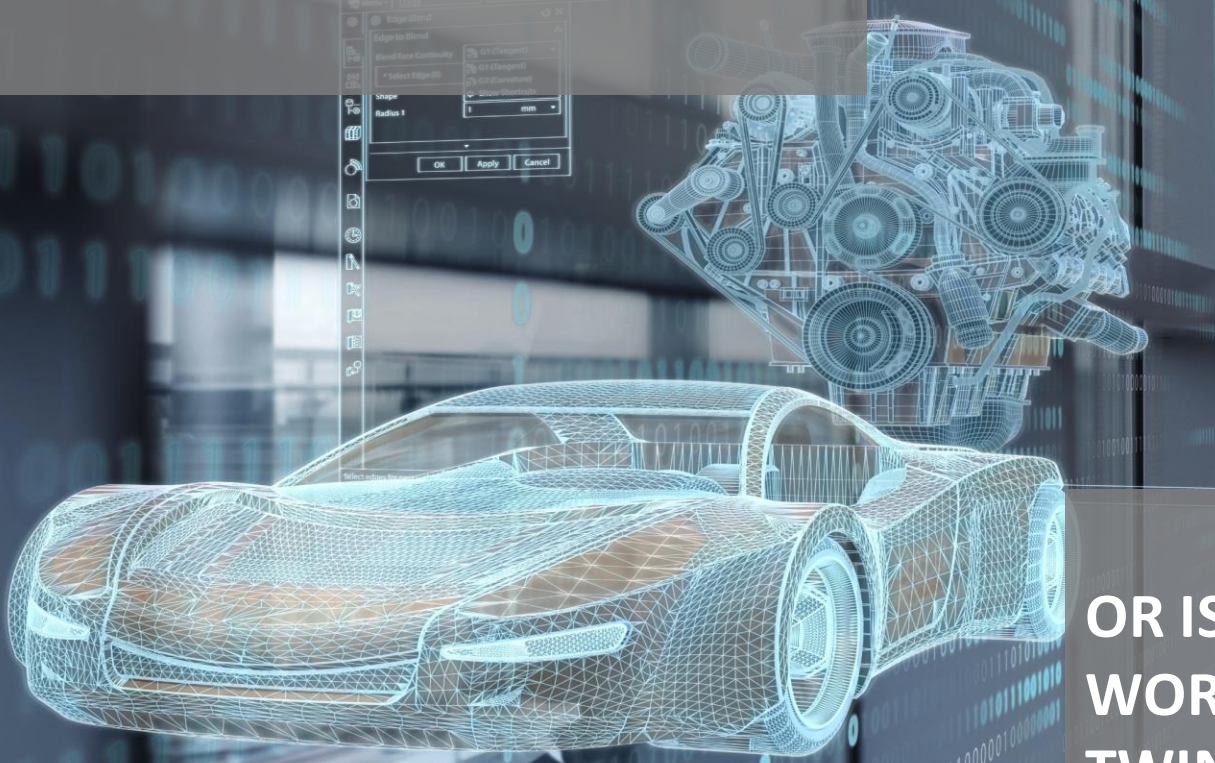


## **BRING YOUR DIGITAL TWIN TO LIFE**

DigiTwin Demo Day 2 @ Aalto University

Ville Pantsar  
Hannu Mäkinen

**A DIGITAL TWIN IS A VIRTUAL REPRESENTATION OF A PHYSICAL PRODUCT OR PROCESS, used to understand and predict the physical counterpart's performance characteristics.**



**OR IS THE PHYSICAL PRODUCT A REAL WORLD REPRESENTATION OF THE DIGITAL TWIN? The result of a human creativity and imagination.**



