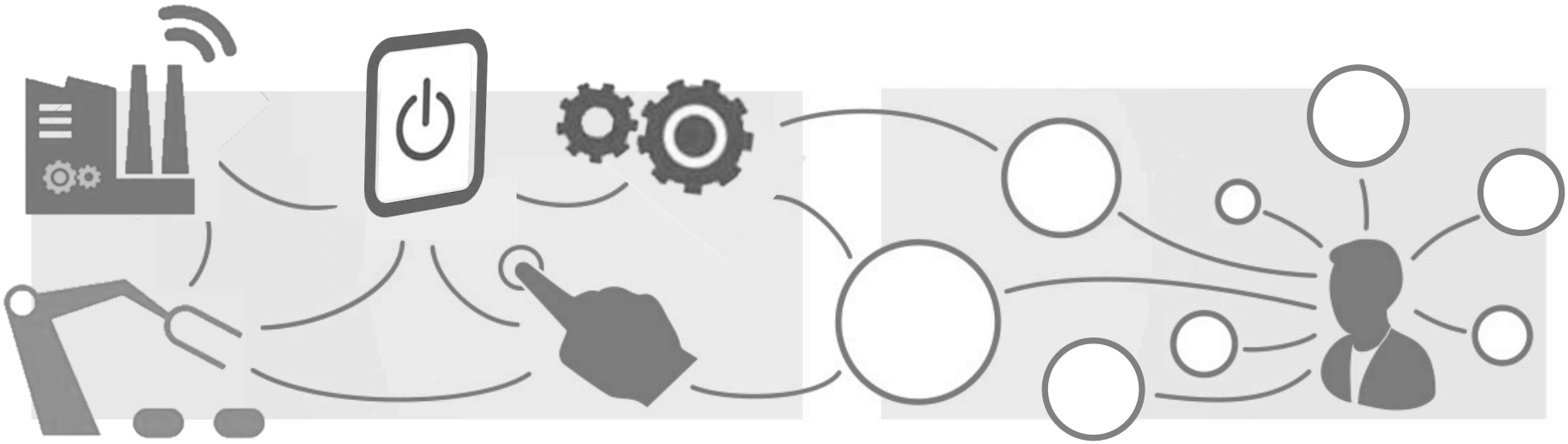
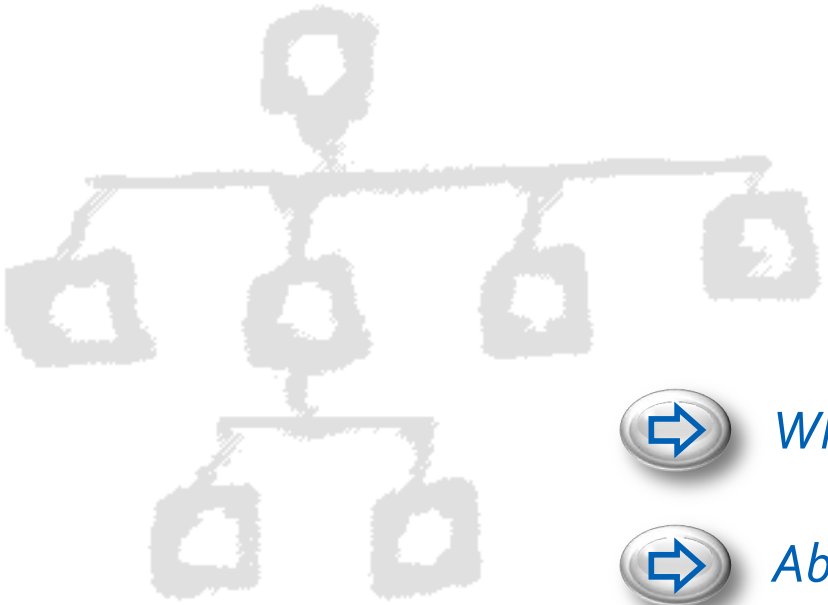
Latest Trends of Industrie 4.0 by IoT and AI

