The white paper explains how to comply with current data standards and get the most out of digital twins.

Bringing the digital twin to life with interoperable data

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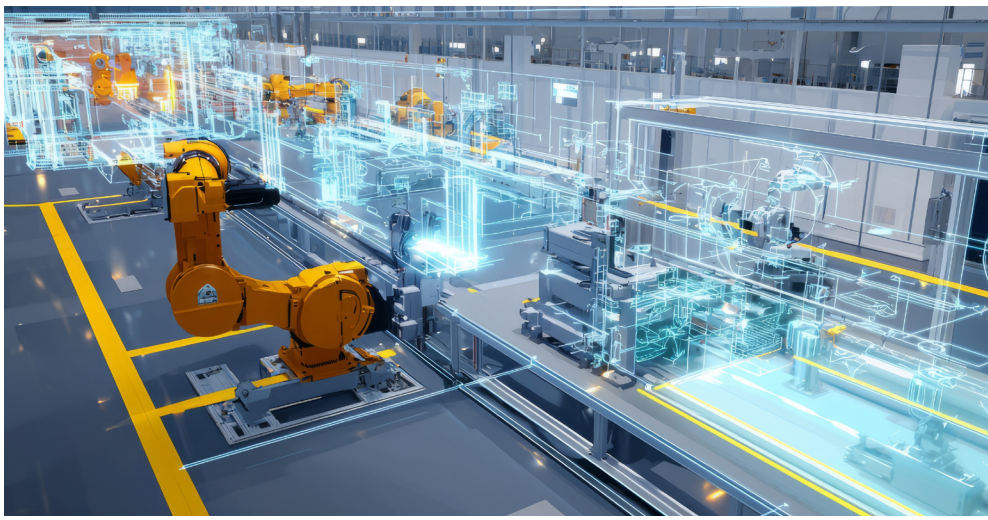
Companies have been investing in digital twins for years. However, these twins only come to life through data exchange within the extended enterprise—with suppliers, prospects, customers, and partners. Until now, interface problems have limited this exchange. Current data standards such as the Application Asset Shell (ASS) and Manufacturing X are clearing this up. But now these standardized data spaces must be filled with interoperable data. Manufacturers are overcoming this challenge with software and services from simus systems. This is how they bring the digital twin to life and reap the full benefits.



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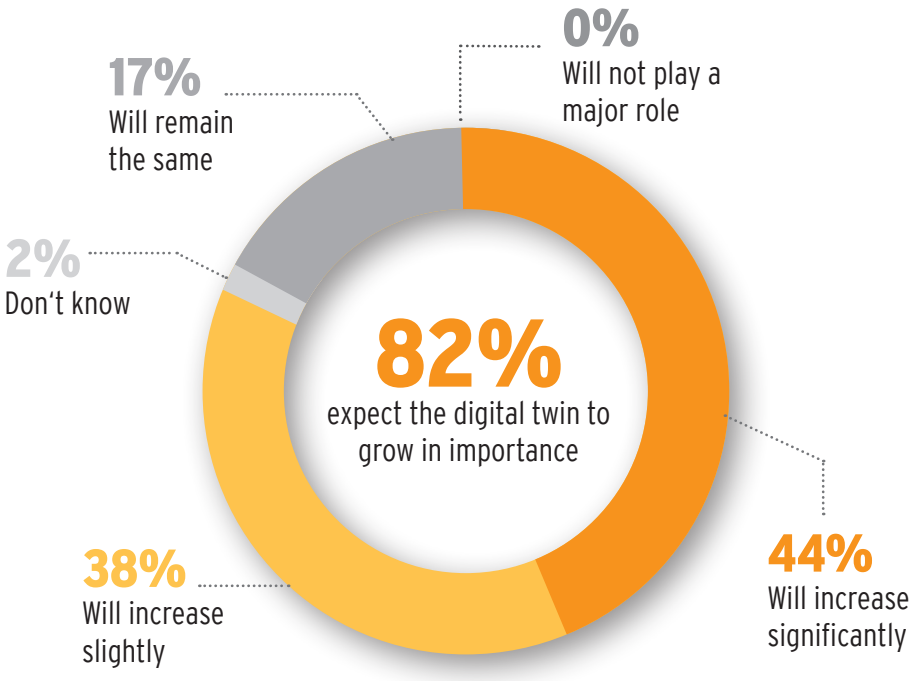
What is a digital twin?

