Powering the Cloud Journey:
Siemens and AWS

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Abstract

Siemens Digital Industries Software (Siemens) and Amazon Web Services, Inc. (AWS) have expanded their strategic collaboration to help industrial companies accelerate their digital transformation in the AWS Cloud. AWS and Siemens offer numerous SaaS solutions based on the collaboration between AWS Cloud expertise and the Siemens Xcelerator digital business platform which enables customers to accelerate their digital transformation easier, faster, and at scale. The powerful Siemens and AWS partnership drives faster and more predictable digital transformation with new manufacturing insights, automated processes, and operational excellence helping customers of all sizes realize their digital journey.

Key Takeaways

- Adoption of and migration to the cloud will continue to be a major focus of industrial organizations of all sizes.
- Industrial organizations that are digitally transforming require trust, support, security, scalability options, and a broad range of cloud-based technologies and functional solutions.
- Companies and organizations that do not undergo their own version of digital transformation will be at a serious disadvantage in the marketplace.
- The shift to more distributed and remote work has made rapid access and complete connectivity to an organization's data, processes, and applications fundamental to successful digital transformation.
- Global availability, speed, and ease of remote access for distributed workers, reduction in IT and infrastructure costs, and modernization of legacy IT systems are all major drivers to move to the cloud.
- The combination of the Siemens Xcelerator open digital business platform and AWS enables industrial organizations to achieve technical innovation and increase the speed of their digital transformation more rapidly.

Introduction

The expanded collaboration between Siemens Digital Industries Software and AWS has created a highly productive cloud-based environment offering state-of-the-art computing services, software, and support. SaaS offerings available from the Siemens Xcelerator open digital business platform, powered by AWS, enable companies of all sizes to achieve their digital transformation with increased flexibility, scalability, and accessibility—all critical factors to success.[1]

The expanded partnership between two industry leaders is eliminating barriers to enable deeper cloud adoption. In a recent independent survey, 97 percent of the 2,833 respondents cited cloud migration and adoption as a top, or emerging, priority for their organization.[2]

Companies digitally transforming using the cloud require trust, technical support, data security, scalability, reduced risk, and a broad range of technologies and solutions. Siemens SaaS solutions delivered via AWS enable a distributed remote work environment with rapid access and connectivity to their organization's data, applications, and processes.

Reluctance to Cloud-Based Computing

Over the past few years, CIMdata has conducted multiple multi-sponsor collaborative research projects on the use of cloud-based solutions to enable product lifecycle management (PLM) strategies and processes in industrial companies. At the time of the initial project, it was clear there was a reluctance on the part of some organizations to migrate their PLM environment to cloud delivery when compared to other enterprise applications such as customer relationship management (CRM), manufacturing execution systems (MES), or enterprise resource planning (ERP).

Security Issues—A Top Concern

In that initial research, many organizations responded that a major obstacle to cloud adoption was security. Respondents felt they would be giving up control of their most valuable assets—their intellectual property (IP). Cyber security threats were, and are, rampant, so the perception was that data maintained behind an organization's firewalls was more secure than data stored in a Web-based service such as AWS. Along with security concerns, many organizations had to abide by government regulatory restrictions, such as the United States State Department's International Traffic in Arms Regulations (ITAR), which is used to control sensitive items in the defense industry. The prevailing thinking was that data in a vault, on-premises, controlled by the organization was the safer option. The same could be said for data and processes in heavily regulated industries, e.g., medical devices, where changing PLM-related processes such as FDA process validation and approval might cause delays to their business operation.

Larger global organizations with a distributed work force were especially conservative in their approach even though many struggled with global accessibility, whether it was bandwidth, security issues, or remote access for their employees, contractors, and customers. Companies also had to be able to conform to regional regulations, such as the General Data Protection Regulation (GDPR), which is a security and privacy law protecting personal information in the European Union (EU).

