



# Digital Twin

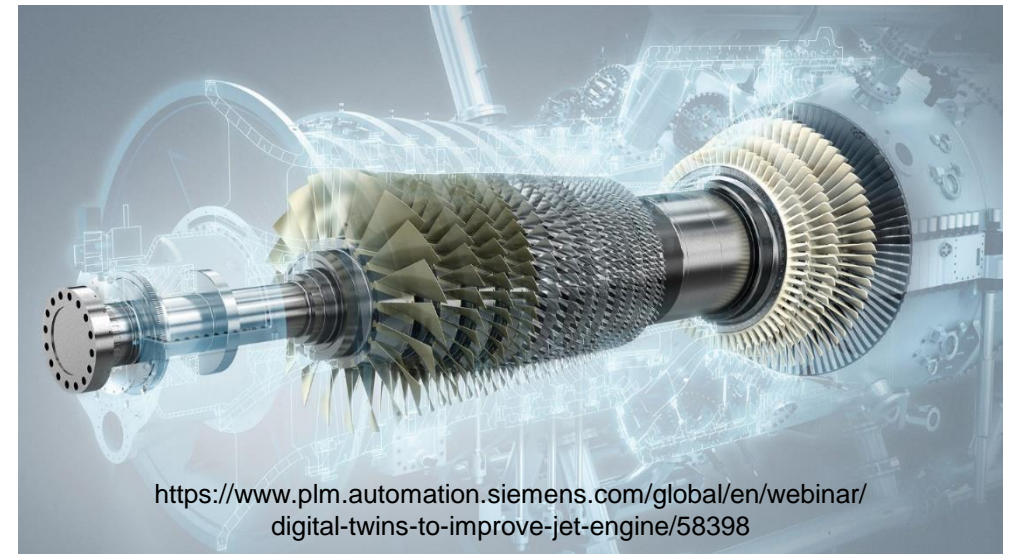
IAQG Supplier Forum, Berlin

Christian Ross, MTU Aero Engines AG

18.10.2019

# The Digital Twin – just another Buzzword?

	Google Hits (14.10.2019)	.and. Quality / Qualität / Qualite	.and. Supplier / Lieferant / Fournisseur
Digital Twin	309 Mio	144 Mio	48 Mio
Digitaler Zwilling	3 Mio	1 Mio	0.1 Mio
Jumeau Numerique	4 Mio	1 Mio	0.2 Mio



# The Digital Twin – just another Buzzword?

Gartner.

## Top 10 Strategic Technology Trends 2017

The trends are categorized into three groups:

- Intelligent:** Applied AI & Advanced Machine Learning, Intelligent Apps, Intelligent Things.
- Digital:** Digital Twins (highlighted).
- Mesh:** Virtual & Augmented Reality, Blockchains and Distributed Ledgers, Conversational Systems, Mesh App and Service Architecture, Digital Technology Platforms, Adaptive Security Architecture.

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## Top 10 Strategic Technology Trends for 2018

The trends are categorized into three groups:

- Intelligent:** AI Foundations, Intelligent Apps and Analytics, Intelligent Things.
- Digital:** Digital Twins (highlighted), Cloud to the Edge, Conversational Platform, Immersive Experience.
- Mesh:** Blockchain, Event-Driven, Continuous Adaptive Risk and Trust.

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## Top 10 Strategic Technology Trends for 2019

The trends are categorized into three groups:

- Intelligent:** Autonomous Things, Augmented Analytics, AI-Driven Development.
- Digital:** Digital Twin (highlighted), Empowered Edge, Immersive Experience.
- Mesh:** Blockchain, Smart Spaces, Privacy and Ethics, Quantum Computing.

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<https://www.gartner.com/smarterwithgartner/gartners-top-10-technology-trends-2017/>

<https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-technology-trends-for-2018/>

<https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-technology-trends-for-2019/>

## Definition of Digital Twin (Source: Gartner IT-Glossary)

*A digital twin is a*

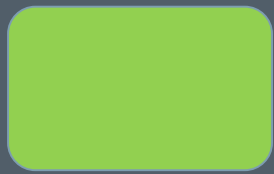
- *digital representation of a*
- *real-world entity or system.*

*The implementation of a digital twin is an encapsulated software object or model that mirrors a*

