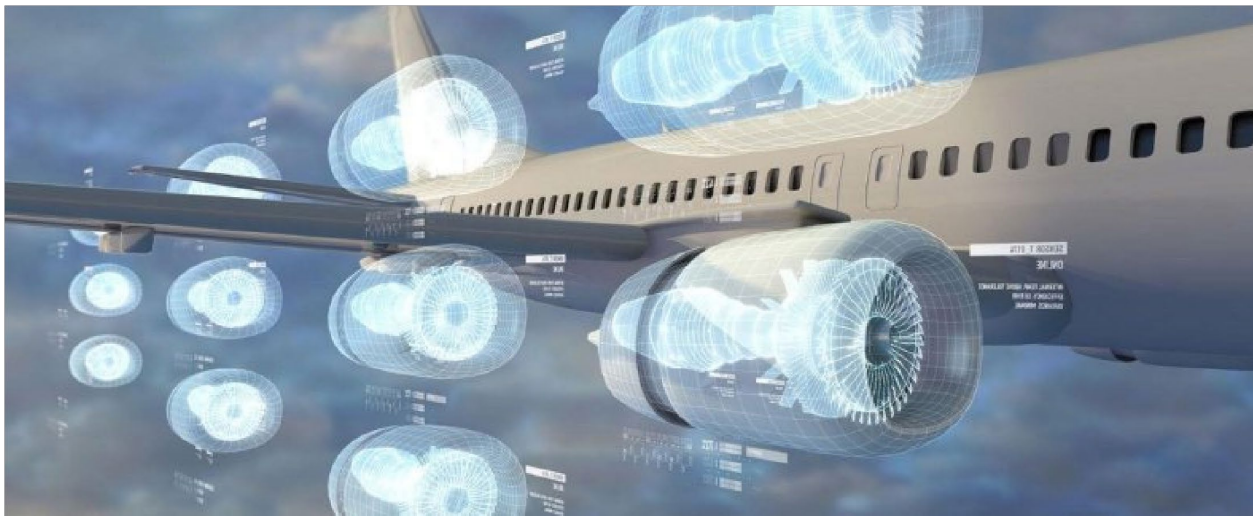
Digital Twin: The Engine to Power Transformation in the Food Industry

By Trevor Cox, Co-founder & COO, Terrantic Inc.

Digital Twins increasingly are essential to solve data interoperability problems and to turn data into intelligence. The food industry can increase top-line revenue and decrease costs by leveraging Digital Twins to manage some of the biggest challenges in the industry today: inflation, labor shortage, supply chain.

Most people aren't familiar with Digital Twins, yet. If you have heard of Digital Twins, you might think about them in the context of the simulation software industry, where designers use CAD (Computer Aided Design) models and simulation software to test different product design scenarios. A classic use-case of this form of Digital Twin is a CAD-based simulation for airplane design. In this case, a large CAD model of an airplane and simulated data are used to simulate changes to the aircraft design. These Digital Twins simulations emerged because it was impractical to build multiple protype airplanes to test every initial design change.

While Digital Twins have been commonly associated with the simulation software market as described above, others in tech and industry have coopted the Digital Twin terminology. The fact of the matter is that the definition of a Digital Twin is much broader than design simulations. A Digital Twin accurately describes an important new technology trend that is all about solving fundamental industrial data problems.



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This white paper will discuss the rapidly evolving Digital Twin technology trend and why it could be critically important to your business. First, let's define Digital Twin. Simply put, a Digital Twin is a virtual or digital representation of the physical world. The core tenants of a Digital Twin are (1) visualization of a physical object, process or system, and (2) connecting all the associated data to the physical object, process or system. Digital Twins can represent a variety of different things, including buildings, factories, farms, energy networks, railways, stadiums, and even entire cities.

As the digital revolution has impacted virtually every aspect of technology, business and life, Digital Twins increasingly are essential to how organizations consume, analyze and leverage data. New information is being captured and digitized with IoT and other sensors.

Collecting, processing, and storing huge amounts of data are possible with Big Data and Streaming technology. Artificial Intelligence and Machine Learning are enhancing our ability to makes sense of these large data sets.

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Digital transformation has dramatically increased the growth of data but has also exacerbated the data overload problem worldwide. Too much data exists for people to effectively process and make use of all this information. Also, due to limitations of existing IT technology, most of the data is trapped in data "silos," making it very difficult to use that information to make critical decisions when it matters most. The resulting data chaos means that organizations can't access the data they need or end up just ignoring it. Even with these oceans of data, people are essentially flying blind because their data is unusable.

