

# How to ride the wave of innovative mechatronics?

19 June 2018

Bart van Dartel | Utrecht

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# Introduction

# **VANDERLANDE**

Research & Development

**STORK**<sup>®</sup>  
*Fokker*

**TU/e** Mechanical Engineering



*Reliable partner for value-added logistic process automation*



**Airports**



**Warehousing**



**Parcel**



## About Vanderlande: Company profile



## Industry Segments: Airports



## Industry Segments: Warehousing





## Industry segments: Parcel



**We improve the competitiveness of our customers  
through value-added material handling solutions**

**Growth**

**Innovation**

**Internationalisation**

**Teamwork**

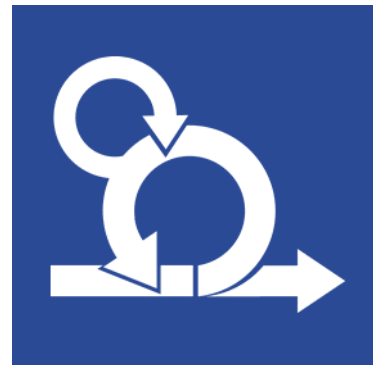
# Innovation: Different approaches

## Processes & Methods



**One way of working**

(ISO, Process Map)



**Modernization**

(Agile, Model Based Design)

## Products



**Technology push**



**Market pull**

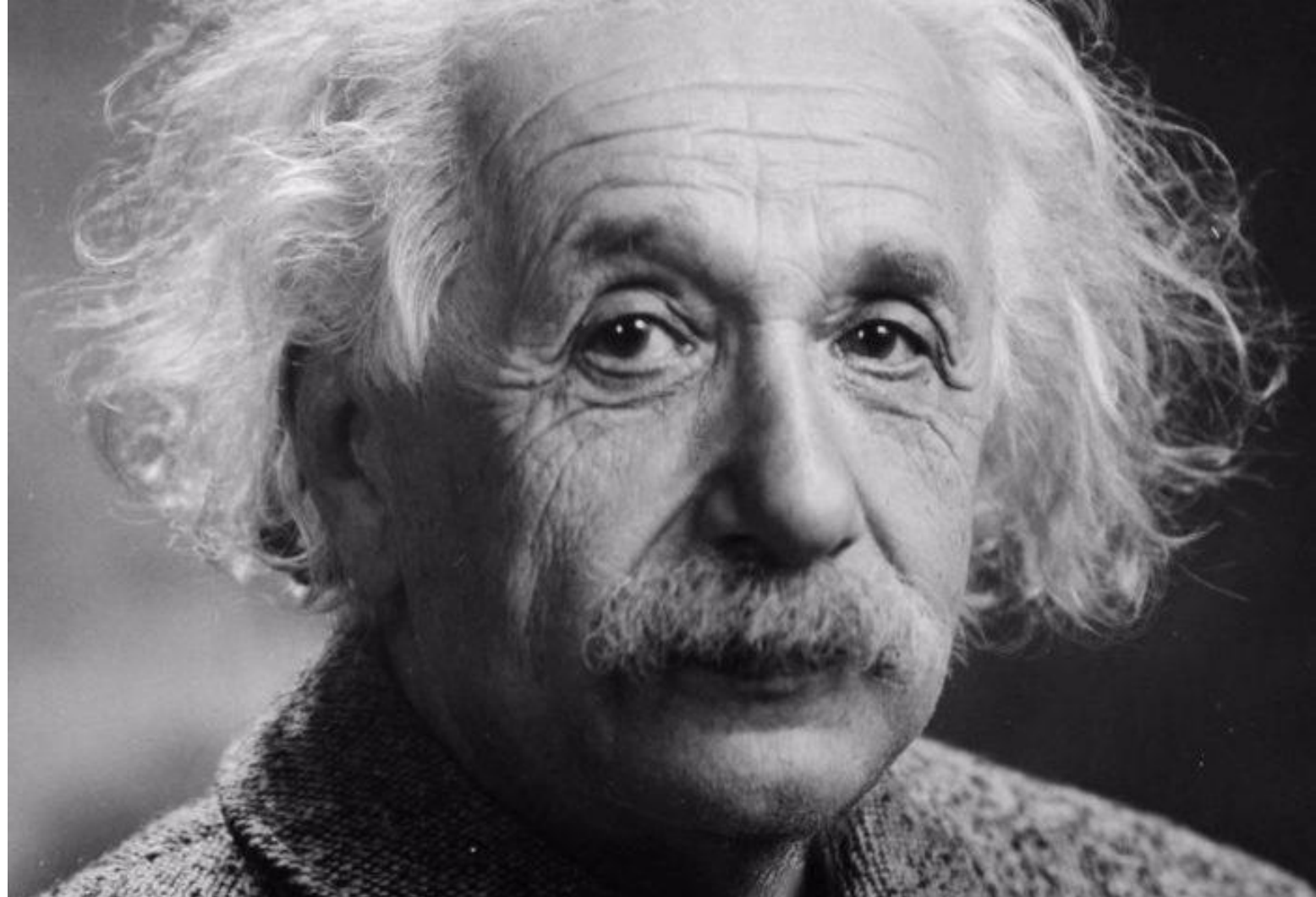


**Co-creation  
with key customers**

## Start with Why



“ Everything should be made as simple as possible, **but not simpler.** ”



## Future solutions: Need for automated item handling



- > More and more tasks can be automated with robot applications
- > One by one, robots will take over responsibility of current operators tasks
- > Operators will oversee a number of robots and eventually oversee whole operation from the control room
- > Resulting in a fully automated flexible warehouse running 24/7 with a higher productivity, optimized output and minimum of errors in product handling