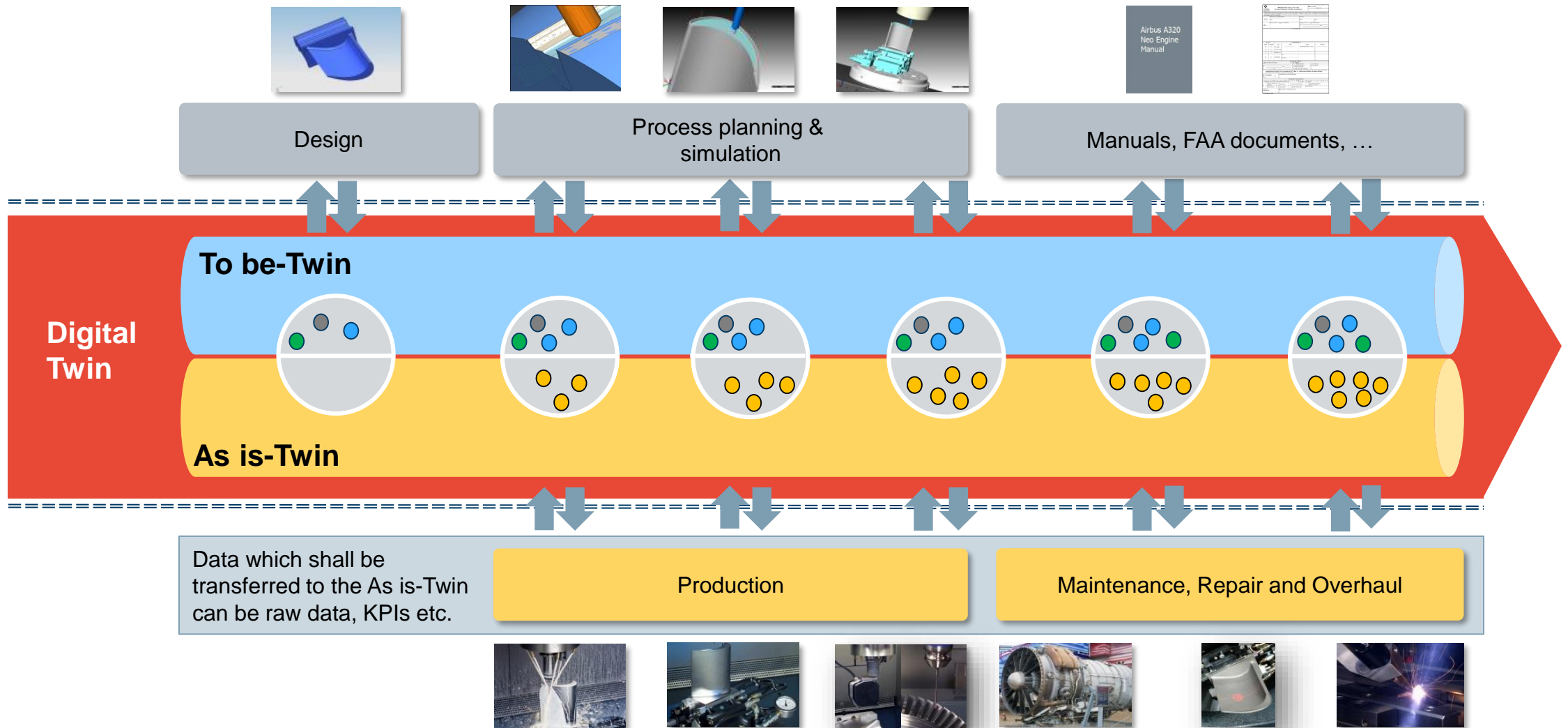
- *unique object,*
- *process,*
- *organization,*
- *person or*
- *other abstraction.*