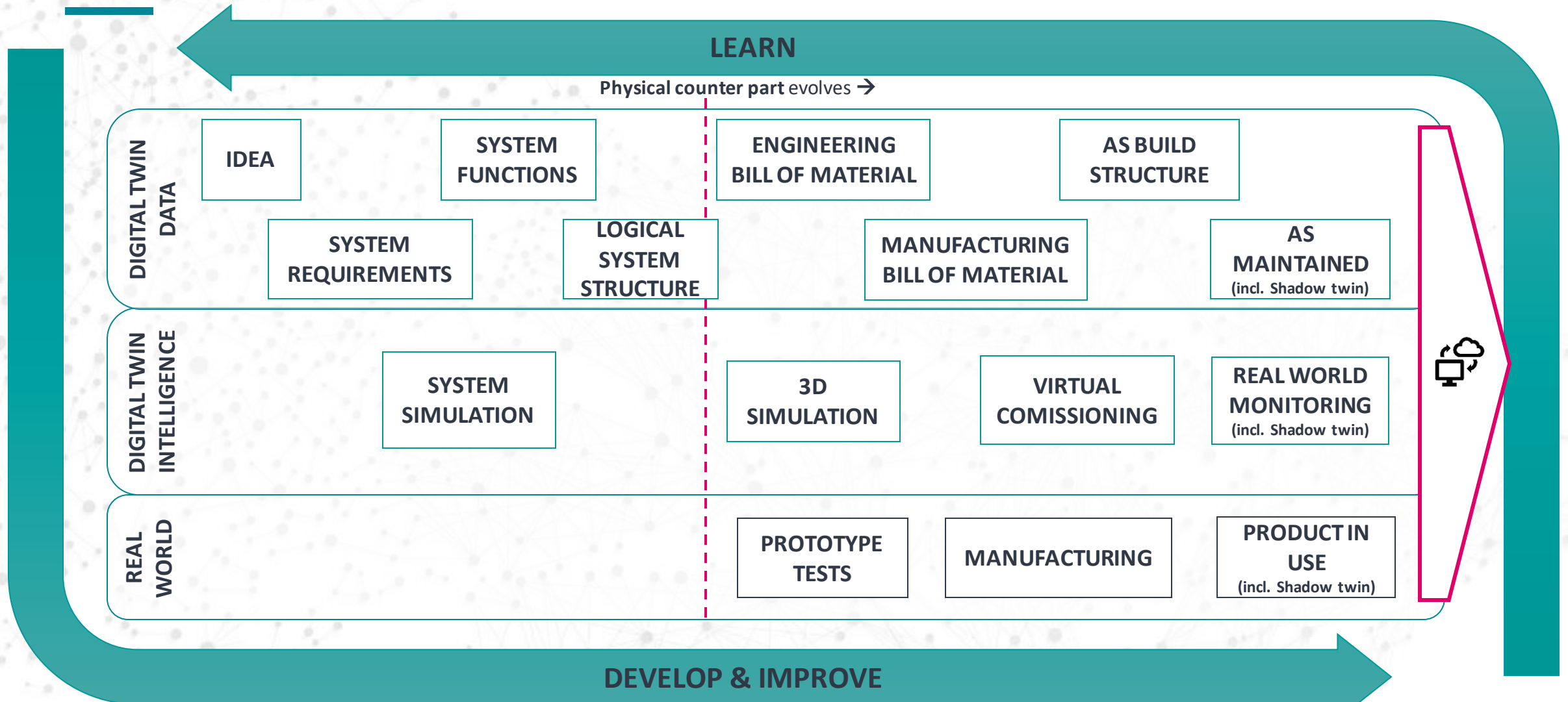
# DNA defines how it should work

Product DNA is formed during the systems engineering and based on that the product is designed.

Real world measurements validates and monitors whether the product is performing according to the DNA.



# From DNA to realization and evolution



# Product DNA in the PLM (Teamcenter)

**Requirements Table**

Element Name	ID	Rev...	S
Move Piece Parts	024609	A	
Application - Manual Assembly Cell	REQ-000437	A	
Application - Robotic cell	REQ-000436	A	
Application - Lifting Loads	REQ-000444	A	
Minimum In-feed Height	REQ-000445	A	10
Incline Angle	REQ-000446	A	20
Description of Loads to Be Moved	REQ-000438	A	
Adjustable Incline Conveyor	024624	A	
Belt Subsystem	024625	A	10
Motion Control Subsystem	024626	A	20
Drive Motor	024631	A	10
Variable Speed Drive	024632	A	20
Motion Control Unit	024633	A	30
Load Detection System	024634	A	30

**Functions Table**

Minimum In-feed Height	REQ-000445	A	10
Incline Angle	REQ-000446	A	20
Description of Loads to Be Moved	REQ-000438	A	
Weight of Loads	REQ-000439	A	10
Maximum Dimensions	REQ-000440	A	20
Loads with liquid	REQ-000451	A	40
Fragile Loads	REQ-000441	A	30
Adjustable Incline Conveyor	024624	A	
Belt Subsystem	024625	A	10
Drive Roller	024627	A	10
Idler Roller	024628	A	20
Belt Support Structure	024629	A	30
Conveyor Belt	024630	A	40
Motion Control Subsystem	024626	A	20
Drive Motor	024631	A	10
Variable Speed Drive	024632	A	20
Motion Control Unit	024633	A	30
Load Detection System	024634	A	30

**Functional Decomposition Diagram**

**Requirements captured**

- 1 REQ-000445-Minimum In-feed Height  
Minimum in-feed height may not exceed 250 mm
- 2 REQ-000446-Incline Angle  
Incline angle must be modifiable between 0-45 degrees

**Functions captured**

- 124615 Latest possible changes in time class
- 124617 Stop Belt Motion if Operator Safety is Endangered
- 124619 Control Part Movement
- 124614 Detect Loads
- 124616 Monitor Belt Speed
- 124620 Softstart Conveyor
- 124621 Soft-stop Conveyor

