Digital twins and their ramifications in digitizing an Enterprise Value Chain

Introduction: The concept of living in a virtual world or using virtual simulation presented in sci-fi cinemas like Matrix or Avatar is becoming a reality today thanks to the advent of technologies like Digital Twin using which virtual models of physical objects can be created at ease.

What is a Digital Twin: Digital Twin is a digital representation of a real-world product, system, or process. Basically, a computer program that uses real world data to create simulations that can predict how a product or process will perform.

In the simplest terms, a digital twin is a virtual replica of a real-world object that is run in a simulation environment to test its performance and efficacy. It can be a jet engine, a building, process on factory floor, and much, much more.

Key Components:

It has 3 main components

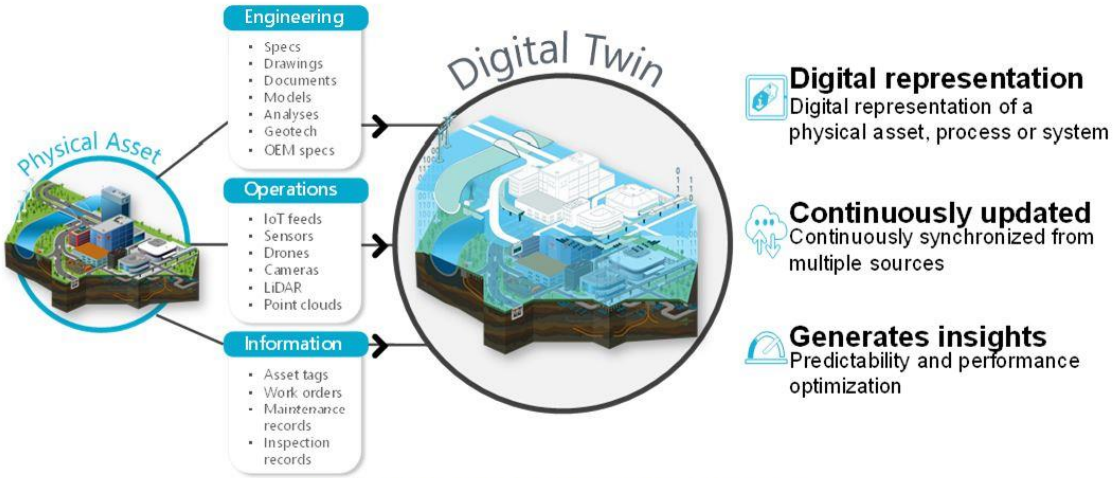
- A physical entity
- Digital Twin in software form
- Data that links first 2 elements together

How does it work: It mainly connects real and virtual world by

a. Collecting real time data from the installed sensors.
b. The collected data is further stored in cloud either decentralized or centralized.
c. The data is then evaluated and simulated in virtual copy of assets.
d. After receiving the information from simulation, the parameters are applied to real objects.

When sensors collect data from a connected device, the sensor data can be used to update a "digital twin" copy of the device's state in real time. The term "device shadow" is also used for the concept of a digital twin.

This entire process helps in optimizing performance of real-world objects thus achieving betterment.



Digital Twins for Plants and Infrastructure
Source: Bentley Systems during the ARC Industry Forum

Types of Digital twin:

Digital twins are commonly divided into subtypes that sometimes include:

Digital Twin Prototype (DTP) - The DTP consists of the designs, analyses, and processes that realize a physical product. The DTP exists before there is a physical product.

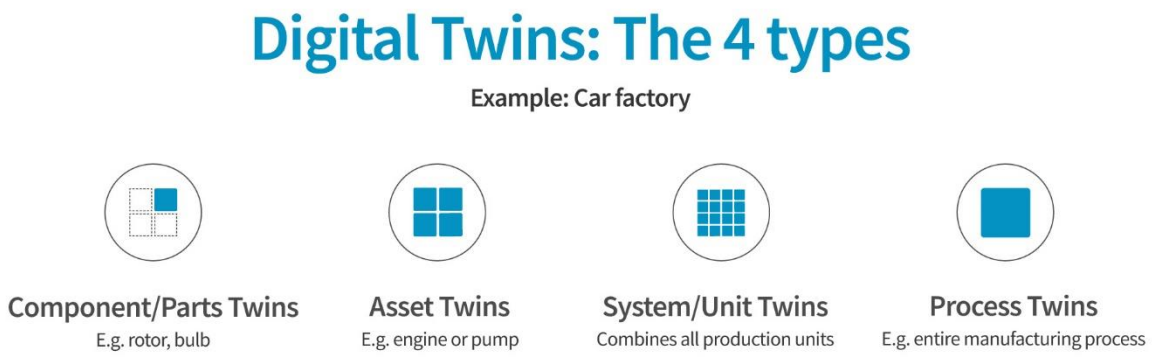
Digital Twin Instance (DTI) - The DTI is the digital twin of each individual instance of the product once it is manufactured. The DTI is linked with its physical counterpart from the remainder of the physical counterpart's life.

Digital Twin Aggregate (DTA) - The DTA is the aggregation of DTIs whose data and information can be used for interrogation about the physical product, prognostics, and learning.

OR

There are following 4 types of Twins:

- Component Twins / Parts Twins - Component twins are the basic unit of digital twin, the smallest example of a functioning component.
- Asset Twins - When two or more components work together, they form what is known as an asset.
- System or Unit Twins - System twins provide visibility regarding the interaction of assets and may suggest performance enhancements.
- Process Twins - Process twins, the macro level of magnification, reveal how systems work together to create an entire production facility



Significance of Digital Twin:

Being one of the fastest growing concepts in industry, 13 % of orgs are currently using Digital twins, while 62 % are planning to implement the same according to a recent Gartner report. And the market is expected to grow exponentially in coming years largely due to the expansion of the Internet of Things (IoT), AI, Extended Reality (ER), and Cloud computing. NASA was the first one to use this technology for space exploration missions.

Impact of Twinning in IT Industry:

Digital Twin creates a simulation model of physical counterpart with the help of integration of technologies like ML, AI, or analytics. This allows companies to assess an entirely computerised development cycle. Also, twinning allows industries to anticipate downtime, react to changing situations and perform improvements wherever necessary.

A digital twin allows users to investigate solutions for product lifecycle extension, manufacturing and process improvements, and product development and prototype testing. In such cases, a digital twin can virtually represent a problem so that a solution can be devised and tested in the program rather than in the real world.

Categorization of market it caters to

Manufacture - Digital twins can make manufacturing more productive and streamlined while reducing throughput times.

Automotive - One example of where digital twins is used in the automotive industry is to gather and analyse operational data from a vehicle in order to assess its status in real time and inform product improvements.

Retail - Outside of manufacture and industry, digital twin is used in the retail sector to model and augment the customer experience, whether at the level of a shopping centre or for individual stores.

Healthcare - The medical sector has benefitted from digital twin in areas such as organ donation, surgery training and de-risking of procedures. Systems have also modelled the flow of people through hospitals and track where infections may exist and who may be in danger through contact.

Conclusion: In short, Digital twin is key to the development of Industry 4.0 to provide automation, data exchange and joined-up manufacturing processes as well as de-risking product rollout.

Industry employees can monitor operations in real time, providing prior alerts of possible failures and allowing for real time performance optimisation and assessment with minimal loss of productivity.