Digital Twins provide a data framework that enables people and organizations to conceptualize and make sense of all their data. The real power of the Digital Twin technology is that it provides the physical world as the frame of reference for understanding and leveraging your data. Instead of static, hard-to-interpret Excel spreadsheets and BI reports as starting points, Digital Twins enable users to make sense of their data by "visualizing" and interpreting it in the familiar physical world. In essence, Digital Twins take a complex world and simplify it into one picture so people can understand and make sense of a complicated situation.

At Terrantic, we call our technology platform Digital Twin 2.0. We have done this to differentiate our advanced technology platform with the first generation of Digital Twin simulation software. We believe our new Digital Twin 2.0 platform will serve as a powerful framework for how organizations – especially industrial and manufacturing entities – consume and leverage their data in the future.

Various Ways to Leverage Digital Twin Technology in the Real World

Digital Twins can have varying applications for a variety of industrial and business situations. Below is a quick snapshot of how we think about Digital Twins and their growing role in solving mission critical problems in industry.

Digital Twins for Visualizations

As discussed earlier, an airplane is a typical example of how a Digital Twin works, because it is a single physical object made up of different component parts and sub-systems. However, Digital Twins can also represent processes or entire ecosystems. Let's look at a few examples to understand the different forms Digital Twin visualizations can take, and why they might matter to you and your business.

A potato chip manufacturer can envision a Digital Twin as the entire process of producing a chip, from the raw materials to the final product. This Digital Twin represents the manufacturing process with different machines: potato slicer, dryers, fryers, packing machines, and other elements of the chip-producing process. Each of these machines will have sensors and associated data. The Digital Twin also includes data about the raw materials in the process, and the corresponding data about how these materials were processed. For example, if a potato chip batch is burnt or oversalted, this data is incorporated into the batch level data in the Digital Twin.

A solar farm management company, on the other hand, might not care about a CAD model for each solar panel or piece of equipment. Instead, their Digital Twin might be a Google Map view of the various solar farms they are managing across a region with output data from each farm, overlaying weather data and warnings about certain panels not working at an individual farm.

For a trucking and logistics company, a Digital Twin might represent a Google Map view of each of their trucks on the road. This would include corresponding data about the trucker (how long they have been awake) and the contents of the shipment, with a simple click on a button on the Google Map.

For a salsa producing company or an apple processor, a Digital Twin might be the entire production process from demand planning to warehousing and shipping. With hundreds of SKUs and constantly changing data sources, a Digital Twin can be the starting point for conceptualizing and understand the food processing data sources and how they relate to each other.

These different examples illustrate how the concept of a Digital Twin is multi-varied and evolving. The underlying premise is still the same: you can visualize your "world" on a single screen. This includes all the associated data so you can make sense of the data and how it relates to your view of the world.

Connecting the Data

Increasingly, Digital Twins are solving fundamental underlying data problems, which have plagued users for decades. Data is generated by different IoT sensors, machines, software programs and manually entered by humans. In the past, data has been trapped in different systems (silos) and thus could not be intelligently integrated or combined with other data sets.

In an industrial setting, disconnected data is a huge problem. Three examples illustrate the problem.

First, if a potato slicer is cutting potatoes too thick and the data is captured during the cutting process, this data needs to be sent to the operations manager before the frying begins to adjust the recipe. Otherwise, the chip may be undercooked, and the batch wasted.

Second, if a shipment of mangos is smaller and of a poorer quality than normal, the production schedule can be drastically affected; the labor required to process the mangos may also increase. This data is usually known by the supply chain team but isn't shared across the organization to the operations manager.

Finally, most competitive manufacturing machines have different data structures and produce incompatible data. However, most business users don't buy from a single vendor and have mixed fleets. In mining, the drills can be a mix of Caterpillar, Komatsu, Epiroc. In farming, the production equipment can be a mix of John Deere, AGCO and Toro. In printing, the printing machines at a print shop can be a selection of Heidelberg, KBA, and Komori.