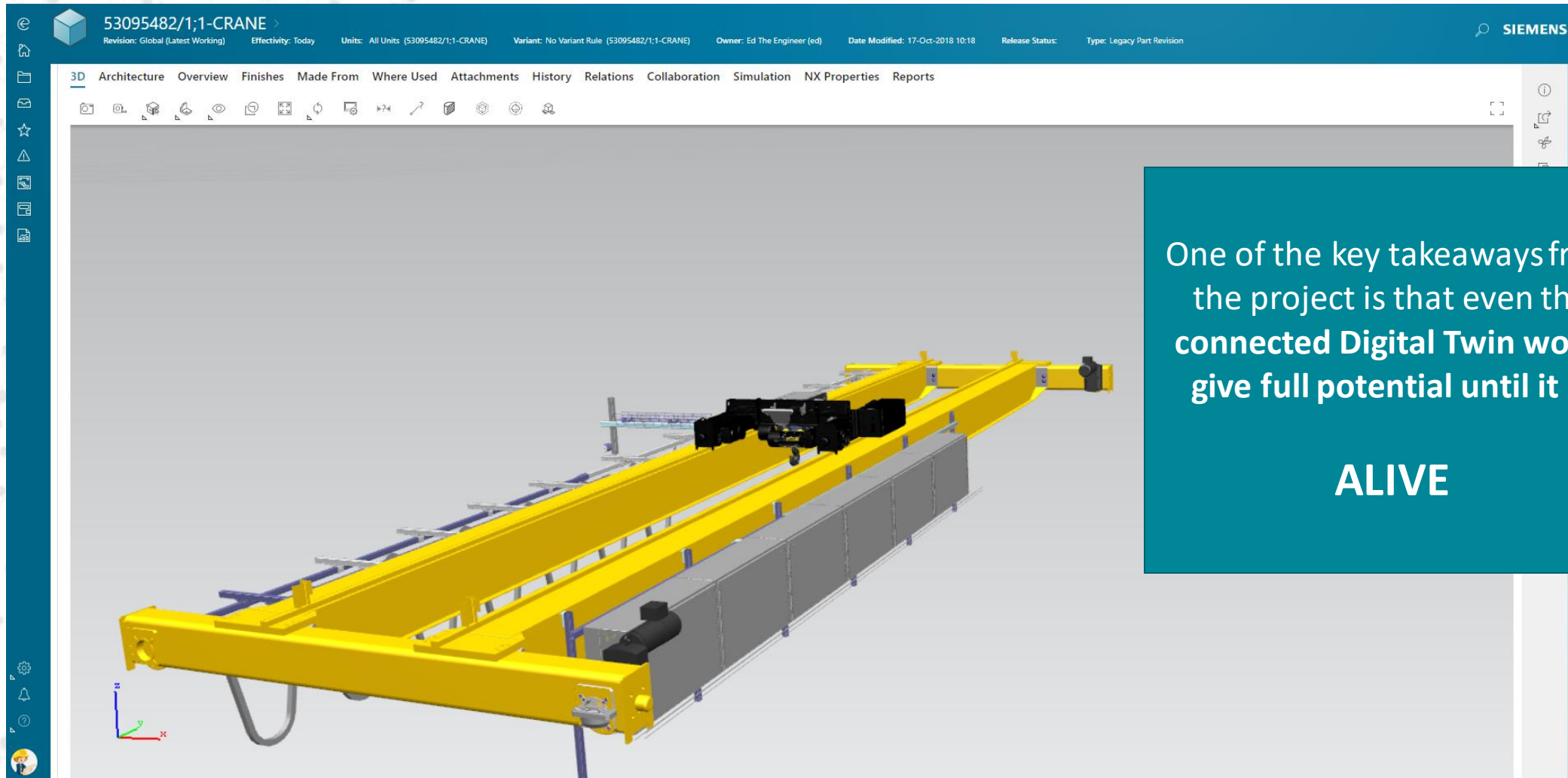
**Traceability**

**Logical modules defined**

- Conveyor Belt
- Load Detection System
- Motion Control Subsystem
- Drive Motor
- Variable Speed Drive
- Motion Control Unit



# We have the DNA, Digital Twin, Physical Representation, Real world data

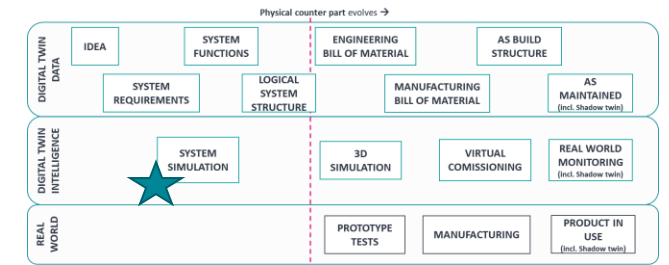
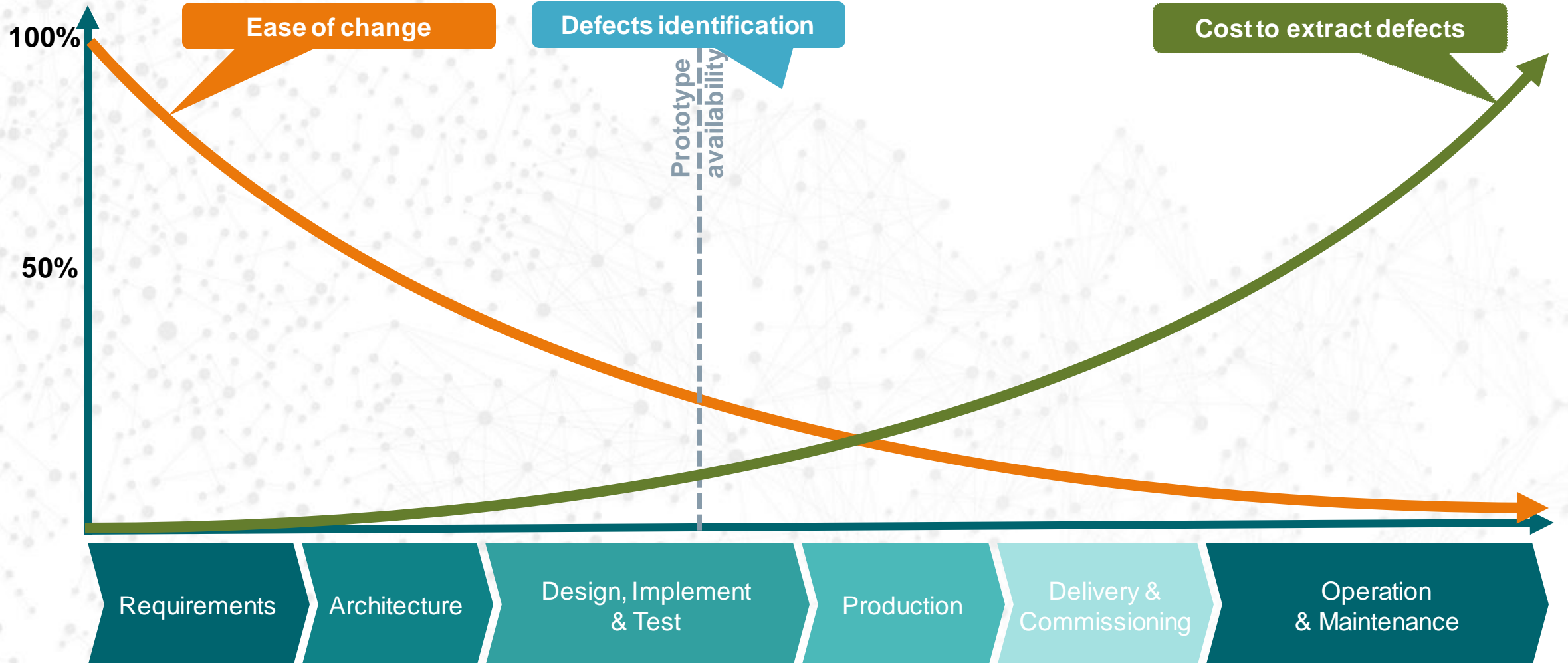


