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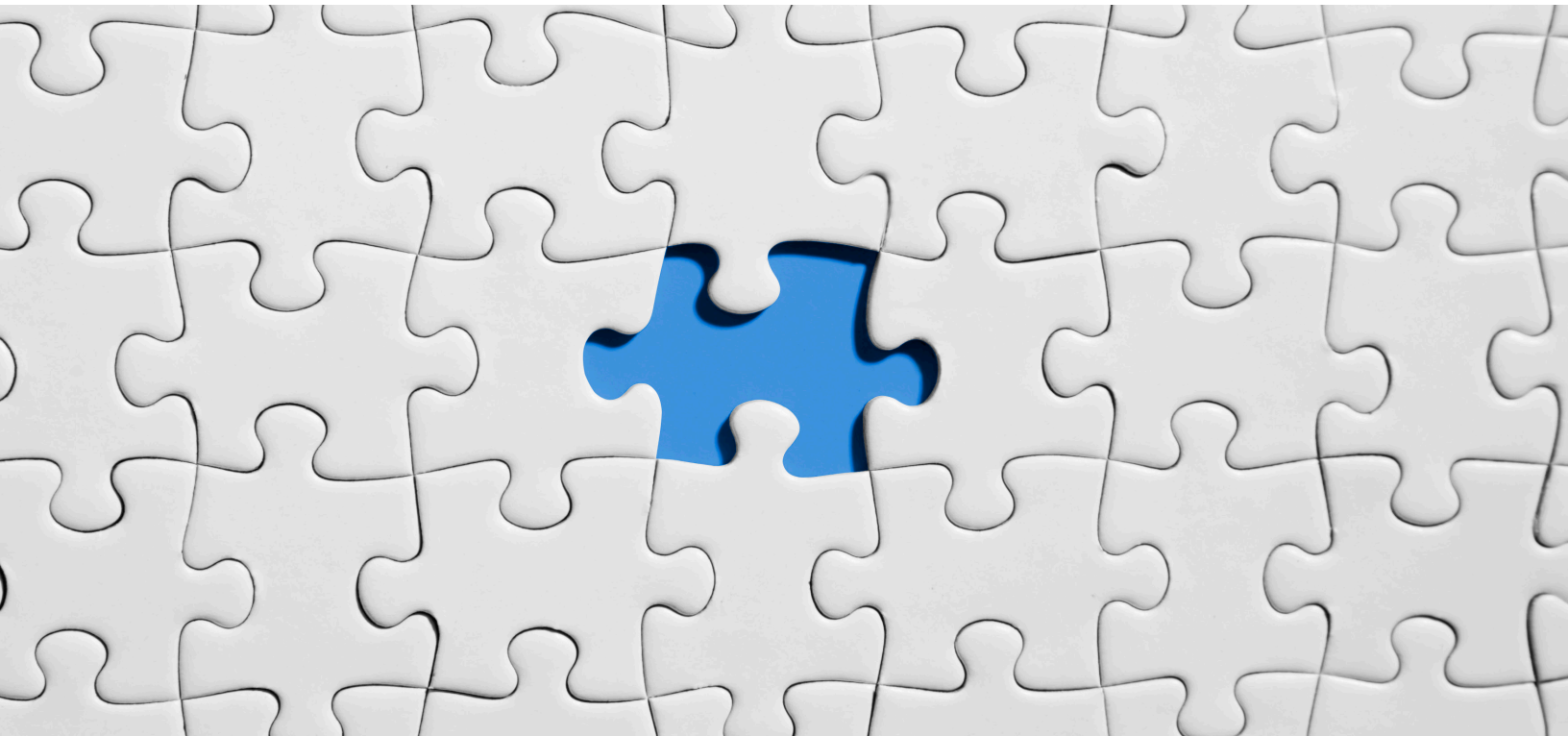
DIGITAL TWINS – PROMISES AND CONCERNS

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Abstract

There are plenty of definitions of 'Digital Twin' flooding the internet but the simplest would be: "A Digital Twin is a real-time digital clone of a physical device". This concept of Digital Twin has been in existence for just a few years but is already garnering attention due to its proposed application capabilities. With Internet of Things (IoT) becoming pervasive and being heavily implemented, the ease of gathering data from the physical world via sensors and sending it to machines to reconstruct has only become easier. Considering all the ways Digital Twins could be useful for business, it is clear that its' applications are nearly limitless.

We are in the nascent stages of development in this technology but can already see the tremendous transformations that lie ahead. Smart cities, Retail, Healthcare, Automotive and Manufacturing are two areas where major applications of Digital Twins can be found. Although the market for Digital Twins is growing fast, its implementation is not as easy as it seems. Agencies face many challenges in constructing a digital twin. Even bigger challenges are posed by lack of clear standards for implementing them and a plan for governance.

Introduction

A Digital Twin is a digital representation of a physical object or system. The technology behind digital twins has expanded to include heavy items such as buildings, factories and even cities, and some have said people and processes can have digital twins, expanding the concept even further. The fourth industrial revolution or Industry 4.0 which embraces automation, data exchange and manufacturing technologies is a hot topic in the business world. Digital Twins is at the core of this new industrial revolution bringing, unlimited possibilities. It changes the traditional approach of 'the first build and then tweak' in the industrial world to a more virtual system-based design process.

