

White Paper

Unlocking Potential: Collaborative Company Perspectives on AAS



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Abstract

This comprehensive paper delves into the collaborative efforts within the Open Industry 4.0 Alliance, focusing on the component supplier work group's exploration of digitalization challenges and the adoption of digital twins. It begins with an examination of the group's vision and the growing centrality of digital twins in product and factory digitalization, particularly in addressing market demands for standardized product information. The text details the implementation of standardized digital twins based on Asset Administration Shells (AAS) and underscores the inevitability of standardized heterogeneity. Emphasizing the importance of inter-company teamwork, it highlights the consortium's approach to achieve implemented standardization and explores emerging use cases such as the digital product passport and value-adding services.

The discussion extends to the technical aspects, emphasizing the role of AAS in standardization and interoperability, alongside initiatives like Catena-X and Factory-X. Furthermore, the paper addresses challenges and requirements for successful Industrial Internet of Things (IIoT) implementation, advocating for industry-wide standards and cross-industry collaboration. The collaborative project's outcomes, including the development of a platform for standardized digital twins based on the Asset Administration Shell concept, are examined, alongside insights into its presentation at industry events and future prospects. Lastly, the paper outlines ongoing efforts to enhance functionalities such as providing extended data and improving digital twin management features, signaling a promising course for standardized digital twin adoption in industrial settings.

Introduction

Specifically, within the component supplier work group of the Open Industry 4.0 Alliance, various component manufacturers, along with software providers, discuss their vision and challenges in the journey of digitalization. The concept of the digital twin has increasingly become central in the digitalization of products and factories. Particularly in the component segment, the topic is tangible today due to the clear market demands for modern product documentation and information in standardized forms, which could be more easily addressed with standardized digital twins. Since last year, an initial implementation has been realized from the component supplier work group, allowing participants to create and independently provide their own digital twins based on Asset Administration Shells (AAS). This paper encompasses the learnings from this implementation and emphasizes why standardized heterogeneity is inevitable.

Collaboration of Companies - Achieving More Together

In the past, each company was looking for individual solutions for digital processes, internally and externally. As long as these individual approaches persist, proprietary solutions will not have a push through in the broad market, as digitalization is only achievable through inter-company teamwork. The key here is "implemented standardization." The work of the OI4 Alliance focuses on the standardized digital twin (AAS), complementing the IDTA's definition work.

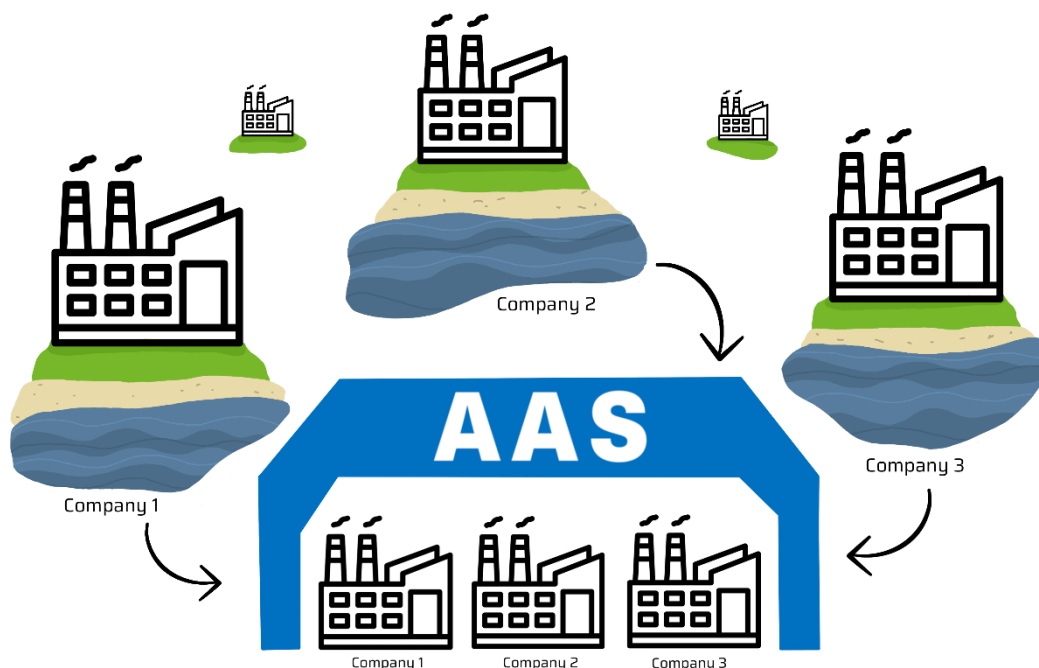


Figure 1: Let's change what did not work - insular thinking

Looking slightly into the future from the current implementation, additional cases emerge, making the technological approach even more interesting. On one side are the increasingly stringent regulatory requirements for products from the EU. These include the digital product passport (DPP), CO2 carbon footprint, supply chain- and cyber resilience act. These requirements demand to provide more product information to customers, end-users, or other participants in the value chain.

