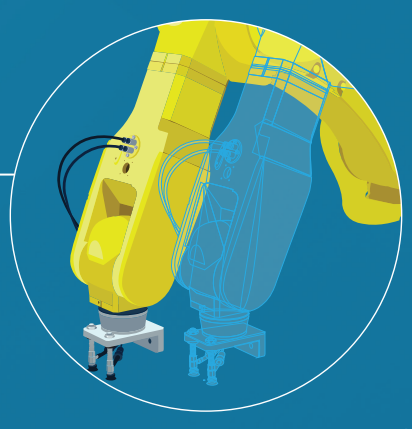
A Digital Twin is a **virtual representation** of a corresponding **physical product**



Digital Twins are a

TOP 10

technology in **2017**[1]
and for good reason:

They can help with a wide variety of engineering tasks:

1. **Conceptual Development**
   Will this product work if I build it?
2. **Virtual Commissioning**
   How can we ensure a fast, successful system integration?
3. **Online Diagnostics**
   Can we detect failures before they become serious?
4. **Smarter Designs**
   Can we predict better maintenance schedules, or replace physical sensors with virtual ones?

There are different ways to create a **Digital Twin**:

Data-Driven

Sensors provide large amounts of performance data that are used for predictive models.

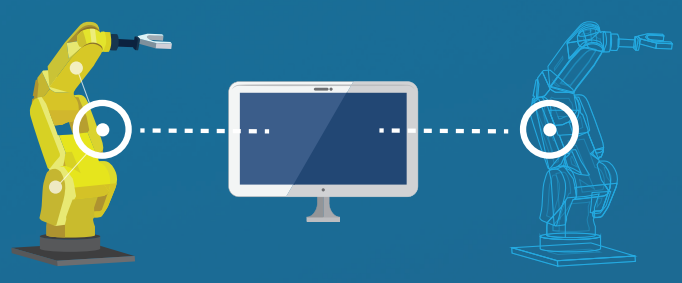
- The Digital Twin is created after the product is operating.
- Sensor-based data makes it hard for accurate extrapolations outside of common operating conditions.

Model-Driven

System-level models use math and physics-based software to simulate product performance.

- The Digital Twin is created alongside product development, adding insight early on.
- A high-fidelity model uses accurate physics to predict a wider range of product performance.

Either type of Digital Twin can be used independently or combined together.



The **cost** of finding design **flaws late** can be **extremely expensive**[2]

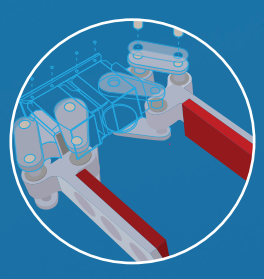
Issue Identified at:	Concept-Level:	Production:	Detailed (FEA/ CFD) Design:	Prototype:	Production Design:	Production:
	1x	2x	16x	64x	240x	800x

Using model-driven Digital Twins

can significantly reduce the risk of developing new, innovative products

They can answer design feasibility questions long before prototyping.

They're essential for "virtual commissioning" – identifying system integration issues before the controllers and hardware are ever connected.



Investing 5-10% more budget into early design work can **reduce overall project cost** overruns by[2]

50-100%

Maplesoft
Mathematics • Modeling • Simulation
A Cybernet Group Company

References:

1. http://www.gartner.com/smarterwithgartner/gartners-top-10-technology-trends-2017/
2. Adapted from: Forsberg, Kevin, Hal Mooz, and Howard Cotterman. Visualizing Project Management. John Wiley & Sons. Hoboken, NJ. 2005.