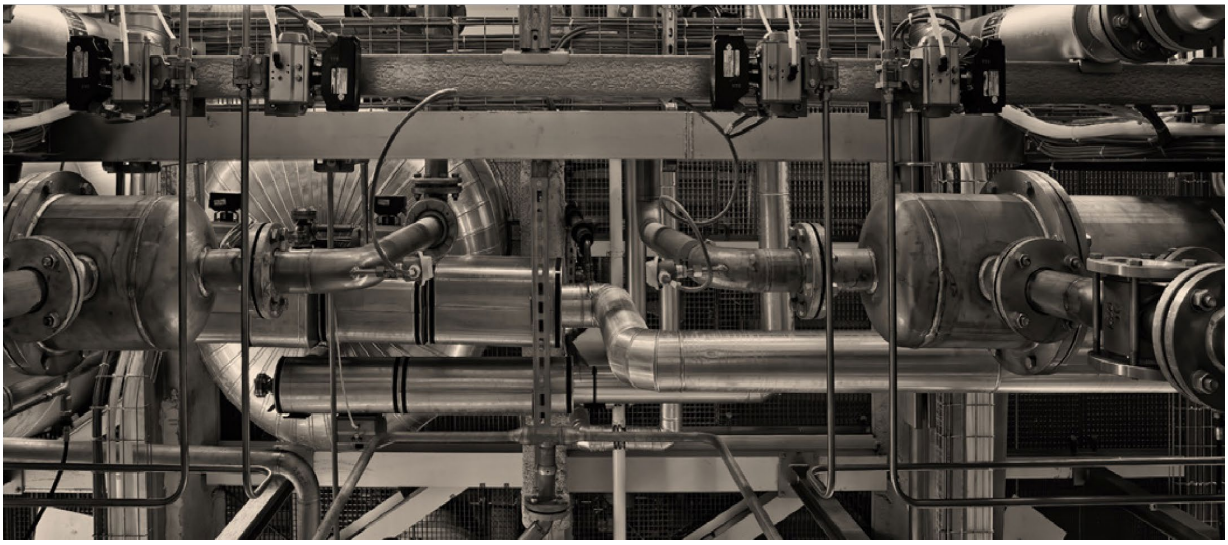
With these incompatible machines and associated data systems, the miner, farmer and printer can't use the data coming off their machines to drive efficiency across their entire operations. These data silos have been undermining the effectiveness and productivity of industrial users for many years now, with growing frustration across industries.

Digital Twins are solving this persistent silo problem by building a connected data foundation. The Digital Twin is a constantly learning and evolving ecosystem whose aim is to find new ways to connect your data and improve operations. The Digital Twin can improve

your Overall Equipment Effectiveness (OEE) by alerting your team about the different thickness of a potato. The Digital Twin connects your production planning data so that you can adjust your production plans based on the different mango sizes. Digital Twins provide a unified data model so the data from any mix of equipment can be used seamlessly to improve operations.

The process of continuous learning and evolving data ecosystem inside a Digital Twin is known as Contextualization. While this sounds like a complicated concept, Contextualization is simply providing better information (data) to inform decision making. In other words, your decisions are informed by (put into context of) other relevant information.