Industrial companies understand a digital twin to be the digital representation of a physical object–ranging from a component to systems to a complete product, such as a machine tool, automobile, or production facility. Built from 3D data, the digital twin can be viewed, flown through, examined with tools, and, if large enough, walked through. Each component is associated with extensive data that can relate to a wide variety of properties. The sheer size of the data volumes alone pushes the limits of today's tools. The data is often incompatible and the interfaces are not permeable. This limits the creation, exchange, and processing of digital twins. For this reason, companies often focus on the essentials when exchanging data with each other and limit the data to a few properties of an object, such as identity, condition, and location. In this case, the digital twin is reduced to a digital shadow.

The importance of digital twins for industry



82 percent expect the digital twin to grow in importance. This was the result of a survey conducted by the digital association bitkom 2022 among more than 553 companies with 100 or more employees.

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What data quality does a digital twin require?

Challenge

Digital twins consist of data – the quality of this data therefore has a major influence on the benefits that users can expect. Digital twins unfold these benefits in interaction with their peers and in interaction with special software tools. During the development process, in design, simulation, and optimization, in the transition to production, and ultimately throughout the entire product life cycle, digital twins are processed using numerous software solutions. In the process, the data passes through many interfaces.

Poor data quality

This only works with high data quality. This involves two aspects: All data in the digital twins must be correct, complete, up-to-date, and unambiguous, i.e., it must meet general data quality requirements. Secondly, it must meet the specific requirements of the respective software in terms of structure and scope. Some intelligent interfaces now ensure that this is implemented automatically. However, this requires that the general requirements for data quality are met. High master data quality within the company is just as crucial for the digital twin as it is for the success of any digitization project. The more processes are to be automated, the more up-to-date and unambiguous data is required.

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Creeping deterioration

Most companies fail to meet the necessary general data quality standards. System changes, lack of attention, and unclear responsibilities lead to a process of erosion that only receives attention on special occasions. The effort involved in cleaning up the data is then considerable.

Too many interfaces

Interfaces have long been both a blessing and a curse of digitalization: they enable different software solutions to work together, but overall they represent the biggest hurdle to data exchange. If the requirements of an interface in terms of structure, format, scope, and content of the data still need to be met, the more internal and external interfaces the data passes through, the more complicated it becomes. With ongoing digitalization and the growing use of digital twins, the problem is becoming even more acute.

Advantages of digital twins

Qualitative advantages

- Reduced product development costs
- High customer satisfaction through faster implementation of customer requirements
- Quick and easy design improvements
- Paving the way for new sources of revenue
- „As-a-Service"-business models

Quantitative advantages

- Strong increase in the relevance of technology
- Sales growth of up to 10 percent
- Reduction in time to market by up to 50 percent
- Improvement in product quality by up to 25 percent

Digital twins provide companies with important advantages (Source: KPMG, 2024)

Requirements for interoperable data

- **Up-to-date, accurate,** and **complete** data are basic requirements.
- The data must be **consistent** and **complete,** i.e., free of contradictions.
- The data must **comply with specific rules** that specify field sizes, formats, character sets, and units of measurement.
- The conventions must **apply to multiple systems,** otherwise interface problems will arise.
- Interoperable data is **free of duplicates.** These are a potential source of errors and cause additional work.

Digital data standards

Enabling data exchange through standards

Smooth exchange of external data can only be achieved using standardized formats. This is precisely where companies, associations, and organizations see the solution to ongoing interface problems. In several large-scale projects, they are moving closer to their goal of facilitating data exchange and advancing digitalization. Two projects are particularly relevant for the digital twin: the Asset Administration Shell (AAS) and the decentralized data ecosystems of the Manufacturing-X initiative.

