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How to ride the wave of innovative mechatronics?

19 June 2018

Bart van Dartel | Utrecht

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Introduction

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Research & Development

STORK®

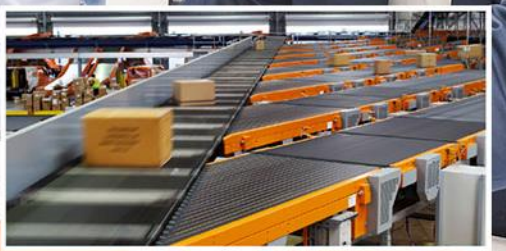
Fokker

TU/e Mechanical Engineering

Reliable partner for value-added logistic process automation

Airports

Warehousing



Parcel


VANDERLANDE
VAN
LANDE

About Vanderlande: Company profile

Global market leader

Established since 1949

>5,000 EMPLOYEES

1.1 Billion REVENUE

innovative systems

intelligent software

life-cycle services

AIRPORTS

10.1 million bags per day

600 AIRPORTS INCLUDING 13 OF THE WORLDS TOP 20

- Atlanta Airport
- London Heathrow Airport
- Hong Kong Int. Airport
- Amsterdam Airport Schiphol

WAREHOUSING

Many of the largest global e-commerce players

- Amazon
- TESCO
- Zalando
- ASDA

PARCEL

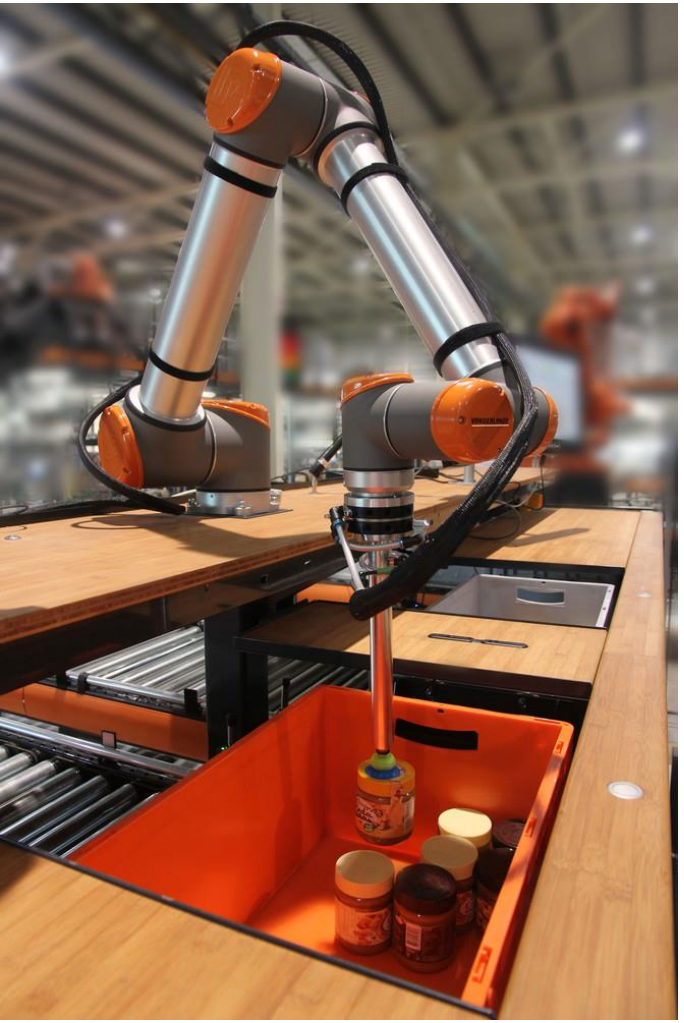
39 Million parcels sorted every day

5 Largest parcel and postal companies

- UPS
- Deutsche Post DHL
- TNT
- FedEx
- SF Express

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

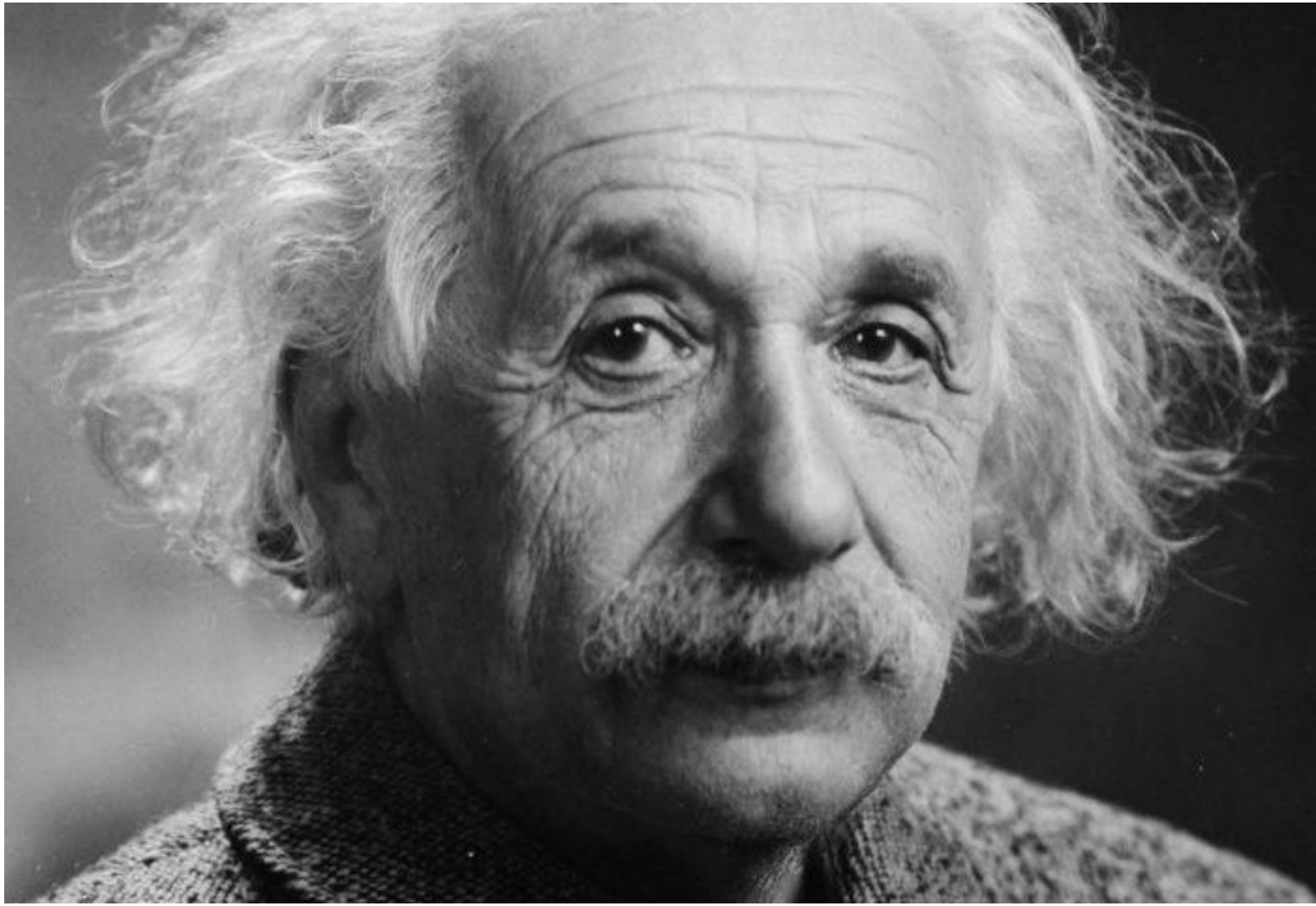
Technology push

Market pull

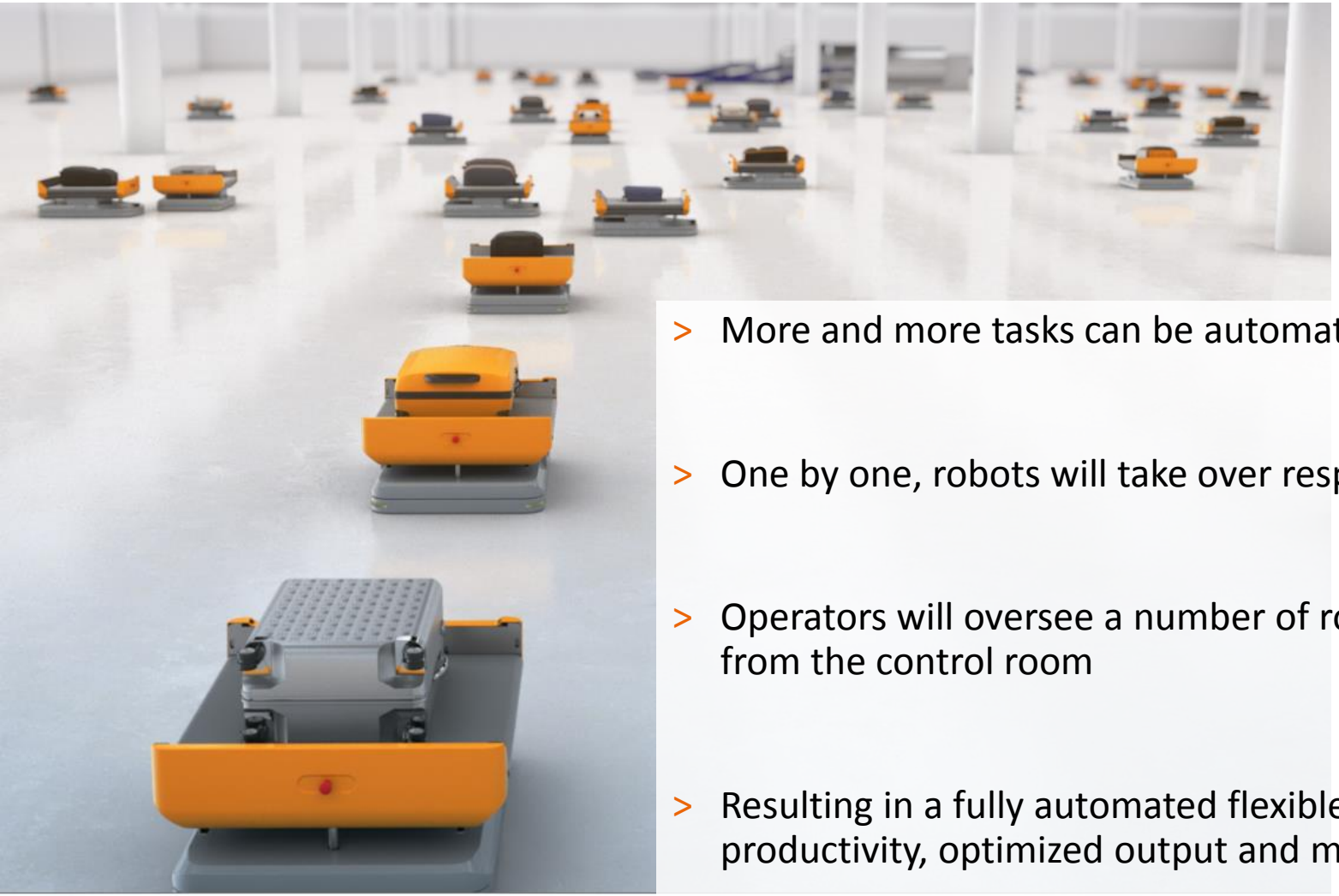