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[1] Research for this whitepaper was partially supported by Siemens Digital Industries Software
[2] Source: Siemens and AWS Benchmark Collaboration Study, June 2023, conducted by Channel Media & Market Research

Migrating On-Premises Applications

Another barrier preventing companies from migrating their PLM solutions to the cloud was the complexity of their on-premises applications, data, processes, and the many integrations they had created between their business applications. Over time, companies developed and deployed legacy applications and unique processes that spanned across organizational boundaries. Oftentimes this was the result of mergers and acquisitions, reorganizations, and the proliferation of home-grown applications. The cost to support highly diverse on-premises IT infrastructure steadily increased, taking a continually larger portion of the IT budget. The time, cost, and disruption to the business of migrating all of this to the cloud seemed overwhelming to many in leadership roles. The shift to distributing work and adopting the cloud reduces the need for on-premises servers, which are expensive to purchase or upgrade and time consuming to maintain.

Almost every company has highly tailored and/or customized software that makes up their PLM solution. The perception of a cloud-based SaaS PLM offering was that it would have to run "out-of-the-box" with no unique tailoring or customization allowed. Companies were concerned that they would lose the efficiencies gained with their customized on-premises applications and that would negatively impact processes critical to their business. Organizations that shift their PLM to the cloud also reduce their legacy technical debt.

Lack of IT Expertise

Another challenge dealt with applications that were either not cloud-enabled or had performance concerns, specifically around the bandwidth required to efficiently access large files, such as CAD or simulation models. It was not clear to company leadership how a hybrid model could or would work.

Many companies lacked IT staff that were cloud knowledgeable. As a result, they had concerns over lack of systems performance and availability and questioned whether a cloud provider would live up to an acceptable Service Level Agreement (SLA). Deployment options and associated costs were also often viewed as confusing. Another underlying concern was the fear of data lock-in to the cloud PLM solution.

Adoption of Cloud PLM

While cloud adoption was historically slower with PLM compared to other enterprise applications, CIMdata does not see anything different about PLM software on the cloud versus other enterprise applications. PLM spans the entire product lifecycle and often demands complex integrations across organizational boundaries. In CIMdata's view, this likely caused industrial organizations to move at a more conservative cloud adoption pace. The results of CIMdata's research indicated that, while PLM cloud adoption had been slow in the past, with only 16 percent of respondents using cloud-based PLM, even though 80 percent were using one or more other cloud-based solutions within their enterprise, it was poised to see significant growth over the next few years.

Adoption and migration to the cloud will continue to be a major focus of industrial users of all sizes. PLM cloud adoption is rapidly increasing as companies look to leverage the benefits of broader connection and ease of remote access for a dispersed workforce. It improves flexibility and increases access to applications as the business evolves. Cloud adoption reduces costs in the modernization of legacy IT systems while improving data security, scalability, and maintenance. Thus, improving overall agility to digitally transform. Adoption occurred earlier and faster in small- to medium-sized businesses (SMBs), but many larger enterprises are now initiating PLM cloud migrations.

Pre-Pandemic Adoption

Prior to the COVID-19 pandemic, the motivations to migrate to the cloud were not "cloud-first" corporate initiatives. Instead, companies were motivated for more practical reasons. Solving specific business challenges such as improving collaboration across distributed locations was often the impetus to move to the cloud. Companies could also refresh and simplify their technology stacks and reduce their IT and infrastructure costs, but those too, were not primary drivers. Digital transformation initiatives, rapid innovation, cybersecurity, global collaboration, and dynamic scaling at lower risk became the driving factors to move to the cloud.

The COVID-19 Pandemic

The COVID-19 pandemic imposed a working from home mentality. The global health crisis uncovered many weaknesses in how companies were hosting PLM applications and supporting their remote workforce. The pandemic revealed issues such as lack of connectivity and accessibility to data and applications. A significant benefit of cloud-based PLM is that data and processes can be accessed from anywhere, allowing teams to collaborate and work remotely, which is critical to widely distributed environments. The pandemic highlighted many issues including legacy skill risk, remote workforce management, high network availability, flexible computing power, disaster recovery, lower cost of backup, the need to become a more resilient organization in terms of business processes, business continuity, and the need for greater business agility.

The COVID-19 pandemic also caused companies to accelerate their digital transformation initiatives. Change is difficult, but it can also be easier in uncertain times. Based on CIMdata's industrial consulting, when there is something else to focus on, employees can be accepting of long desired but potentially disruptive changes.

The SMB market sector has the same issues as its global counterparts, but with even fewer resources to acquire and maintain an on-premises infrastructure. The limited IT staff of a SMB cannot compete with the services of a large enterprise. A SMB also generally has fewer legacy applications, data silos, customizations, integrations, and organizational boundaries to overcome—reducing the scope and impact of migrating to the cloud.