Administration Asset Shell

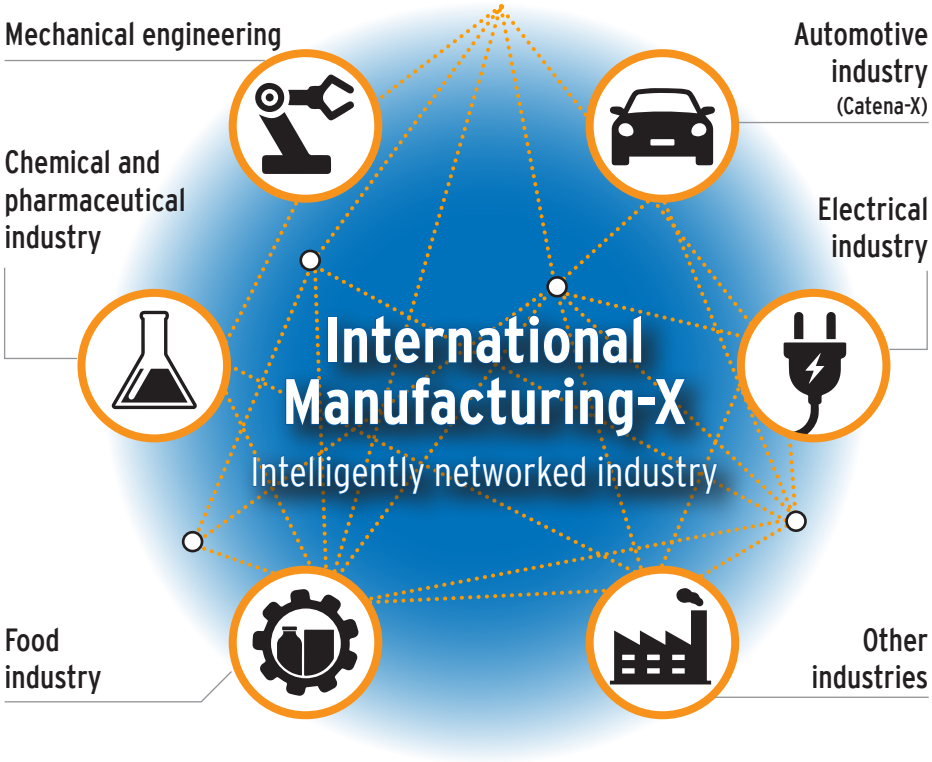
Version 3.0 of the AAS, published in July 2023 by the Industrial Digital Twin Association e.V. (IDTA), describes how companies can create and structure management shells that are ready for practical use. This means that the data of a digital twin is available in a standardized, interoperable manner throughout its entire life cycle and along the value chain. Each asset can be identified and addressed to provide information in a uniform language. The administration shell acts as a standardized interface for digital twins, comparable to a standardized data format.

This is how the IDTA defines the administration shell:

- The administration shell is the implementation of the "digital twin" for Industry 4.0.
- The administration shell creates cross-manufacturer interoperability.
- The administration shell is available for non-intelligent and intelligent products.
- The administration shell maps the entire life cycle of products, devices, machines, and systems.
- The administration shell enables end-to-end value chains.
- The administration shell is the digital basis for autonomous systems and AI.

The Manufacturing-X initiative, funded by the Federal Ministry of Economics via the Industry 4.0 platform, has set itself a much broader goal: to enable stakeholders from business, politics, and science to facilitate the Industry 4.0 data space and the transformation to a digitally networked industry across the board. Companies should be able to use data confidently and collaboratively across the entire manufacturing and supply chain.

Manufacturing X aims for resilience, competitiveness, and sustainability



The Federal Ministry of Economics supports companies participating in Manufacturing X.

In both initiatives, users, software providers, organizations, and associations are cooperating to standardize the most promising data formats and generalize interfaces. The results are already widely available and have been successfully implemented by the first companies. This gives them an important competitive advantage.

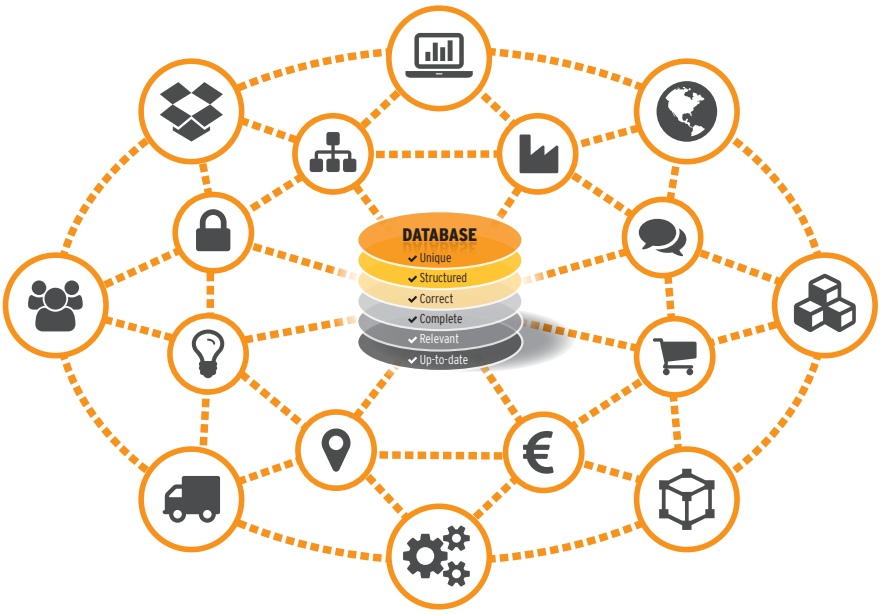
Secure competitive advantages

Prepare data based on rules

Challenge

Companies now face a new challenge: in order to use these data exchange standards for their digital twins or digital shadows, they must comprehensively prepare their data sets. This involves both general quality improvement and compliance with the new, relevant standards. However, many companies have found that this task cannot even begin to be accomplished using conventional, manual methods.

