PERFORCE

Start Innovating with Digital Twins Technology

What Developers and Decision-Makers Need to Know to Be Successful

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Introduction

Cutting-edge teams across industries are using digital twin technology to drive innovation in many areas of business, from product design to marketing. Digital twins are being used for prototyping, maintenance, collaboration, customer experience, and so much more. This white paper covers:

Digital Twin vs. Digital Replica

Before diving into how multiple industries are using this technology and how your team can get started, it's important to understand the key differences between a **digital replica** and a **digital twin**.

DIGITAL REPLICA

A digital replica is a digital recreation of a real-world object or system. It typically refers to highly accurate representations rather than simplified models. One example of a digital replica is a 3D model of an office building, complete with electrical and plumbing systems.

DIGITAL TWIN

A digital twin is much like a digital replica in that it is a digital model of a real-world object or system. The key difference is that a digital twin incorporates simulated data or data that is continuously collected from its real-world counterpart, using that data to simulate the object or system's actions and performance in real-time. Digital twins are therefore more complete representations of the real object or system. They give teams insight into how various parts of the whole interact, or how the item interacts with other parts or systems.
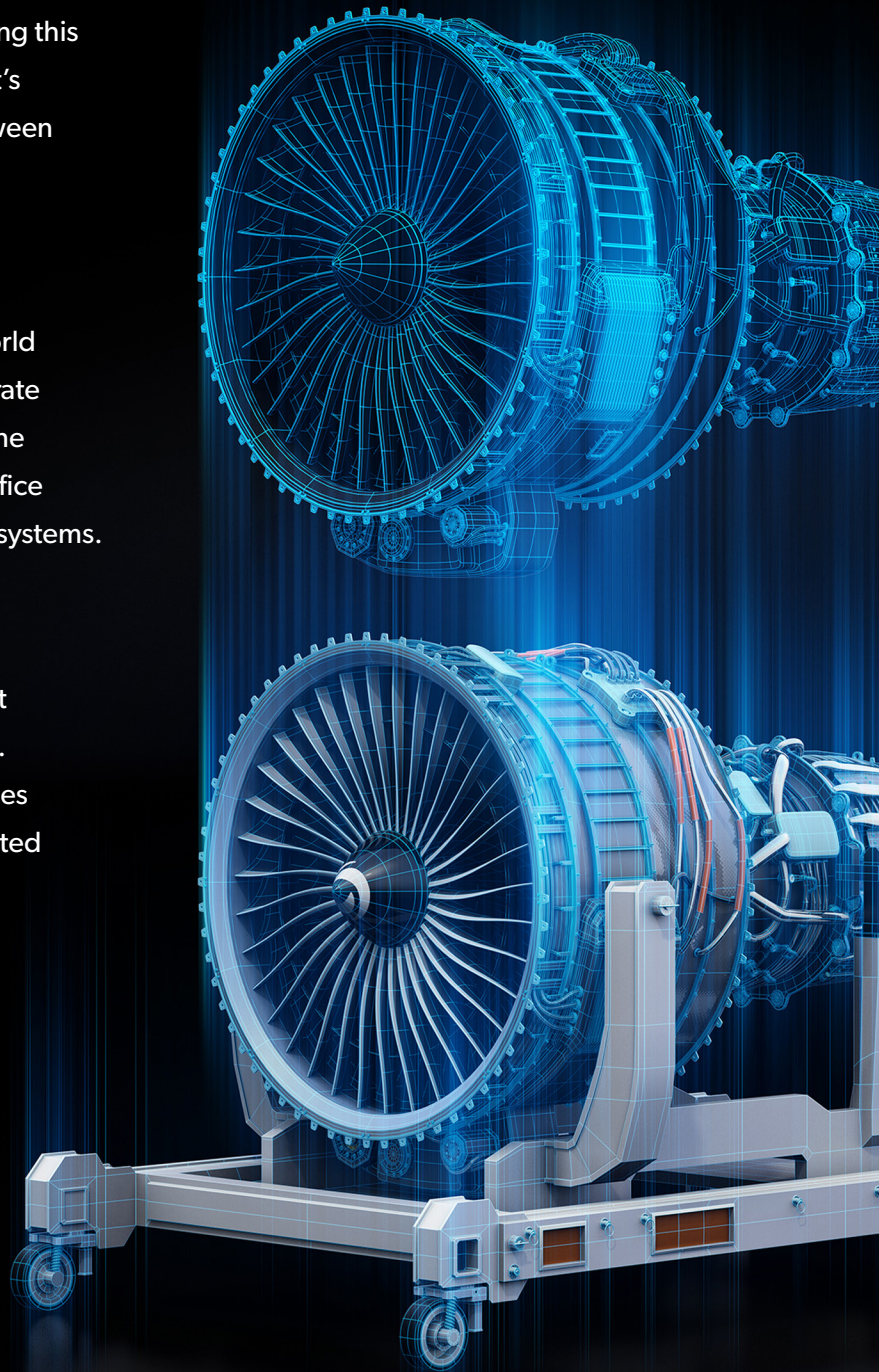
Why Start Building Digital Twins?

