Digital Twins: Better Decision-making Requires Better Data

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Advancing Infrastructure

Can you tell me about your digital twin offerings? What do they entail?

We provide PlantSight®, a digital twin for process industries, that brings together plant data and operating information, contextualizes it, validates it, and visualizes it in a single "pane of glass." PlantSight transforms raw data into a living and evergreen digital twin that is accessible from anywhere 24/7 using a standard web browser. It maintains a timeline of change that captures who-changed-what-when so you always know you have trustworthy and actionable information on which you can confidently make informed decisions. PlantSight is a commercial-off-the-shelf digital twin template that Bentley co-developed with Siemens.

We also provide digital twin workflows called iTwin® Design Review and iTwin Design Validation, which support engineering design coordination and collaboration for engineering, procurement, and construction firms that are developing digital twins. These cloud services enable digital information managers to align engineering data, reality data, and associated data from diverse design capabilities and file formats and transform them into a digital twin with no disruption to their current applications or workflows.

In addition, we provide a range of digital twin-enabling technologies for visualizing, simulating, and monitoring assets in the built and natural environments. These applications include ContextCapture for reality modeling, SYNCHRO™ for 4D construction modeling, LEGION® for pedestrian simulation, CUBE and Streetlytics™ for vehicle simulation, OpenFlows® FLOOD for flooding simulation, and AssetWise Digital Twin Services for immersive digital operations.

Our digital twin offerings are built on an open source platform called iModel.js, which developers use to create digital twin-enabled applications. Our platform's distinguishing capabilities are its ability to scale to the largest digital twin models, even city-scale, and its ability to record the timeline of engineering change at a granular level.

We believe that no one vendor will be able to satisfy the myriad requirements and potential applications of digital twins that will emerge over the next five or more years. No one knows what a digital twin is going to be five years from now, but it's a safe bet that it will be connected to more systems than are possible today. Users want the flexibility to change as requirements change and as new things become possible. In software terms, that means being open. So, it is important for organizations to take an open approach when they are selecting digital twin technologies and vendors to work with. Open wins.

What advances have you made in the past 18 months?

In the last 18 months, we at Bentley acquired several companies that further our digital twin strategy. These companies include Citilabs, a leading provider of transportation simulation and analytics software, and Orbit Geospatial Technologies, a leading provider of software for managing and sharing very large amounts of imagery, point cloud, and 3D mapping data for use with digital twins and reality modeling.

In mid-2019, we launched PlantSight, iTwin Design Review, and SYNCHRO 4D. We also released version 1.0 of iModel.js, our open source library for digital twins.

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In October 2019, at our *Year in Infrastructure* Conference, digital twin advancements featured in <u>24 finalist projects in 15 categories</u> in project locations across 14 countries ranging from power stations, steel plants, and buildings to transportation, water networks and treatment plants.

Among them, Hatch completed pre-feasibility, feasibility, and detailed engineering for a sulfuric acid facility in the Democratic Republic of the Congo. Our plant design software enabled the project team to design a complete, intelligent digital twin to the most granular level of detail, moving the engineering quality processes upstream as part of the 3D modeling effort compared to traditional drawing-based quality processes. Hatch was able to reduce production ramp-up after hot commissioning from six months to one week.

Why have you made these advancements? Were they technology driven or developed to meet market needs?

Many asset owners struggle to pull together a single, holistic, and up-to-date view of their asset or project portfolio. Having access to trustworthy and actionable asset data is critical for them to demonstrate compliance with health, safety, and environment regulations, as well as to make better-informed decisions.

We provide a digital twin platform that pulls together asset data from multiple sources into a single pane of glass, forming a single view of the truth (accessible 24/7 from wherever you are), helping asset owners improve asset performance and reliability, reduce risk, and ultimately deliver lower whole-of-life costs.

Asset owners are looking to digital twins to help increase maintenance planning effectiveness, minimize site visits (such as helicopter flights to offshore structures), and reduce health and safety risks associated with traditional inspection methods. Maintenance activities can be rehearsed virtually and sometimes remotely assisted.

Digital twins have become practical due to the convergence of 3D and 4D visualization, reality modeling, mixed reality (XR), and geotechnical engineering, enabling an immersive and holistic view of infrastructure assets above and below ground.

How do you see the market for digital twins developing?

