Some Digital Twins Definitions
Trend No. 4: Digital Twins

A digital twin is a digital representation of a real-world entity or system. In the context of IoT, Digital Twins are linked to real-world objects and offer information on the state of the counterparts, respond to changes, improve operations and add value. With an estimated 21 billion connected sensors and endpoints by 2020, digital twins will exist for billions of things in the near future. Potentially billions of dollars of savings in maintenance repair and operation (MRO) and optimized IoT asset performance are on the table.

In the short term, digital twins offer help with asset management, but will **eventually offer value in operational efficiency** and insights into how products are used and how they can be improved...

“Over time, digital representations of virtually every aspect of our world will be connected dynamically with their real-world counterparts and with one another and infused with AI-based capabilities to **enable advanced simulation, operation and analysis...**”

**From Gartner:**

Top 10 Strategic Technology Trends for 2018

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gartner.com/SmarterWithGartner
Another Definition of Digital Twin
(from SMARTUQ)

"An integrated multi-physics, multiscale, probabilistic simulation of an as-built system, enabled by Digital Thread, that uses the best available models, sensor information, and input data to mirror and predict activities/ performance over the life of its corresponding physical twin."[1].

The Digital Twin is a methodology that leverages the strengths of simulation and physical data to efficiently resolve issues throughout the product’s lifecycle.

[1] DAU Glossary of Defense Acquisition Acronyms and Terms
Cambashi’s IIoT/Digital Twins Opinion

• “...most of the technology used in IoT solutions has been around for some time. A recent trend driving its growth is commercial – the reduced cost of sensors and the affordability of cloud computing.”
  – i.e., the pieces/component applications for Digital Twins have been around a while, but there is now enough business justification for integrating the pieces.

• “The digital performance twin runs an online simulation during operation of the product. The simulation is fed by real data from the device, enabling the digital twin to be able to predict potential issues. For example, it can help an operator identify why a motor is going wrong, or predict the lifetime of a product. This continuous simulation helps to verify design decisions, or improve future designs.

However, in order to run this continuous simulation, much smaller models are required – going from 1 million degrees of freedom to just 100.

• My comment: Not necessarily true, and not true for much longer! See Akselos information (on subsequent slides), among others.
CIMdata Definition of Digital Twin

• CIMdata defines a digital twin as a smart (dynamic), virtual representation (model) of the physical product, production process, or product’s utilization. It has the **required accuracy and fidelity to predict actual, physical performance**. Ideally, the twin accompanies its real-world companion throughout its lifecycle—being changed in tandem with the physical version, and is continuously updated to reflect improvements in product and process development.

  *(My emphasis)*

• From “wishful” to “possible” to **required**
More from CIMdata

• **Physics-based Digital Twins: Beyond Data Analytics**
  SDSD (Simulation-Driven Systems Development) Knowledge Council Round Table chaired by CIMdata

• "While not entirely new as a concept, the area of Digital Twins is gaining significant engineering attention, as well as executive mindshare with the rapid emergence of IoT platforms and big data analytics. Each product as used by an end customer can now have a unique “Digital Twin” or even a series of Digital Twins* depending on the business use case for the digital performance models deployed and the related in service data acquired. A key point to be explored … is that the Digital Twin cannot help to predict and optimize “as used” system performance unless there is a physics-based model in the loop with the IoT acquired raw data. But what are the practical business applications today and what technical challenges remain?"

• *The added risk of synchronization/updating multiple models (My emphasis)