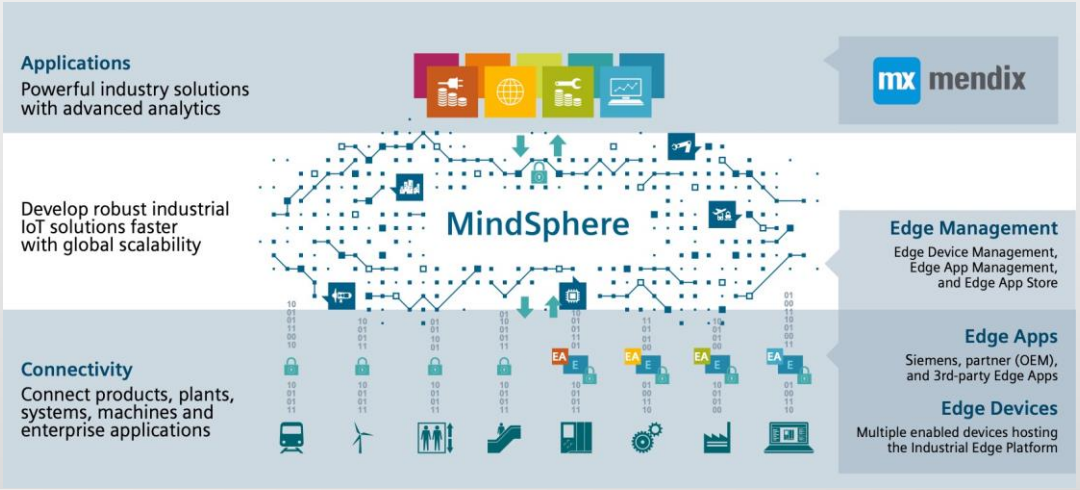

Image courtesy of Siemens

Covering the Full Lifecycle

Xcelerator provides solutions across multiple functional domains

End-to-End extended enterprise support is much more than just transferring BOM items from product development to manufacturing. Customers buy and use products not items. Modern products consist of items (e.g., parts and subsystems) created by many domains including mechanical, electronic, and software and often have interdependencies across domains. Siemens investments in organic development, acquisition, and integration have put many of the domains needed to create complex products under one roof. Examples of their acquisitions in technology and applications to enable multi-domain solutions include Mentor (electronics), Polarian (software), LMS and CD-adapco (simulation, test, and analysis), and Mendix (low code development and integration platform). They have also established relationships with other technology and solution providers to extend the reach of their solution portfolio.

Siemens and SAP recently announced a strategic relationship designed to drive industrial transformation and digitalization in support of Industry 4.0. These two industry leaders are combining their expertise in PLM, supply chain management, project and portfolio management, and asset management to deliver new innovations and business models that will enable their customers to remove process and information silos as well as accelerate industrial transformation. The objectives of this relationship are to offer pre-configured solutions that:

- Create a comprehensive digital thread throughout the complete lifecycle.
- Enable enterprises to deploy a sustainable and closed-loop development process.
- Fuel the design of products with real-time supply chain connectivity and in-use feedback.
- Dramatically improve time-to-value for both customer bases.

Manufacturing is expensive and increasingly complex. The investment required to develop complex, personalized, and/or high-volume products is sizable. Manufacturing companies need to be innovative and financially predictable to win in the market, so they need technology environments that are stable and predictable yet enable innovation while rapidly adapting to changing market and business requirements. Siemens has effectively blended their historical industrial focus and, more recently, their software-based businesses to create the Xcelerator portfolio of solutions that address the needs of today's manufacturing enterprises.

Xcelerator is a broad, deep solution portfolio that enables customers to begin their digital transformation journey wherever it is most pertinent to their individual business needs. By continuously enhancing and improving its portfolio of solutions using an open ecosystem, platform approach, Siemens is enabling their customers to maintain their competitiveness in today's global markets.

Image courtesy of Siemens

Xcelerator Case Study

VinFast: From Automobiles and Cell Phones to Ventilators in a Month

VinFast, a Vietnamese conglomerate known to be decisive and fast moving, has used Siemens Xcelerator portfolio solutions to quickly transition some of their manufacturing capabilities to produce ventilators based on the design that Medtronic released to the public.

Siemens and VinFast have an intriguing partnership. Initially, Siemens helped VinFast develop an automotive design and production facility in fewer than two years, an astounding achievement. VinFast used Siemens' Xcelerator portfolio to create digital twins of both the automobiles and the production facility. The fully digital process enabled VinFast to meet their aggressive targets.

With the help of Siemens Xcelerator solutions, VinFast automotive engineers were able to reconfigure a cell phone and TV panel production system into one that produces ventilators in less than a month. Since a ventilator has a lot in common with an automotive HVAC system, their manufacturing digital twin enabled virtual prototyping and virtual commissioning allowing engineers to quickly consume the Medtronic design and transform it into ventilators.

Image courtesy of Siemens

Conclusion

Siemens Xcelerator, a comprehensive solution suite for enabling manufacturing enterprises

Effectively dealing with change is necessary for survival—today's complex, smart, connected products require manufacturers to evolve their businesses, as well as enhance and accelerate their digital transformation throughout their extended enterprise ecosystems. The successful enterprises will be those that turn complexity management into their competitive advantage. To do so, they need to establish a MEIP that spans development, manufacturing, and service, as well as create and manage an open value chain ecosystem.

Siemens AG's digital enterprise vision for its customers extends the traditional product view of the lifecycle to a full, end-to-end inter-enterprise view. Xcelerator, from Siemens Digital Industries Software, is a comprehensive, integrated suite of software and services. Its application development platform provides the foundation for collaborative manufacturing and enables a manufacturing enterprise's digital transformation.

CIMdata believes that the Xcelerator portfolio provides the breadth and depth that manufacturing enterprises need to create a comprehensive, actionable digital twin and manage the complete product lifecycle from creation through production and service across a heterogenous value chain. Enterprises facing today's complexity challenges should include Siemens Digital Industries Software's Xcelerator portfolio in their evaluation of solutions for implementing a flexible, adaptable, open manufacturing environment and support their digital transformation process.

Image courtesy of Siemens

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