According to Research and Markets, the global digital twin market size is expected to reach $63.5 billion by 2027, rising at a market growth of 41.7% CAGR (compound annual growth rate) during 2021-2027. This rapid growth is indicative of the technology's immense value to many industries.

Digital twins can save your team time and money, as well as help you make better decisions. For example: General Electric used digital twin technology to identify a supply leak on a gas turbine and saved $9 million. It also used the technology to detect increased suction temperature on a centrifugal compressor, saving $3.2 million.

CHEAPER PROTOTYPING & BETTER TESTING

Typically, errors with a design don't become known until the product has been prototyped. Digital twins, paired with advanced physics engines like the kinds found in game engines, allow your team to replicate complex testing scenarios. This allows you to predict and address issues before you create and test the physical prototype.

DEVELOP FASTER & ACCELERATE TIME-TO-MARKET

Being able to create digital prototypes and run digital tests means new changes can be tested faster. The development process is therefore accelerated, and time-to-market is sped up. Your product can reach its consumers faster without compromising quality or safety.

PREDICTIVE MAINTENANCE

Digital twins give companies the opportunity to move to a predictive maintenance model that strikes a balance between corrective maintenance (I.e., fixing a part once it is spent) and preventive maintenance (I.e., fixing a part before it fails and disrupts production). IoT devices collect data on your systems and feed them into your digital twin. Outliers, spikes in usage, or unexpected behaviors can be monitored. If a problem begins to develop for a component, teams will be aware of it before it has the chance to halt production or before it becomes a hazard.

BETTER DECISION MAKING

Digital twins allow your team to incorporate real-time data from sensors and the environment for better decision-making. Whirlpool Corporation, for example, uses data from its smart, connected products and a digital twin to test new concepts. They're able to use facts gathered from real products to base new ideas and decisions on. (Source: PGS Software)

Examples of Digital Twin Innovations Across Industries

AUTOMOTIVE

Automotive companies like Porsche and BMW use digital twins to build more prototypes without the added expense. CAD models that were static and did not offer highly dynamic views are now being transformed with real-time rendering. Crash tests are simulated, and physics altered to learn how a car will perform on different terrain or in unique situations. They are also using game engines to train driver assistance systems with synthetic sensor data.

MANUFACTURING

Manufacturers are using augmented reality (AR), virtual reality (VR), and mixed reality (MR) applications for training and maintenance. Through AR headsets, technicians can view the most up-to-date models of the machine laid over the one in front of them. This ensures they always have the right specs as they need them. Digital twins can enhance this process even more by overlaying real-time data and simulations.

AEROSPACE

Boeing has used digital twins to predict the performance of different components. They even achieved a 40% improvement rate in first-time quality, saving development time and money. They have also used IoT sensors to determine the ideal cargo load balance.

ARCHITECTURE & CONSTRUCTION

Architecture firm Foster + Partners used digital twin technology to oversee development on a site in London. They used a robot dog to collect data around the site, which was fed into their digital twin of the building. The digital twin could then be used to compare the design to its built reality.

5 Things Your Team Must Do to Succeed in Developing Digital Twins

Teams developing digital twins for the first time can make several mistakes:

- Storing data improperly.
- Trying to do too much too soon.
- Not testing enough.
- Integrating tools in their pipeline improperly or inefficiently.
- Not getting buy in from stakeholders throughout the process.