## Our Challenges: Diversity in a critical process

### Carriers

- ULD Aircrafts, Pallets, Trailers/dollies, Swap bodies, roll cages
- All different sizes and shapes
- High filling rate required

### Items

- Very large number or indefinite number of items
- All types shapes, weights, quality, surfaces
- Content of the items sometimes unknown

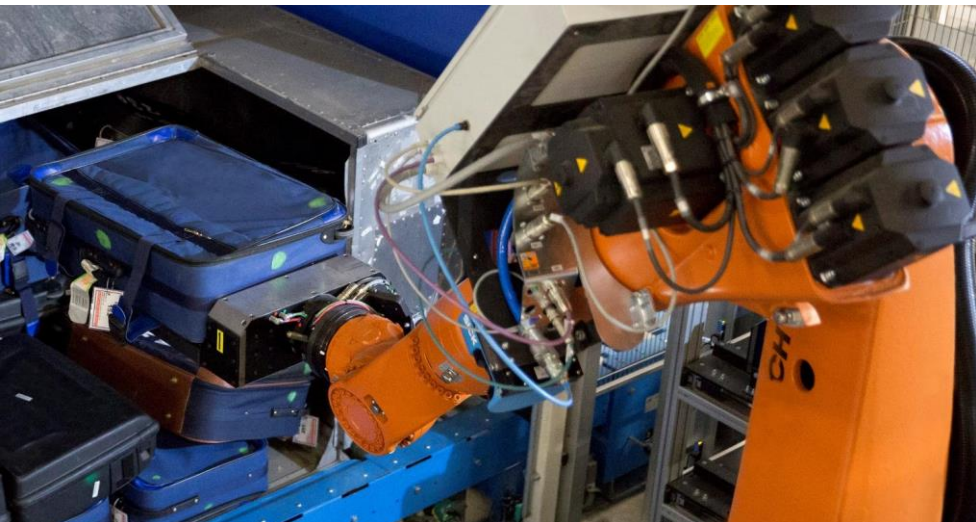
### Process

- Time critical and capacity is key
- Operator handles variety of exceptions
- Value Added Services if applicable