Digital twins bring benefits across the project and asset lifecycle and for use cases at different scales, ranging from individual assets and buildings to networks and campuses, cities, and regions to national digital twins and international property portfolios. Digital twins are used for many different purposes—such as visualizing, simulating and monitoring—which require different levels of granularity and frequency of update. Some digital twins require millisecond updates while others are updated only weekly or periodically. Increasingly, synergies or value-add will be created by connecting digital twins, such as integrating device and equipment digital twins with building digital twins and campus digital twins. Ecosystems of connected digital twin "system of systems" will evolve. Ecosystems of developers and independent software vendors will coalesce to support them.

The volume of data that is available to decision-makers today is simply overwhelming. It is typically of variable quality and in incompatible formats, which make it difficult to

consume. Many organizations are data rich and insight poor. It is important to present data and, more importantly, insights in the vocabulary and in the context that users can understand and relate to. No one has really cracked the code for a fast and easy way to consume data in downstream workflows. However, mixed reality, voice-activated bots, and object identification via machine learning point the way for digital twins for high-value remote monitoring and remote assist workflows. Better decision-making requires better data, and better data requires effective information management.

Are there any industrial sectors that you are targeting?

Some of the most interesting applications for digital twins are in the oil and gas, as well as the process industries. A Fortune 500 industrial company applied reality modeling and construction modeling during the construction of a chemical plant. It developed a digital twin model of the construction site and simulated the effect of flooding and pooling to help construction sequencing and logistics. On digital projects, we are seeing field rework rates and claims drop to less than 2% – that is significant value.

Water and power utilities are also realizing benefits of digital twins, especially when combined with asset performance management and reliability-centered maintenance strategies. One power plant recently reported a reduction of 10% in maintenance activities, a potential 25% reduction in forced outages and a potential 10% increase in availability.

Bentley also has a large footprint in transportation with road network and rail network operators. Digital twins have broad application in advanced design environments, in which a fully functioning digital twin model is developed, allowing for different design choices to be analyzed right up to the construction phase – a more evolved approach compared to conventional methods. One engineering firm was able to deliver a significant project that was benchmarked at 33 months in just 18 months. The value of digital delivery is proven – higher efficiency, lower rework, and shorter schedules.

Can you give me details of any partnerships in this area?

Bentley has a strategic alliance with Siemens. The two companies jointly developed PlantSight. Siemens Digital Industries and Bentley also collaboratively developed Teamcenter for CALM (Capital Asset Lifecycle Management), designed to optimize the performance of capital assets—such as a plant, facility, or factory—in project delivery and operations.

Bentley also has a strategic partnership with Microsoft. Monthly active users of Bentley's cloud-provisioned applications, including digital twins, made Bentley one of the top 25 consumers of Azure in 2019. In both 2018 and 2019, Microsoft named Bentley as Partner of the Year in its CityNext category.

What challenges does industry face in making best use of digital twin technology? And how can you help overcome this?

With the Industrial Internet of Things, Industry 4.0, and the Fourth Industrial Revolution, companies are generating exponentially more and more data. However, 99% of that data is "dark." It is unstructured or in an inaccessible or incompatible format and there-

fore unusable. "Lighting up" and making use of that dark data leads to better decisions, ultimately resulting in better asset outcomes.

Much of the data that is collected is of questionable quality, so it needs to be validated before it can be acted upon. Bentley excels at the aggregation and alignment of engineering data. Our infrastructure digital twins federate data from multiple applications and formats, bridging and synchronizing design models from third-party design applications and common interchange formats with the digital twin. What differentiates us is our open approach. Open data and open source mean that users retain control and flexibility.

What are your plans for digital twins in the coming years?

We plan to make our open source digital twin library available as a platform-as-a-service. We believe that improving the productivity of the construction industry will require an industry-wide effort that can only be addressed by an ecosystem. We have a platform that the ecosystem can build on, that will help software developers accelerate delivery and rapidly scale up. We are also launching a partner program to offer developers support and to help them go to market.

When you think that we have to build six new Europes by 2030 to keep up with global population growth and urbanization, and then you consider what we can afford, you realize that the only way we can close the gap is by becoming more efficient, as well as making better use of the infrastructure that we already have.

How would you characterise your strengths/specialities in digital twins?

Our objective is to provide an open platform and enabling technologies for infrastructure digital twins. Bentley's core competencies are: CAD, BIM, and GIS data aggregation; 3D visualization; and 4D management of change.

We like to say that the greater the engineering density, the greater value we add. But often, there is great value from simply visualizing engineering data in context. Bringing layers of data together into a single pane of glass, or single view of truth, provides an intuitive way for many people to understand and interact with very complex information.

Further Reading

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

From Vision to Reality, From Idea to Action

For Digital Twins, Openness Wins

Digital Twins: The Path to Maturity