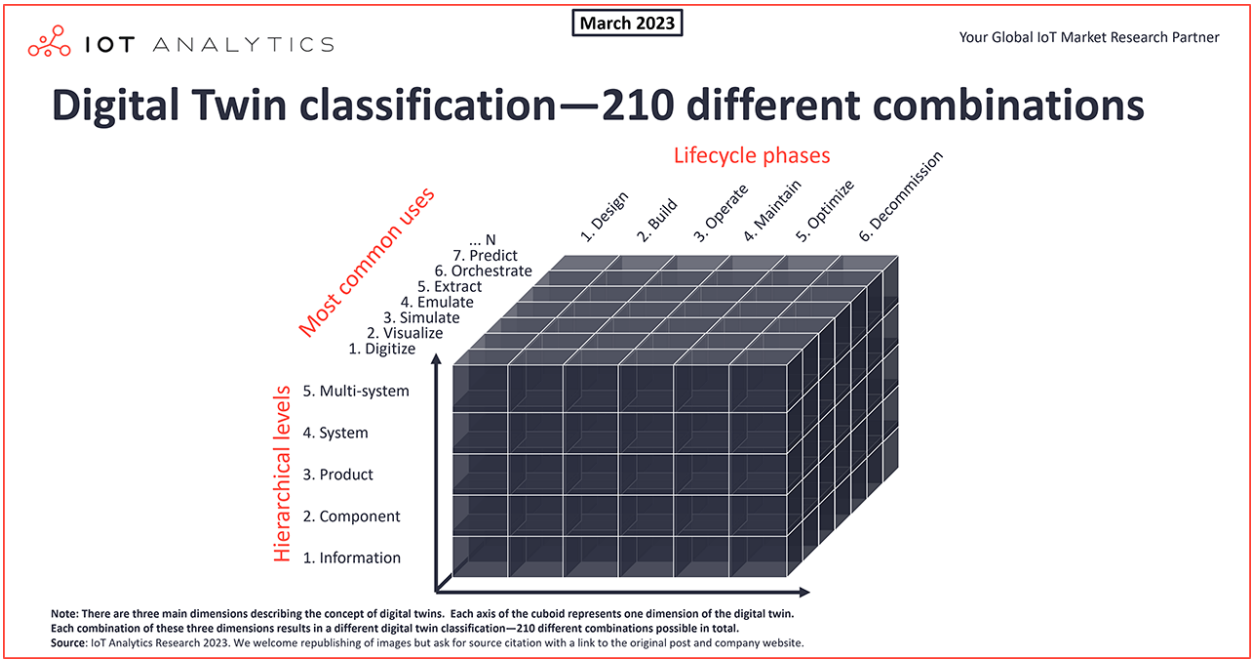
For example, as Customer Service manager, would you commit to increasing short-term capacity for Wal-Mart with certain penalties if you knew that some of the machines at your factory required maintenance and necessary replacement parts were not available? The likely result is that the machines would break in the short-term. With a Digital Twin, the different pieces of information can be connected to inform decisions like this, thus avoiding the disruptions caused by machine maintenance and resulting customer penalties.



While a deeper look at data foundations and Contextualization are beyond the scope of this article, they are core component of how Digital Twins are fundamentally changing business and industry by connecting data and solving decades long technology problems.

Emerging Digital Twin Use Cases

Obviously, the Digital Twin industry has expanded well beyond simulation software to design new products. IoT Analytics Research has created this matrix showing 250 classifications for how Digital Twins are being utilized today.



For the lifecycle phases indicated in the matrix, Digital Twins are used from the design phase to active operations, and ultimately to decommissioning. Digital Twins are used for the entire lifecycles of buildings, factories, farms, energy networks, railways, stadiums, etc.

In the factory example, the Digital Twin is the visualized design and the single source of data for the factory. The Digital Twin can assist teams during the design and build phases by leveraging past factory data to simulate and predict results and optimize performance.

As the other examples in this article have illustrated, Digital Twins provide tremendous value during the operational lifecycle phases including optimization when a factory is becoming older. Finally, the Digital Twin can assist in decommissioning of a factory by optimizing reusing of equipment at other facilities and orchestrating the decommission schedule and maintaining ongoing compliance records.

For the Most Common Uses listed in the above matrix, the core foundational use- cases are storing and connecting data (data foundation) and visualizing the data. On top of the data foundation, users can simulate, emulate, orchestrate, and predict performance of a factory. Terrantic's solutions for Forward OEE, Adaptive Production Planning, Best Batch Quality, and Traceability, are examples of these use-cases. For more information, check out the solutions section of our website.

Finally, for the Hierarchical Levels, this illustrates that a Digital Twin can be created for a single part (an airplane engine or even a single screw) all the way to a complex multi-system

Digital Twin with many sub-Digital Twins components. For example, a Digital Twin of a city can contain a complex array of digital twins for buildings, factories, rail systems, power grids, and countless other Digital Twins.

Conclusion

Today, we are on the cusp of a fundamental change in how we interact with and ultimately use data. For too long, the data silos of the past have hindered how organizations have been able to use their data to make critical decisions and drive better productivity and results. Clearly, we need better ways to consume and interact with data. The Digital Twin is a powerful new answer, especially suited to manufacturing, industrial and process development organizations.

Digital Twins are the emerging framework for pulling together this data and becoming the foundation of all future data consumption and management. We are just at the beginning of this journey, but it will be transformative well into the future.

About Terrantic

Terrantic empowers organizations to transform their data into a powerful competitive advantage. Terrantic's Digital Twin 2.0 platform unifies real-world data in real-time, enabling users to easily extract the critical insights they need to make better, faster business decisions. Terrantic's customers include leading manufacturing and industrial food processing companies. Founded by enterprise software veterans, Terrantic is backed by leading VC's and private investors. For more information, visit www.Terrantic.com.