Care And Feeding Of Digital Twins: How To Keep Good Data Flowing

Andy Bane Forbes Councils Member
Forbes Technology Council COUNCIL POST | Membership (Fee-Based)

Apr 6, 2022, 08:00am EDT

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When you read studies about identical human twins, it's fascinating that we have a scenario that starts with identical conditions to allow researchers to compare the twins later in life and look at the impact of lifestyle choices like diet and exercise. It seems like a pretty clear cause-and-effect situation.

But a study from Iceland found that out of 387 genome pairs gathered from identical twins before birth, the twins had about 5.2 unique mutations each while in utero. So even identical human twins aren't identical at birth. Their data is already diverging and drifting. And this points to one of the biggest challenges with managing a digital twin.

Industrial organizations are seeing impressive results from digital transformation. But they need to keep feeding digital twins fresh, clean, organized and governed data, or the twin will drift and lose value over time. The biggest challenge isn't getting the visualizations or calculations correct. It's keeping the underlying systems coordinated and integrating changes in the data streams to fit the digital twin's living data model.

Digital twins evolved from static models pointing to a single optimization solution into living, growing tools that look at past history and current status and also model future scenarios. Rob Tiffany has described the digital twin as mapping three areas: the physical space, the digital space and the connection between the two. Maintaining the connection between physical and digital spaces can be the most challenging aspect, especially for an industrial system creating millions of data points daily.

A successful digital twin strategy can result in millions to billions in potential value. GE worked with an aluminum smelter in Greece to cut energy consumption by 2%-3%, saving $2.5 million. Michelin created a digital twin sourcing model that reduced logistics costs more than $10 million annually. Abu Dhabi's largest oil company, ADNOC, built a Digital

Command Center that generated more than $1 billion in business value in three years.

The real value of a digital twin comes when companies use what they learn in one plant and extrapolate those improvements to other plants. If we can make operational technology (OT) data more useful, we'll get better results from digital twins. Unfortunately, most OT data is low quality and ill-defined when ingested into a company's data hub/lake/etc. This diverging data makes it almost impossible to build analytics that apply generally. The problem is caused in part by inconsistent data labeling, compounded by a lack of metadata context. Metadata can provide the broader context needed to make OT data more useful for digital twins over the long term.

Any company using a dynamic digital twin needs to ensure operations data is easy to use to discover useful insights. Industrial companies can get ahead of their competitors if they look at five key areas:

1. Contextualization Of Data

Contextualizing industrial data is critical to make direct comparisons of similar equipment types and processes by combining different high dimensionality data sources into one (or many) digital twins. The relationships and connections between the data can be as important (or more so) than the raw data alone. Data dimensionality across systems, and not just increasing data volumes, must be addressed.

Data contextualization also supports organizing assets into hierarchical or process-oriented relationships to create a complete picture of an operational system. Creating a holistic view of multiple systems used to require months of manual processing spreadsheets or cobbling together different point products. This antiquated approach leads to errors and reduces the quality, scalability and security of a digital twin. And it ultimately increases the frequency of unexpected equipment failure.

2. Create A Comprehensive View

OT data is often captured in siloed systems at specific sites, isolated from similar data streams collected at other work sites. Pulling this data together in a coherent way is crucial to keep digital twins operating effectively and generate more useful insights, especially data from ERP or other IT-managed systems. By combining data from multiple sites with a layer of contextualized, enriched metadata, organizations can discover new ways to improve operations across the complete enterprise instead of optimizing each asset in isolation.

3. Data Governance And Maintenance

Governance of proliferating IT/OT data and analytical silos has never been more important, requiring organizations to manage semantically consistent data and data models across the enterprise. OT data is largely ungoverned and companies have been unable to leverage OT data across the enterprise because it's impossible to compare different sources of information. Implementing governance practices across an enterprise can ensure OT data is reliable, stable and secure over time.

4. Expansion Of Scale And Scope

One of the common threads across all industries—including oil and gas, food/beverage, utilities and pharma—is the need to scale. Implementing a system where connected metadata is managed centrally makes it easy to build and deploy analytical applications at scale. This can result in millions of dollars in value for use cases like OEE, predictive maintenance, emissions control and safety.

5. Leverage The Ecosystem

Most organizations are adopting digital twins so they can improve their operations and perform simulations on the twins before implementing a change in engineering or production. But the complexity of the problem means no single vendor can deliver everything needed. Companies need to look for vendors with strong partnerships. Organizations are beginning to use powerful analytical tools to significantly speed up digital twin development and improve effectiveness with contextualized and governed

metadata. Getting the metadata right results in more reliable and easier to maintain analytics—and pay-offs with improved operations.

Looking forward, we have a tremendous opportunity to use the data that industrial information management systems are already capturing to analyze scenarios and improve efficiency. But we need to feed these digital twins with relevant, contextual data to create the most useful digital twins. If you want your digital twin to stay in sync better than a human twin, you need to keep feeding it relevant data that's consistent and contextualized.

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