Co-creation
with key customers

Start with Why

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

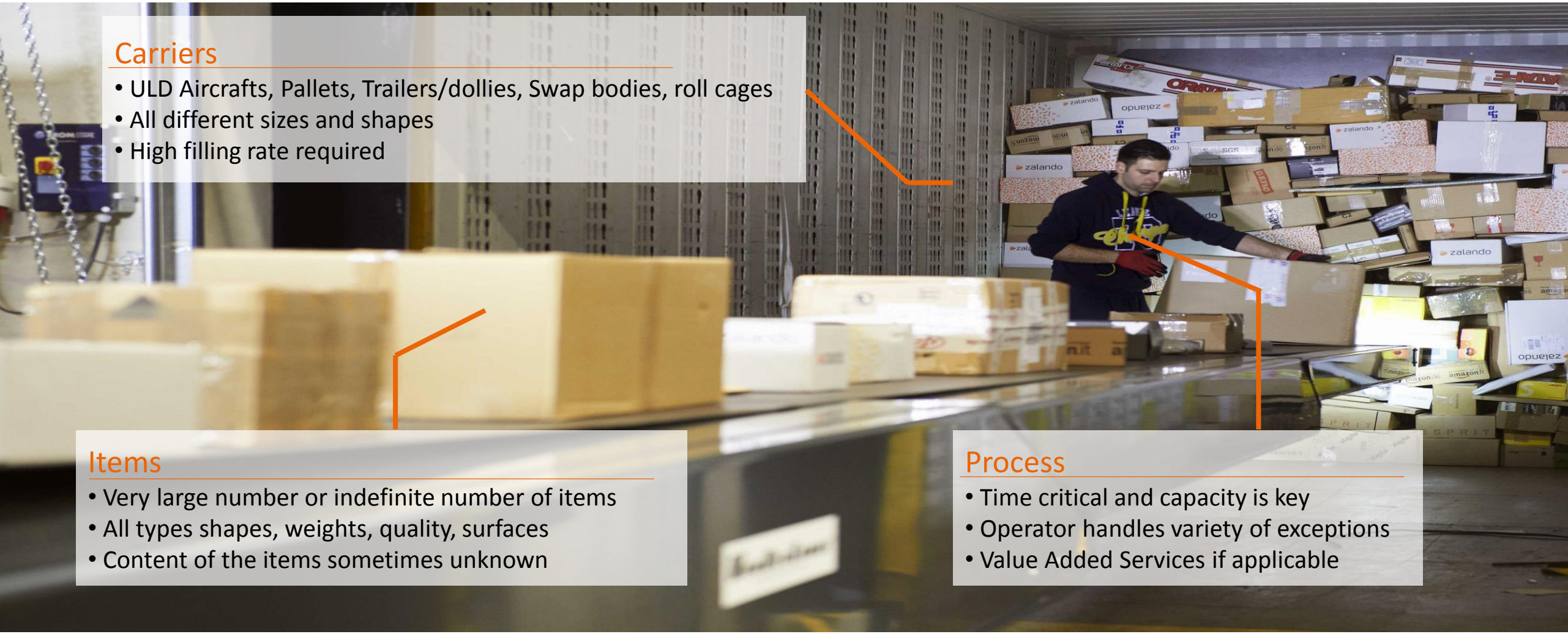


Future solutions: Need for automated item handling



- 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

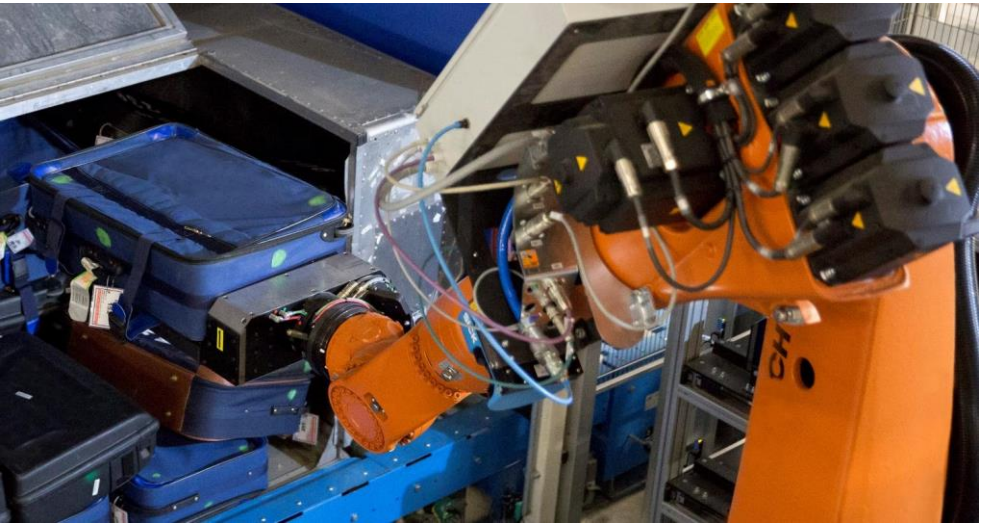
Process

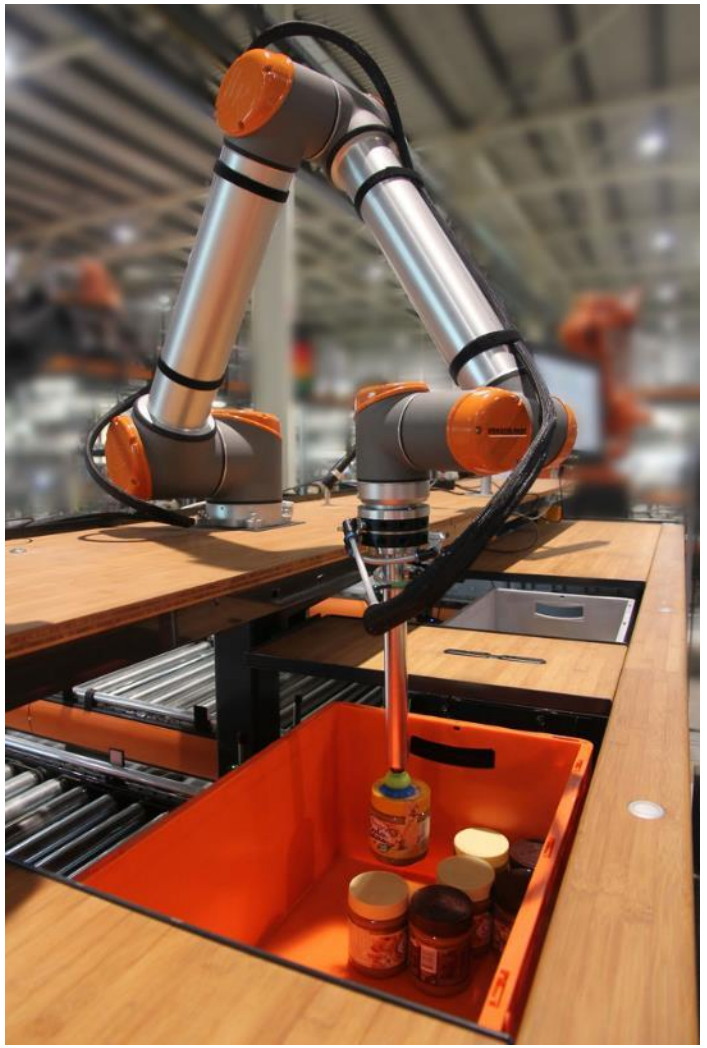
- Time critical and capacity is key
- Operator handles variety of exceptions
- Value Added Services if applicable

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

Robotic Item Handling:

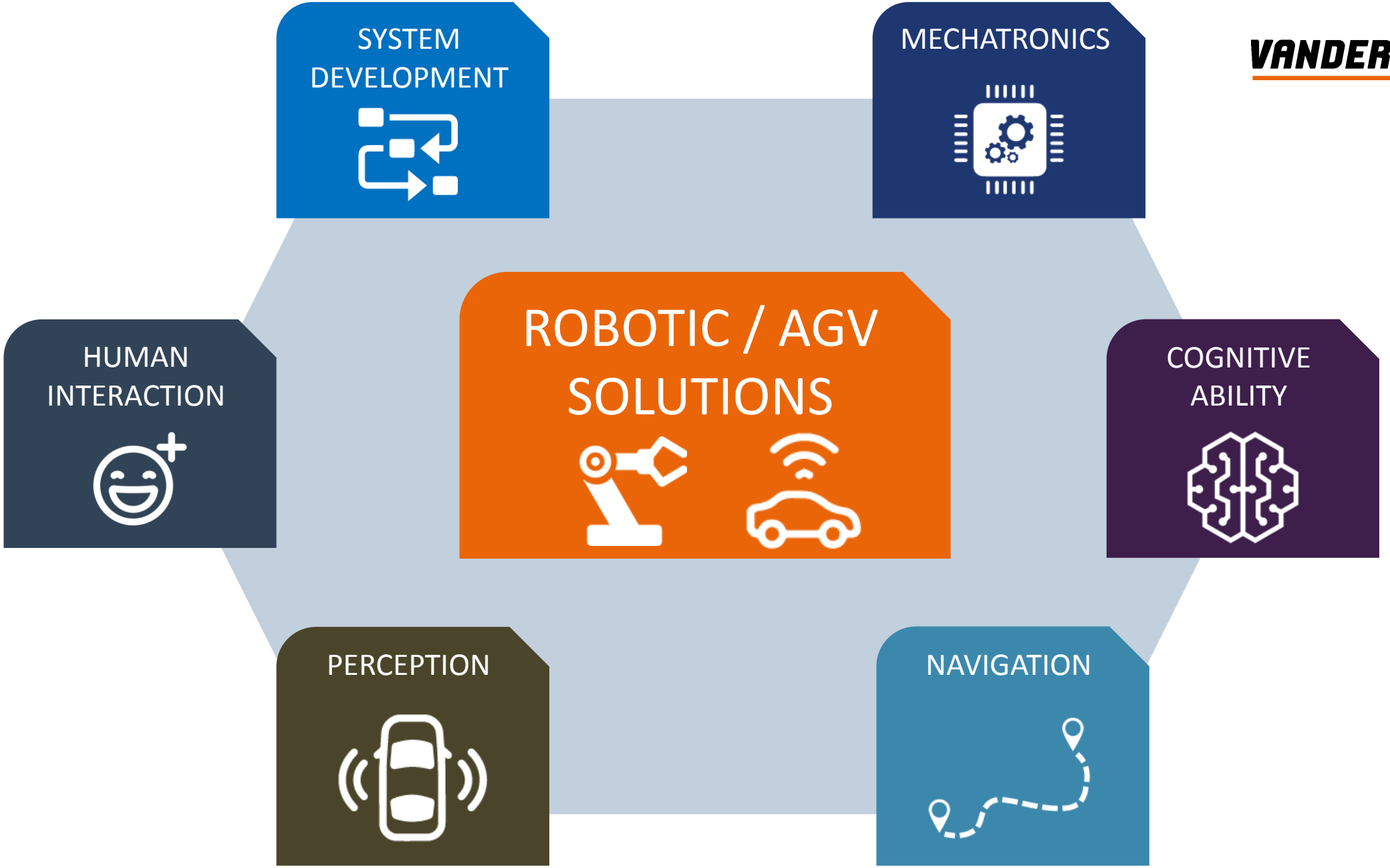
- Machine Vision
- Deep Learning
- Gripping