A structured and well-maintained database is the foundation of all digitalization projects.



Efficient cleansing of master data

With its simus classmate software suite, simus systems offers powerful tools for efficiently processing large amounts of data according to variable rules. Hundreds of master data projects have resulted in the development of a methodology and approach that efficiently delivers the desired results:

- The relevant data is read from the affected systems and processed, sorted, enriched, and stored in a database using best practice rules.
- The results are reviewed in workshops with the customer's relevant departments. However, deviations and errors are corrected not via individual data records, but via the underlying processing rules.
- The data, including the new structure, is then transferred back to the original system via an interface.

Thanks to this methodology, both the customer and the service provider save up to 80 percent of the effort required for data processing.

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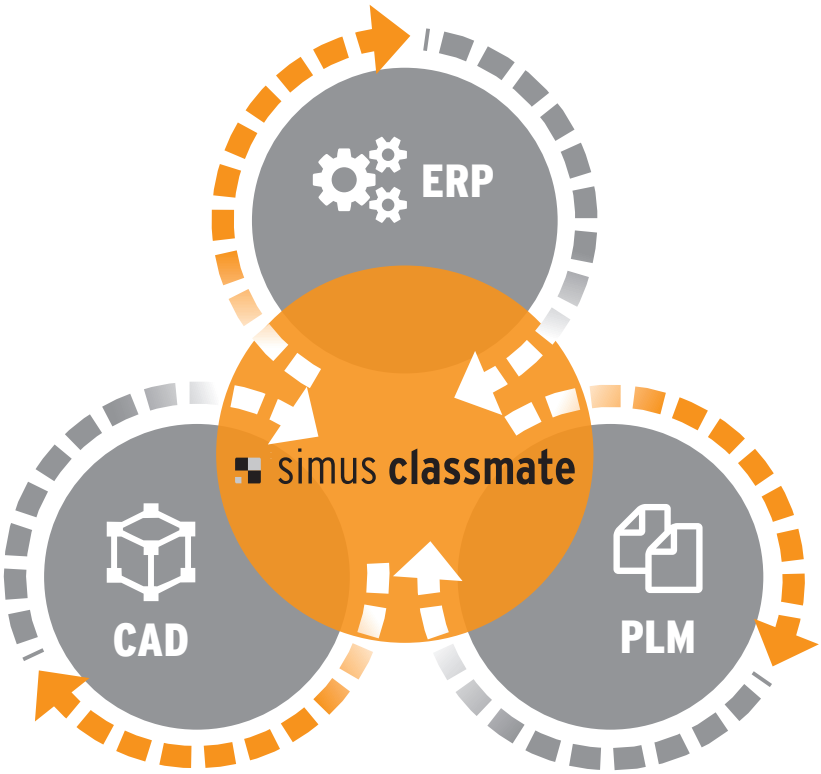
The classmate CAD software module also makes it easier for designers to classify and describe new CAD models. Regardless of the modeling methodology and the features used or known, 3D data from all common CAD systems is analyzed and automatically entered into the company-specific classification tree based on the native geometry.

The creation of error-free and communicative digital twins can begin!

End-to-end digitalization through integration



Achieving an interoperable database with simus systems

- Consulting with experience from over 400 projects
- Preliminary project to define costs and objectives
- Clear, proven methodology
- Flexible, usage-based models
- Adaptation of industry-specific standard regulations
- Achieving goals on schedule and within budget

Automatic classification of CAD models

Data magic without duplication of work: simus classmate integrates seamlessly into existing systems