The guidelines below will help your team be more successful with your first digital twin project.

1. CREATE AND COMMUNICATE STANDARDS

When working on digital twins and replicas, teams may use a variety of tools for design and development. It is important to create standards across your project early so that you do not run into issues down the line. For example, decide how code changes should flow, how often to test, and how all components will work together. Then, communicate these standards out to the teams involved.

Furthermore, at the most basic level, it is vital to have a naming convention for your data that can be easily understood by everyone on a team. It is significantly better to have tools that make asset storage, tracking, and versioning your data easier and more streamlined.

2. STORE DATA EFFICIENTLY

Digital twins rely on data from the object they are emulating. They rely on it in the initial design of the digital twin itself, as well as in the twin's continuous iterations. But when you are working with potentially multiple models of the digital twin and continuously updated data, you will be dealing with a huge mass of data. All this data needs to be stored efficiently and in such a way that each iteration is clearly labeled and identifiable. This means assets need to be versioned and tracked throughout development.

3. START SMALL AND SCALE

Creating digital twins and replicas of an entire system or structure is a goal for many companies. Just like in real life, many of these larger projects include interdependent systems. With any project, it is important to start small and scale. Breaking up your project into easily replicable components will allow you to build (and potentially reuse) as you go. Where possible, use automation to make processes as seamless as possible.

For many teams, component-based development lends well to building digital twins because different teams can bring different aspects of the project together. You can split up your final design into reusable pieces, allowing you test components together and see how they can work in a variety of designs.

4. ITERATE AND TEST OFTEN

Digital twins and replicas rely on data, but not all data is the same. Human errors and duplications can throw off a model. If something feels off, it is important to look at the source data and iterate/test often. This goes back to storing and versioning both your data and prototypes the right way.

5. COLLABORATE AND GET BUY IN EARLY

If you are a company looking to leverage this emerging technology, make sure you are collaborating with all stakeholders. The goals, capabilities, and limitations of your digital twins project must be clearly communicated early on in order to receive buy-in and continued support throughout its development. All stakeholders need proper visibility into the project. They should also have the ability to collaborate on it within the project's tools, where the information lives.

How to Start Building Digital Twins

PLANNING

Solidifying a plan, or proposal, for your digital twin is likely your first step in securing buy-in from decision-makers. This is where you will determine what your first digital twin project will be. Planning will require you to ask:

- Which processes or products could be understood better, or made more efficient, with a digital twin?

- What will be the function(s) of the digital twin? (Prototyping? Monitoring & maintenance? Automation?)

- What goal(s) would it support?

- Who will have access to which data?

DESIGN

Determine the kinds of information required across the lifecycle of the asset you are creating a digital twin of. How will this information be exchanged between systems?

Revisiting the question of your digital twins' function — who will it ultimately be shared with? If your digital twin needs to be highly realistic for marketing or other purposes, you may want to implement a game engine (such as Epic's Unreal Engine or Unity) that can handle advanced rendering.

OPERATION & ITERATION

This process tends to develop naturally. As you begin utilizing a digital twin, you will find more opportunities to collect and layer additional data. Again, start small and scale. You might start with a digital replica and eventually start adding in real time data.

It's important that your tools don't dictate your process and interfere with your ability to adjust the project to fit your team's needs. If your ultimate goal is to implement digital twin technology to solve evolving business needs, it pays off to begin with a solid foundation of tools. You want tools that can handle increasingly more complicated projects.
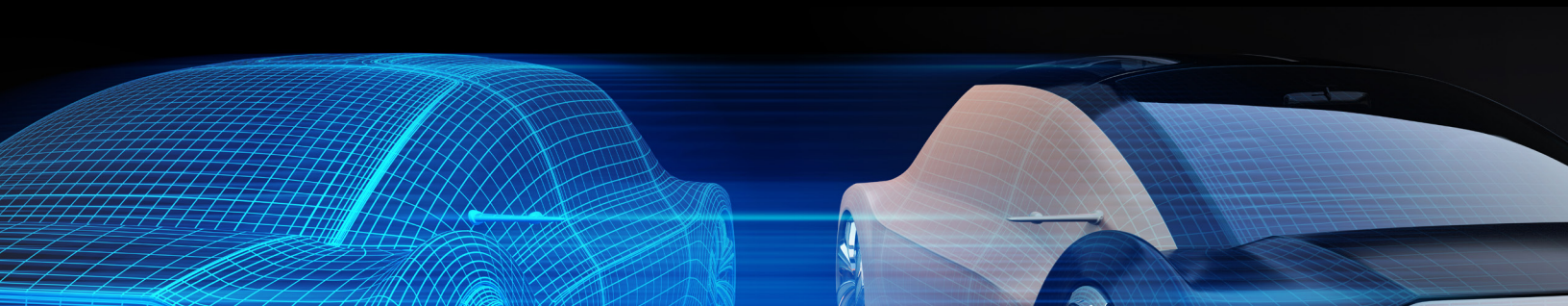
Build Your Digital Twins Development Pipeline