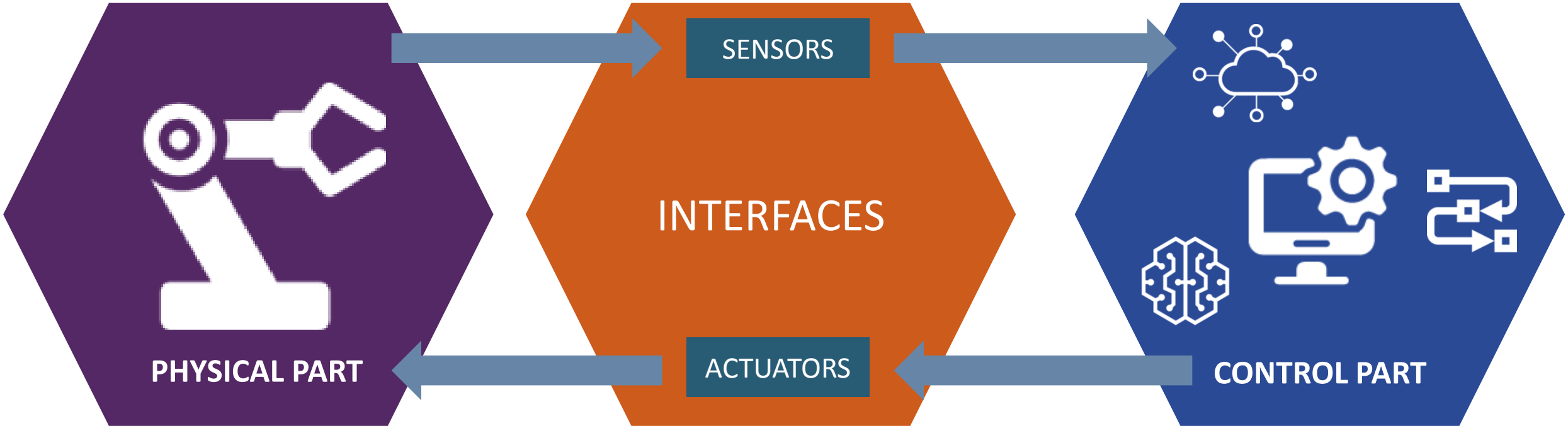


Mobile Robotics:

- 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



~~Mechatronical~~ → CyberPhysical

Κυβερνητική

Governance

Today → Future

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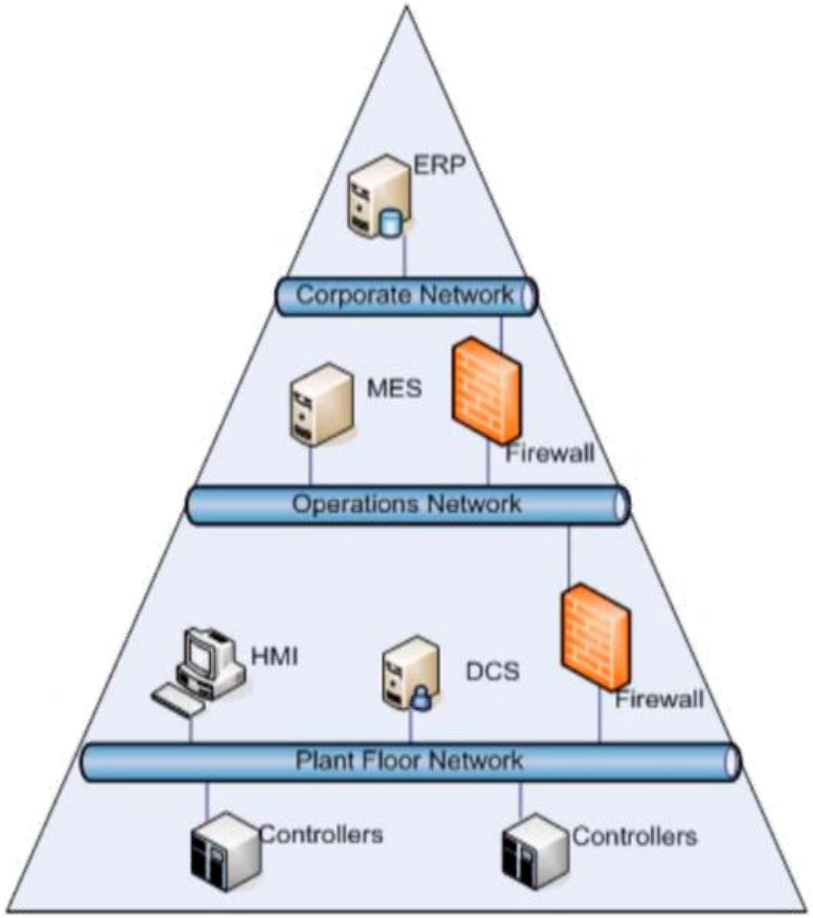
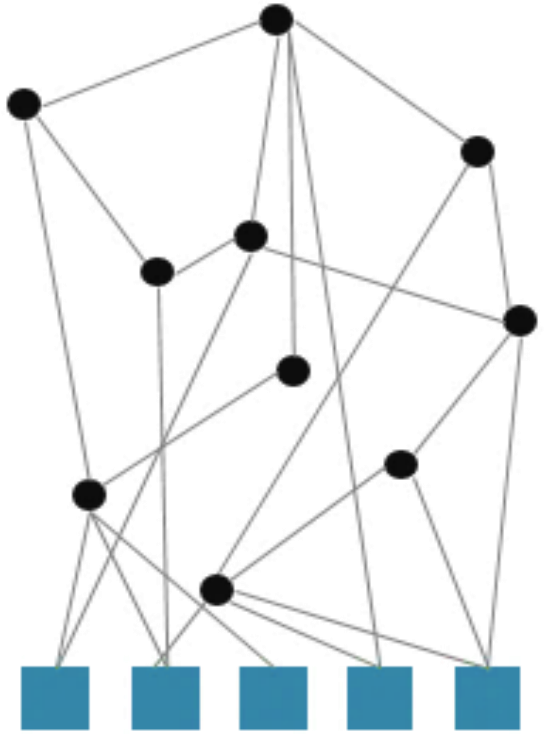
5-layer architecture