Moving Beyond the Pandemic

Today, organizations of all sizes are adopting and migrating to the cloud to achieve the many benefits Siemens and AWS offer. Siemens SaaS solutions on AWS increase broader connectivity and availability of data and applications. Remote workers gain both speed and ease of remote access. Cloud-delivered remote work provides more flexibility for the worker, increased autonomy, and enhanced productivity across the enterprise. It's also enabling companies to hire from a wider range of talent by empowering them with the flexibility to work from remote locations. Furthermore, they have the flexibility to access Siemens SaaS solutions on AWS from anywhere on any device, empowering teams to collaborate across the globe. The ability to scale up and down to support teams of remote workers without the prolonged delays formerly associated with purchasing and installing additional hardware saves time and money. Siemens SaaS solutions on AWS are delivered via a modern, high-availability infrastructure of services including backup and disaster recovery which lowers the total cost of ownership when compared to on-premises implementations. Organizations are no longer burdened with large upfront capital investments or lengthy deployments and upgrades.

One of the biggest cloud benefits is improved security features and more effective data protection than on-premises solutions can offer. The perception that a company's product data was more secure behind its firewall with on-premises software and hardware, which was likely not being kept up to date with security patches, was, in fact, far riskier than that provided by AWS, which has the additional advantage of being able to respond more quickly to threats. Individual companies, no matter how large, cannot commit the IT resources (financial, technological, and human) to security programs that AWS provides. CIMdata believes companies of all sizes will continue to adopt PLM on the cloud and using Siemens SaaS solutions on AWS enables companies to continuously transform to a more digitalized work environment

Digital Transformation on the Cloud

Successful digital transformation requires trust, support, reduced risk, flexibility, and a broad range of scalable technologies and solutions.

Why Some Transformations Fail

While successful digital transformation requires a focus on people, process, and technology, many digital transformation efforts historically stalled, plagued by on-premises applications, outdated infrastructure, poorly maintained legacy applications, rigid processes, and an overburdened IT staff. This resulted in inadequate digital transformation attempts that typically ran over budget, fell behind schedule, and failed to deliver the needed business benefits. Such efforts did not foster a culture that embraced change. Transforming to the cloud with a broad set of technologies that can more effectively connect the enterprise offers a much better opportunity to create an environment that can readily adapt to meet an organization's needs.

How to Successfully Move to the Cloud

Industrial organizations are under constant pressure to adapt to change and improve how they operate. Successful companies continuously digitally transform their business to create and sustain their

competitive advantage. Digital transformations transcend organizational boundaries and processes, enabling companies to adapt to the ever-changing landscape of market and business requirements. Fundamentally, it's a strategy for dramatically improving business operations and profit margins by leveraging data, corporate knowledge, information technology, and the intellectual assets of the organization's people and processes.

Being successful at transforming a business requires a broad range of technologies and solutions and the dependability of both the software and the cloud provider. Companies must enable a flexible data-driven approach that provides organizations with the ability to collaborate in a reliable fashion. Effective digital transformation enables organizations to leverage digital data and obtain data-driven actionable insights, resulting in faster, better decision making. This empowers businesses to evolve their processes and business model rapidly, creating a more agile, resilient, and competitive business.

The Importance of a Reputable Cloud Provider

A major factor in the success of digital transformation is the dependability of the cloud provider. AWS has been an incredibly reliable cloud provider with more than 200 featured services providing exceptionally reliable scalability and an agile, low-cost cloud platform running in more than 190 countries. AWS exceeds 99.99 percent SLA in multiple categories and provides huge bandwidth, enabling companies to grow at their own pace with essentially unlimited disruption. AWS powers hundreds of thousands of businesses globally, providing IT support and security that far exceeds what an individual company can afford to offer.