## About R&D: (Mobile) Robotics & Item Handling

### Robotic Item Handling:

- > Machine Vision
- > Deep Learning
- > Gripping



### Mobile Robotics:

- > Semantic World Modelling
- > Operate autonomously in changing environments





SYSTEM  
DEVELOPMENT



MECHATRONICS



HUMAN  
INTERACTION



ROBOTIC / AGV  
SOLUTIONS



COGNITIVE  
ABILITY



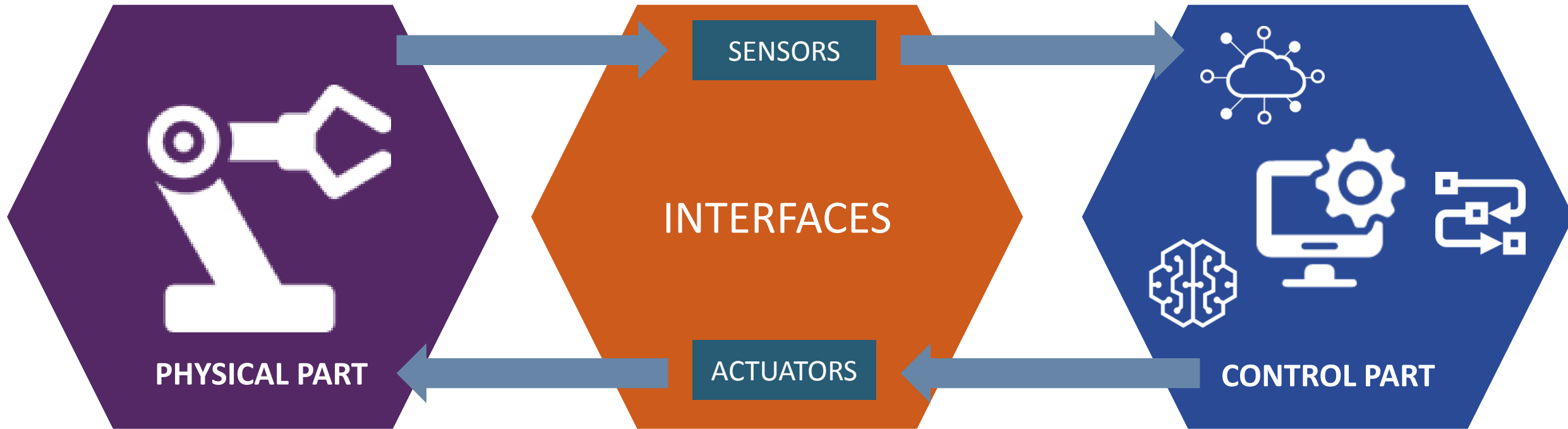