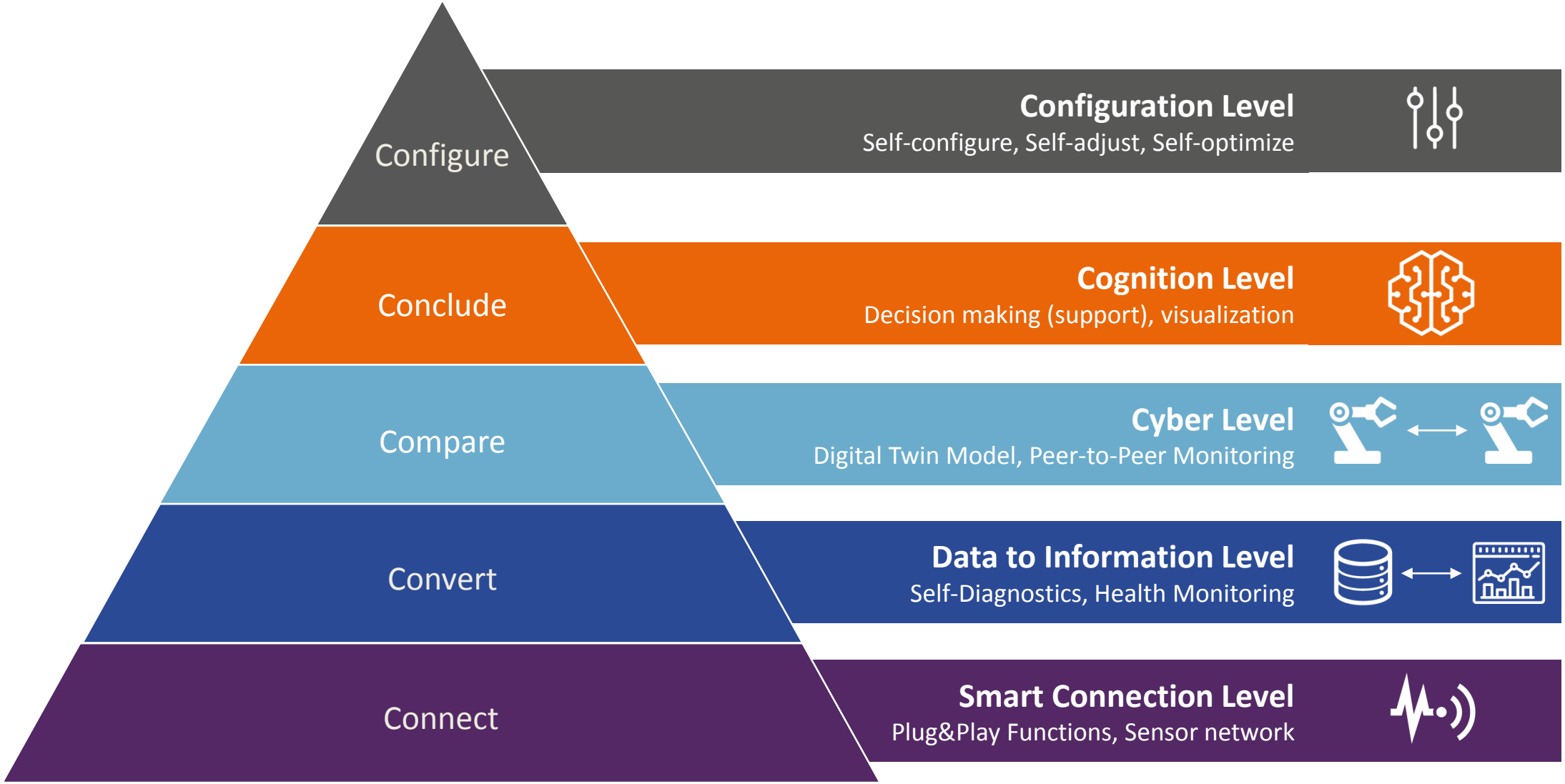


Cyber-physical system (CPS) based automation



Source: IOT-Analytics.com Cyber Physical Systems based automation

Data architecture for Cyberphysical systems



Source: Lee J., Bagheri B., Kao H.A. A Cyber-Physical Systems architecture for Industry 4.0-based manufacturing systems 2015

A cyberphysical example

Bring new learnings to all vehicles

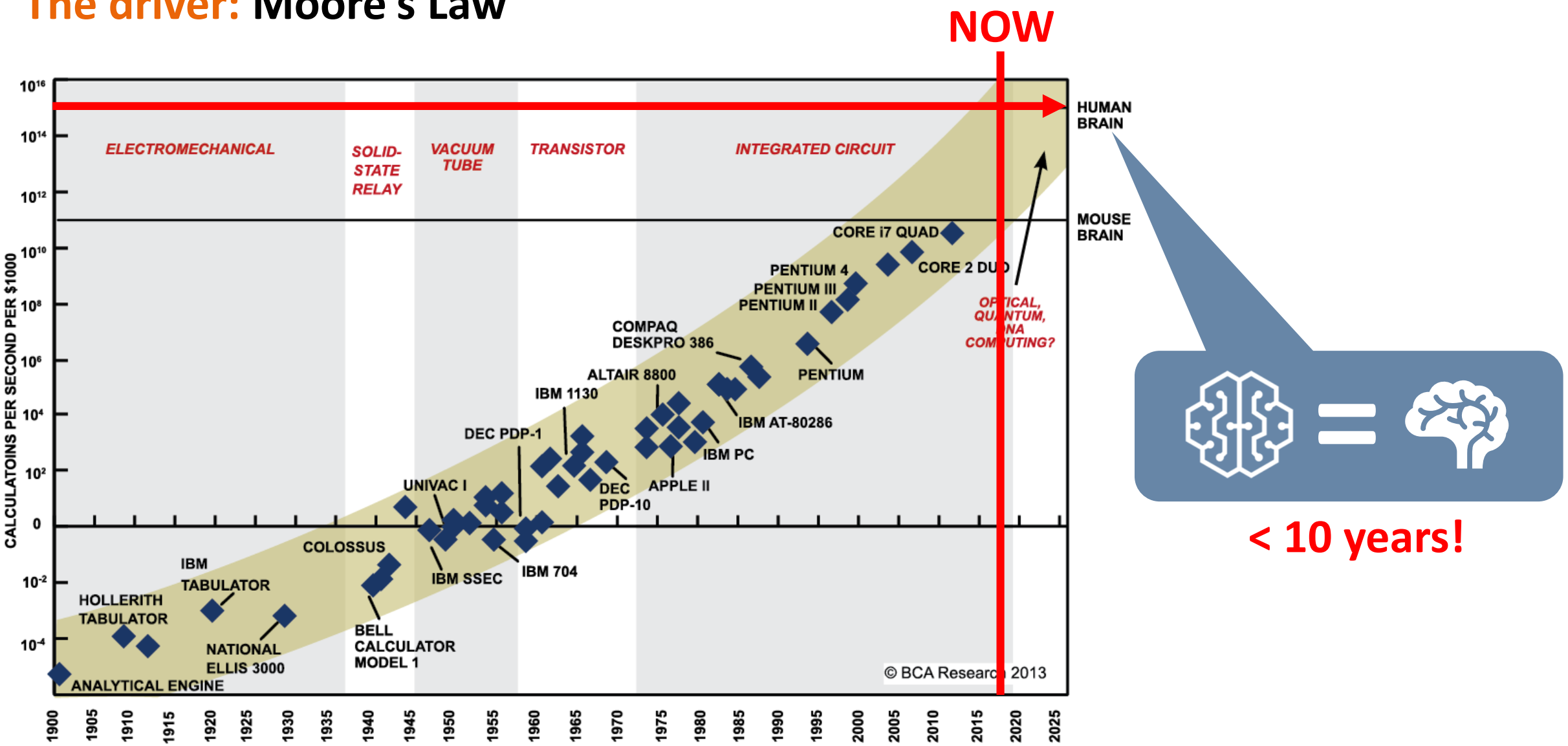
Learning: It is better to follow an alternative path