Andreas Dengel

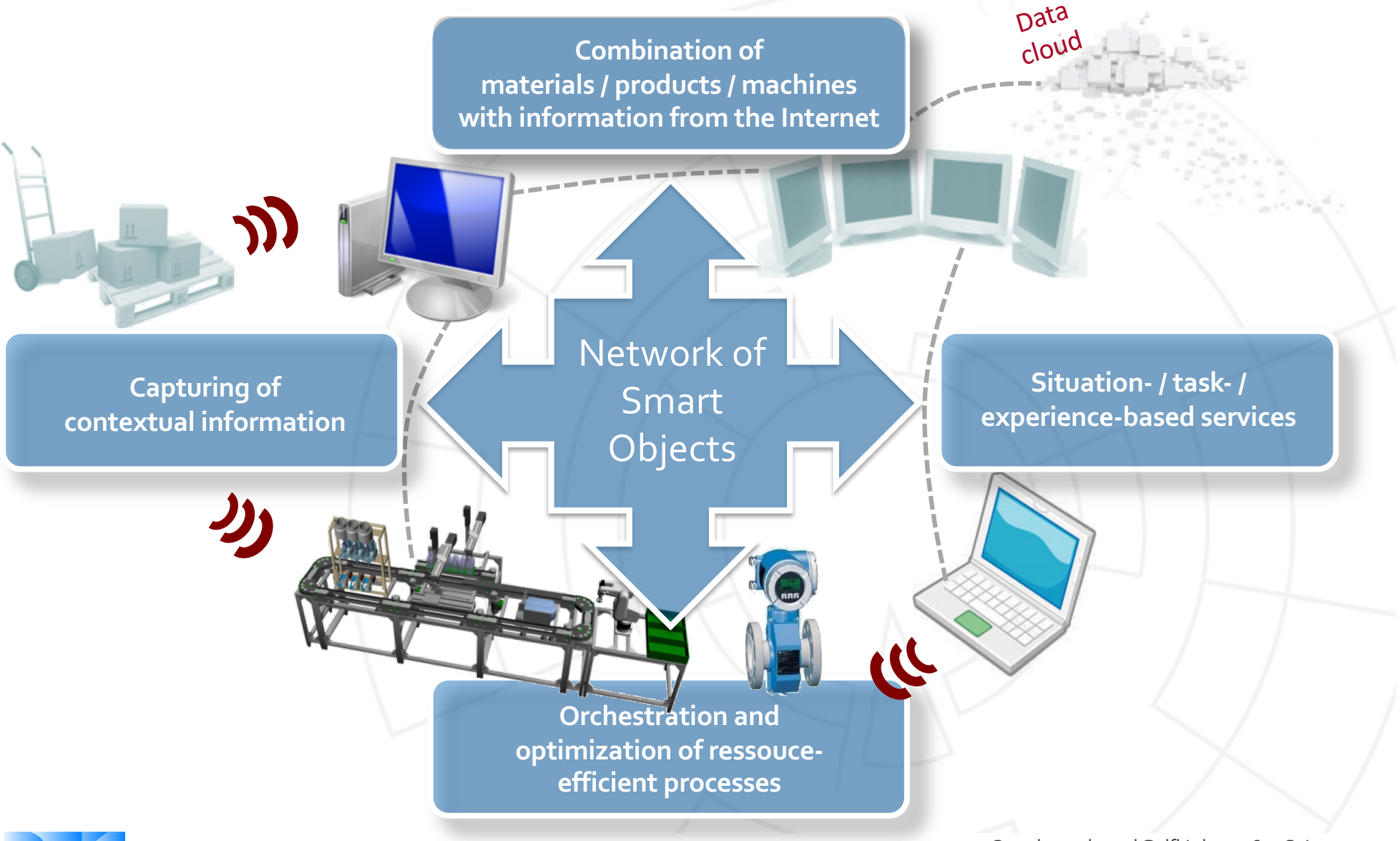


Agenda



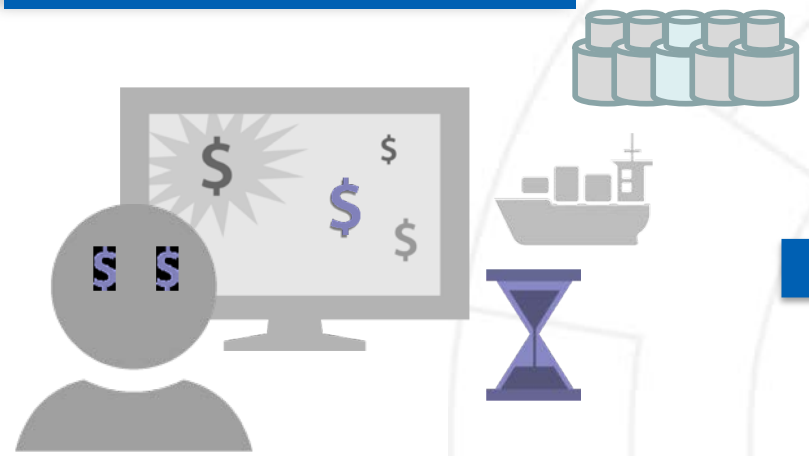
- *What is Industrie 4.0?*
- *About Smart Components and Smart Machines*
- *The Smart Factory^{KL} @ DFKI*
- *Towards Digital AI-based Companions*
- *From Hindsight to Insight to Foresight*

The „Internet of Things“ is entering the factories



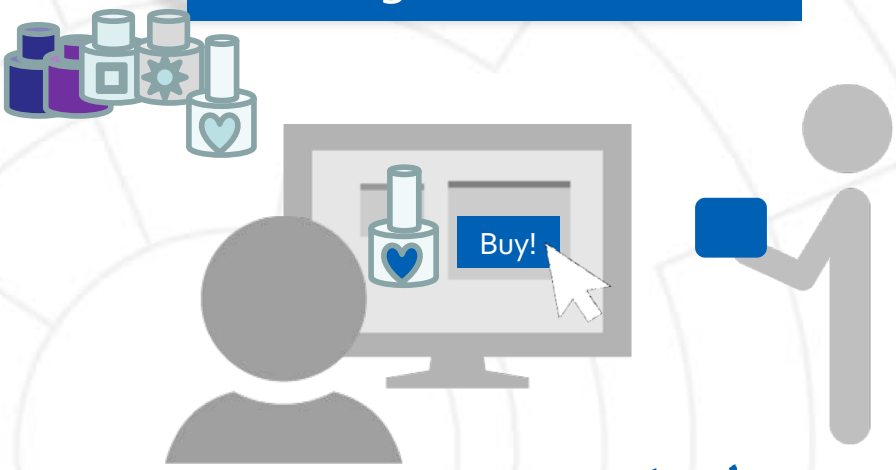
We have to rethink production because the paradigm of customers is changing!

Paradigm of the past



Cheap, cheaper, cheapest!

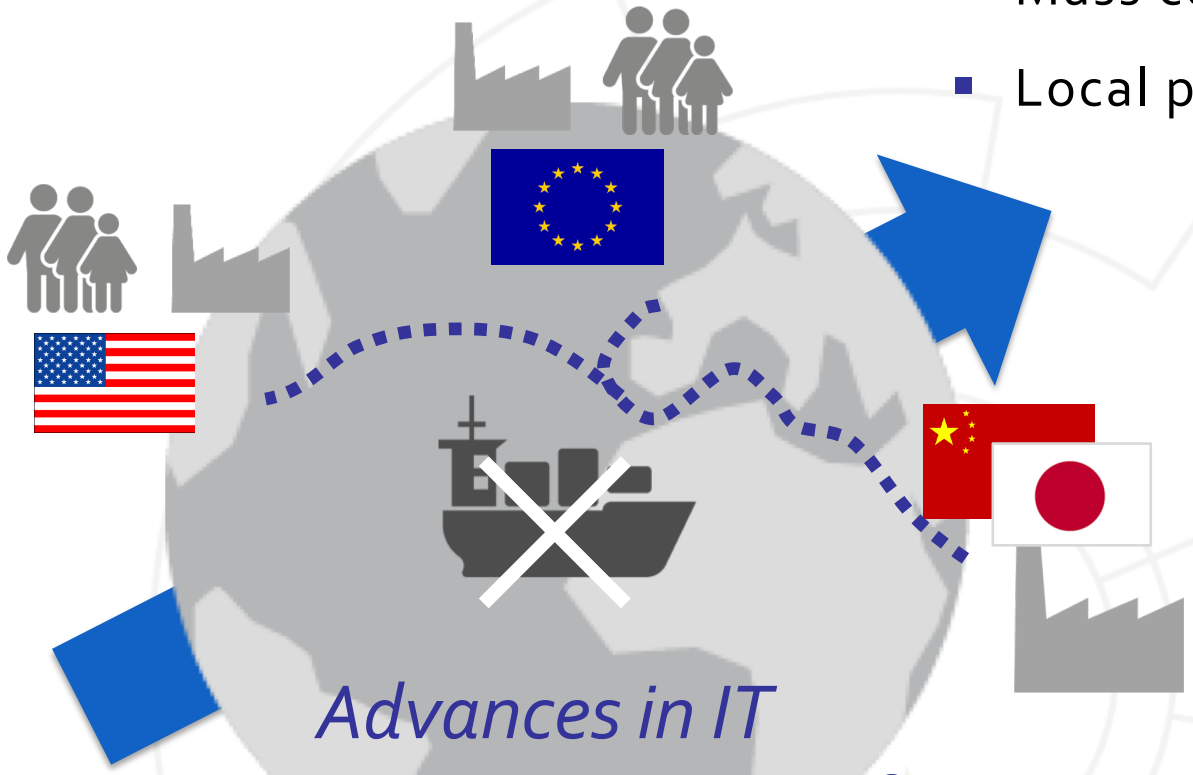
Paradigm of the future



Order by a mouse click
get YOUR product tomorrow!

The new developments in IoT and Indutrie 4.0 lead to a reshoring of production

- Mass customization
- Local production



Advances in IT
Shorter product lifecycles

- Mass production and low wages
- Long delivery times

Leading to a new world economic structure?