More than Software: simus systems guides companies safely to their destination

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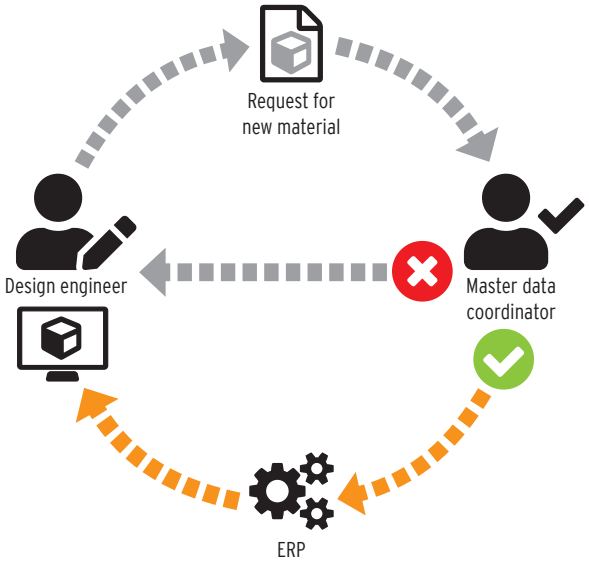
Ensuring the data quality achieved

To ensure that the high data quality achieved is maintained despite the increased use of digital twins and that the investment in the master data project is protected, simus systems supports those responsible with methods and tools to establish company-wide data governance and enforce the multitude of complex rules.

- Design engineers can check all data in a freely customizable graphical search engine. It is accessed directly from the CAD system. With flexible search options, including geometric similarity and individual features, it instantly delivers all relevant components with 2D and 3D preview images.
- Employees without a CAD system, such as those in purchasing or work preparation, use a similar web-based search engine to easily find individual parts or products.

simus classmate allows you to set up comprehensive processes that simplify the creation and maintenance of material master records.



Material master creation process

A guided material master request process for new parts further ensures master data quality. Supported by the software, users submit a material request when they cannot find a desired part in inventory. A master data office reviews the material requests. Automatic processes and notifications are set up for this purpose. After a positive decision, the material is automatically created in ERP systems such as SAP via simus classmate.

Getting the most out of the digital twin

Manufacturers are already reaping significant benefits from digital twins. Even during product development, production planning and process optimization prior to production, as well as procurement and logistics, benefit from digital representations. In all these areas, quality analyses, for example, reveal potential for improvement before the first real product has even been created. However, the benefits extend across all phases of a product's life cycle. Service employees receive transparent, detailed product usage data and can improve after-sales services – thereby increasing customer satisfaction and loyalty.

Internal benefits

Predictive maintenance based on virtual images of the company's own machines is already in use. In addition, machine manufacturers can offer their customers added value, such as product-specific circuit diagrams, production parameters, instructions, or even automated web shops for spare parts.

New business models

The sustainability of products can also be improved with digital twins or shadows: the standardized and automated collection of product data on ecological footprints or energy consumption simplifies the implementation of sustainability initiatives and legal regulations, for example in the form of a digital product passport (DPP).

Sustainable products

The software from simus systems can be used to implement numerous other useful processes and automations. The possibilities range from automatic text generation, for example of quotations or short material texts, translation, determination of customs tariff numbers, and automatic creation of work plans for mechanical processing, to component or project calculation.

Multiple additional benefits

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Digital future

Favorable timing

Unleash your digital twins on suppliers, service providers, and prospects!

Conclusion

Bringing the digital twin to life

The idea of a globally networked data economy is not only relevant for large corporations, but also a smart idea for medium-sized companies that want to generate growth without physically expanding. Those who can supply their product data with all tolerances, individual measurement protocols, or even complete digital twins are successfully preparing for the future and tapping into additional benefits. Mechanical engineers could offer self-services that lead to the automatic ordering of wear parts or services.

Thanks to initiatives for standardizing interfaces such as the administration shell or Manufacturing X, the vision of seamless data exchange is already within reach. Now it is up to industrial companies and suppliers themselves to create access to unrestricted use of their digital twins with a master data project. Software and services from simus systems guarantee a successful project, secure the investment in well-maintained master data, and create added value.

Those who bring their digital twin to life with cleaned and structured data are also investing in greater sustainability, quality, and efficiency. Better internal processes, support in complying with regulations, and greater cost transparency help to improve your competitive position. Create the data basis for a successful future for your company with simus systems!

simus systems

Founded in 2002 and based in Karlsruhe, simus systems GmbH is one of the market leaders in the field of automatic classification of CAD models, data cleansing of mass data, searching and finding existing data, and automatic calculation with its simus classmate product family. The independent company offers experience from over 400 successful projects in the mechanical and plant engineering, automotive, and electrical engineering industries. The simus classmate product family integrates with leading 3D CAD and PLM solutions as well as with ERP systems such as SAP.

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We are looking forward to an exchange

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