An alternative path is simulated by virtual twin

It reduced my performance with 20%

I see and report an obstacle on my path

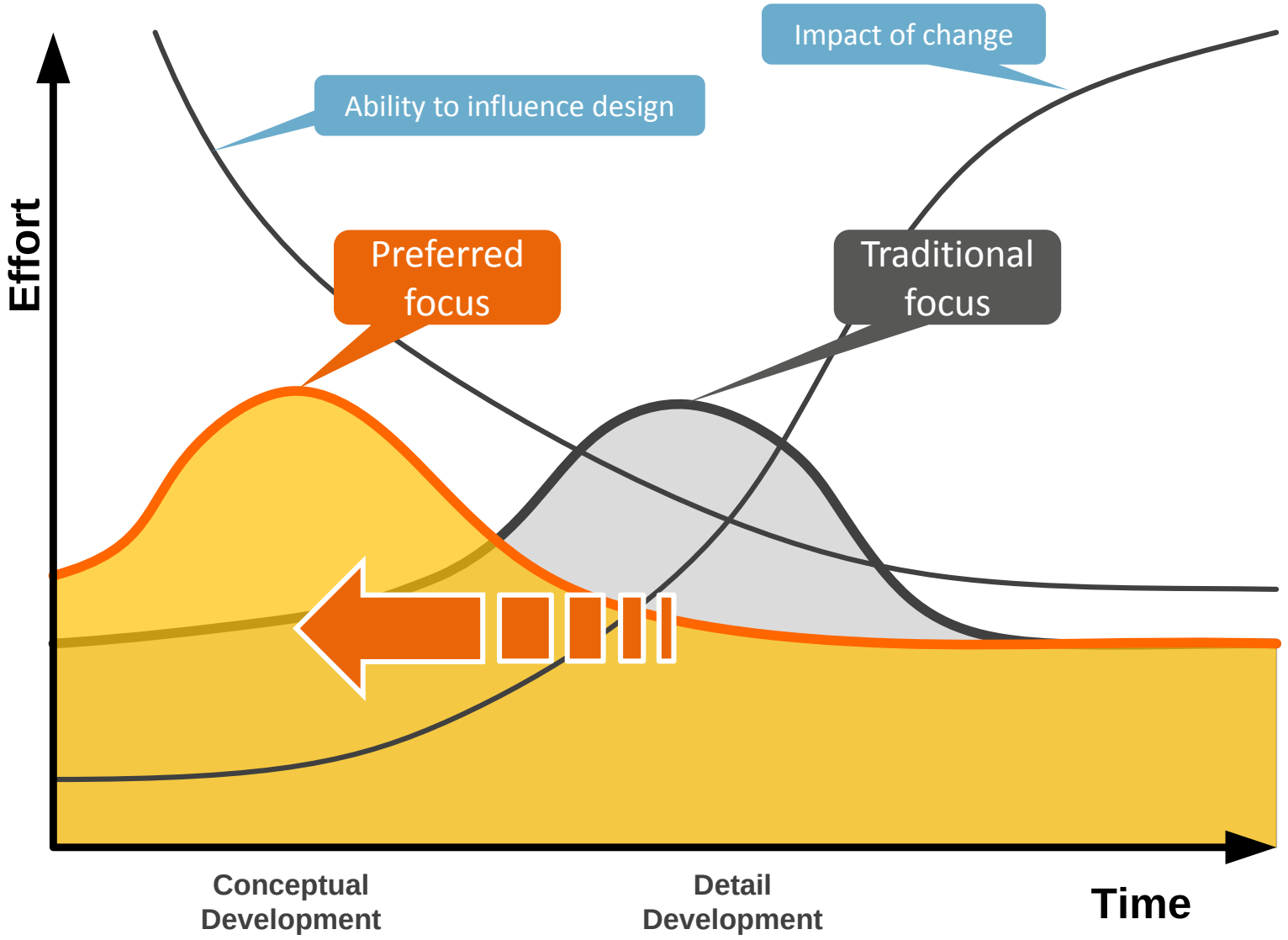
The driver: Moore's Law



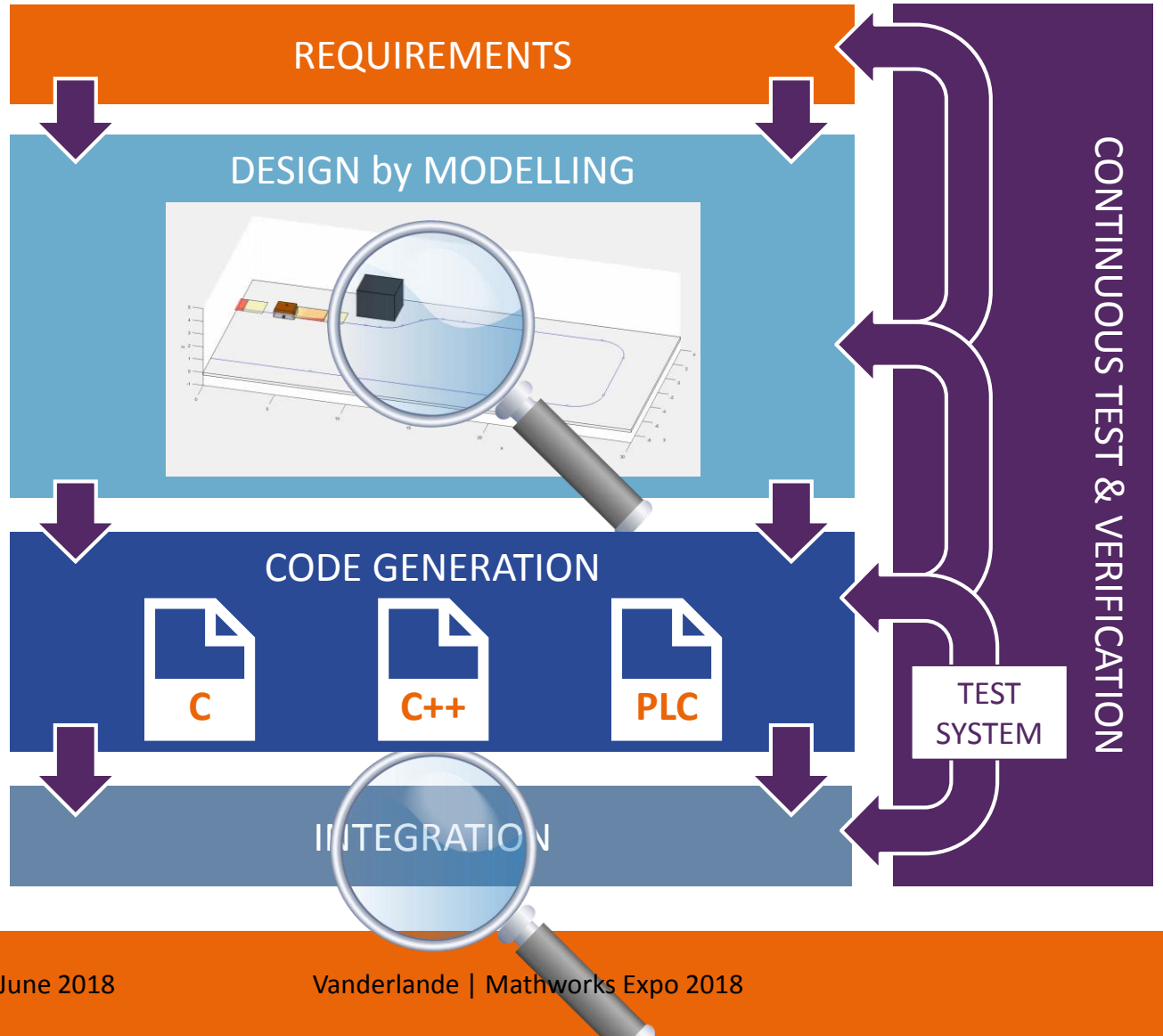
Source: Kurzweil R. The singularity is near: When humans transcend biology