Industrie 4.0 means digitalization and networking of all processes, products and resources

Pervasive Engineering

Internet of Things

It´s not a standard

Big Data

INDUSTRIE 4.0

Smart Products

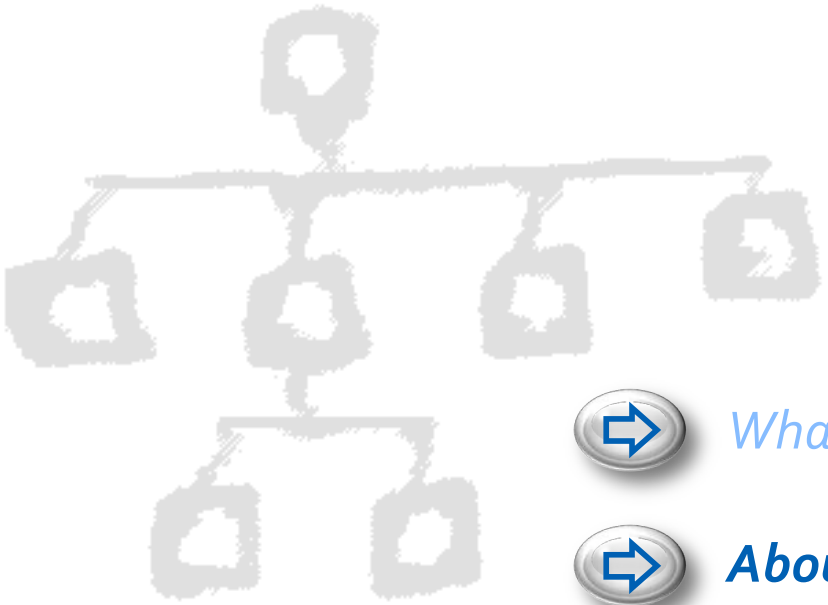
It´s not clearly defined

Virtual & real world

Human & work

Standardized Interfaces

Agenda



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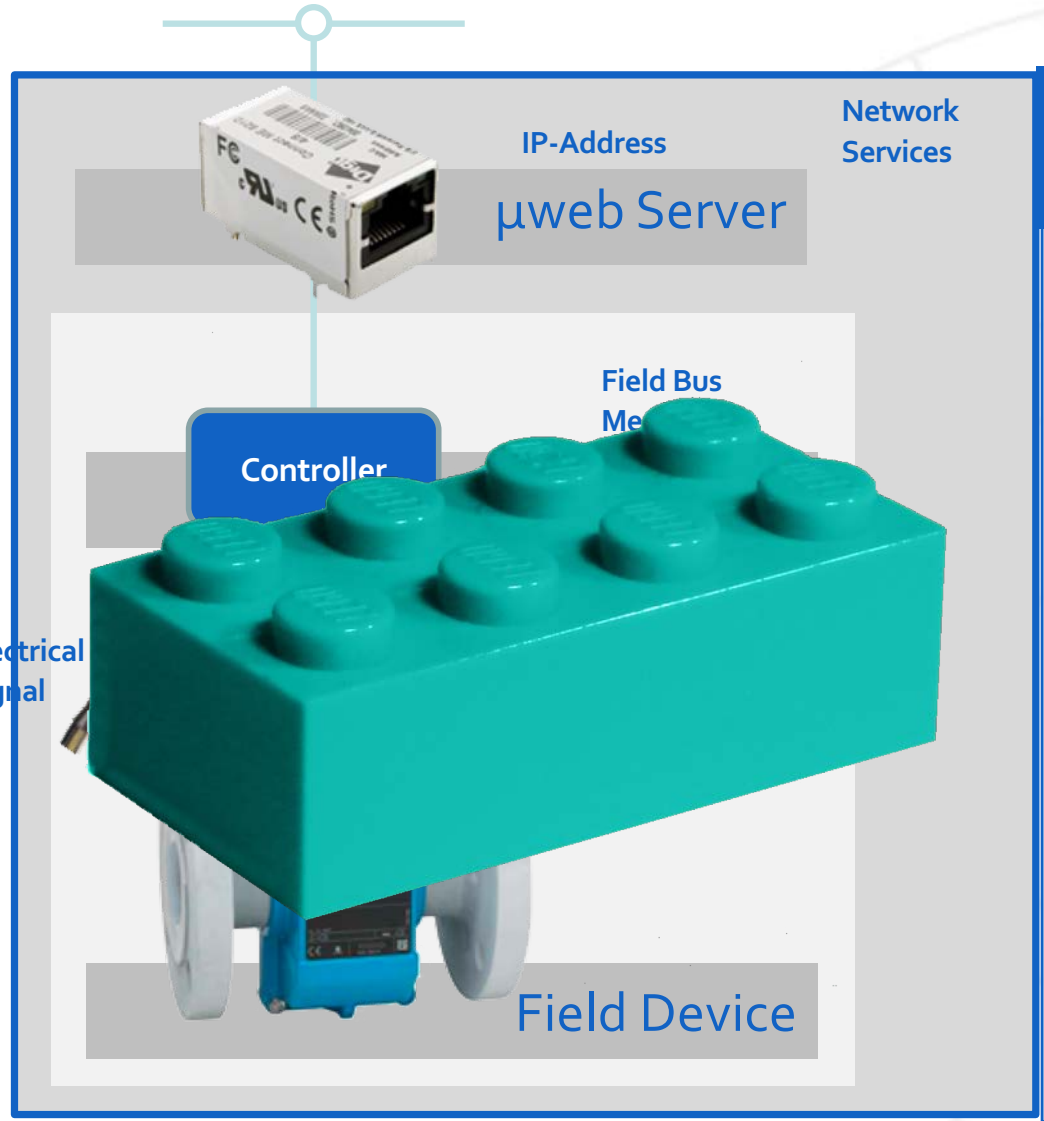
Towards smart components …



