DIGITAL INDUSTRIES SOFTWARE

Teamcenter X – a SaaS PLM solution powered by AWS

Executive summary
In this era of constant change and uncertainty, agility is key. A manufacturer's ability to swiftly adapt, innovate and respond to shifting dynamics is a determining factor to success.

Moreover, the increasing complexity of modern manufacturing now requires close collaboration among partners, suppliers and employees scattered around the globe. While this has several advantages, it also makes it more difficult to ensure that everyone has access to the most up-to-date information when and where they need it.

Given these dynamics, it is now more critical than ever for manufacturers to transition to a more digitalized work environment. Among the many approaches is moving to a Software as a Service (SaaS) methodology. The flexible and scalable SaaS-based PLM solution, Siemens Teamcenter® X, is a proven and well-tested approach that will help digitally transform operations of any size – anywhere on the planet.

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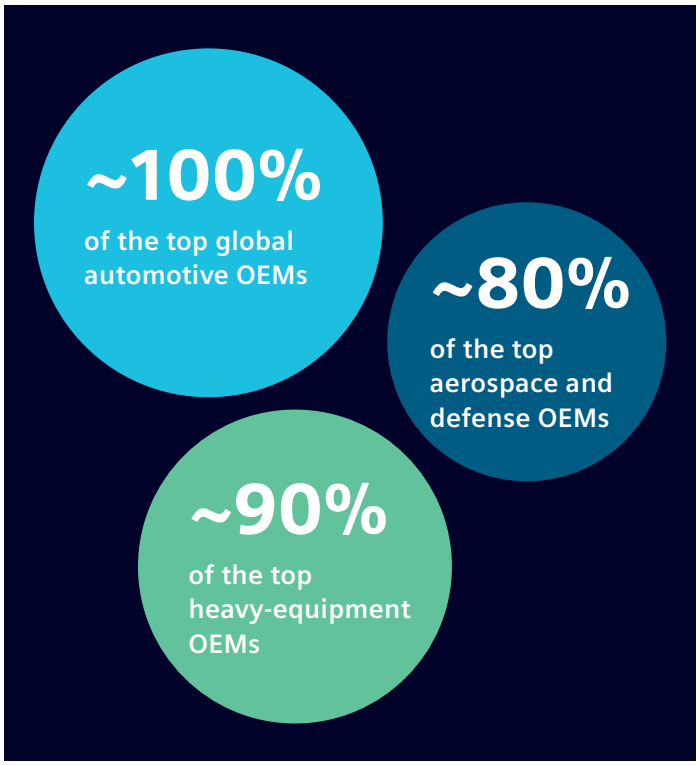
The need for a proven PLM approach – as a SaaS solution

For over a decade, manufacturers large and small have used the Siemens product lifecycle management (PLM) solution, Teamcenter, to address the pressing challenges of today and drive their digital transformation initiatives.

The Teamcenter PLM customer base includes:

- ~100 percent of the top global automotive OEMs
- ~80 percent of the top aerospace and defense OEMs
- ~90 percent of the top heavy-equipment OEMs

Teamcenter has enabled customers to integrate various stages of a product's lifecycle and enhance cross-functional collaboration by providing a centralized repository for all product-related data and documentation. The software breaks down silos and facilitates version control, ensuring there is always a heightened level of transparency.



Now with Siemens Teamcenter X powered by Amazon Web Services (AWS), manufacturers can take the next step on their digitalization journey by transitioning to Software as a Service (SaaS) PLM on the secure AWS Cloud. This eliminates the burden of operating, managing and securing the PLM environment, allowing organizations to focus resources on critical business needs.

Teamcenter X part of the Siemens Xcelerator open digital business platform

Teamcenter X is one of many SaaS offerings available in the Siemens Xcelerator open digital business platform. Siemens Xcelerator is both a modular portfolio of software, hardware solutions and services as well as a partner ecosystem with the sole intention of assisting Teamcenter X customers with the opportunity to accelerate their digital transformation easier, faster and at scale. Siemens Xcelerator also facilitates the next steps toward combining the real and digital worlds of manufacturing with the Siemens comprehensive digital twin.