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



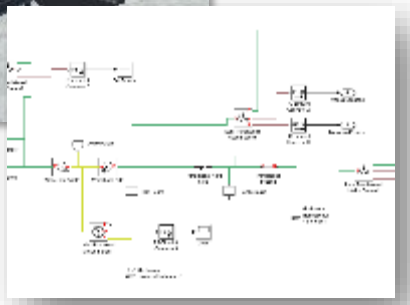
Model Based Design: Focus on design & integration



MATLAB® & SIMULINK®

MathWorks®

Model Based Design: Creation of a virtual world



Algorithm or Controller Model

SIMULATION

Plant Model
(System, Subsystem or Component)

CODE GENERATION

HIL testing

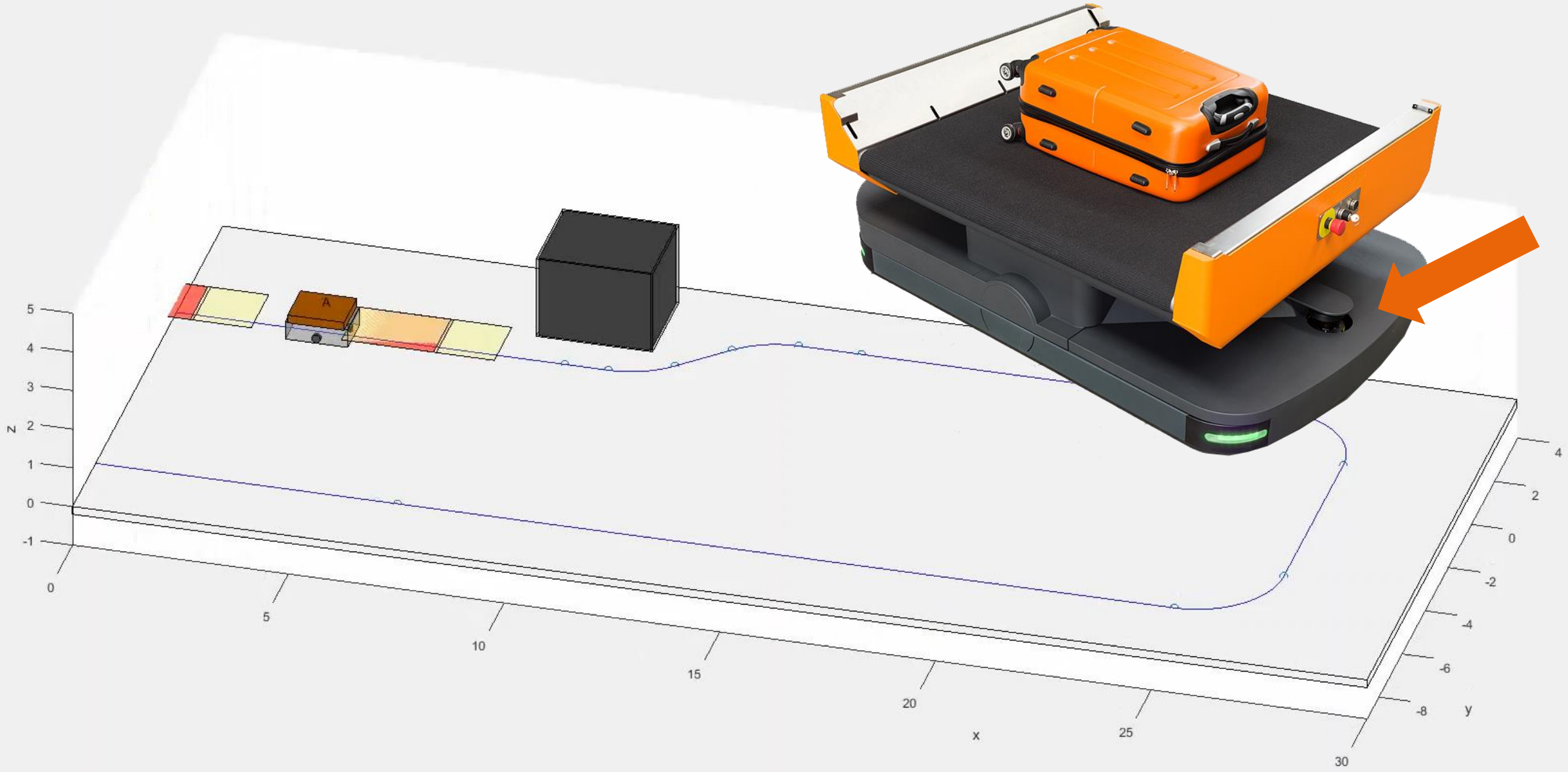
EMULATION

SPECIFY

Industrial PC
PLC
Embedded Controller

I/O

Product or System Prototype


A
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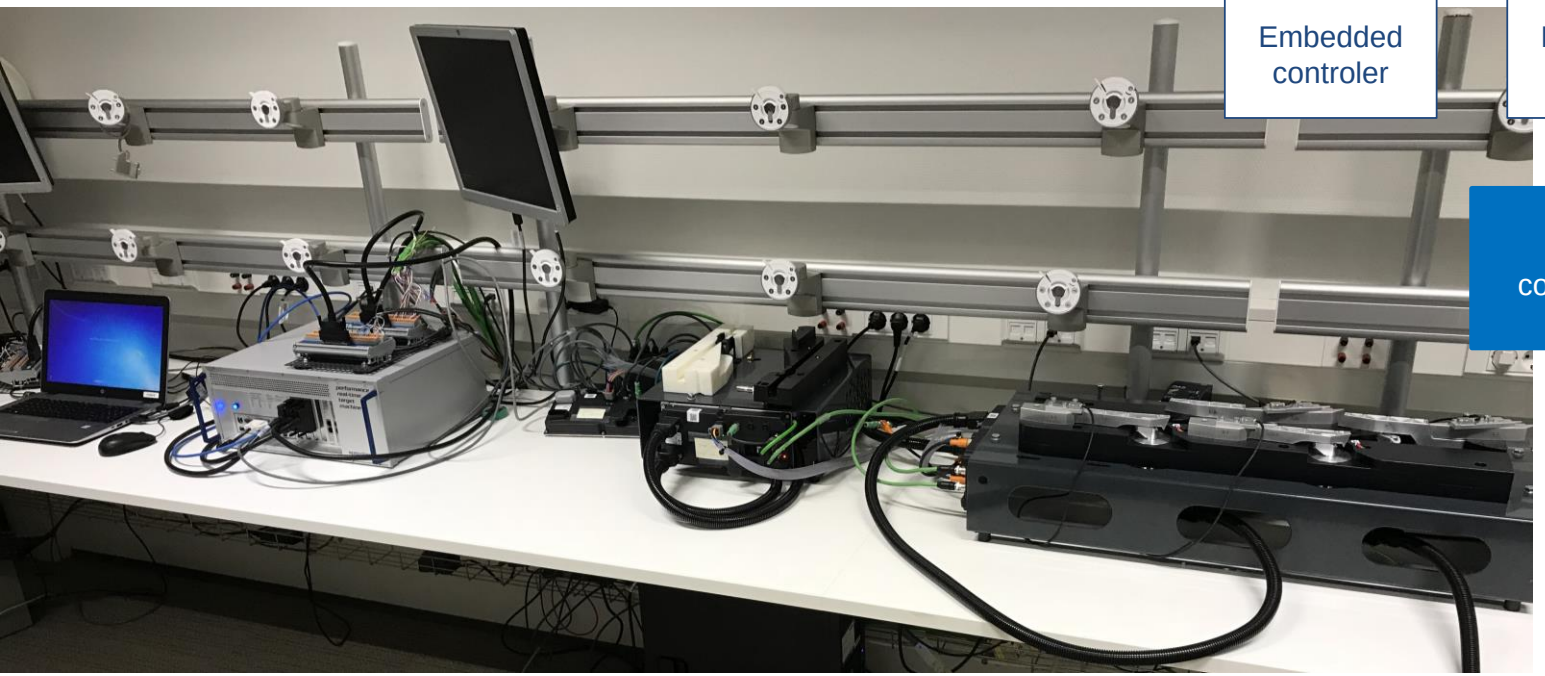
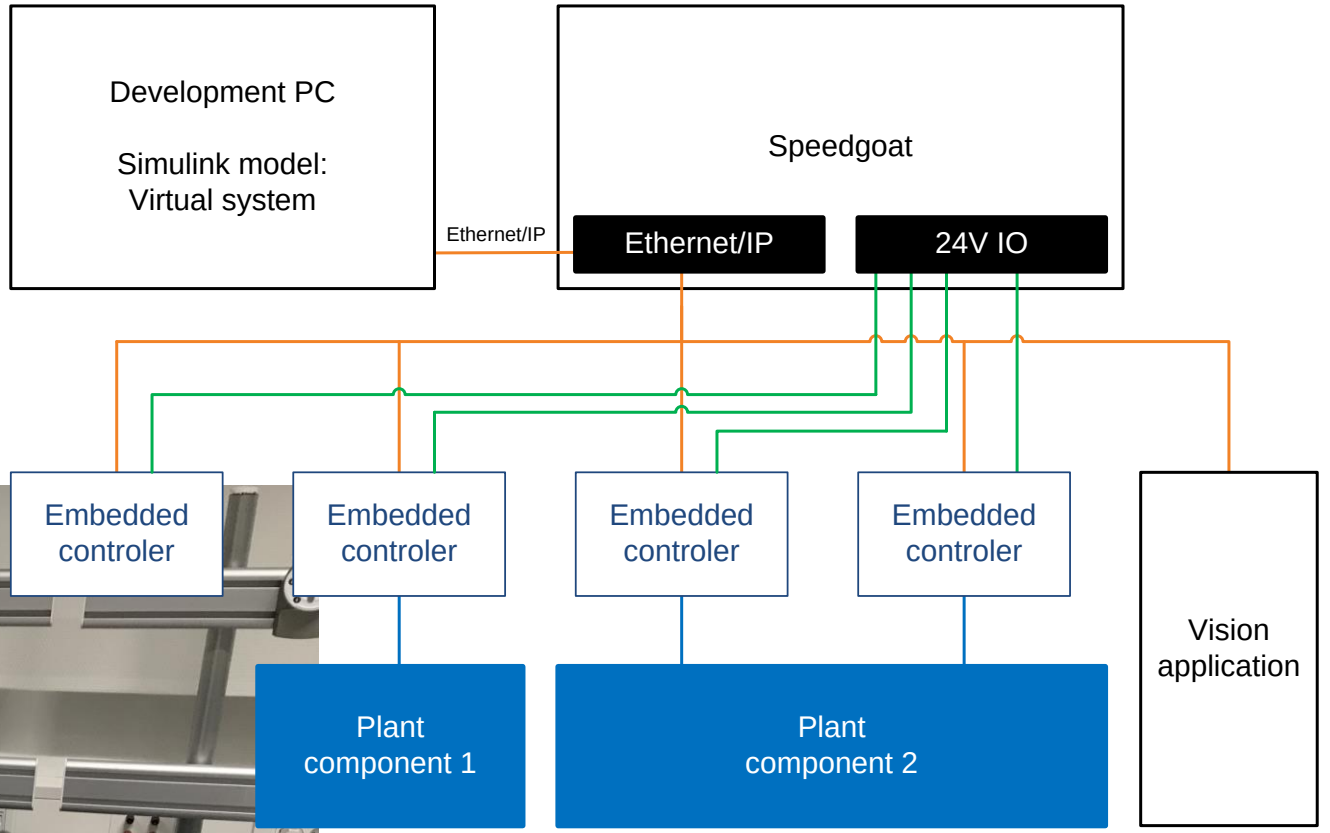