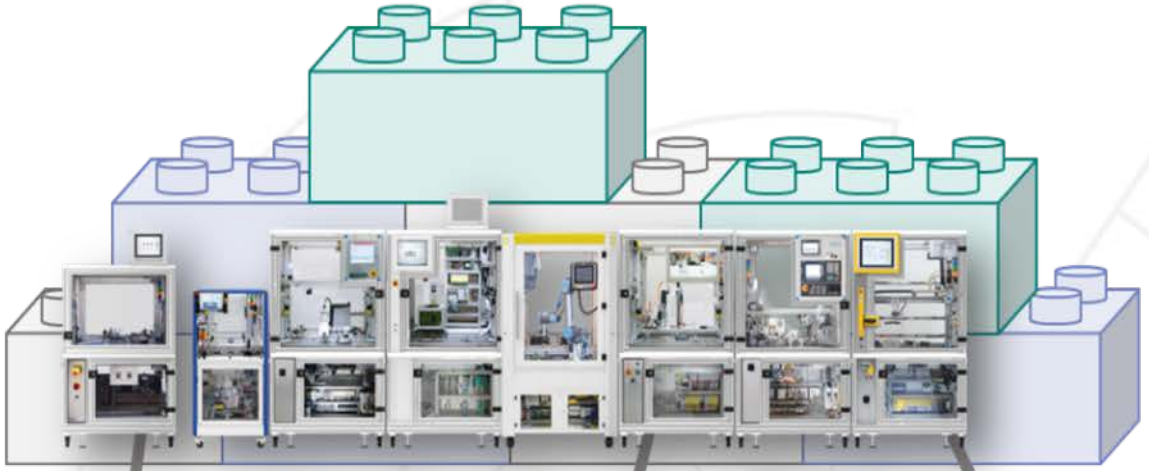
Cyber-Physical System

Fundamental Principles

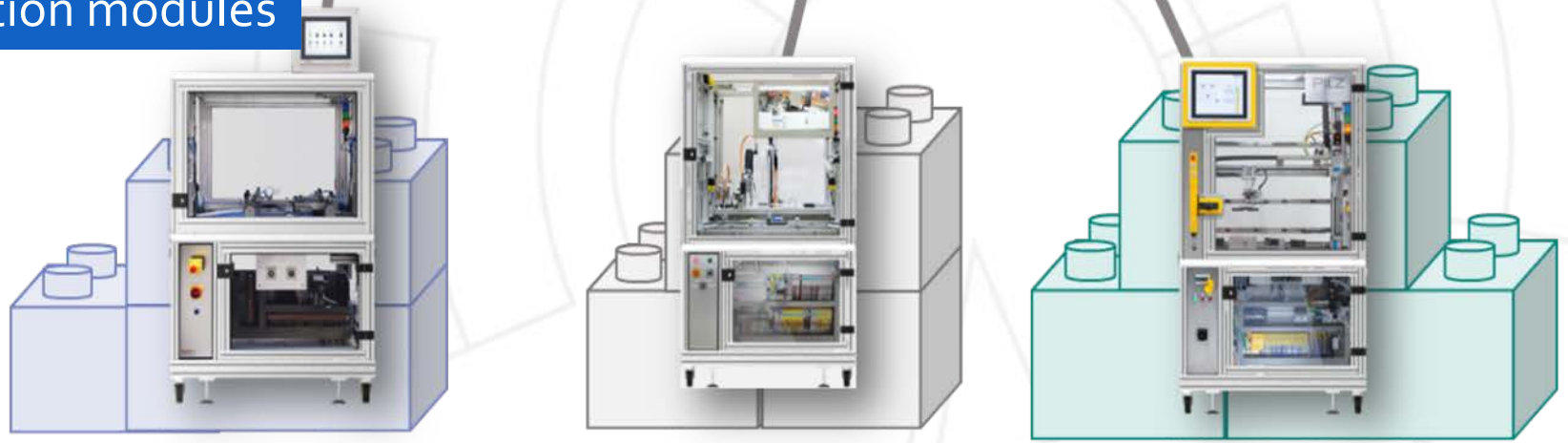
- **Self Identification**
  (who am I?)
- **Services Exploration**
  (what do I offer?)
- **Autonomous Networking**
  (who are my partners?)

As a result we receive a modular agile factory kit

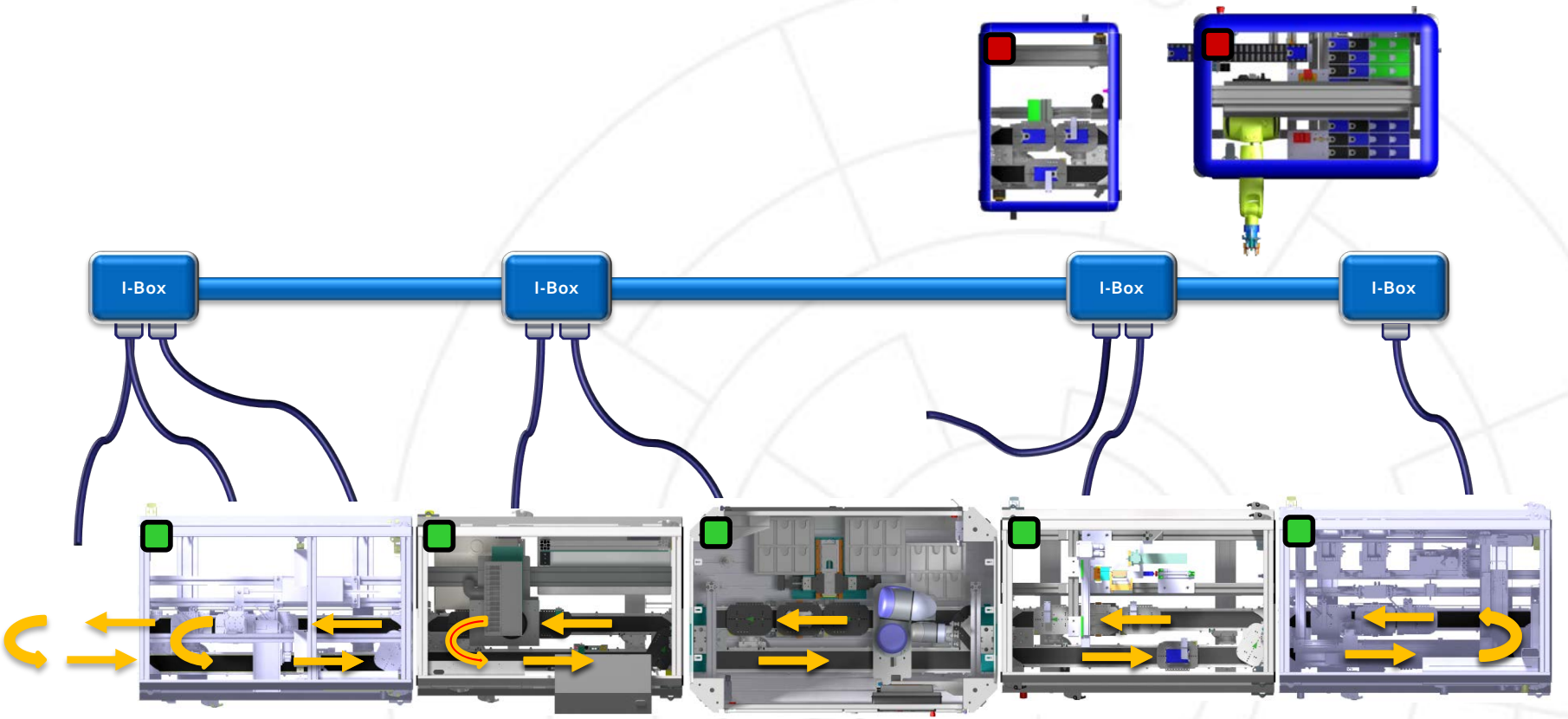
Production line



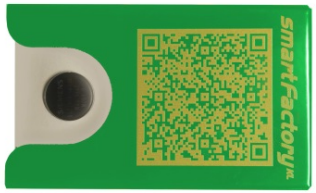
Production modules



In particular, the SmartFactory^{KL} will demonstrate an innovative „Plug & Play“ Scenario