To meet these demands, especially for medium-sized companies, standardized bundling and provision of product-related data is required. On the other side there are digital value-added services, including successful monetization. These data can also be used internally for process improvements or cross-system data exchange. In this context, component manufacturers such as AS-Schneider, ifm, Endress+Hauser, Kübler, Bürkert and Dunkermotoren have joined forces to evaluate the topic from their perspective. This is an area that component manufacturers are intensively working on, often facing the hurdle of data sovereignty. Components are integrated into machines, which are operated in factories by plant operators. The data for analysis, through which component manufacturers could offer analyses to machine builders, pragmatically lies not with either but with the plant operator.

While the issue can be solved in pilot and lighthouse projects through complex individual contracts, it often represents an obstacle that serial companies cannot overcome. Here, a more visionary approach sees the digital twin as a central element of the solution. Alongside the physical product, the standardized digital twin of the component supplier is delivered and can be embedded by the machine builder into the digital twin of the machine. Then, as part of the machine or directly as a single component, can be passed on to the plant operator and residing in their digital twin enabled environment. As soon as in operation phase, the data from the component's operation enriches this digital twins as well.

If use cases such as predictive maintenance are to be implemented, the plant operator can share the data through synchronization of their digital twin with the digital twin generated by the component manufacturer during product creation. This enables clear voluntary business transactions, extending to the point where data from the component manufacturer may not only be counter-calculated but even repurchased, with the analysis sold in return.

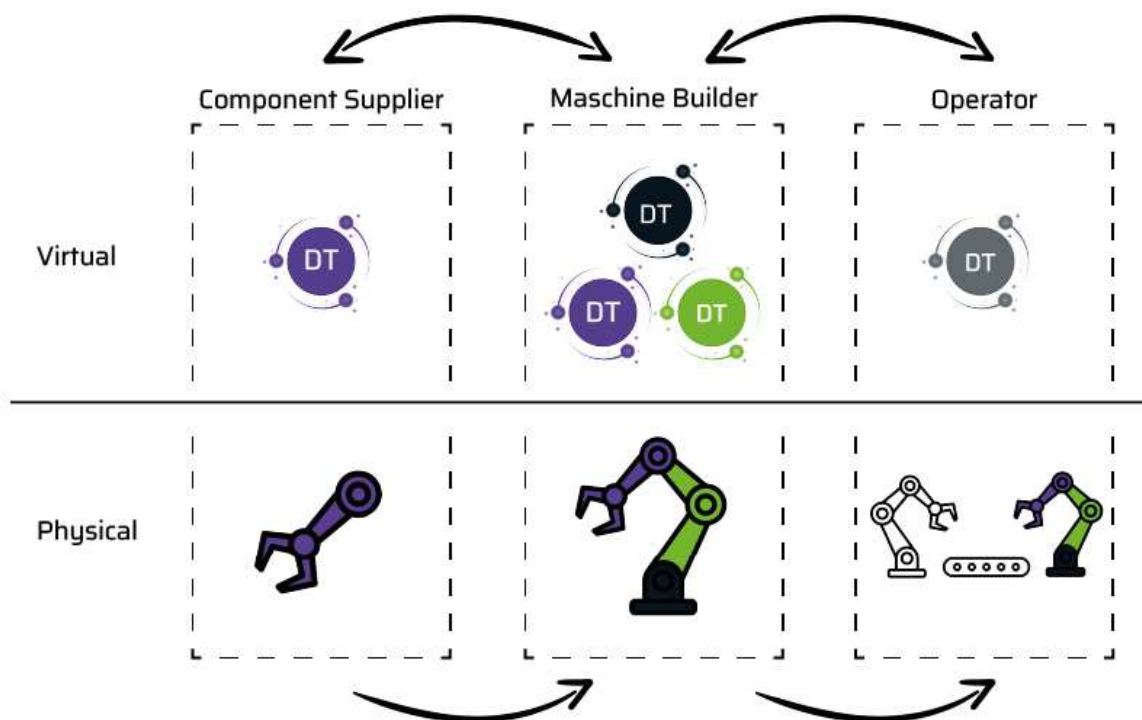


Figure 2: How data can be shared through digital twins

Thus, through standardized digital twins and the networking of data spaces, implementing cross-value chain digital value-added services becomes feasible. While it's understood that several pieces of the puzzle need to fall into place for this vision to be realized, a tendency in this direction is clearly evident, which is why the component supplier work group within the OI4 Alliance believes in this approach. The following sections will delve into what currently exists and what efforts are underway to make this vision a reality.