PERCEPTION



NAVIGATION



**Transition: Adding brains to mechatronics**



**~~Mechatronics~~ → CyberPhysical**

**Κυβερνητική**

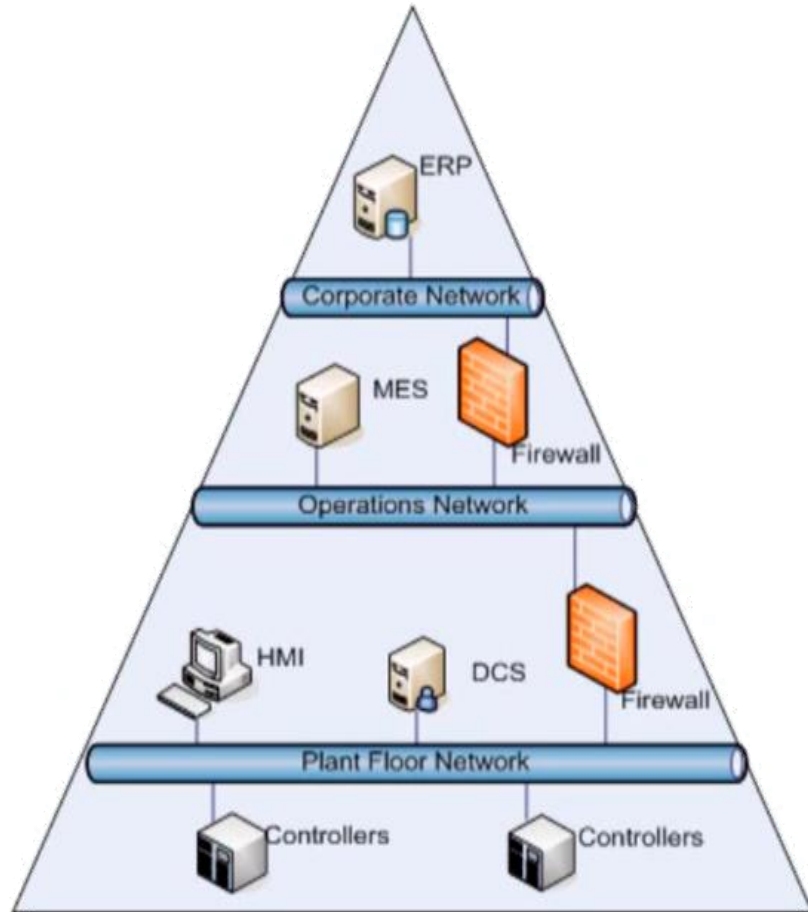
**Governance**





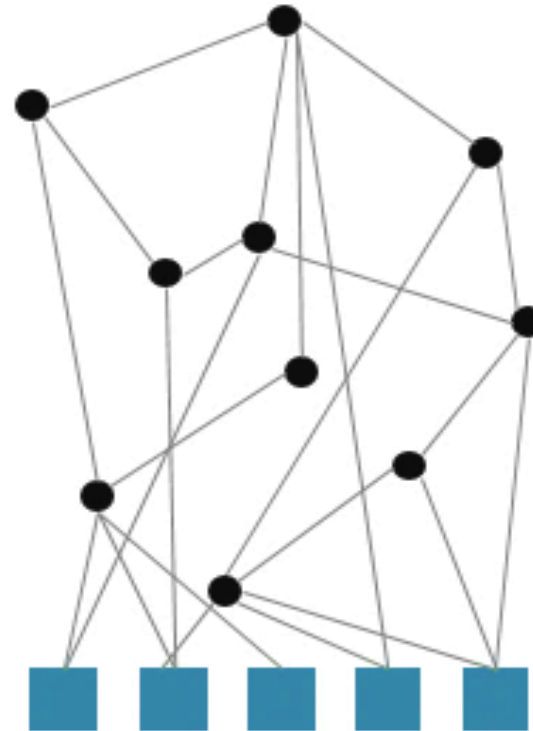
# Today

*5-layer architecture*

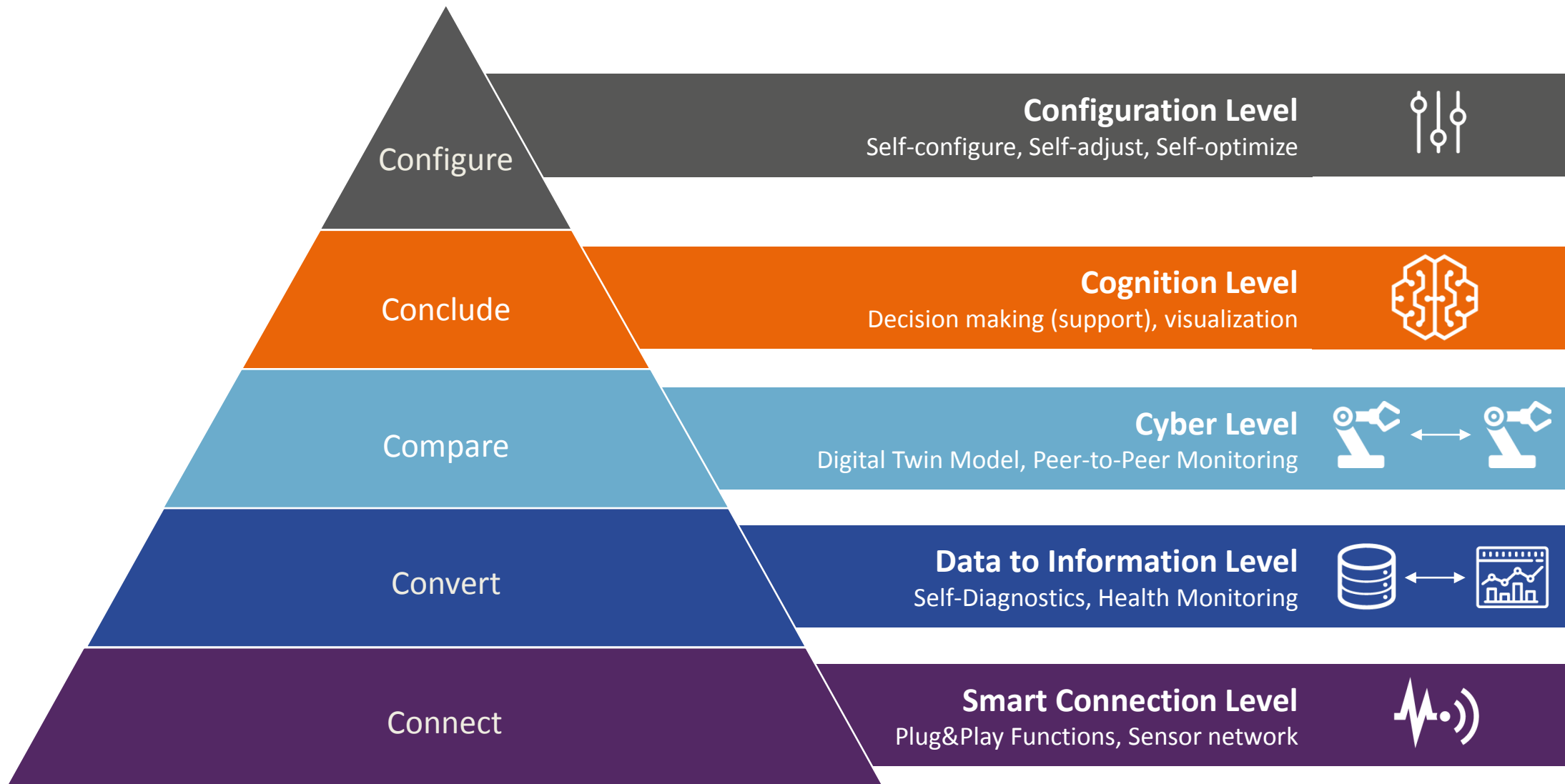


# Future

*Cyber-physical system (CPS) based automation*