# **WAKE UP YOUR DIGITAL TWIN WITH THE POWER OF VIRTUAL VALIDATION**



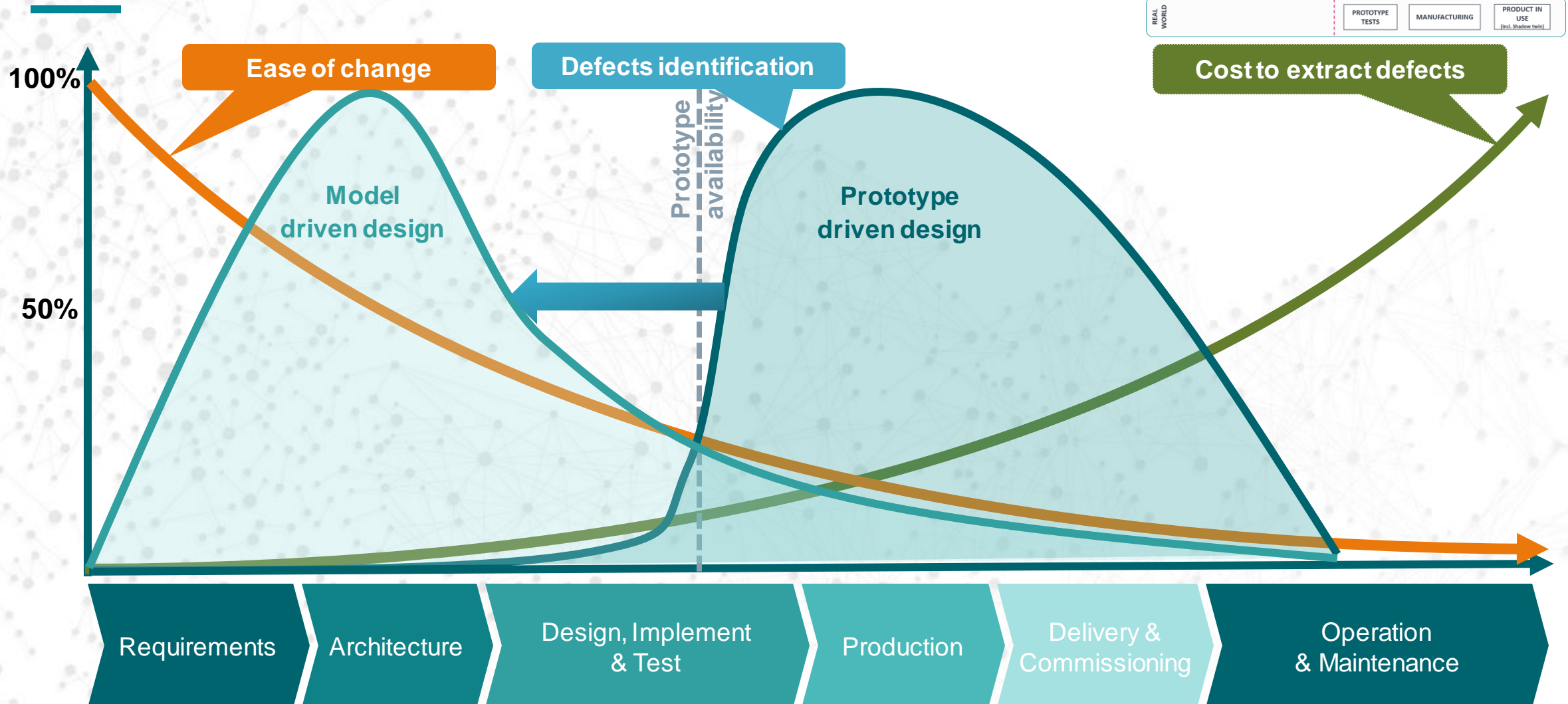


# SYSTEM SIMULATION