Siemens Xcelerator enables interoperability and easy integration of operations to help organizations on their digital transformation journey.

The benefits of transitioning to SaaS PLM

While total cost of ownership (TCO) reduction is another benefit of transitioning to a SaaS PLM solution, it is not the primary driver of business value. A recent survey conducted by IDC found that over 90 percent of the economic business value from cloud adoption comes from non-TCO factors (e.g., reduced IT staff with increased user productivity). Further, Gartner has forecasted that cloud spending is expected to exceed $1 trillion worldwide by 2026 and that in the next three years nearly 75 percent of all organizations will adopt a digital transformation model predicated on cloud as the fundamental underlying platform.

A cloud-based SaaS PLM model affords companies several important advantages:

Increased scalability and productivity

With SaaS PLM, organizations can onboard users with ease, speed up deployments and expand their cloud environment based on business needs, such as geography, distribution, solutions and processes. According to a study by Salesforce, businesses that adopt cloud-based solutions experience an average 19.3 percent increase in productivity. A separate report by Oracle found that businesses that adopt cloud solutions experience a 77 percent improvement in operational efficiency.

Reduced costs

SaaS PLM significantly reduces IT resource needs and infrastructure costs, making it easier for companies of any size to use the tools for innovation once reserved for only the largest companies. A SaaS PLM

model can eliminate the need for on-premises hardware and software, which can lead to savings in terms of hardware, maintenance and upgrades. Businesses can save up to 50 percent on IT infrastructure costs according by a study by Nucleus Research. In addition, according to a report by Gartner, SaaS can lead to a 50 percent reduction in software licensing costs.

Improved data recovery and faster time to recovery

According to a study by BetterCloud, 91 percent of IT professionals believe that SaaS applications are more secure than on-premises software. SaaS providers can also quickly deploy updates and patches to address security threats or other issues, reducing the time it takes to recover from a disruption. A report by IDC found that SaaS solutions can reduce time-to-recovery by up to 80 percent compared to on-premises solutions.

Low employee turnover

SaaS enables PLM users to access the platform from anywhere with an internet connection, making it easier for employees to work remotely and maintain business continuity during disruptions. This is critical in today's work because several studies have shown companies that allow remote work have a lower employee turnover rate of up to 30 percent.

Increased uptime

SaaS typically offers higher levels of uptime and reliability than on-premises software. According to a report by Gartner, cloud-based services can deliver up to 99.9 percent uptime compared to on-premises systems, which typically have around 95 percent uptime.

Sustainability

WSP Global (a Canadian consultant firm) and Accenture estimate that cloud computing can help companies reduce their per-user carbon footprint from 30 to 90 percent when compared to on-premises deployments when operating costs such as electricity, hardware updates and upgrades to IT are taken into consideration. AWS cloud computing resources can accomplish the same tasks (versus on-premises) with 88 percent lower carbon footprint. "When we factor in grid carbon intensity and renewable energy to calculate relative carbon efficiency, AWS's advantage extends even more, to over 8.5. This means that the carbon footprint for the same server performance on the AWS Cloud is 88 percent lower than the median of surveyed enterprises."[1]