# Data architecture for Cyberphysical systems



# A cyberphysical example



Bring new learnings  
to all vehicles



Learning: It is better to  
follow an alternative path



An alternative path  
is simulated by virtual twin



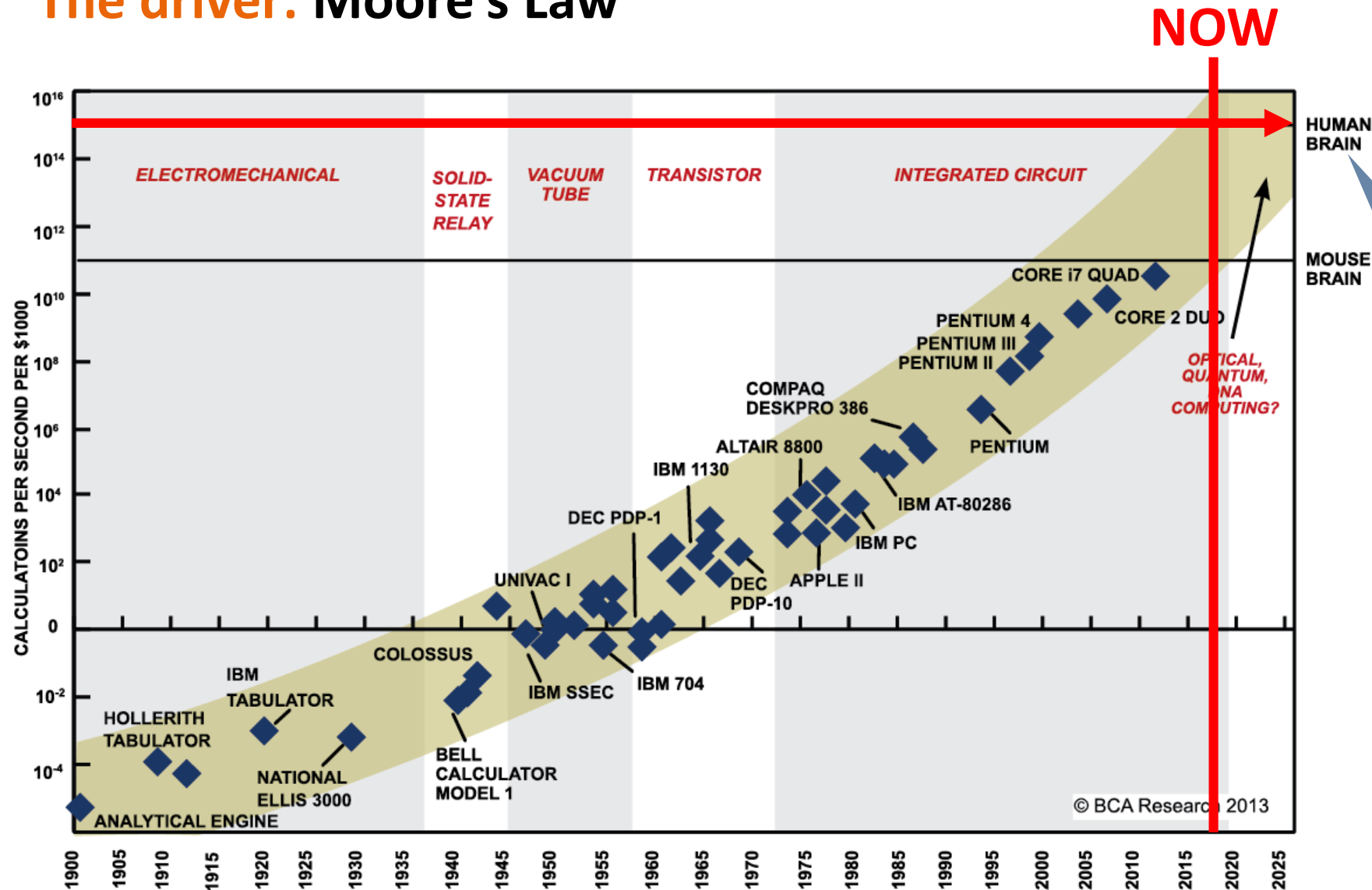
It reduced my performance  
with 20%



I see and report an obstacle on my path



# The driver: Moore's Law



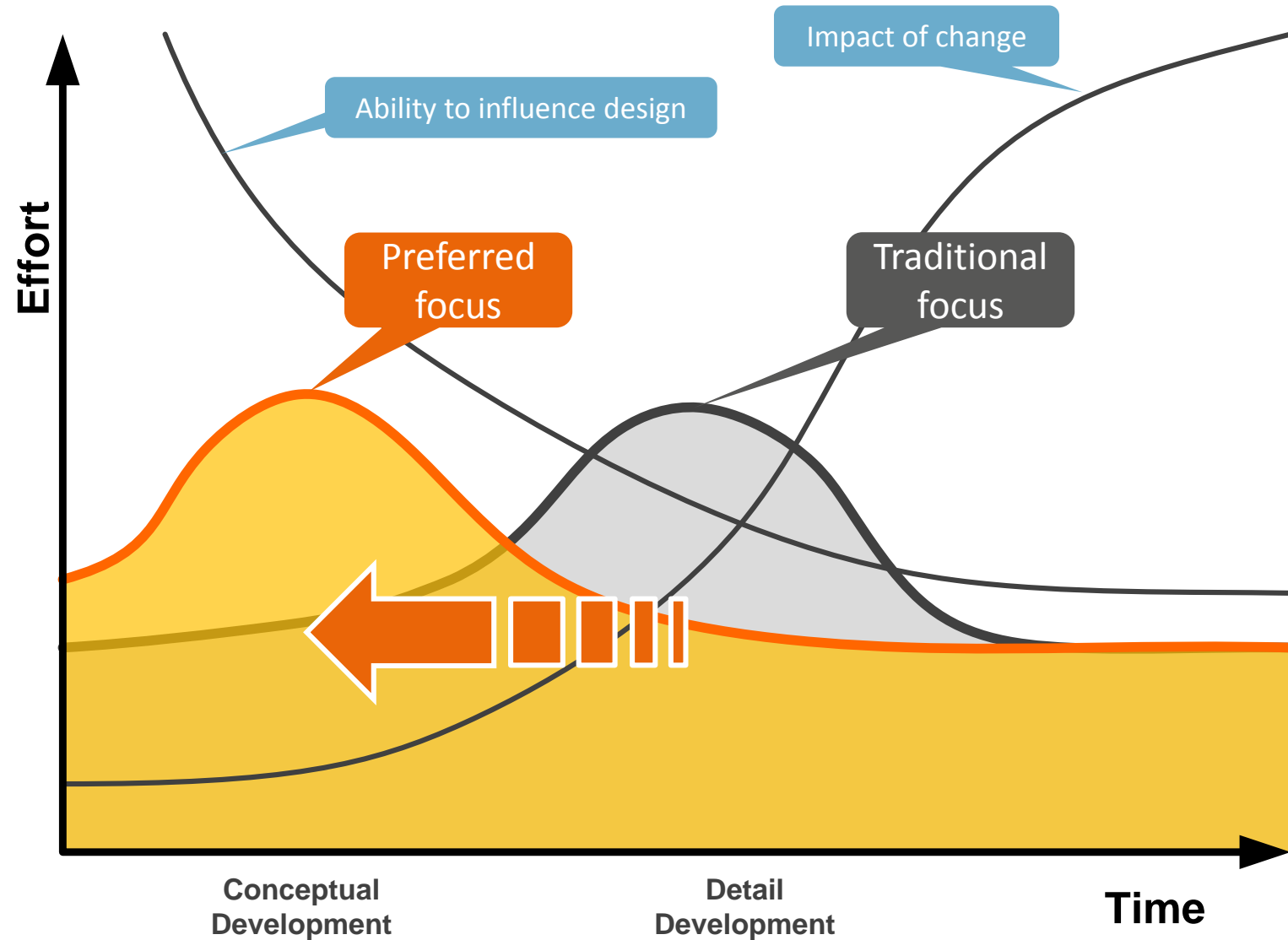