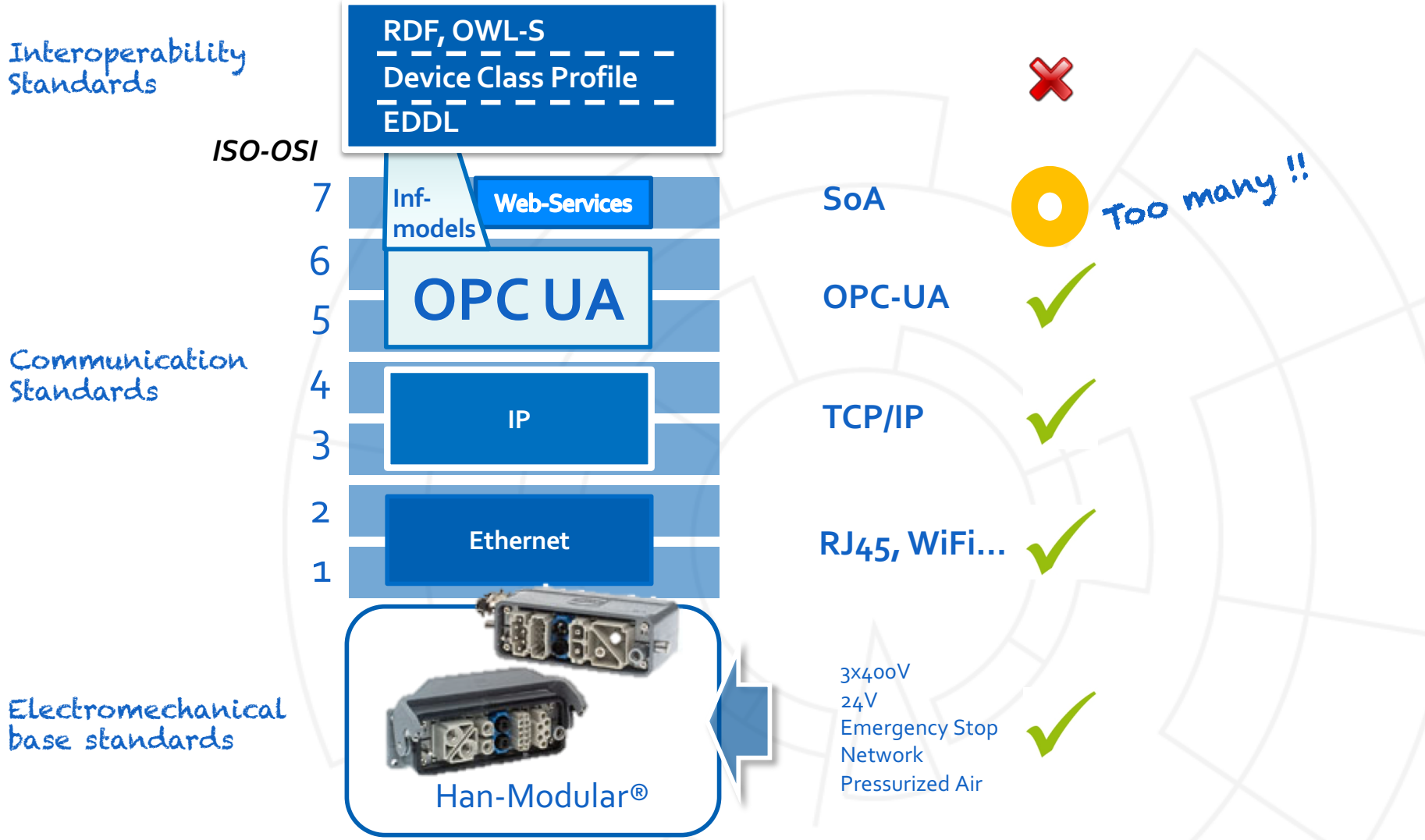


Product:



Urgent Order PO#27653 !

Different state in standardization is still revealing some challenges



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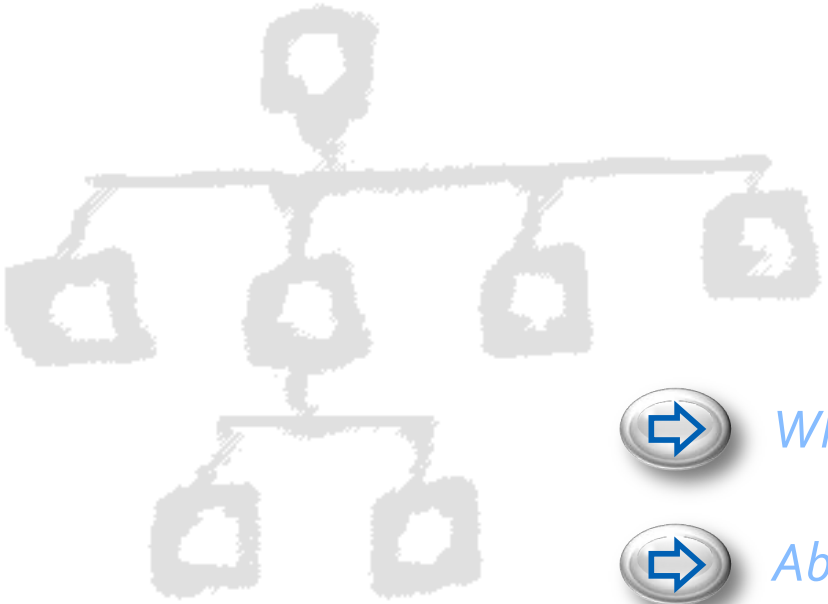

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The *smartfactory*^{KL} is the largest and most popular independent research and demonstration center for INDUSTRIE 4.0 technologies

smartFactory^{KL}®

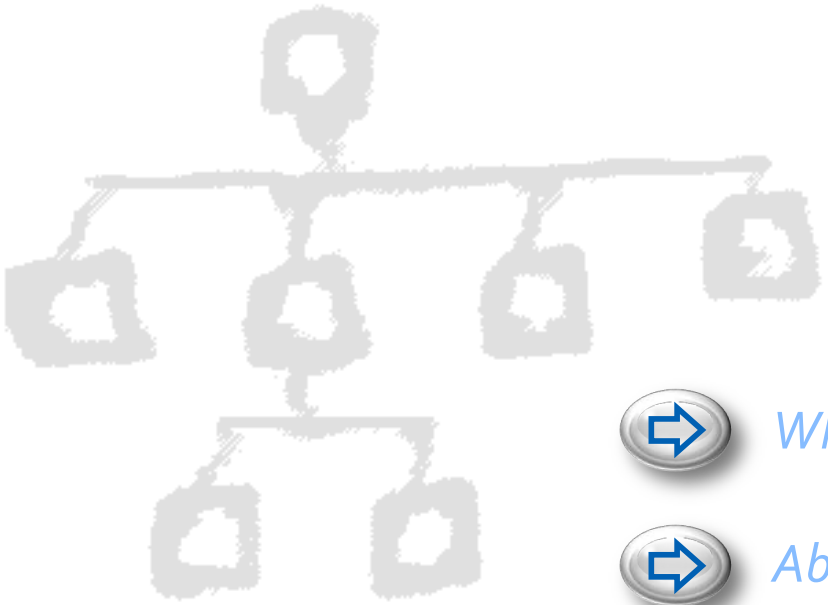
organized as a registered non-profit association

we **Learn Work Build Present** ***together***

- **Certification Organizations**
- **Security Providers**
- **Component Manufacturer**
- **Software Providers**
- **Network Providers**
- **Research Organizations**
- **Marketing Organizations**
- **Users**