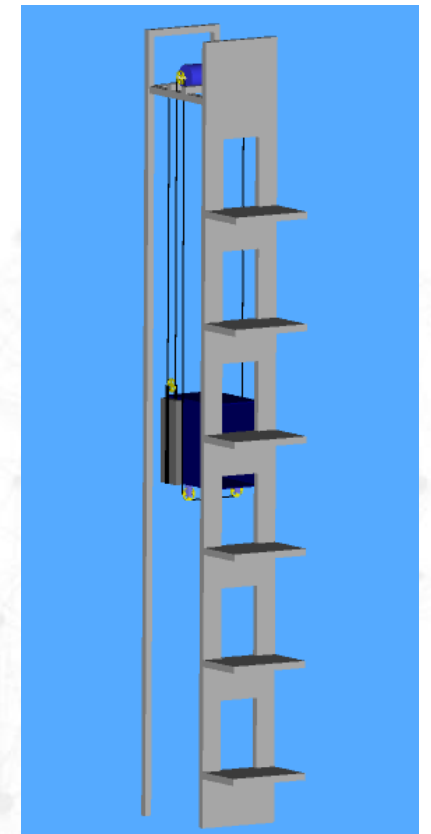
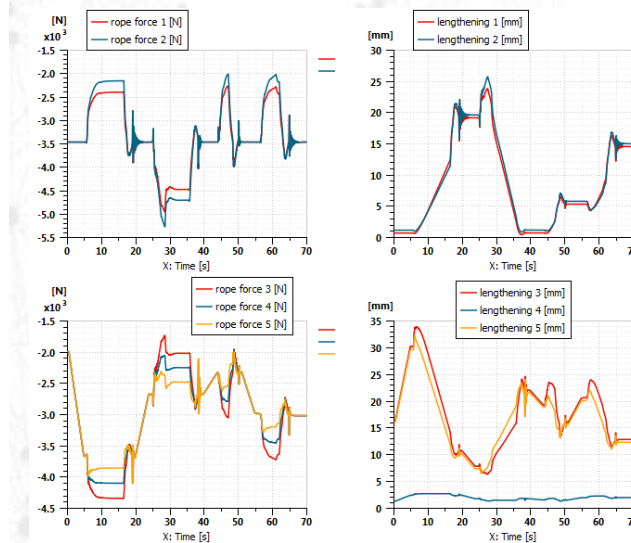
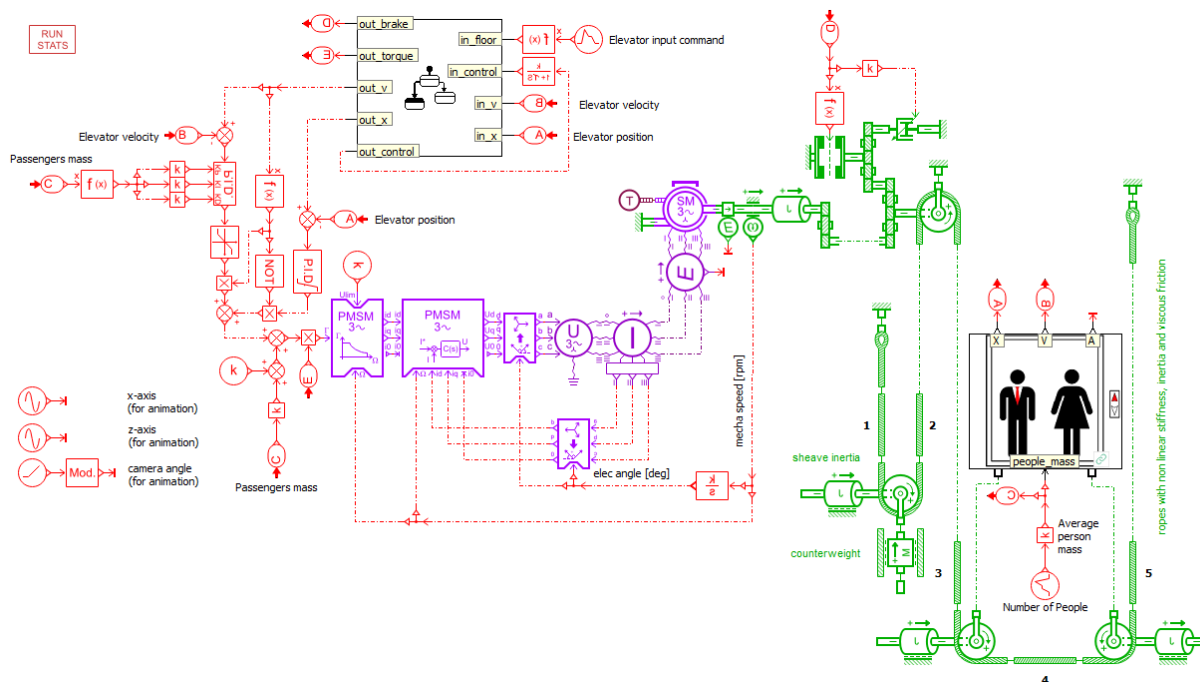
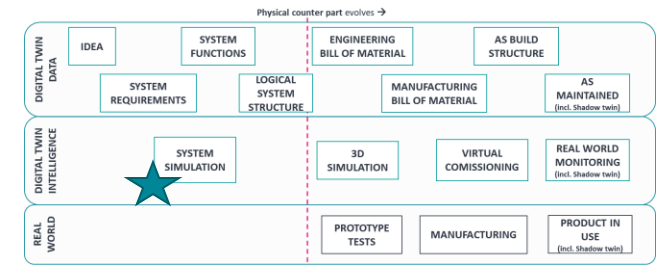