Even with these advantages – barriers still exist

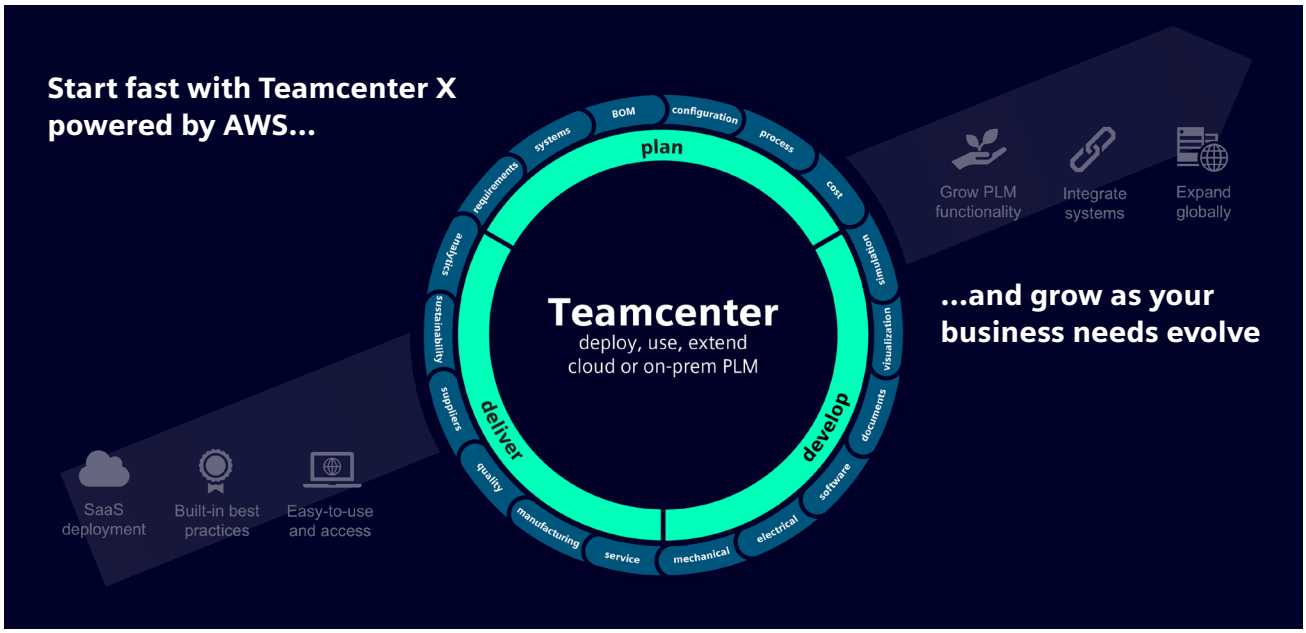
While the benefits of SaaS PLM are clear, even the most committed industrial leaders are cautious about moving to the cloud. While much of their trepidation stems from data privacy and cybersecurity concerns, they also must ensure that their cloud solutions are accessible globally, including for remote workers. That these solutions can scale as the operation grows and are readily customizable to specific user needs.

The complexity of on-premises applications, data and processes is another common barrier preventing companies from migrating their PLM solutions to the cloud. Many companies have legacy applications and unique processes that span organizational boundaries, because of past mergers and acquisitions, reorganizations, and the proliferation of home-grown applications. The time, cost and disruption to the business of migrating all of this to the cloud is daunting to many leaders.

The expanded collaboration between the largest global automation and industrial provider, Siemens, and the most comprehensive and broadly adopted cloud provider, AWS – now enables industrial leaders to address these risks and move their PLM environment to the cloud in a way that is both predictable and prudent. Siemens and AWS have pressure-tested every step of the cloud-based journey and employ a methodical approach to ensure that the migration is seamless.

1. "The Carbon Reduction Opportunity of Moving to Amazon Web Services," *Amazon Web Services*, 2019.

Teamcenter X powered by AWS



The strategic collaboration between Siemens and AWS provides a foundation for manufacturers to drive their digital transformation forward with flexible, scalable, next-generation industrial software. The partnership removes the traditional barriers a business is likely to encounter when transitioning to a digital enterprise.

Siemens Teamcenter X powered by AWS, allows industrial leaders to capture all the benefits of a cloud-based PLM, without the burden of managing the environment themselves.

As a SaaS offering, Teamcenter X supports the complete virtual representation of a product (the Siemens comprehensive digital twin) by managing electrical, electronic, mechanical and software components in a single, multi-domain bill of materials (BOM). With web-based access and no installation, teams can access the most up-to-date product data from any device, at home, in the office or on the shop floor.

Teamcenter X targets both core and advanced PLM use cases. Regardless of the organization's starting point, the platform grows with customers by providing the ability to onboard new users quickly, add new solutions to meet evolving needs and ensure that IT infrastructure is always right sized for their business. Quite simply, the advantages of Teamcenter X on the AWS Cloud over traditional on-premises deployment of Teamcenter are numerous.