The *smartfactory*^{KL} has 50 members some of which are international

Agenda



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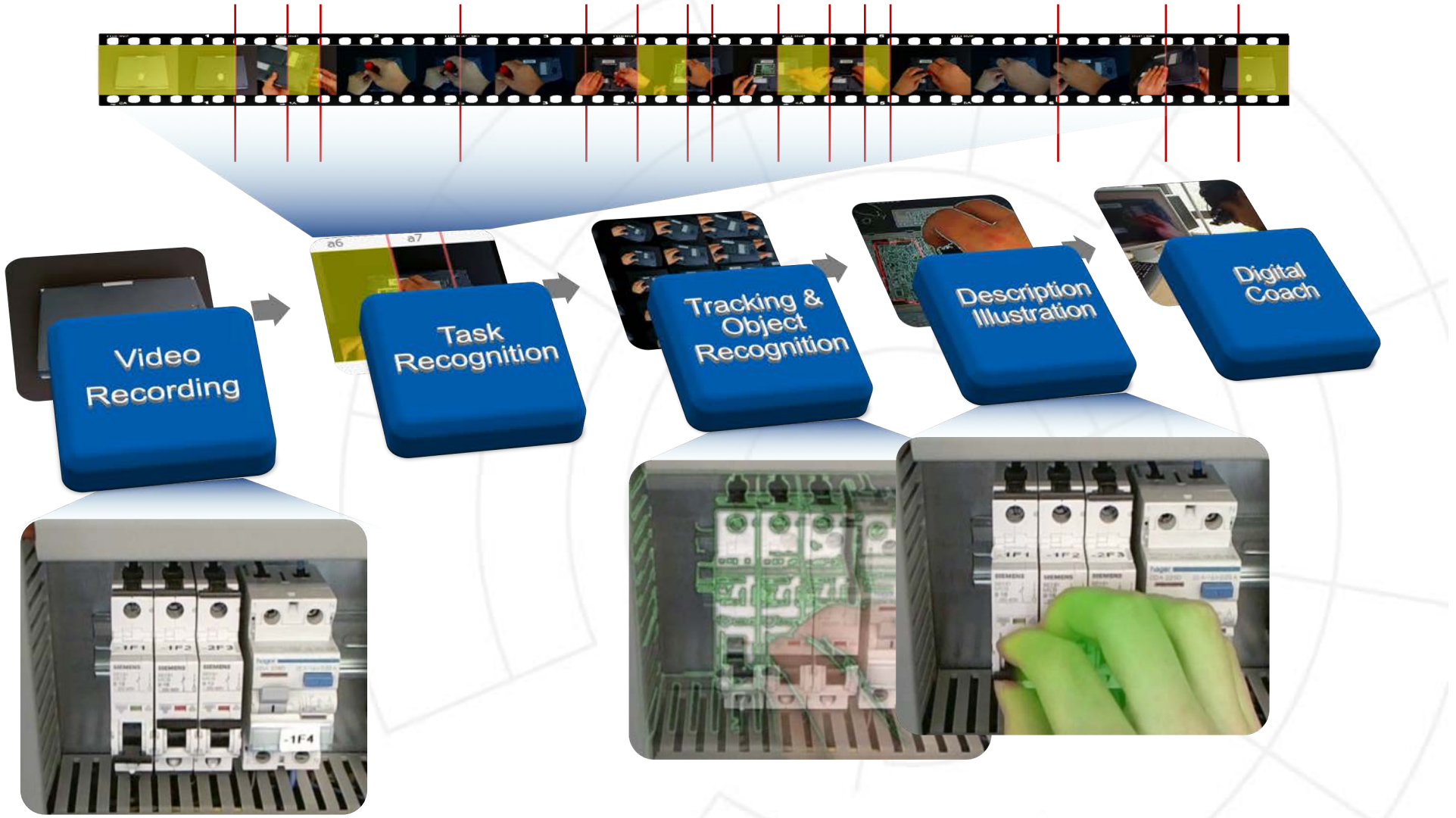
Digital Taylorism addresses the shift from cooperative via co-dependent to competitive*

Human Being	Smart Machines	Human Being + Smart Machines
• Adapt to dynamic situations • Persuade and influence • Develop new scenarios in real-time • Switch focus rapidly • Exercise spidey-sense • Empathize	• Process volumes at superhuman speed • Take respective actions for precise results • Fulfill niche purpose without distraction • Structured analysis • Find best-fit pattern from mass information	• Synthesize multiple viewpoints • Blend areas of expertise • Lasso and analyze inputs • Attack large-scale global problems • Anticipate threats and opportunities