Let's Get Technical

What might a "standardized digital twin" look like? For that, we see the Asset Administration Shell (AAS) as a key technology and central standard. The use of this AAS in industry reflects the growing tendency towards standardization and interoperability within Industry 4.0 and digital transformation. The increasing availability of software solutions providing this AAS meta-model, such as the [Twinsphere](#) Suite developed as part of the OI4 Alliance's component supplier work group consortium project, indicates a growing demand.

Companies seek to enhance their competitiveness by deploying standardized and interoperable digital twins. The AAS enables efficient cross-company interoperability based on internationally recognized standards, laying the foundation for digital exchange

and data utilization across the entire value chain. Initiatives like Catena-X and Factory-X further underscore this development, aiming to create data-driven value chains based on trustworthy, collaborative, open, and secure industry-specific dataspaces. The activities and goals of Factory-X, Catena-X and Process-X, as well as initiatives to build a unified SaaS platform for providing standardized digital twins based on the AAS, illustrate the industry's commitment to building interoperable digital ecosystems, enabling efficient collaboration and secure data exchange across corporate boundaries.

They promote the standardization and use of the AAS of the IDTA, ultimately contributing to realizing the potential of digital twins and optimizing business processes. The charm lies here, similar to the development of the Internet, in a decentralized approach that allows data exchange from different environments via a common standard. To stick with the internet analogy, one can compare various product catalogs with browsers, enterprise IT with homepages, and the AAS with REST interfaces. In addition to a clear structure, the Asset Administration Shell offers high flexibility through existing and expandable sub-models.

What's Missing to Make the Vision Reality

The integration and functioning of the Industrial Internet of Things (IIoT), as highlighted in several areas, are significantly dependent on the interoperability and standardization of the involved systems, devices, and platforms. The Asset Administration Shell (AAS) plays a central role as a unified data model for digital twins. Now, what needs to happen concretely for IIoT to work? For successful IIoT implementation, agreement on industry-wide standards as well as the application of them are essential.

Standards such as the specification according to which the AAS of the IDTA was developed ensure a common understanding and uniform structure in dealing with digital twins and their data. Seamless communication and data integration between different devices, systems, and platforms must also be enabled. This requires open interfaces and protocols that allow for data exchange and processing across system boundaries. The security of transmitted and stored data must also be ensured through suitable encryption methods and access controls.

Furthermore, data privacy requirements must be met to strengthen user and operator trust in the IIoT. To make the importance of data across system boundaries understandable, the use of semantic technologies is a crucial and part of the AAS. In terms of concrete technical usability, fostering the collaboration of different companies is particularly important. The development and implementation of IIoT solutions require cross-industry collaboration between manufacturers, suppliers, IT companies, and standardization bodies. New platforms for digital twins must be developed and operated collectively, existing platforms,

systems and applications must be enabled to handle standardized digital twins to be part of this future digital twin ecosystem.

With this said, the component supplier work group has come together to collectively move in precisely this direction. In addition to the common challenges in terms of interoperability based on standards, the responsibility lies with each company itself to prepare and structure its data in such a way that it can then be made available as digital twins. Existing processes, applications and systems should also be adapted and optimized to meet the new requirements, especially considering the shortage of skilled workers.