Applications

Types and applications of Digital Twins often seen:

Manufacturing

Digital Twin is poised to alter the face of the manufacturing industry. Digital twins have a huge effect on how produced and maintained goods are designed. This makes production more effective and streamlined while reducing throughput times. The digital twin significantly influences product design and development. After getting the details, it alters the old process where products were produced directly.

Automobile

In the automotive industry, Digital Twins can be used to build a virtual image of a connected vehicle. It collects the vehicle's behavioral and operational data and helps to assess the overall performance of the vehicle as well as the linked

features. It also helps provide consumers with a genuinely personalized/customized service.

It can also be designed to build a virtual vehicle model prior to its actual construction. It helps to capture the car's actions while it is driving, generating feedback from time to time about the performance and maintenance needed.

Healthcare

Digital Twins and Internet of Things (IoT) data will play a key role in the health care field, from cost savings to patient management, preventive maintenance and providing personalized health care. Through reviewing reports and history of patient wellbeing, Digital Twin offers a convenient way for physicians to determine appropriate medicine for their patients.

Space Research

NASA face lots of challenges leading up to space launches. To effectively diagnose and fix spacecrafts pre-launch, NASA developed a Digital Twin spacecraft where all the information is processed and conditions are simulated.

Significance

Digital twins increase the reliability of articles and production. It improves overall effectiveness of the equipment, reduces downtime, and improves performance. The ability to anticipate problems before malfunctions occur reduces the risk of product unavailability and market exposure and lowers maintenance costs. Digital twins enable new business opportunities such as increased productivity, shorter production times, and small-scale mixed manufacturing. Customer-specific products can be configured remotely, improving customer service. Product quality and increased product insights and profits in multiple real-time applications improve maintenance procedures and on-site equipment support, reducing downtime cost while extending the life of equipment. Digital twins has proven to be very useful and beneficial for all types of machines and equipment.

Concerns

While we see countless applications of digital twins, the blurring of the overall picture most businesses create of the technology itself is a bit vague and can be daunting, casting doubt on the concept's true potential.

A few reasons that fuel these concerns are:

- Connectivity Issues – In the digital global realm, the Internet is a critical asset.
- Security Issues – Security is a chief concern. To maintain virtual integrity, dependable safety and rules are mandatory. Dependable surroundings are likewise vital to running virtual twins.
- Manufacturing and international proliferation – There are enough statistics at the generation/strategies required for manufacturing it. Recreating the precise

physical infrastructure is strenuous, to estimate the indoors of the physical article. To conquer this, dismantling the item which certainly requires expertise, or some other choice might be developing an animation or write a code manually. A major concern is global improvement. Because the physical infrastructure advances, upkeep and logging the facts with the digital twin is an essential but tedious task.

- Big price range for globalization – Cost plays a significant role because it is not only big business in the picture. An optimal option is required to tackle this scenario.

While most of the above concerns can be mitigated using modern technology and adopting security standards, there are concerns regarding the dangers of the technology itself:

- **Hazards of erroneous digital replicas** – Since each physical item that we're trying to replicate is unique in its own sense, depending on the complexity of the physical item, the twin may run into a few difficulties when it comes to replicating the internal part of the object. To solve this problem the digital twin software might adopt averaging algorithms which could result in the replica not being an identical twin and might not serve the purpose it was built for. However, there are ways being developed to solve this problem; the physical object may need to be opened or the inside portion of it must be represented manually, using animation and code. When it comes to representing systems and processes such as customer relationship management, prospect marketing, and acquisition or service delivery funnels, the process may look more complicated at first glance, but it is possible to generate a clear, transparent and accurate picture of the system you want to digitize. In most cases, it involves working with digital twin software and performing manual revisions to ensure the accuracy of simulation.
- **Accuracy and dependability on the predictive and prescriptive analysis** Since the applications of digital twins are widespread and have potential use in every sector, checking the accuracy of the simulations is becoming even more important. Most of these digital counterparts should be scrutinized and undergo thorough testing before being used for predictive models.
- **The possibility of unknown and unheard biases slipping into a digital twin** It's crucial that no biases seep into this new technology due to bias present in its physical counterpart. This could be hazardous in fields such as Medicine and HealthCare.

Conclusion

In recent years, innovations and capacities of both the physical product and the virtual product – the Digital Twin – have made unexpected progress. Machine learning, artificial intelligence, sensors, data and analytics are typically powered by Digital Twin and rely on IoT technologies. Therefore, Digital Twin IoT is expected to boost deployments of industrial IoT. Professionals also believe that, over the next five years, more than 85 percent of digital twins will be adopted by all IoT platforms.

For many businesses, digital twins can be a disrupter that will fundamentally alter business models. Ultimately, digital twins can alter how companies develop, simulate, operate, predict, and self-heal by capitalizing on the power of IoT and data concerning products, services, individuals, and networks. However, concerns regarding this new technology remain and can pose a serious threat if not addressed with expertise.

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