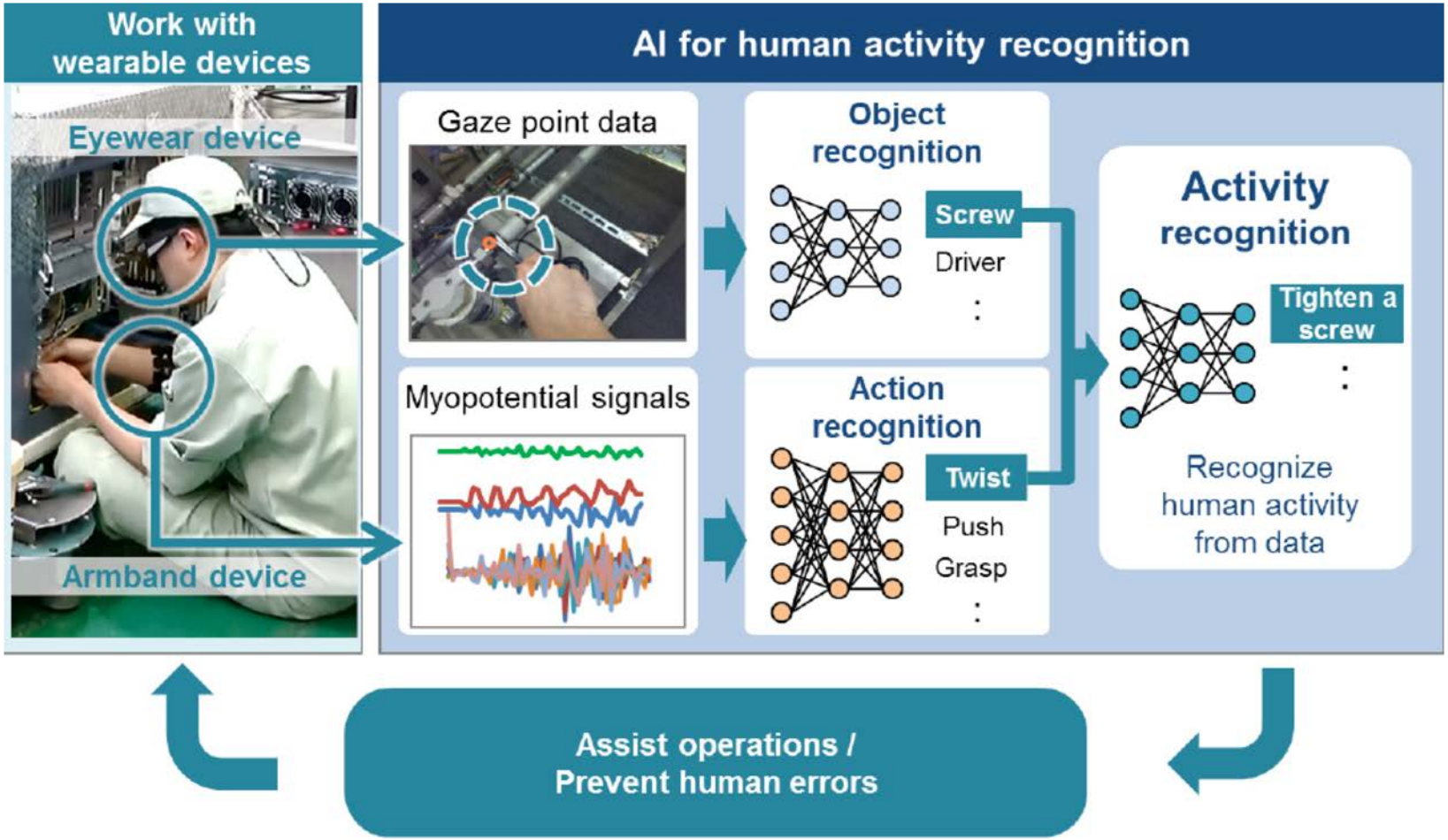
* Source: Gartner

By measuring visual and embodied attention, digital AI-based companions may learn from experts but also teach how to do things

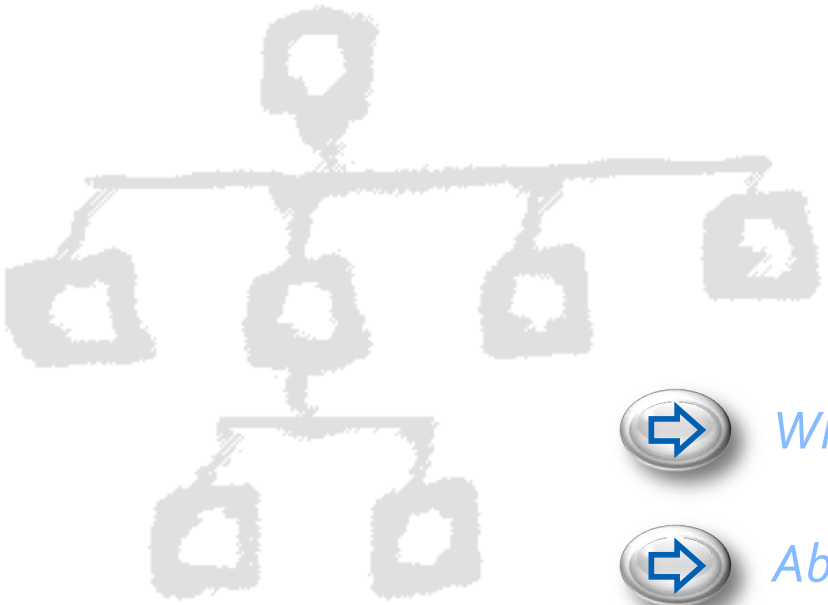
Best Practices are recorded, analyzed and semi-automatically annotated



How does it look like in practice?


Work with wearable devices
Eyewear device
Armband device
AI for human activity recognition
Gaze point data
Myopotential signals
Object recognition
Screw
Driver
:
Action recognition
Twist
Push
Grasp
:
Activity recognition
Tighten a screw
:
Recognize human activity from data
Assist operations / Prevent human errors

Agenda



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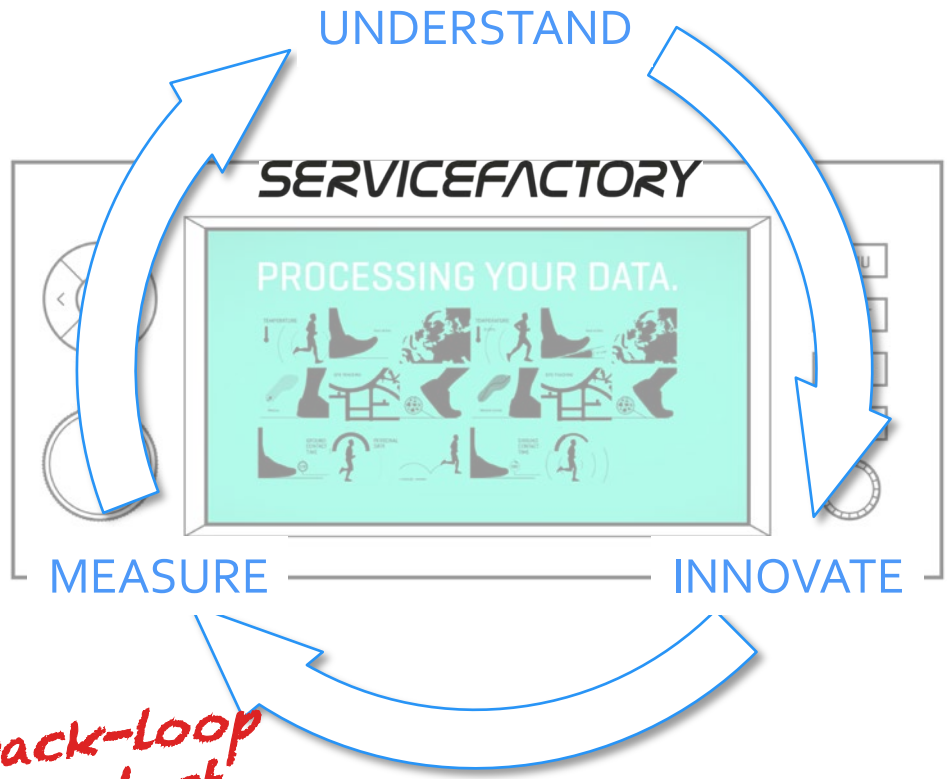
The SERVICEFACTORY project focuses on recommender systems for smart objects in the context of IoT and Industrie 4.0

- Sensor-based smart textiles generate Big Data streams
- Open Big Data platforms with appropriate modules for data analytics and smart services are not available at the market yet
- Different interests of key players generate Lock-Ins which inhibit market participation