*(...)*

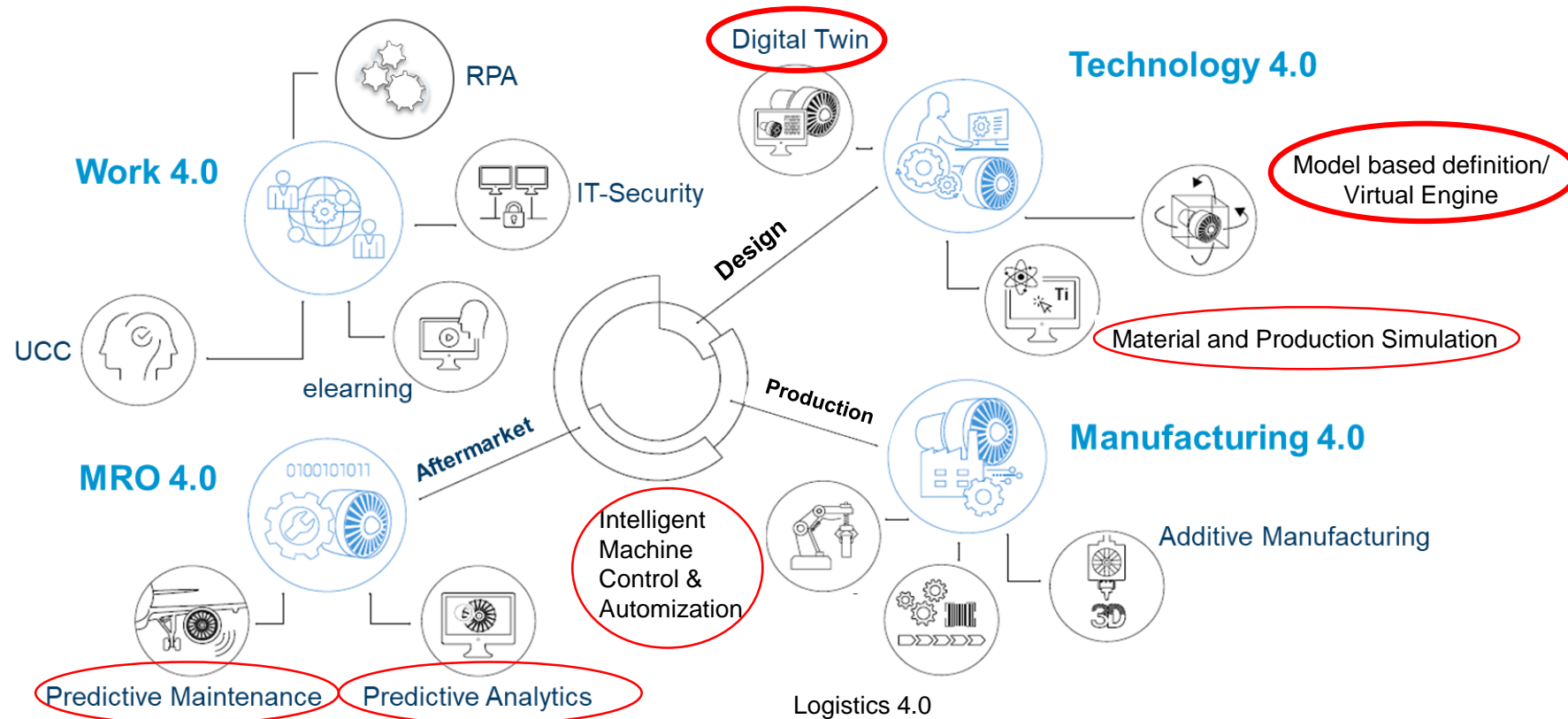
<https://www.gartner.com/it-glossary/digital-twin>



# Digital Twin for Product „Engine“



# The Digital Twin is Part of MTU's Digitalization Strategy



# Example for Digital Twin in the Context of Quality

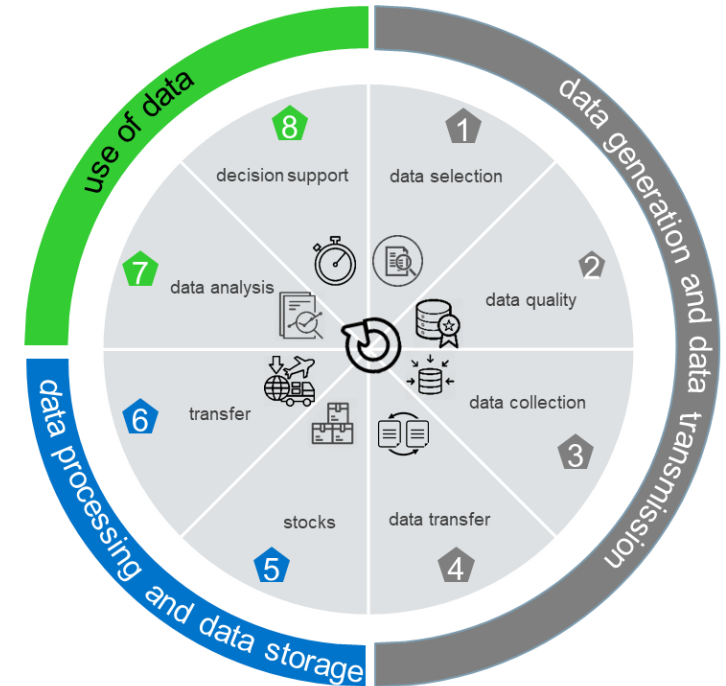
## Usage of Quality Data

### Objective

- Utilization of Inspection Data
- Electronical transfer of quality data to Digital Twin
- Change in quality handling
  - From today: Focus on parts with quality deficits in the past
  - To future: Focus on parts with currently critical process quality