# SYSTEM SIMULATION



# SYSTEM SIMULATION

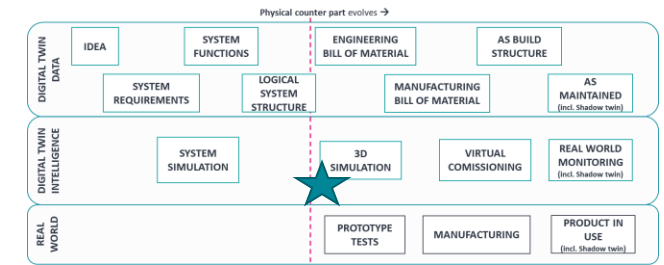
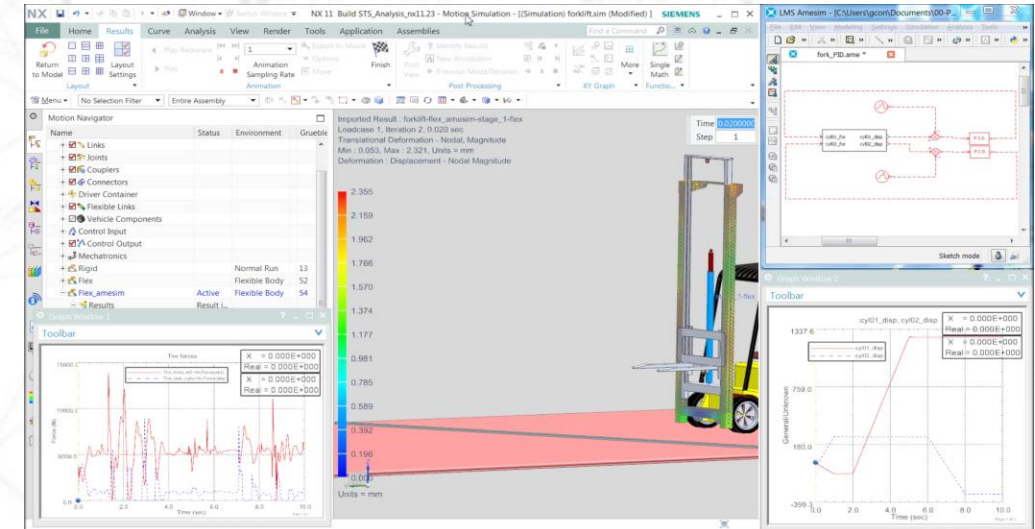
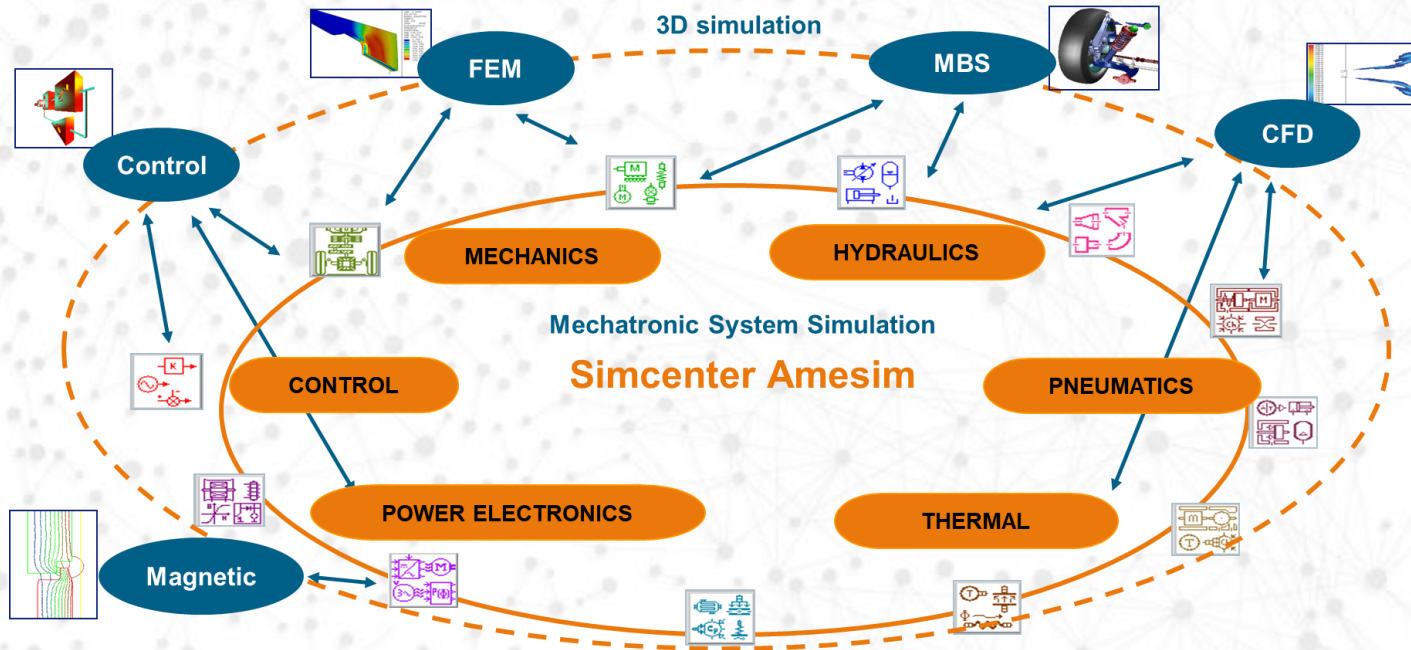
- System simulation allow you to investigate different concepts at the very early stages of the design, even before any 3D CAD geometry is available.