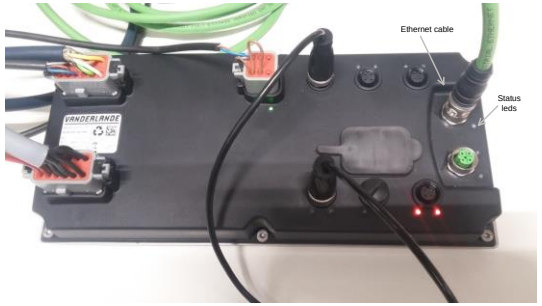
-2
-4
-6
-8

Continuous Test & Verification







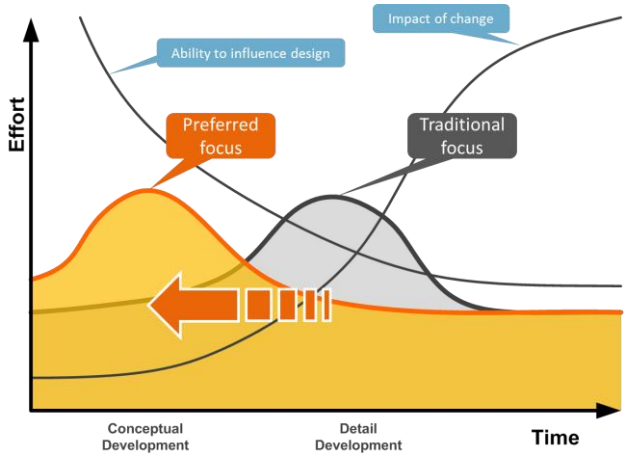
Development Teams: A knowledge Ecosystem approach

- Autonomous
- Cross-functional
- Many interactions
- Models as technical truth

Partnership approach

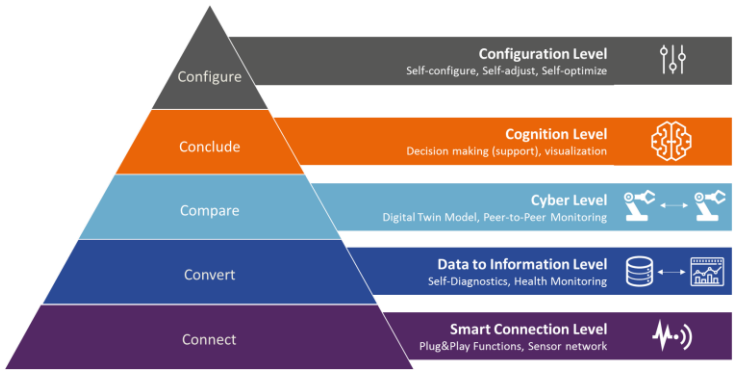
Complex Cyberphysical Systems

Shift of Focus

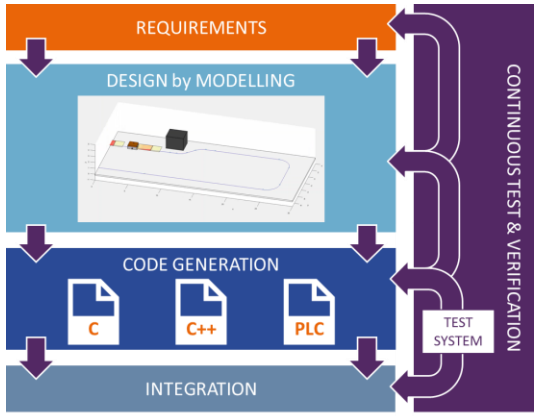


Autonomous Teams

Architecture



Design Automation



Partnership approach

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Embrace complexity and work together!

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