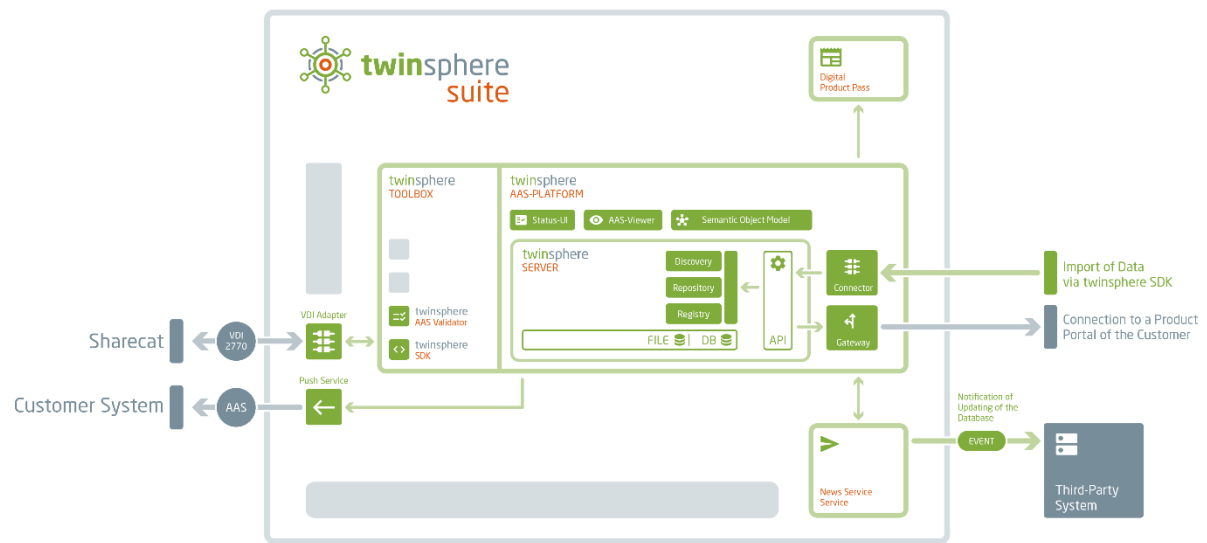


Figure 3: Twinsphere Suite leading example

Companies as Partners - The Consortium Project and Insights Gained

Five component manufacturers from the component supplier work group of the Open Industry 4.0 Alliance - AS-Schneider, Dunkermotoren, Endress+Hauser, ifm, and Kübler - together with Complement as the implementation partner, have joined forces for pioneering work to take the first step towards AAS & digital twins. They aimed to provide standardized, digital, and interoperable basic product data such as digital nameplate data, technical data, or accompanying documents. Strictly adhering to the motto "Start Easy," or in other words, recognizing that without successfully implementing basic product information, more complex use cases are futile, they opted for a simple approach - with shared risk.

Through this collaborative consortium approach, initial costs could be shared and kept within manageable limits. By focusing on the AAS standard and, more importantly, the underlying approaches of product-centric data bundling and standardized modeling and exchange of data, a path was chosen that inherently brings a certain level of investment security, as this is undoubtedly the future from their perspective. The realization was a platform that allows companies to generate, host, and manage standardized digital twins based on the AAS concepts in large quantities and, of course, make them available to respective customers. Moreover, all others benefit from this pioneering work, as the platform is now available on the market as a finished SaaS product, significantly reducing the entry barrier on the tool side for companies starting with AAS.

In the fall of 2023, the solution was presented at SPS 23 as part of a "Digital Twin Challenge" in a hands-on manner, open to all interested companies. Alongside the five pioneers, other companies, with or without OI4 Alliance membership, provided their digital twins for the challenge. This event effectively demonstrated standardized openness and interoperability. Due to the overwhelmingly positive response, a repeat event is planned for HMI24 in Hannover and other trade fairs, inviting everyone to witness the progress and possibilities behind standardized digital twins firsthand. This presents an ideal opportunity to gain detailed insights at the Open Industry 4.0 Alliance booth. Furthermore, individuals have the chance to become part of the OI4 Alliance and participate in various work groups to gain experiences for their own implementations.

Just as important as open collaboration between companies is the interaction between different organizations and associations. The IDTA and OI4 form an ideal power couple for companies involved in implementing digital twins based on AAS or planning to do so. Regular joint hackathons are held to further advance the Asset Administration Shell as the standard for digital twins. The IDTA oversees the fundamental standardization and specification of the AAS, crucial for functioning interoperability, while OI4 Alliance provides best practices for successful implementation across different industries and use cases.

Depending on the level one operates at, ideal partners can be found to exchange information about current respective obstacles. This collaborative effort, alongside a reliable idea, is essential for successfully navigating the path forward.



Figure 4: Together to success: taking on step at a time

Outlook and Further Collaborative Implementations

Where does the journey go from here? After successfully mastering the simple use case of basic data provision such as digital nameplates, the focus has shifted towards defining and realizing new functionalities. Specifically, efforts are directed towards providing extended data such as the CO₂ carbon footprint, which naturally includes work within the respective companies to accurately determine this for individual products. Additionally, features related to the handling of digital twins are currently in development, such as direct pushing into customer systems and various versioning and convenience features to facilitate easier management of a large number of Asset Administration Shells.