**< 10 years!**

Source: Kurzweil R. The singularity is near: When humans transcend biology

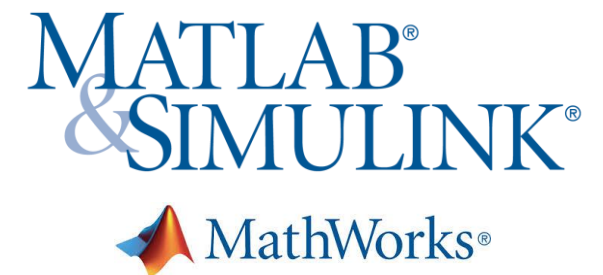
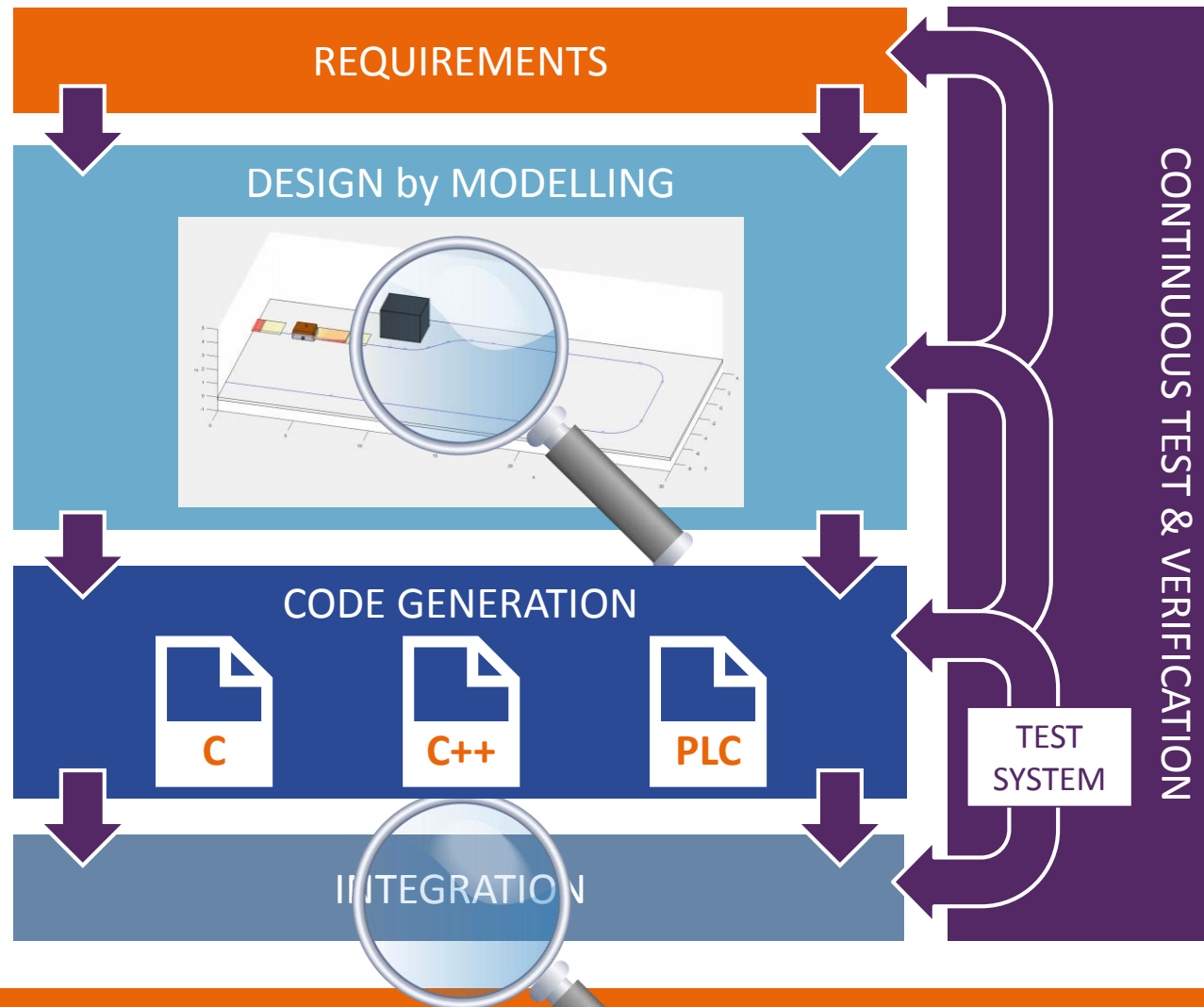


# Setting the focus

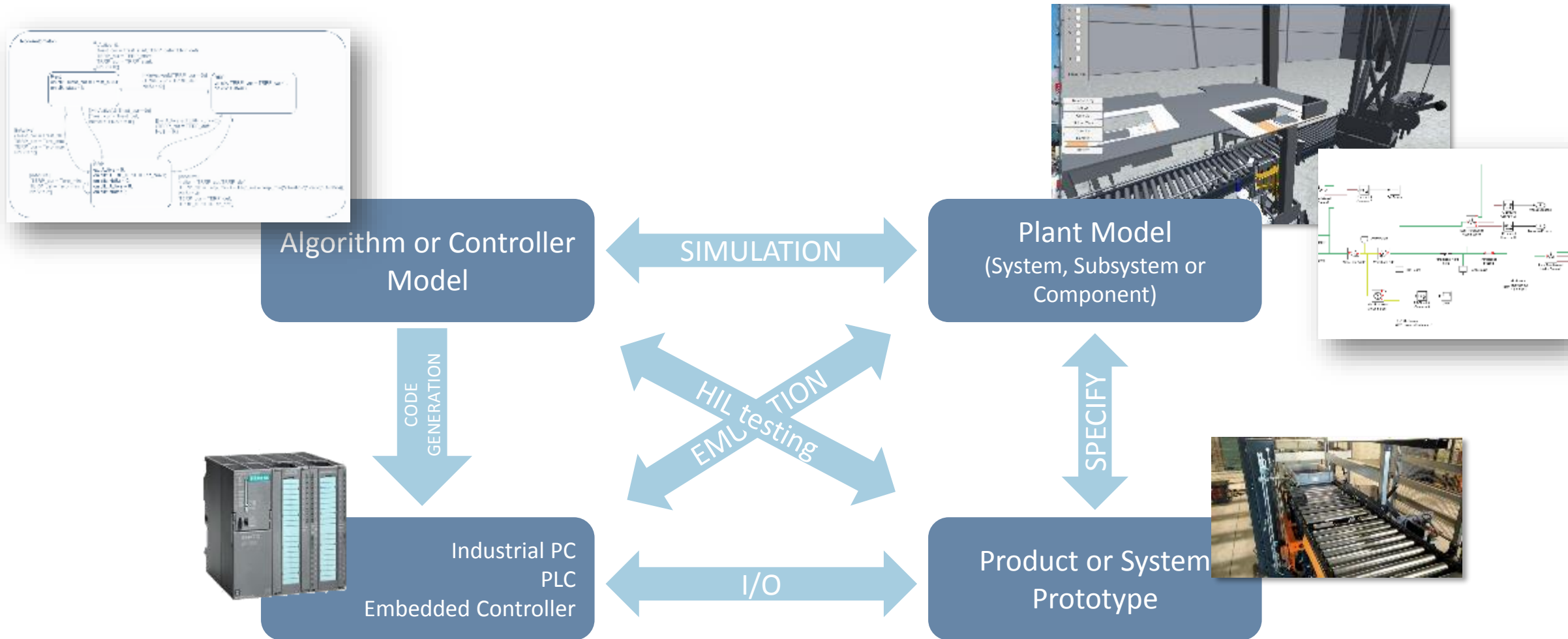
- Ability to influence design and roadmap
- Act swift and agile on customer demands
- Prepare design work for partners
- Automation of design work