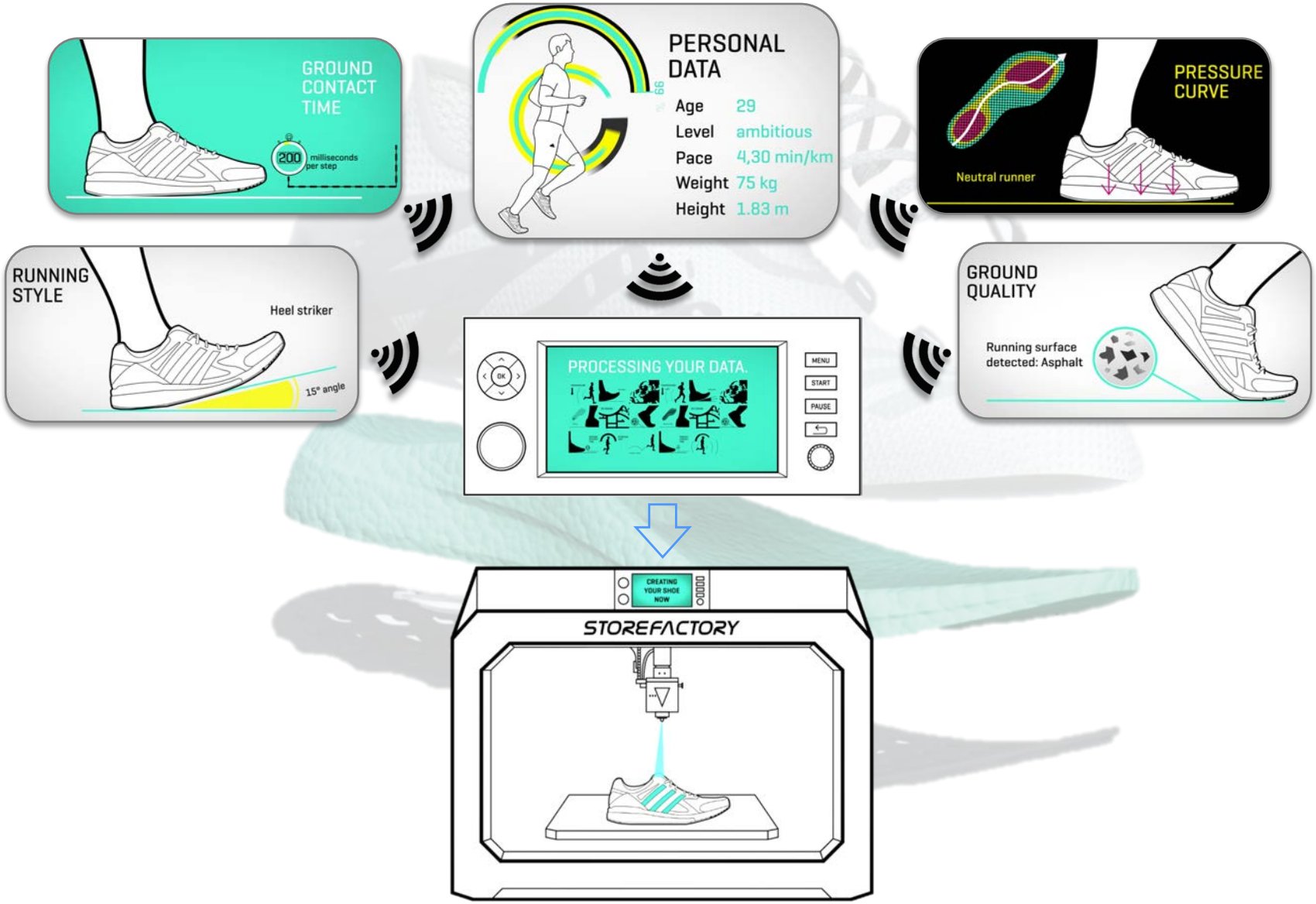


Provide feedback-loop between the product, the environment and the action

Funded by
Smart Service World
Program of BMWi

Bundesministerium für Wirtschaft und Energie

Multiple sensors provide insights into usage as well as state of product and thus create the basis for "Batch Size One" production



This information can be complemented by behavioral and contextual data capturing in order to provide individual recommendation

Personalized Recommendation

Health Protection

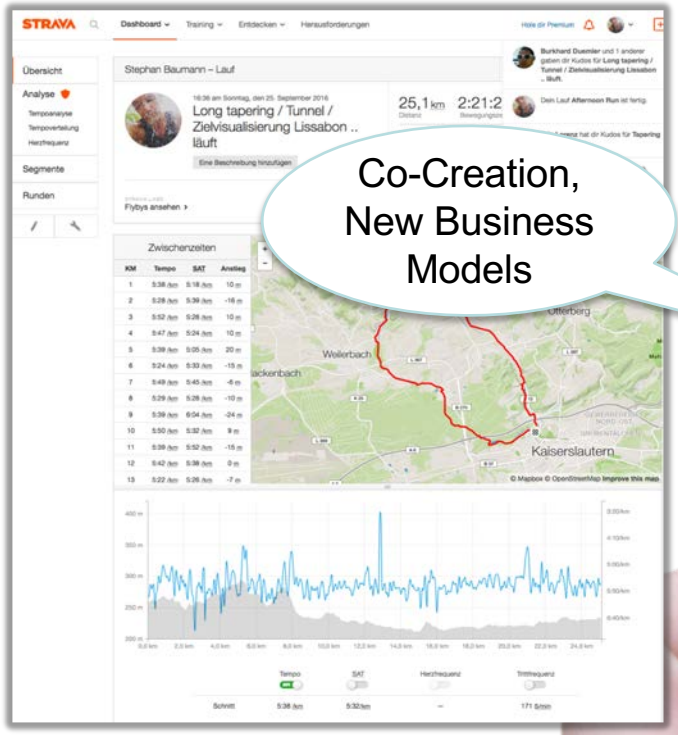
Product Recommendation

User Recommendation

Rehabilitation

Data may be visualized via a dashoboard

Such rich applications provide a multitude of options for data analytics

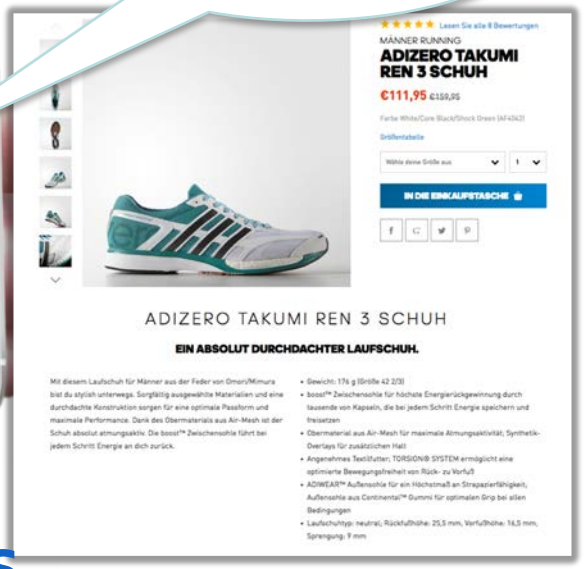


Content-Based Filtering

Co-Creation, New Business Models

Social Network Analysis

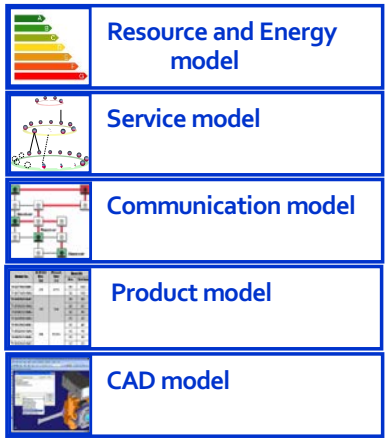
Contextual recommendation



Collaborative Filtering

Time Series Analysis

Some final take-aways …



Future Products must…

be described by abstract models

have a unique identy (by birth)

IP$_{V6}$ `[2001:0db8:85a3:08d3:1319:8a2e:0370:7344]`

be linked in worldwide networks

have a semantic notation

```
<span class=
"latitude">let format
VEC</span>
```

…be treated as abstract objects and …

be locatable at all times

…but are co-created in cyber-social settings

Questions?

Adresse:
Prof. Andreas Dengel
DFKI GmbH
Trippstadter Straße 122
67608 Kaiserslautern
email: andreas.dengel@dfki.de
http://www.dfki.de/~dengel