E-BOOK

AN INTRODUCTION TO

DIGITAL TWINS

A PRACTICAL GUIDE TO NEXT-GEN OPTIMIZATION

TWINTHREAD

THE DIGITAL TWIN IMPERATIVE

For decades, the industrial sector has been contending with an ever-widening skills gap, the challenging operational state created when skilled workers exit the workforce faster than new hires come onboard to close the gap. This challenge persists today and is exacerbated by an even broader talent shortage.

Add to the mix skyrocketing energy costs, supply chain challenges, and rapidly-escalating inflation, and the industrial sector is experiencing something of a perfect storm. As a result, digitization and optimization efforts are accelerating.

Digital twins, and the process improvements they introduce, are gaining in popularity, but selecting the right one can be a challenge.

TwinThread can help.

In an effort to share our insight and expertise with this essential technology, TwinThread created both this ebook - which introduces the concept - and *Not All Digital Twins Are Created Equal*, a companion whitepaper that explores the topic at a deeper level.

Taken together, these resources will help you to learn more about the next chapter in process optimization, how it applies to your organization, and how to select the digital twin approach that is best suited for you and your business.

For additional information, or to schedule a discussion with one of our process improvement experts, visit us online at www.twinthread.com.

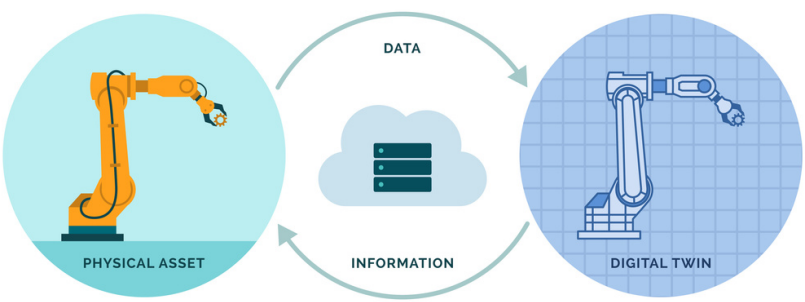
WHAT IS A DIGITAL TWIN?

A digital twin is a virtual, real-time representation of a physical asset, system, or process. The twin can reflect a single process within a manufacturing environment, a collection of field-based assets, or an entire multi-site industrial operation. In short, if the data can be acquired, the process can be modeled.

The representation of the twin is based on historical and real-time data captured from physical assets and processes impacting those assets.

Data captured from the asset or process serves as a virtual model which provides the foundation for generating insights and action through monitoring and analysis. This can drive performance improvements for the assets, associated processes, and the skilled workers required to operate and manage both.

Although digital twins are relatively new, they're more evolutionary than revolutionary. They simply represent the natural evolution of continuous improvement.



WHY ARE DIGITAL TWINS NECESSARY TODAY?

Digital twin technology provides the foundation for driving innovation through continuous and autonomous improvement, addressing the operational performance and skilled resource challenges facing industrial businesses. Maximizing operational productivity with minimal human intervention is the primary goal.

Digital twins enable businesses to establish and power a Virtual Center of Excellence (VCoE) to facilitate continuous innovation and improvement across a geographically-dispersed enterprise. This approach amplifies the expertise of engineering, operations, IT, and other teams of specialists within your business, empowering them to support multiple sites, processes, or assets.

The VCoE, acting as a synthesizer for operations, is composed of subject matter experts with deep domain expertise in the assets, processes, products, technologies, and services that make up the business. The VCoE, powered by the digital twin infrastructure, drives best practices and autonomous improvement across the enterprise through data capture, insight generation, advanced analytics, and new business process generation.

The VCoE eliminates physical location constraints enabling skilled experts and workers to drive operational improvement, maximize efficiency, and impact any asset or process regardless of their location at any particular time.

FOUR KEY FUNCTIONS. LIMITLESS POSSIBILITIES.

There are four foundational components and processes of digital twin solutions. They include:

1. Data connectivity and collection
2. Data contextualization
3. Analytics
4. Operationalization

Connect & Collect

The first phase of any digital twin initiative or journey includes automating the collection of data from data sources on a specific asset or across a manufacturing production line or plant. Typically a software data agent is used to rapidly connect to a data source, capture all the required data, and pushing that data into a digital twin architecture. Each asset or process will likely have multiple sources of data, so you must ensure that you're capturing information at the scale and frequency required to provide a *complete* picture of what you're trying to model. Any gaps in data can create gaps in analysis, and that could significantly hinder your optimization efforts. Completeness counts.

Contextualize

The foundation of any digital twin strategy and plan starts with data contextualization. Contextualized data are the datasets that can be visualized, monitored, analyzed, and acted upon. They also feed analytics engines and AI models for advanced and predictive analytics applications.

Contextualized data is captured from the raw time series and event data representing physical assets and processes. Part of this process includes capturing and harmonizing data points such as time, location, speed, operational states, and other such identifiers. This complete set of data increases both accuracy and actionability.

Analyze
As normalized and contextualized data is captured, detailed analysis can be conducted with a high degree of accuracy and insight. A robust digital twin platform will typically include a library of preconfigured applications, each designed to shed light into a drive greater efficiency and effectiveness.

Pre-built applications include:

- Quality
- Throughput
- Uptime
- OEE
- Energy utilization
- MTBF
- And others

In addition to the preconfigured applications designed to provide information in these critical areas, you should also be able to access the data and create your own applications and views. This capability empowers your engineering teams to derive unique insights without spending valuable time developing these applications from scratch.

Operationalize
As the analysis step translates raw data into actionable information, the digital twin will provide specific, prescriptive actions to operations personnel. As more data is collected and analyzed by the digital twin, the recommended steps become increasingly precise, even helping you to *actively avoid* issues before they transpire. This is perhaps the greatest strength of the digital twin model: it moves your entire organization from a reactive, to proactive, to predictive operational state.

World-class organizations will even integrate their digital twin directly into the control infrastructure. In this capacity, the twin moves from *recommending* the appropriate action to *taking* the appropriate action.

This move toward *autonomous operations* represents the next evolution of automation and optimization efforts, so the digital twin platform choices you make today are critical.

GETTING STARTED

Now that you've learned the basics of digital twin technologies, the next step is assessing which approach is best for you. There are several different paths to take in your optimization and autonomous operation journey, but no matter where you are in that process, the right platform can "meet you where you are" to accelerate and improve your efforts. What. you can not do, however, is delay developing a strategy.

The whitepaper *Not All Digital Twins Are Created Equal* is a companion piece TwinThreads has created to provide a more in-depth exploration of digital twin technologies and to help you determine the approach that's best for you and your business.

To request your copy of the whitepaper, or to discuss your specific optimization needs with one of our consultants, visit us online at www.twinthread.com.

ABOUT TWINTHREAD

Purpose-built to drive innovation at scale, TwinThread's AI-enabled industrial operations platform delivers actionable equipment and process insights. Whether that equipment is on the plant floor, on the move, or in the field, you can improve performance, eliminate downtime, and ultimately create an autonomous, predictive Virtual Center of Excellence.