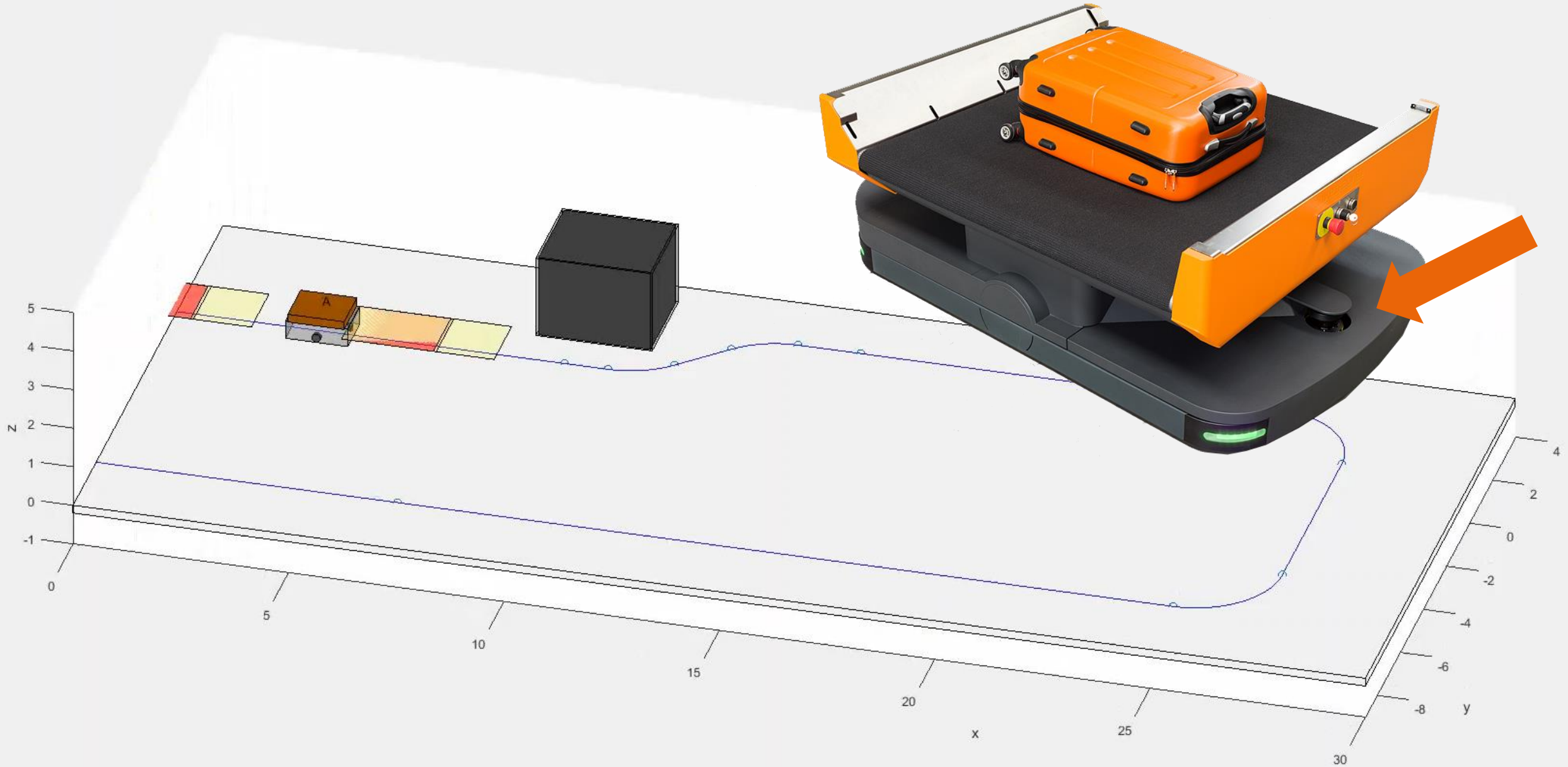


# Model Based Design: Focus on design & integration

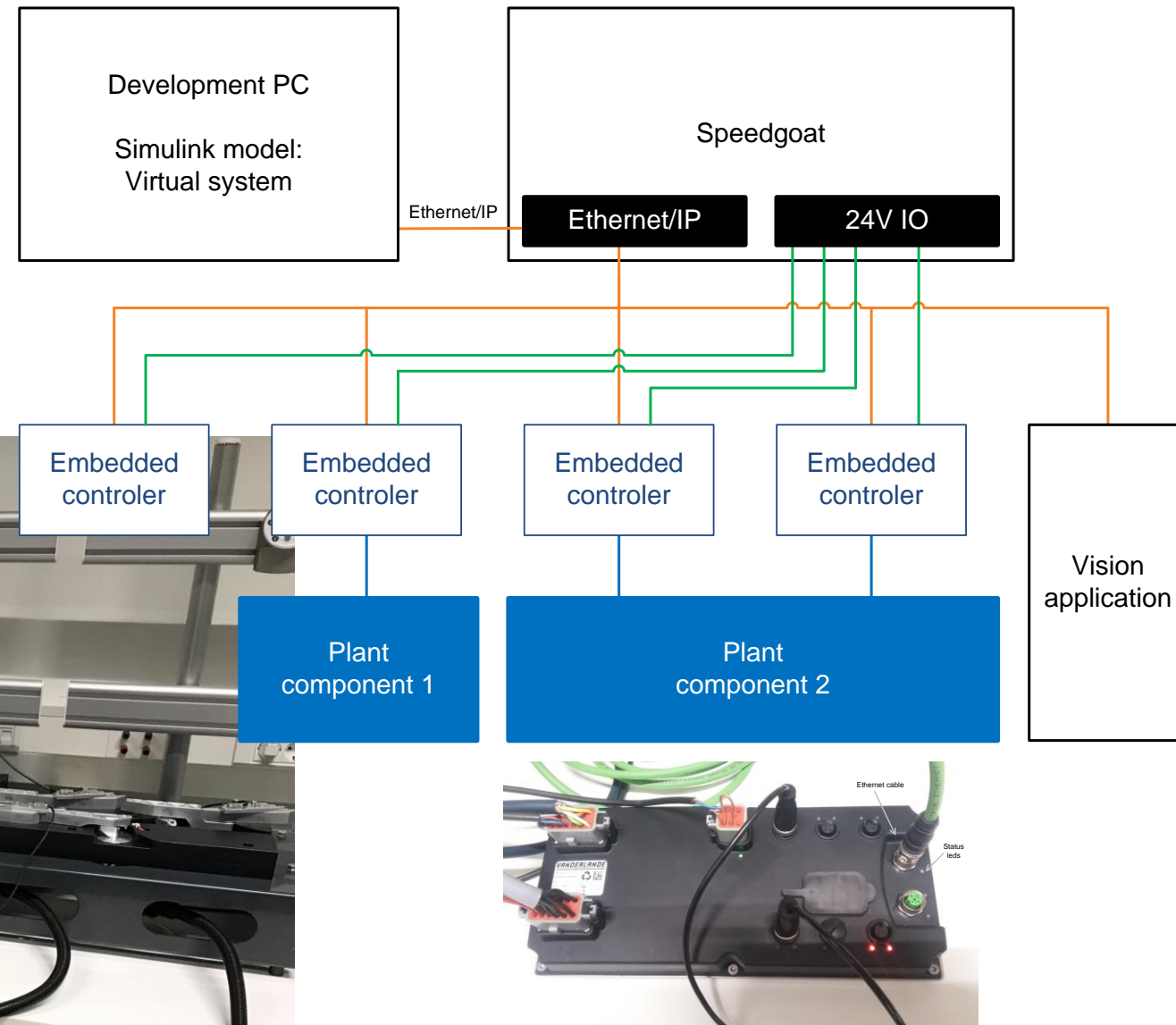


# Model Based Design: Creation of a virtual world





# Continuous Test & Verification



## Development Teams: A knowledge Ecosystem approach

Autonomous

Cross-functional

Many interactions

Models as technical truth



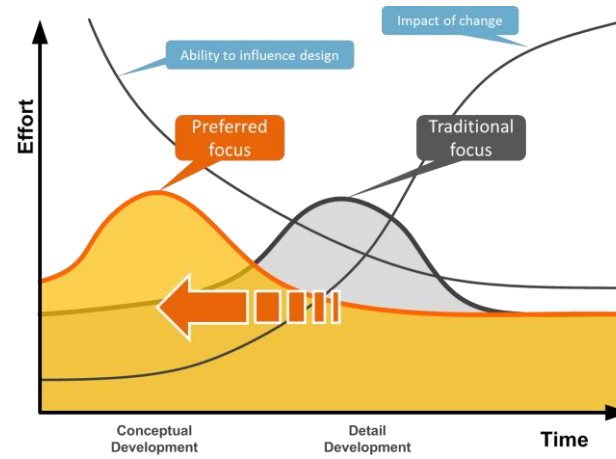
## Partnership approach



## Complex Cyberphysical Systems



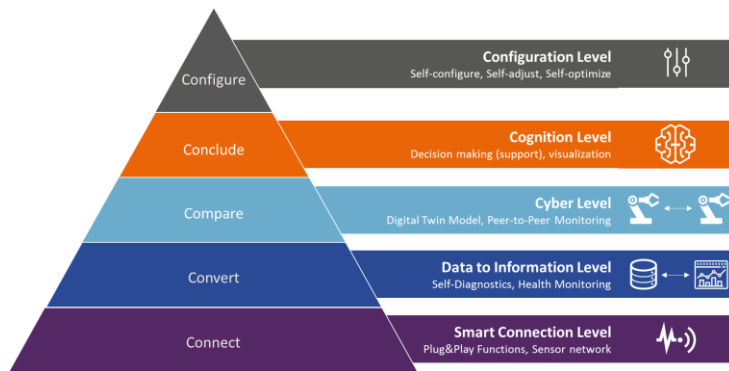
## Shift of Focus



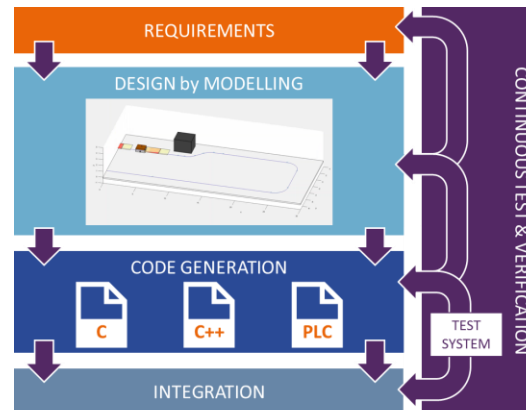
## Autonomous Teams



## Architecture



## Design Automation



## Partnership approach





A full-page background image of a surfer riding a large, curling wave. The surfer is positioned in the lower right quadrant of the frame, riding the face of the wave. The wave is a deep teal color with white foam at the crest. The sky is a clear, light blue.

# How to ride the wave of innovative mechatronics? *Embrace complexity and work together!*

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