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MindSphere for a closed-loop digital twin

Solution brief

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The inefficiencies of product and process design

To reduce risk and ensure the performance of products and processes they support, industrial organizations need to be able to validate and optimize their designs before they're put into production. However, many industrial organizations can only do so with physical prototypes. This approach creates significant downside because physical prototypes can result in higher costs and longer simulation, testing and analysis at the front-end of a project. Furthermore, many products require multiple rounds of prototyping before the product is ready to be implemented or released to the market.

Once a product is put into production, many industrial organizations have no way to track its operational data, and thus have limited transparency into aspects such as machine status, energy usage, health and more. Without these insights, it is not only difficult to optimize current operations, but also to improve future product iterations in any meaningful way.

To overcome these challenges, industrial organizations need a way to virtually test products and processes prior to implementation, and continually enrich them with insights from operational data.

Use MindSphere to implement digital twin

By leveraging MindSphere – the cloud-based, open Internet of Things (IoT) operating system from Siemens – you can connect your physical assets to the virtual world to establish digital twins. A digital twin is a virtual copy of a physical product or process that can be used before it is put into production to test designs, analyze outputs and more – all without investing in physical prototypes or impacting production.

Challenges

- Diminish high prototyping costs and long development cycles
- Lack of production data used for product/process design
- Understand how operational variables impact products and processes

Solutions

- Use a virtual product/process to test designs and analyze outputs
- Use closed data feedback to optimize operations
- Maximize asset health, performance and energy usage based on operational data

Results

- Achieve shorter product development cycles
- Understand the impact of operational variables
- Experience less risk and costs associated with adjusting products and processes

Solution focus

Once your products are in production, with MindSphere you can create real-time feedback loops between the physical machines and their respective digital twins. This enables you to monitor operational data, like energy usage, health and performance. Operational data can be used to both support the product in production (via energy optimization, predictive maintenance, performance tuning and more) and improve the design of future iterations.

MindSphere supports three types of digital twin used in different phases of the product/process lifecycle:

- **Digital twin of product**: In the early stages of a planned product, you can use the digital twin to virtually simulate and validate properties in place of physical prototypes. This enables you to better understand how it will perform under various conditions, while reducing development time, improving product quality and enabling faster iterations
- **Digital twin of production**: The digital twin of production can also be implemented in the early stages of a project. However, instead of a single project, it is used to validate every aspect of production – from assets to plant controllers. This enables industrial organizations to identify sources of error or failure in a production line without negatively impacting anything on the factory floor
- **Digital twin of performance**: Once products are put into production, real-time data is gathered from the individual assets and overall production plant using the digital twin of performance. This enables industrial organizations to make informed decisions to optimize products and plant operations, as well as feed data back into the digital twins of product and production to inform future iterations

Core components

The digital twin solution from MindSphere is made up of several core components that enable you to virtually test, validate and predict the performance and health of products and processes. These components include:

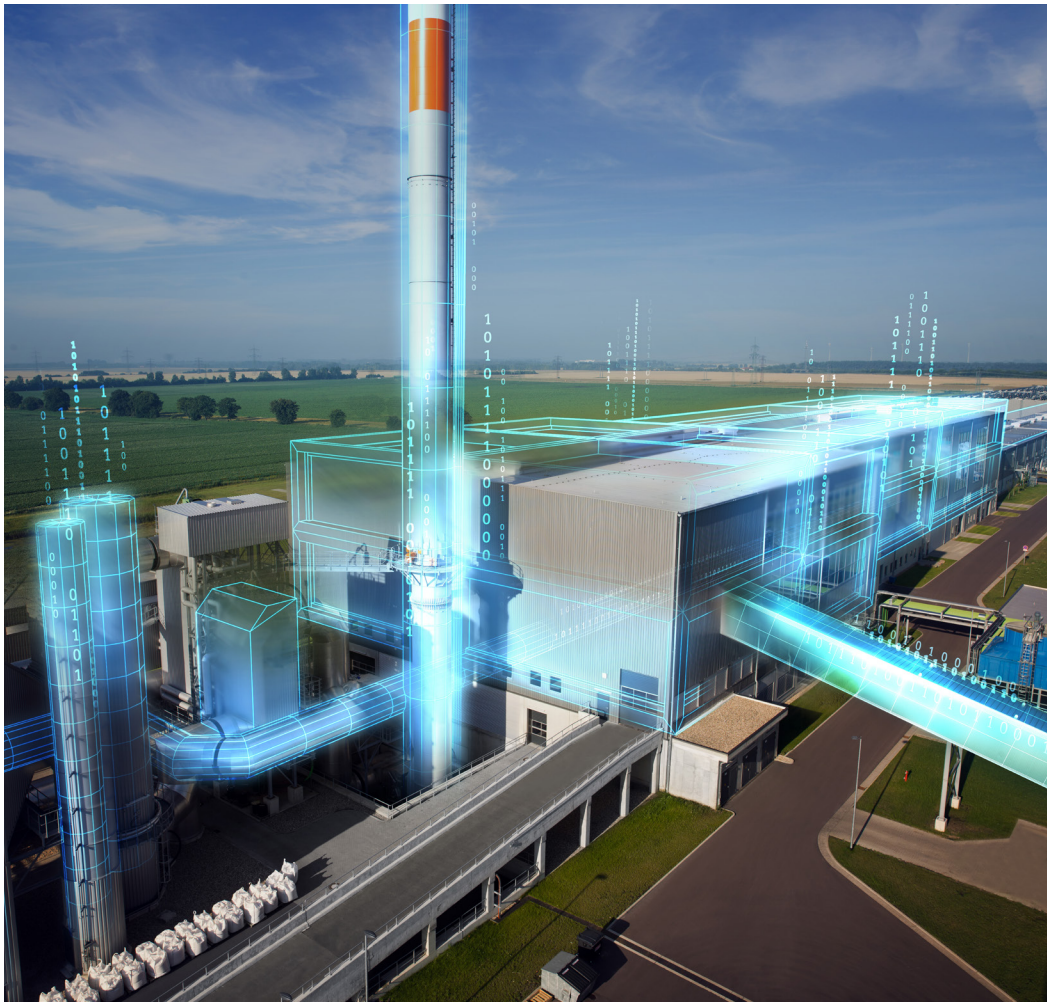
- **Digital thread**: A framework that enables real-time data flow between the physical and virtual components of the digital twin over the product's entire lifecycle
- **Generative design**: Design lighter components more rapidly, resulting in material savings and lower shipping costs
- **Intelligent models**: Maintain information: For example, the 3D computer-aided design (CAD) models and bill-of-materials (BOM) needed to optimize the construction and performance of products and processes over time
- **Smart products**: Integrate your virtual product definitions and production execution. Smart products generate massive amounts of data that can be used to help you optimize utilization and effectiveness
- **Predictive learning**: Build prediction models with machine learning to optimize product quality and reduce potential field failures and performance issues
- **Big data analytics**: Derive meaningful insights from product or process real-time health and performance data to detect issues earlier and optimize performance
- **Additive manufacturing**: Easily design and print parts by integrating design, simulation and digital manufacturing systems
- **Advanced robotics**: Use industrial robot programming to automate processes to save time and money building products. This helps you get higher quality products to market more quickly
- **Cloud technology**: Support your digital twin implementations with up-to-date, flexible and cost-efficient cloud-based information technology (IT) infrastructure that enables quicker innovation and time-to-market

Industry success story: Rittal GmbH & Co. KG

Rittal is a German manufacturer of electrical enclosures and one of their offerings is the Blue e+ – an energy efficiency climate control unit. When designing the Blue e+, Rittal sought ways to:

- Improve its efficiency and cost-effectiveness
- Better and more quickly understand machine performance, efficiency and health insights
- Reduce the burden on management

By leveraging MindSphere, Rittal was able to implement a digital twin solution that fed real-time operational data from the Blue e+ cooling units into its design and product lifecycle management (PLM) systems. This facilitated the use of a closed feedback loop to improve design capabilities on future iterations. Additionally, Rittal implemented predictive maintenance and performance monitoring capabilities that helped them lower operational and maintenance costs while also simplifying management.



Begin your IoT journey

To optimize and improve the design of products and processes, industrial organizations can leverage the digital twin solution from MindSphere. Virtually test, validate and analyze products and processes before they are put into production – all without the expense and time associated with physical prototypes or the risk of performing tests in production. Once in production, your team can use the digital twin to implement a closed feedback loop that helps you optimize assets in production while also enhancing future iterations.

To realize these benefits, you can contact your local Siemens representative or visit the MindSphere website.

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