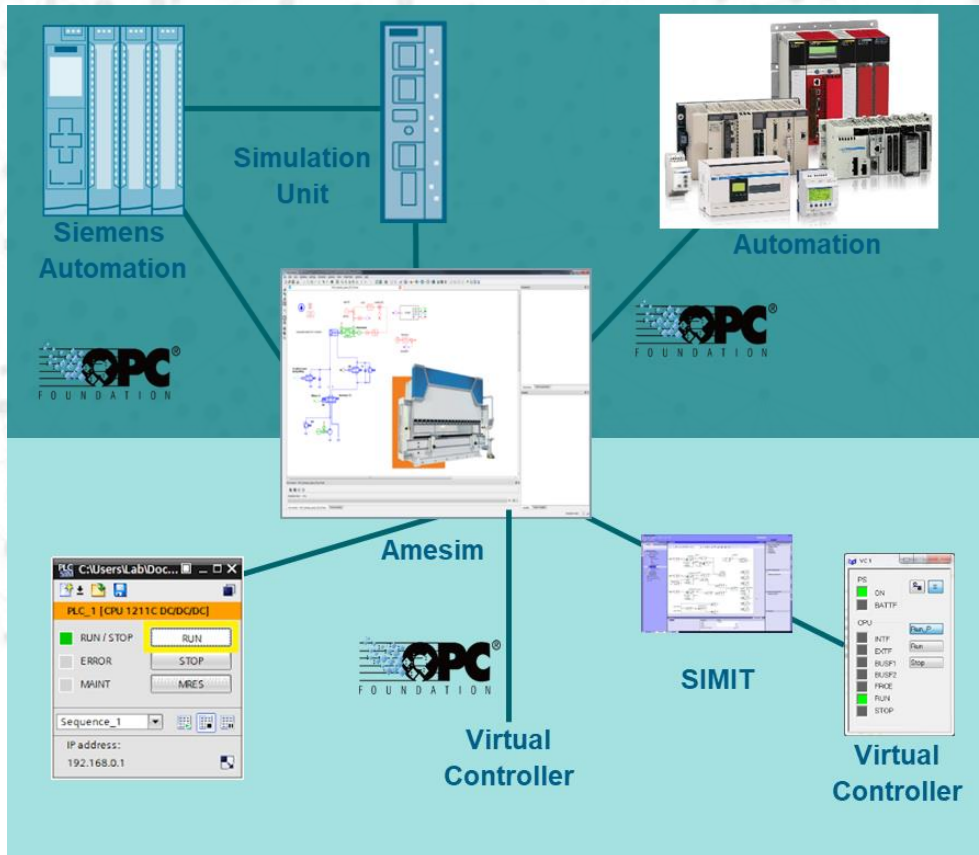
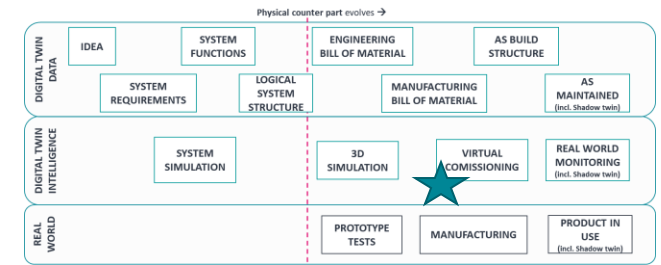
# 3D SIMULATION

- Parameters can be refined, and details can be added as they become available, making system simulation a perfect complement to detailed 3D CAE throughout the entire design cycle.



# VIRTUAL COMMISSIONING

- Validate and calibrate and optimize PLC programs using a system simulation model of the machine.

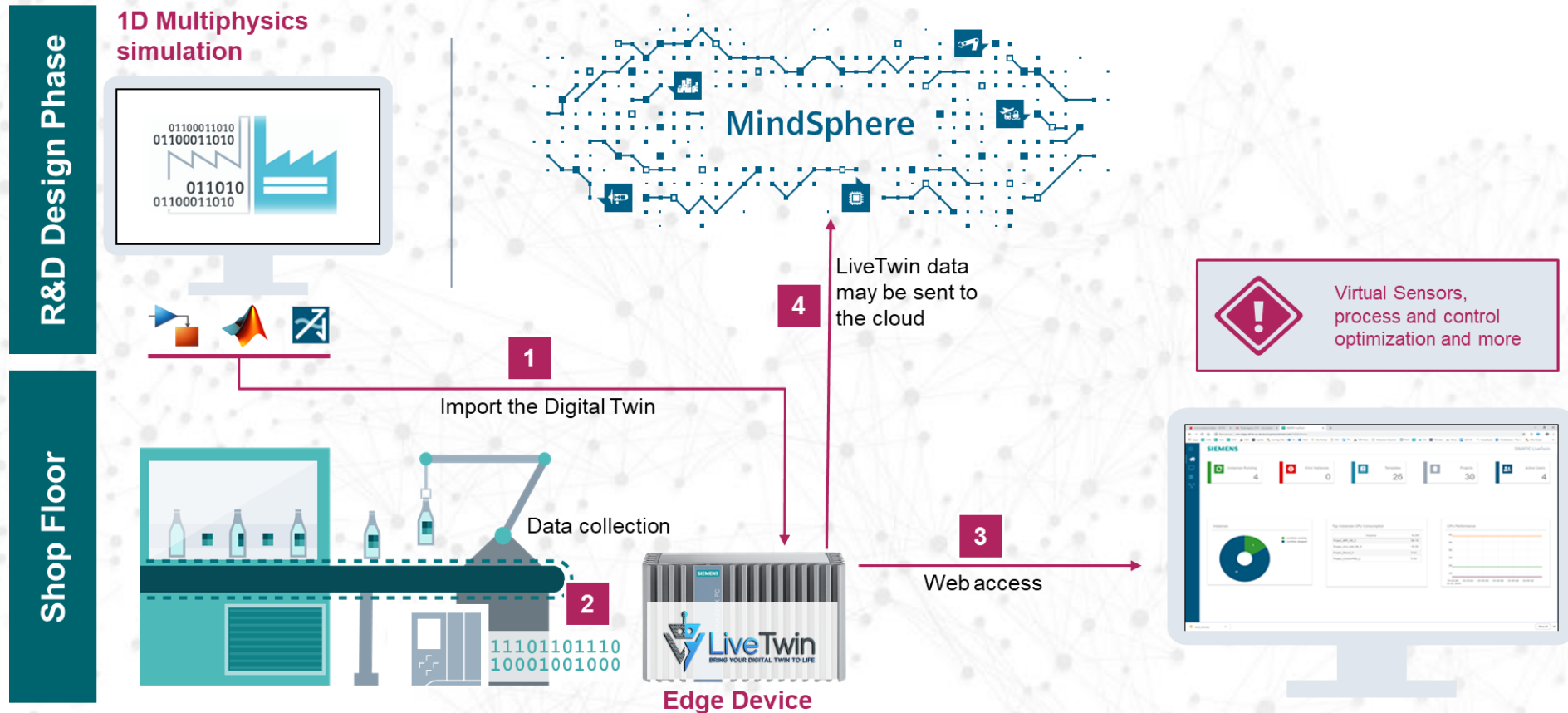
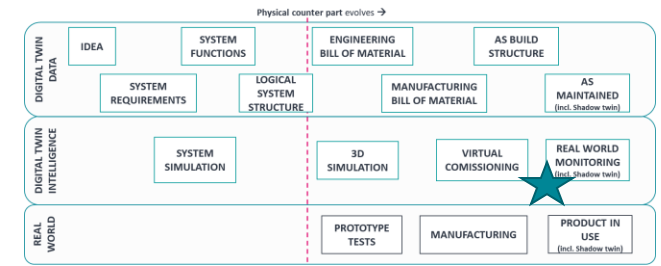


