Digital Twins: What They Are and What They Mean for Your Engineering Firm

As digital twins become mainstream, how can they help advance your engineering work practices? We answer all your questions

Adam Klatzkin
Vice President, Business Development
Bentley Systems

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What is a digital twin?

A digital twin is a digital representation of a physical asset in the moment. You can leverage the digital twin to understand what is happening with real-world assets in real time, giving you visibility into these assets without having to leave the office. It helps you collaborate more easily and more effectively with distributed teams or stakeholders and, ultimately, make more informed decisions that lead to better performance.

The relationship between the digital and physical asset should be symbiotic. The analysis and insights that happen within the digital twin become actions and interventions that feed back to the physical asset, resulting in outcomes or changes to the digital twin. Ultimately, organizations leveraging digital twins will not only reduce costs and risks for a single asset. Their digital transformation can also allow them to optimize performance across an entire portfolio, and future projects as well based on the lessons that have been learned.

Give an example of how an engineering firm might use a digital twin in the design and construction of a bridge.

There are two realities that we need to recognize. The first is that engineering projects have massive amounts of data, which is typically understood by a single application or expert user and not available in other contexts. To compound it further, the data is always changing as the project progresses. The second reality is that engineering projects tend to store data in multiple, siloed data sources, making it even more difficult to track and manage data.

Digital twins need to handle these massive amounts of data while bringing it all together in a single view. The digital platform needs to align and federate data.

Users begin creating a digital twin by first developing a reality model. The engineering team provides data about the physical location of the site where the bridge would be constructed. Team members would use a reality capture via unmanned aerial vehicles to establish a reality mesh or use their reality capture data in combination with map and terrain data. All data would be brought together to show true site conditions as the model is continuously surveyed and synchronized.

As design and engineering progress, the files will likely reside in a connected data environment. Connections are then established between the model and the files in the connected data environment. Now, you have a digital twin that uses the data to detect changes. It is aligning disparate data together into a single digital representation of the physical bridge that you're engineering and showing you the changes as they come in. The digital twin can validate the trustworthiness of that data through data quality services, which are all automated and validated against codes and standards that you input.

Immediately, the engineering team can start recognizing the benefits of an easy-to-use, web-accessible model that is not just a mirror of what they are designing against a physical reality, but rather provides a deeper understanding due to all data being in one view. Clients and stakeholders can view the digital twin too, seeing how things are changing over time while accessing the data they need in the moment.

Bentley offers iModel.js, which is our open-source development platform, and iTwin® Services, which is our commercial offering built on the platform, to help our users create and manage their data in a digital twin.

Do you see a lot of clients using digital twins?

Yes, there is no doubt that there are a lot of users implementing digital twins. It is a rapidly growing market, and we see some interesting third-party research showing that the digital twin market will soon surpass that of BIM. This does not mean, however, that BIM is going away. Digital twins will not replace BIM but advance BIM, complement BIM, and enable further digital transformation.

When we look at who is driving the adoption of digital twins, most of the initiatives are by owner-operators, but there is significant drive within engineering service firms, especially in the transportation sector. Transportation is a leader of digital twin adoption, closely followed by plant, particularly oil and gas and chemical, metals, and mining.

Can digital twins be used on small projects as well as large ones?

The size of a project is not an inhibitor. The benefits of digital twins can apply to projects of all sizes.

Does everyone involved in the project need to be using the digital twin for it to work?

You recognize more value as more data is connected into the system. The value of the digital twin is only as great as the data that has been federated into it.

If there are members of the team who are not adding data to the digital twin, there will be constraints on maximizing the value of all the asset data when creating the digital representation. You will still have a working digital twin but without all the information, you may miss out on some of the insights that it can provide.

How do digital twins help users manage their data?

Digital twins are connections of multiple data sources. There are three main types of data sources across an asset lifecycle: engineering technology, informational technology, and operational technology. Digital twins need to federate and connect all this data to make it easily accessible.

A project or asset may have different sources of truth for information, whether an enterprise data base, a design file, or a connected data environment. A digital twin should not be a source of truth; rather, it should be a view of the truth. A digital twin needs to be a federation of all the relevant information and data sources wherever they reside. The information is brought together into this single view where you can look through it all, almost like a single pane of glass.

What opportunities do digital twins present?

Digital twins present a new business opportunity for engineering services firms. Many of the users that we have spoken to see digital twins as a way to deal with challenges, such as aging workforce, skills shortage, and shrinking profit margins. There is an opportunity not just to do things more effectively and efficiently, but also to create a new business model where they start delivering digital twin services to clients and, therefore, expand more into operations and maintenance because they have more data to support these phases.

There is a growing opportunity for these firms to maximize the value of all the owner's data into operations, providing digital leadership and transformation to the owner during operations. They are really focused on following that data and maximizing the value of it over the entire asset life cycle.

These opportunities are generating a lot of optimism, as well as new opportunities, around the value of digital twins, beyond just the efficiencies.

Where do you see digital twins going in the next few years?

One potential for digital twins is with machine learning. Right now, there is a large amount of data that is collected within the digital twin—due to all the changes and connections among information. With machine learning and artificial intelligence, users would no longer need to manually manage it all. Machine learning creates an opportunity to see the lessons learned from a portfolio of projects and identify trends and patterns that resulted in mistakes, cost increases, or safety incidents. We can flag those trends and machine learning will automatically alert us if they appear in future projects.

It is important to get started using digital twins as quickly as possible to avoid being left behind. . We really encourage everyone to take a look at digital twins, find that low hanging fruit on those lighthouse projects, and get started now.

A good place to learn more about digital twins is: http://www.bentley.com/iTwin.