With cloud-delivered SaaS solutions, companies receive rapid, strong technical support. One of the primary benefits of using cloud-based PLM software is the ability to rapidly deploy the solution. Unlike traditional on-premises solutions, cloud-based PLM-enabling software can be deployed and in production in a matter of hours or days rather than weeks, months, or years. Siemens SaaS solutions on AWS offer flexible and scalable functional options coupled with continuous enhancements to future-proof a business. Instead of the IT staff being overburdened trying to keep the lights on with an outdated, on-premises legacy infrastructure, they are freed to focus on activities that create more business value. Teams are better able to explore new boundaries and test their future aspirations—they are in fact free to "create without limits." This type of freedom allows companies to quickly realize the benefits of product development software without the need for significant upfront investment or IT resources. Together, Siemens and AWS provide the broad range of technical support needed to deploy a pre-validated, edge-to-cloud solution quickly and reliably. The other significant benefit of moving to the cloud from an on-premises data center is scalability. Organizations, enterprises, and especially SMBs, can scale up or down based on demand or business climate. AWS offers infinite technology resources available on demand as an operating expense. Capital planning and hardware acquisition timelines are no longer an issue.

But How Secure is it?

Businesses that operate and transform on the cloud dramatically increase their data security. AWS offers highly reliable encryption and security with multiple services such as access control, identity management, encryption at rest and in-transit, and network security.

AWS has achieved third-party validations to meet security and compliance standards for thousands of regulatory requirements, such as SOC1, SOC2, SCO3, PCI DSS Level 1, ISO 27001, HIPAA, and many others. AWS GovCloud meets the requirements for the Federal Risk Management Program (FedRAMP), which meets stringent security requirements for U.S. government agencies and their contractors that

host ITAR regulated data. AWS is also compliant with the Code of Conduct for the EU (CISPE), which demonstrates compliance with GDPR and their commitment to data protection and privacy of their EU customers.

Similarly, Siemens SaaS offerings were built aligning with Siemens security baselines[3] which leverage the latest cloud technology for data protection and data storage.

CIMdata believes that as organizations transform their product development to the cloud, the ability to scale with little to no unplanned downtime and secure access to their data and applications will support a company's need to pivot and react quickly to whatever challenges they face, giving them a competitive advantage.

Siemens SaaS solutions on AWS provide companies with tremendous flexibility. Not only can they transform with a broad set of technical solutions, but they can connect to the Siemens Xcelerator open digital business platform which includes the Siemens comprehensive digital twin—along with many other industry software solutions. Mendix, a low-code development app available as a Siemens SaaS solution enables users to quickly build flexible, intuitive web and mobile applications with visual modeling tools. This helps companies adapt to evolving business needs quickly without changes to the underlying infrastructure.

CIMdata believes to out-innovate their competition, organizations must adopt a continuous approach to digital transformations. This necessitates deploying a range of product lifecycle applications that are flexible and scalable from providers they can trust to support them. Siemens SaaS solutions on AWS represents an extensive, proven partnership that serves as a solid foundation for continuous and sustainable digital transformation.

Technical Innovation and Increased Speed of Digital Transformation

With rapid advancements in technology, consumers have come to expect more personalized, complex, smart, connected products. Consumers are increasingly buying products that offer more convenience and underpinning that convenience is connectivity. This has given rise to industry 4.0 enabling devices to communicate with each other and transfer data useful for both the consumer as well as the company providing the service. While the benefits are obvious, companies must continually transform to provide cutting-edge, innovative products and services that meet and exceed their customers' expectations.

Digitalization is fundamental to the technical innovation that tomorrow's products require because it enables faster and more efficient communication across multiple disciplines. It enables more extensive use of simulation and software—all critical to the increased efficient communication and collaboration required by globally distributed product development teams that need access to increasingly substantial amounts of product data in real-time regardless of location.

Beyond the need to produce smarter, more connected products faster, companies are using their increased digitalization capabilities to disrupt their competitors with new business models. Digital platforms such as Amazon, Uber, and Airbnb use digital tools to connect buyers and sellers to provide services at reduced costs. Many industries are selling services instead of products. These new business

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[3] https://www.sw.siemens.com/en-US/trust-center/

models drive the need for digital twins and the digital threads that connect data flows across the product's lifecycle.