Security

There's often hesitancy among customers (particularly small- and medium-sized businesses) when moving operations to the cloud because of where sensitive data will be stored.

With Teamcenter X, Siemens and AWS take responsibility for security, providing customers peace of mind knowing that their data is protected. The AWS Cloud is consistently recognized as the most flexible and secure cloud computing environment on the

market and is built to satisfy the secure requirements for defense, global banks and other organizations with highly sensitive data. AWS service offerings and associate supply chains have been vetted and accepted by many organizations who handle data that has been deemed "top secret."

Additionally, AWS has a dedicated team of engineers and solution architects who build algorithms and mechanisms to proactively detect and prevent misuse of all cloud services. It's a 24/7 operation, so AWS can respond quickly to any suspicious activity.

Resiliency

Operational resilience refers to the ability of organizations to adapt and respond to unexpected disruptions, such as natural disasters, cyberattacks, or supply chain disruptions. It involves ensuring that business operations can continue to function, even in the face of unexpected events. In virtually all cases, Teamcenter X offers greater resiliency than on-premises or private cloud deployments because the entire cloud infrastructure – including software and networking – is managed by Siemens.

The AWS Global Infrastructure is specifically designed for highly resilient workload architectures. Each AWS region is fully isolated and consists of multiple availability zones. Availability zones isolate faults that could impact workload resilience, preventing a fault from impacting other zones in the same region. All zones in an AWS region are interconnected with high-bandwidth and low-latency networking on fully redundant dedicated fiber. This, in turn, provides high-throughput, low-latency networking between availability zones.

Reliability

One of the pillars of the AWS Well-Architected Framework is high reliability and uptime. This is achieved through design principles, such as automatically recovering from failure; scaling horizontally to increase aggregate workload availability; and measured capacity when needed. The latter addresses a common cause of failure and on-premises workloads, which is resource saturation when the demands placed on a workload exceed capacity. With Teamcenter X on AWS Cloud, users can monitor demand and workload utilization and automate the addition or removal of resources.

Scalability and speed

Deploying Teamcenter X on AWS Cloud allows customers to quickly ramp up as needed. With no perpetual license or hardware to purchase, organizations have the flexibility to test new functionalities and add new users to meet their changing business needs. Manufacturers using Teamcenter X can quickly develop and roll out new PLM solutions and teams can experiment and innovate with speed.

Elasticity

Manufacturers using on-premises or private cloud PLM deployments typically must overprovision IT infrastructure just to ensure that they have enough capacity to handle their business operations at peak activity level. This often involves guesswork and purchasing capacity that won't be utilized. With Teamcenter X on AWS Cloud, however, users can provision exactly what they need.

Cost

Companies using on-premises PLM must purchase software licenses and also bear the costs associated with customization, IT personnel, maintenance, hardware and training. Plus, they pay recurring costs associated with applying fixes, patches and upgrades; ensuring and monitoring security; reducing downtime; and maintaining hardware, networks and databases.

Companies that use Teamcenter X on AWS Cloud no longer need to invest in expensive hardware and software installations or maintain these systems on their own. The license fee turns into subscription fees, which are realized in operating expenditure (OPEX) budgets. And the burden of operations and maintenance of the software is shifted to Siemens and AWS, reducing the need for hardware and supporting personnel who can be relocated to focus on other business needs.