CAD OR 3D MODELING TOOLS

CAD designs can be exported into other tools in the pipeline. Having CAD or 3D modeling tools in your pipeline means you do not have to make the same changes twice in two different tools. If a change must be made in a CAD design, it can be brought over seamlessly into the enhanced digital twin. This makes for faster development

IOT/CONNECTED DEVICES

IoT & connected devices and sensors supply continuous, real-time data from the real-world object that is emulated in the digital twin. Data collected from the IoT devices is transferred via the internet or an edge server to the IoT platform, where it is organized based on the team's needs.

GAME ENGINES

Because of their powerful rendering abilities and advanced physics engines, game engines like Unreal and Unity supercharge the capabilities of digital twins. They make visualizations easier to understand by bringing them to life and enabling an emotional connection with the thing they represent.

VERSION CONTROL

When designing digital twins, version control becomes the foundation for your pipeline. All of the data collected and created in the digital twin process (and there is a lot of it) can be securely managed with the right tool. Being able to manage changes to files over time and store these modifications in a database allows you to capture the true benefits of digital twin technology.

For teams in heavily regulated industries, version control is critical for the audit process, as you need a complete history of all of the changes made to the digital twin project. Plus, the right version control tool protects your proprietary data. Some version control systems require individual team members to download entire repos, giving them access to more information than they should have. It's better to opt for version control that allows you to lock down assets to the individual file (like Perforce Helix Core).

Conclusion

Digital twin technology could revolutionize your team's processes. When you have a process that relies on up-to-date data, a digital twin could make it faster, more efficient, more cost-effective. Moreover, it allows your team to be informed with the latest and most comprehensive data.

To build digital twins, your team will need to manage a huge mass of data. Doing so efficiently and securely requires a robust version control system.

HelixCore

YOUR FOUNDATION FOR DIGITAL TWIN DEVELOPMENT

Helix Core, enterprise version control by Perforce, is your team's most foundational tool in digital twin development. It integrates with your existing toolset and pulls in, stores, and versions changes to all of your digital assets. It ensures your team always has a single source of truth so that your digital twin is always operating on the best data.

SECURITY & COMPLIANCE

Helix Core is known for iron-clad security. It can even protect down to the individual file-level.

SAFETY STANDARDS

Helix Core allows you to trace every change, helping you comply with regulations and audits.

GLOBAL COLLABORATION

Helix Core delivers files and feedback at lightning speed, even if you're collaborating with remote teams across the globe.

REQUEST A DEMO

perforce.com/products/helix-core/demo

Case Study: Manufacturing Company

"Everyone loves Helix Core. Using it significantly simplified our workflows and reduced delivery times by at least 50 – 60%."

— Technical Director at a global manufacturing company

At a global manufacturing company, a Technical Director and team of 10 artists create assets for AR and VR simulations for training. This team often needs to send files back and forth with the development team. Helix Core was their solution for managing, versioning, and collaborating on their assets. With Helix Core, the team reduced delivery times, automated their workflows, and increased velocity on remote collaboration.

"We would never want to go back to the old way." — Technical Director

Read more about this customer >>

Start Small and Scale with Helix Core

You don't need to build an enterprise-sized digital twin project to use enterprise-grade tools. Helix Core version control is free for up to 5 users & 20 workspaces.

Start small and scale as your digital twin capabilities evolve.

Get complete control over all your digital twins assets.

Deploy your way, on-premises or in the cloud.

TRY HELIX CORE FREE

perforce.com/products/helix-core/free-version-control