Connecting to the Digital Twin

A digital twin is a virtual representation of a physical product or process used to understand and predict the physical counterpart's performance characteristics. Digital twins are used throughout the

> CIMdata's Digital Twin definition—A virtual representation (i.e., digital surrogate) of a physical asset or collection of physical assets that exploits data flow to/from the associated physical asset(s).

product lifecycle to simulate, predict, and optimize the product and production systems before investing in physical prototypes and assets. A digital twin enables design and operation for optimized performance, reduced downtime, and improved efficiency. Having real-time access to a virtual representation enables an OEM or owner/operator to predict when maintenance is required, lowering their costs, and delivering more up-time. It also provides useful insights that allow engineering teams to eliminate waste inefficiencies and identify improvements in future upgrades and new product introductions. Digital twins are also used to simulate and test designs and production facilities before going into production, leading to improved quality, better performance, and improved time-to-market.

Siemens SaaS solutions on AWS

Siemens SaaS offerings delivered on AWS enable companies of all sizes to become digital enterprises. Siemens SaaS solutions are part of the Siemens Xcelerator open digital business platform which enables customers to accelerate their digital transformation easier, faster and at scale. Siemens Xcelerator encompasses the entire lifecycle of software and services from design and engineering to manufacturing and service.

Irrespective of global location, using Siemens SaaS solutions on AWS enables greater collaboration across disciplines and the extended supply chain. This results in greater efficiencies, improved quality, reduced costs, and a faster time-to-market. It further increases an organization's ability to use the many Siemens solutions available in design, simulation, analysis, manufacturing, and more with all data managed in Siemens Teamcenter.

Siemens SaaS solutions on AWS provide the ability to easily scale (both in scope and size), allowing organizations to expand their digital capabilities as their business evolves and needs change. The combination of this open, modern, and scalable architecture with the Siemens Xcelerator digital business platform enables companies to continuously transform as they continue their digital transformation.

Siemens and AWS:
Using the Cloud to Transform to Net Zero

Human induced global warming and the resultant climate change poses the greatest existential threat to society, the natural environment, and the survivability of future generations. The earth has already warmed to 1.1ºC above the pre-industrial era temperature causing devasting climate change consequences.[4] To transform away from the use of greenhouse gases and toward a more renewable, carbon-free, and sustainable economy will be the biggest transformation in our lifetime. To limit global warming to less than 1.5ºC, in keeping with the Paris Agreement by 2050, we must reduce greenhouse gas emissions by more than 45 percent before 2030.[5]
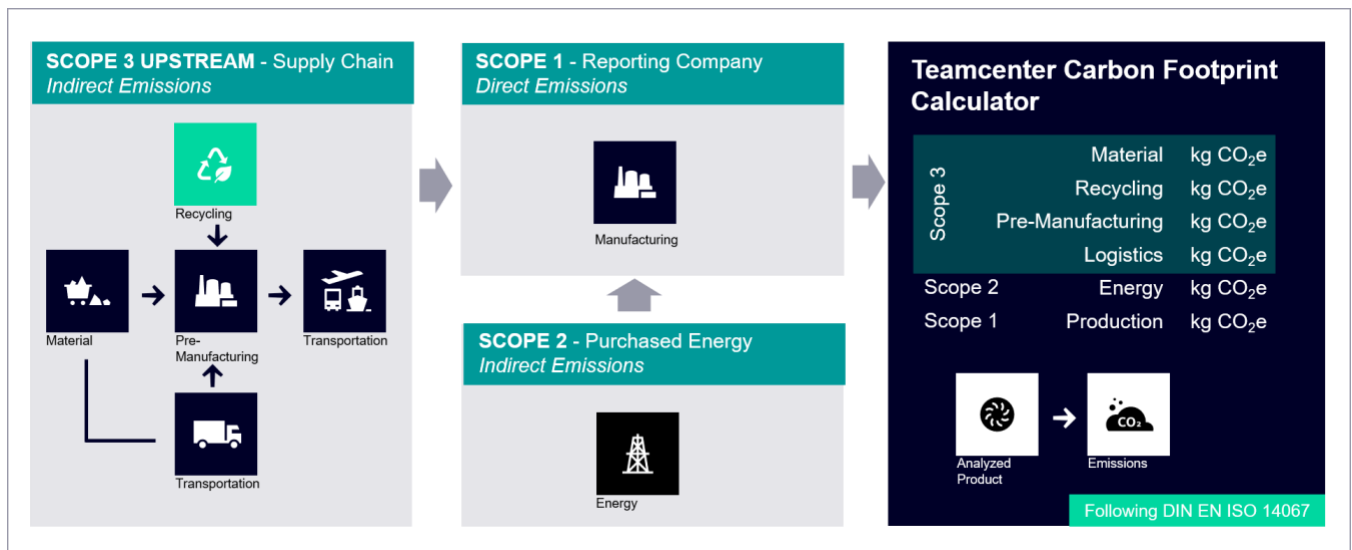
Both Siemens and AWS are leading the way. Mr. Adam Selipsky, CEO of AWS, has called climate change the issue of our generation. Amazon is on track to power its operations with 100 percent renewable energy by 2025. They have pledged to reach net-zero carbon emissions by 2030. Siemens has also pledged to achieve a net zero carbon footprint by 2030. Both Siemens and AWS are including their supply chains (scope 3 emissions), which is where the highest percentage of emissions are found. In addition to leading by example, Siemens and AWS offer solutions for other companies to meet their net zero ambitions. Approximately 80 percent of the environmental impact associated with a product is locked-in during the design phase.[6] Siemens offers a **Teamcenter® Carbon Footprint Calculator** (see the following figure) as part of Teamcenter's product cost management solution. This allows organizations to measure, simulate, reduce, and track a product's carbon footprint early in the development phase, where up to 80 percent of a product's carbon can get locked into the product. Siemens partnered with Sustamize GmbH to provide a pre-packaged CO_2e emissions factor library, enabling designers to reduce their product carbon footprint and scope 3 emissions (purchased parts and external services), which is where most emissions are located.