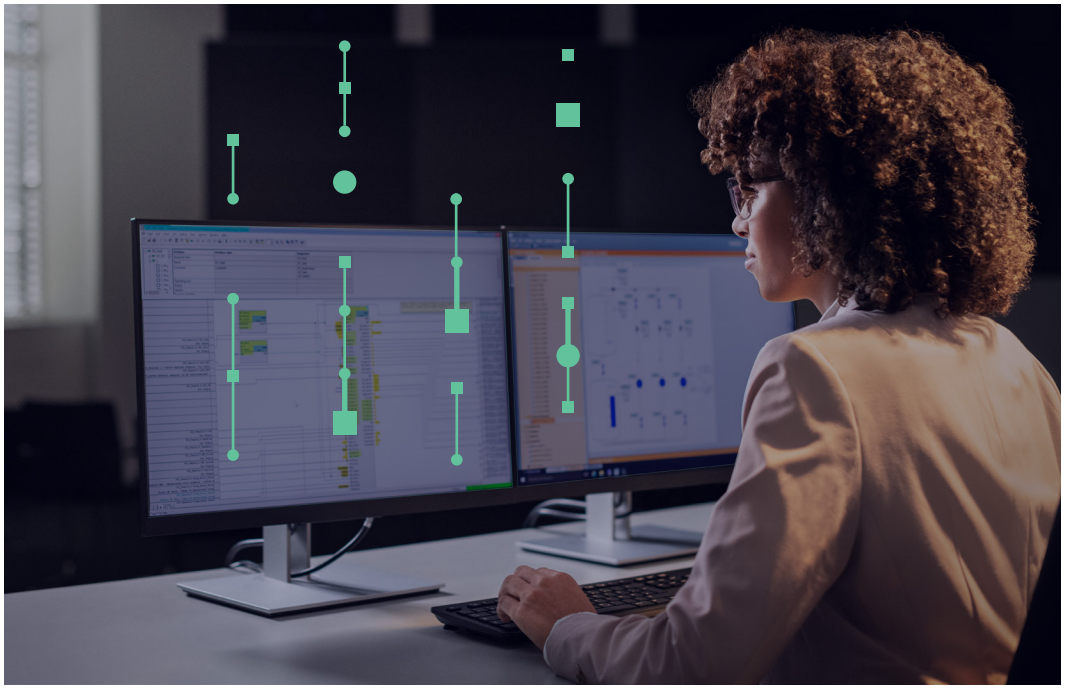
The focus with Teamcenter X is on implementation, software configuration and training, all of which are bundled into the subscription fee. This allows customers to right-size their infrastructure spend. On average, organizations that migrate to AWS see a 20 percent reduction in total infrastructure costs, with top performers realizing savings of up to 47 percent.

Sustainability

A significant but less-cited benefit of moving to a cloud-based PLM is a reduced carbon footprint. Multiple studies conducted by 451 Research found that moving on-premises workloads to AWS can lower customers' workload carbon footprints by nearly 80 percent and up to 96 percent once AWS is powered with 100 percent renewable energy. AWS infrastructure is 3.6 times more energy efficient than the median of surveyed U.S. enterprise data centers and up to 5 times more energy efficient than the average European enterprise data center.

Recognizing the increasing importance of ESG/ sustainability in business success, Siemens and AWS offer solutions to track net-zero progress. The Teamcenter Carbon Footprint Calculator software, part of the Teamcenter product cost management solution, 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 also collaborates with Sustamize GmbH to provide a pre-packaged CO_2 emissions factor library, enabling companies 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 energy, 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.