- **Hardware in the Loop (HIL)**
  - exchange of data between a real PLC and Simcenter Amesim
- **Software in the Loop (SIL)**
  - exchange of data between an emulated PLC and Simcenter Amesim



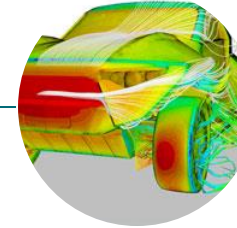
# REAL WORLD MONITORING

- Use your digital twin for virtual sensing, better process control, state observers and feedback to the design team (Closing the loop).



## Summary

### LIVING DIGITAL TWIN OF A PRODUCT OR A PRODUCTION



**Virtual  
validation**



**Traceable product DNA**



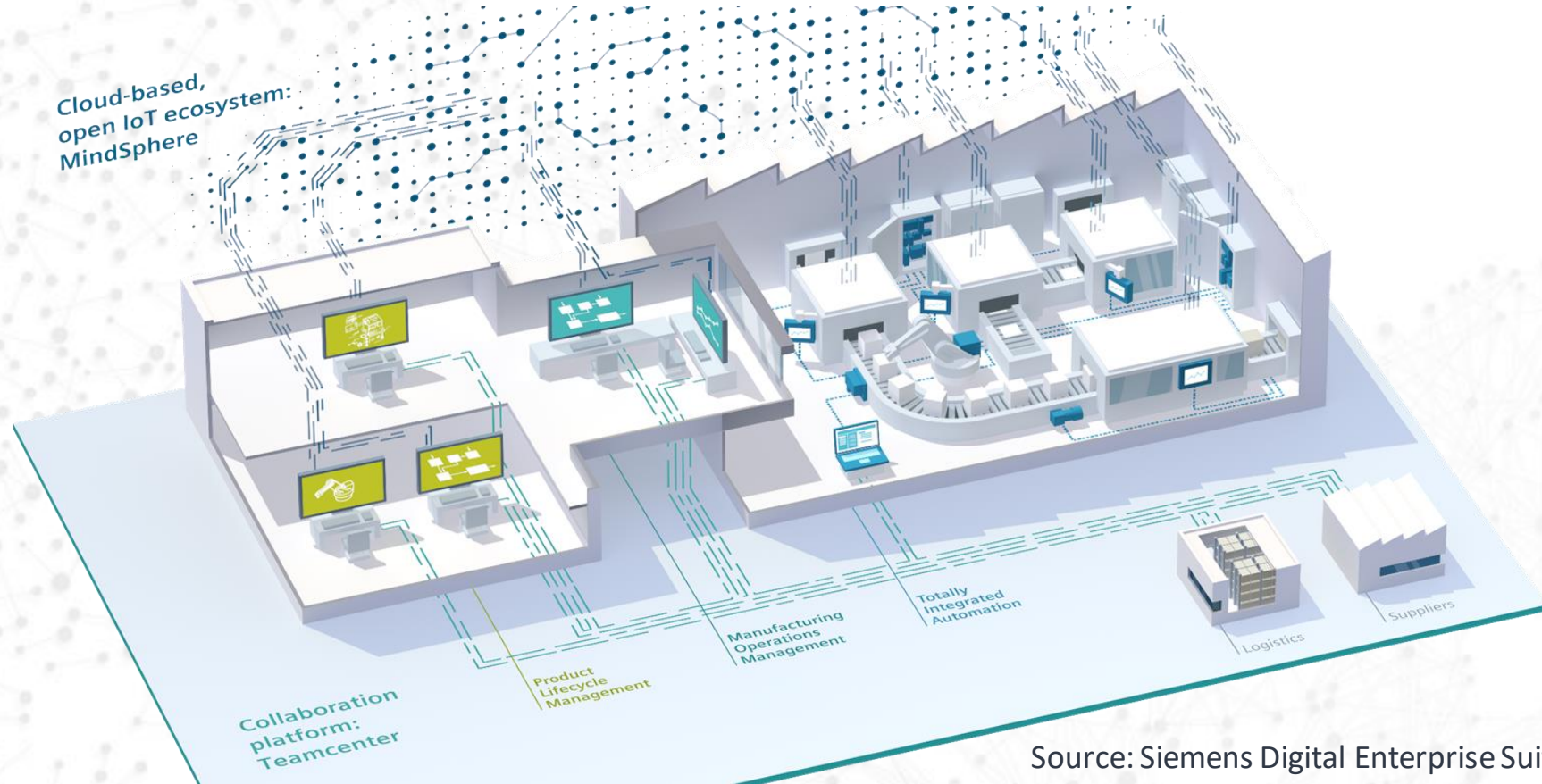
**Connected  
physical  
product**



**Shadow twin(old  
products e.g. in  
service)**



Do not forget that Digital Twins can be integrated to form a full Digital Enterprise  
**THANK YOU!**



Source: Siemens Digital Enterprise Suite