By placing their data in a cloud that will run off renewable energies, companies also reduce their scope 2 emissions (indirect purchased power), transitioning away from fossil fuel energy and lowering their carbon footprint. AWS also hosts many data sets that can further enhance the ability to improve a company's environmental footprint. The future potential for these two leaders in sustainability cannot be underestimated.

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[4] https://earthobservatory.nasa.gov/world-of-change/global-temperatures
[5] https://climate.nasa.gov/news/3246/nasa-says-2022-fifth-warmest-year-on-record-warming-trend-continues/)
[6] https://ellenmacarthurfoundation.org/news/an-introduction-to-circular-design

The Teamcenter Carbon Footprint Calculator and The Three Corresponding Scopes

Conclusion

The collaboration between Siemens and AWS, two industry leaders, provides companies of all sizes with dependability, support, and reduced risks across all aspects of design, development, manufacturing, and service. CIMdata believes this combination can enable organizations to rapidly scale their operations so teams can focus on value-driven innovation with fast, reliable, and secure collaboration.

CIMdata believes this end-to-end solution can provide companies with both a broad range of Siemens SaaS solutions as well as a connected product ecosystem provided by the Siemens Xcelerator digital business platform. CIMdata believes the adoption and migration of PLM to the cloud will continue to grow and be a major focus for companies of all sizes. Organizations that are digitally transforming require the dependability, support, reduced risk, and scalability that Siemens and AWS offer together. Those that keep a high percentage of their PLM software on-premises will incur more technical debt, higher maintenance costs, and cause them to fall further behind their competition. Clinging to an on-premises environment can hold back the ability to innovate and digitally transform and result in a lack of resiliency to respond to unforeseen business and technical challenges as well as supply chain disruptions.

The shift to a more distributed, remote work environment is here to stay. While it provides greater autonomy for the worker, it demands rapid access and improved connectivity to an organization's data, processes, and applications. These are fundamental to digital transformation. Those adopting PLM on the cloud can take advantage of the speed and ease of remote access for their distributed workers, reduce their costs, scale faster, deploy faster, and take advantage of a more modern and secure infrastructure.

Siemens and AWS can enable industrial organizations to achieve technical innovation and increased speed of digital transformation using a combination of existing software as well as the many new solutions and services available from Siemens. CIMdata encourages companies looking to migrate their PLM operations to the cloud to consider Siemens SaaS solutions powered by AWS and the comprehensive Siemens Xcelerator digital business platform.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design, deliver, and support innovative products and services by identifying and implementing appropriate digital initiatives. For forty years, CIMdata has provided industrial organizations and providers of technologies and services with world-class knowledge, expertise, and best-practice methods on a broad set of product lifecycle management (PLM) solutions 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.