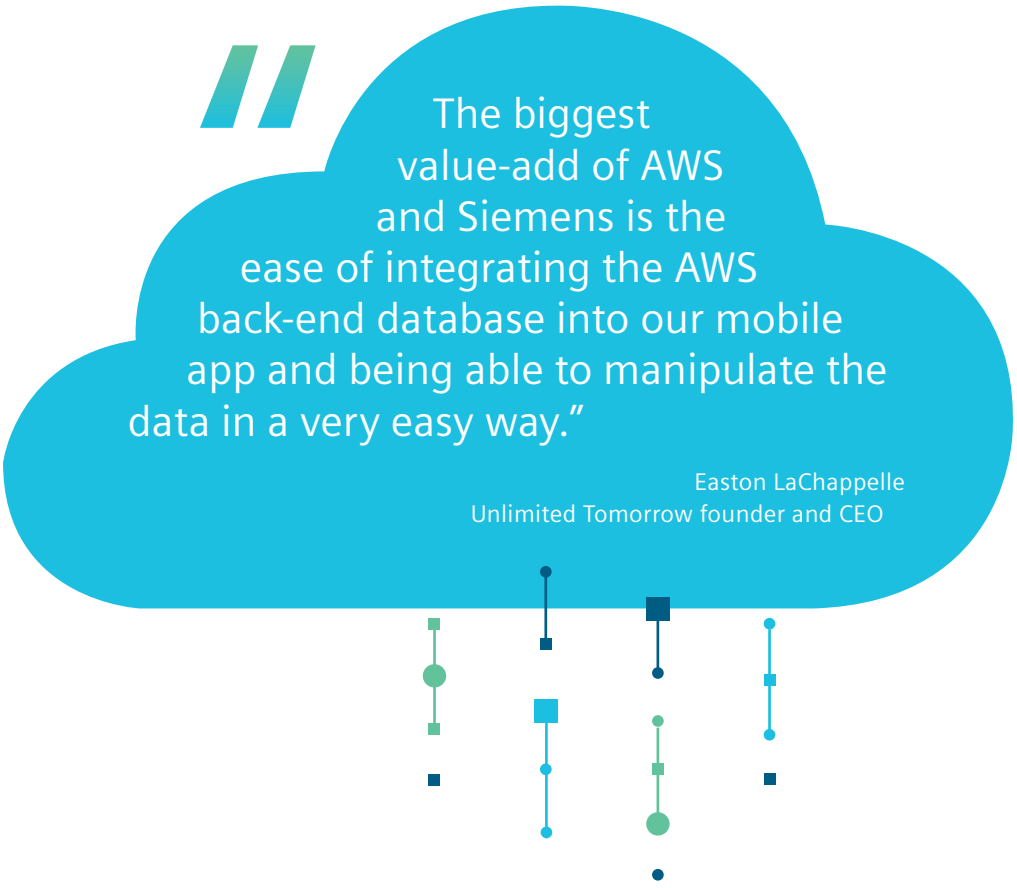
CUSTOMER CASE STUDY

Unlimited Tomorrow

Unlimited Tomorrow uses the Siemens Xcelerator open digital platform to create high-functioning, quick-to-market, low-cost personalized limbs for pediatric amputees.

Unlimited Tomorrow transforms at-home 3D scans of people into 3D printing of artificial limbs. To store and process the complex 3D CAD files, the workflow uses Amazon FSx for Windows File Server and Amazon AppStream 2.0 provides high-performance streaming of both the NX and Teamcenter X applications. Amazon Elastic Compute Cloud (Amazon EC2) is the source of the compute resources, while Elastic Load Balancing helps Teamcenter X achieve high availability.

The digital workflow created by Teamcenter X on AWS not only improves production efficiency, it also gives Unlimited Tomorrow the ability to create prosthetic limbs at as little as one-tenth the price of traditional prostheses. Additionally, it improves the speed of product development: When a user outgrows a device, they can simply send it back to Unlimited Tomorrow for recycling and then be measured for a new one that arrives in a few weeks.



Making the leap to the cloud: create without limits

In the constantly changing business environment where agility and speed of innovation are critical to success, organizations have no choice but to embrace the cloud or risk becoming obsolete. As digital transformation takes hold, more companies are recognizing this reality and are moving away from on-premises and private cloud deployments in favor of SaaS solutions. Recent developments in generative artificial intelligence (AI) and its potential to disrupt existing processes further magnify the urgency to embrace the cloud/SaaS approach.

The expanded collaboration between the global technology leader in industry software, Siemens Digital Industries Software, and the leading cloud service provider, AWS, provides a pathway for industrial organizations to do just that.

By leveraging the Siemens Xcelerator open digital business platform, which includes Teamcenter X on the AWS Cloud, customers can effectively navigate product and production complexity and reduce risk across all facets of design, development and manufacturing. Customers can scale engineering efforts, optimize operations and focus their time and resources on doing what they do best – create without limits.

Siemens Digital Industries Software

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For additional numbers, click here.

Siemens Digital Industries Software helps organizations of all sizes digitally transform using software, hardware and services from the Siemens Xcelerator business platform. Siemens' software and the comprehensive digital twin enable companies to optimize their design, engineering and manufacturing processes to turn today's ideas into the sustainable products of the future. From chips to entire systems, from product to process, across all industries, Siemens Digital Industries Software – Accelerating transformation.

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