

The synergy between digital twins and Internet of Things (IoT)

We live in the era of the metaverse. Virtual representations of entire events, classrooms and office spaces can be created on the metaverse. However, in order to ensure seamless functioning of the metaverse, it is important to ensure to incorporate digital twins in the same. A digital twin, by definition, is an object's physical representation in the virtual world. With the proliferation of IoT, along with digital twins, we are reimagining the physical world.

A digital twin is a static representation of an object in a 3D space. Combining a digital twin with IoT has transformed the digital world, by enabling static/unresponsive virtual models to come alive. This facilitates us to analyse and simulate the behaviour of objects in real time.

As the use of IoT increases, it will open up more possibilities in the realm of digital twins. Real-time insights could be generated when a device is connected to the internet. Rigorous analysis would become possible and a variety of use cases could be implemented.

Possible applications

The availability of large amounts of data through IoT has made finely tuned digital twin models possible.

Digital twins are helping us in a number of ways, some of which are highlighted below:

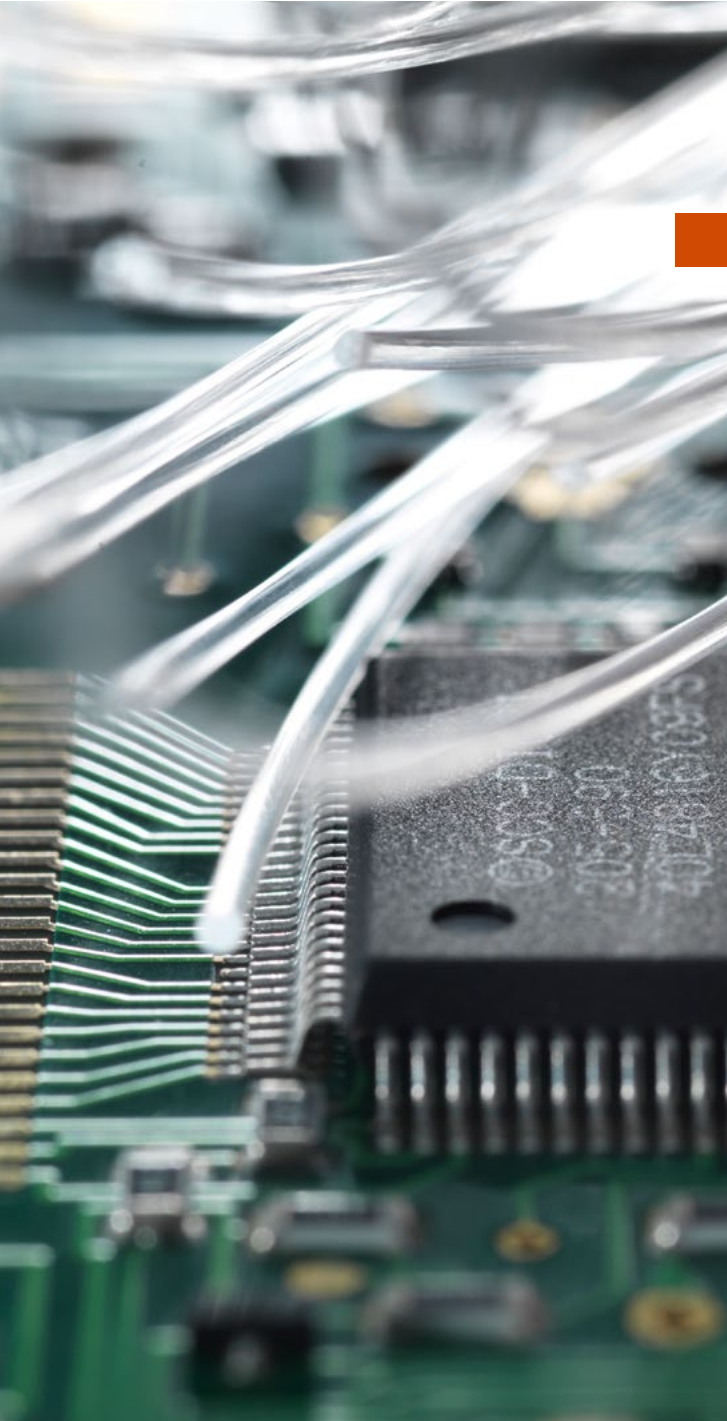
- 01** In manufacturing, we use the term 'smart factory' for factories that have a virtual replica. A smart factory has the capability to optimise production processes through predictive maintenance. Sensors attached to machines can provide asset health information in real time. A 3D model can be generated using this data, which can further be used for real-time condition monitoring. Using machine learning, predictions about equipment downtime can be made.
- 02** Asset tracking is another use case for digital twins. Through asset tracking, we can track materials on the factory floor. We can install sensors on machines and create a digital twin of the entire factory floor, which will enable workers to find the exact position of an object placed there. We can improve factory overall equipment effectiveness (OEE) and improve production schedules using asset tracking.
- 03** In healthcare, sensors can create a virtual image of a patient. This constitutes creating an entire physiological model of a patient, known as digital patient twin. Studying the biological markers of a patient can help in the accurate diagnosis of diseases and open avenues for hyper-personalised patient care.
- 04** Smart cities are another avenue for digital twins. Using digital twins, we can improve operations within a smart city. These can include traffic optimisation, irrigation and medical services. We can also implement energy and waste management strategies in an innovative manner using the data collected from various sectors in a city.
- 05** Digital twins have made real-time digital imaging of farming animals possible. Any anomaly in animal health can be detected using sensors, and the same can be reported to farmers in advance. Moreover, a 3D representation of the field environment can be created by simulating environmental factors, like soil moisture and temperature, in order to continuously evaluate the viability of the climate and maximise yield. Field information systems can further be used to apprise farmers about plant health.
- 06** In retail, supply chain management has become digitised. As products move from manufacturing units to warehouses to different parts of the world, they can easily be tracked and traced using digital systems. We can enable tracking of individual objects as they move through the world or even vehicles in a 3D representation of the world. Warehouse management can be revolutionised by generating a 3D model of the warehouse and analysing it for space utilisation, product placement monitoring of goods, etc.