### Benefits

- optimize process quality and reduce / avoid non-conformances, reworking etc.
- closed loop to design with the possibility of quick design changes  
→ improve efficiency for production
- react quickly in case of decreasing process quality  
→ avoid problems with module delivery to OEM due to problems with parts production



## Example for Digital Twin and Model Based Definition (3D only)

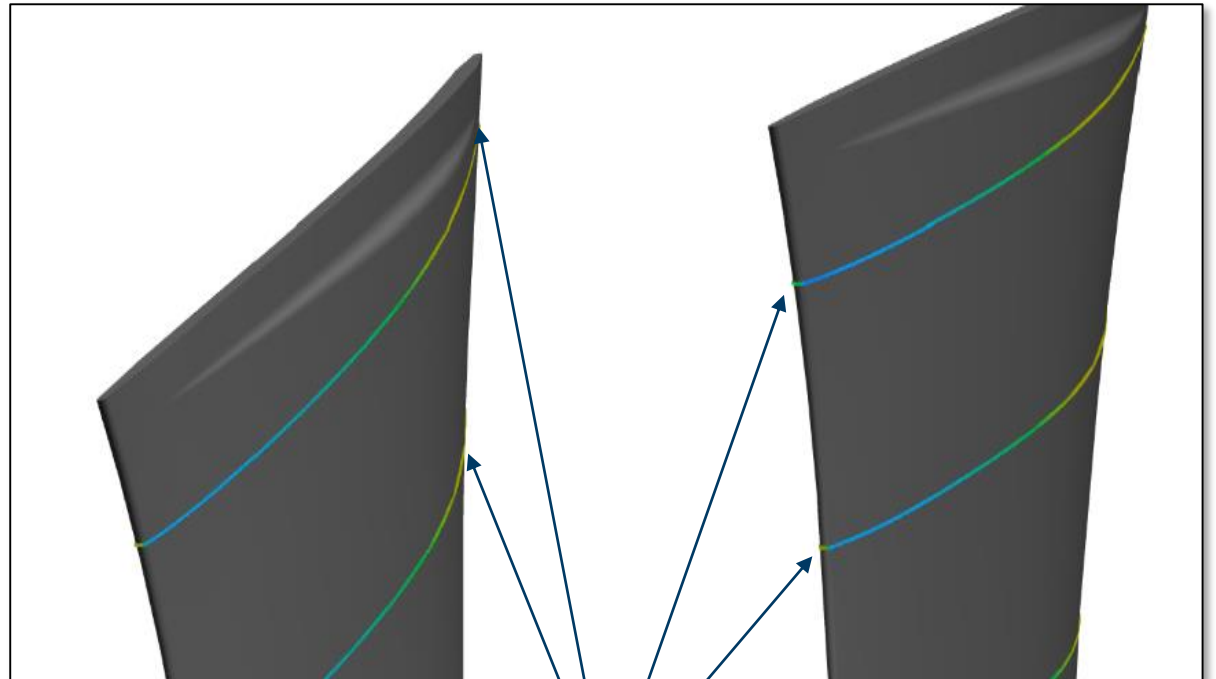
### Usage of Production Data Together with CAD-Geometry and PMIs

Precondition:

Product Manufacturing Information (PMI) is added in the design phase to the CAD-model of the part

Objective:

- Continuously show measured data during / after the production at the position of the PMI in the CAD-model
- Realize potential problems early in the production process
- Changes in production can be implemented before non-conformances occur
- Simplify non-conformance management
- Closed-loop back to design  
→ optimize the design to reduce / avoid non-conformances



Position of PMIs  
along the Profile



## Summary

- The Digital Twin is one of the Top strategic technology trends – and its implementation and usage will definitely grow over the next years.
- One of its main advantages is the single point of truth for all product-relevant data and the connection between the different sources (design, production and MRO).
- The Digital Twin is not necessarily covered by one single IT system. But the navigation between different IT systems must be possible to profit from the Digital Twin's potentials
- The Digital Twin in combination with a move to a purely 3D-based product definition will offer a lot of additional chances for all involved parties.



**Thank you for your attention!**