Challenges

In the 21st century, it is imperative that data is carefully handled. Implementation of solutions related to IoT and digital twins require the creation of data lakes and complex 3D models with deep subject matter expertise. This is problematic for organisations that don't have access to the required resources.

Unlocking the true potential of digital twins and IoT requires careful people, process and technology planning because implementation of these technologies often means a fundamental change in the way an organisation works. Therefore, carefully measuring and mapping changes to each step in the business process is crucial. Moreover, employees need to be convinced that these changes will bring positive changes to their way of work.



What's next?

In 2024, it is predicted that digital twins will continue to proliferate across industries, as a building block to the metaverse. This means that companies will continuously try to implement various use cases of digital twins in their business-critical processes. The rate of digital twin adoption will be fastest in asset-heavy industries like manufacturing. Industrial IoT will further support digital twin adoption, further creating new use cases.

The rise of industrial cloud, i.e. industry-specific use cases on the cloud, will also contribute to digital twin and IoT adoption. Cloud technologies will be adopted at a faster rate in industries such as healthcare, banking, financial services and insurance (BFSI), pharmaceutical and retail which will make implementation significantly easier.

In 2024, the most used term in emerging technologies is generative AI. Generative AI will play a crucial role in making digital twins more relevant and powerful. Massive amounts of data generated through IoT can be used to train foundational models, which can be used to make better predictions about asset state, asset performance and multilingual chatbots that work together with the digital twin of a physical object.

Overall, digital twins are here to stay, and organisations that don't have digital twin implementation in their roadmap should think of use cases that can possibly change their business in a positive way.

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