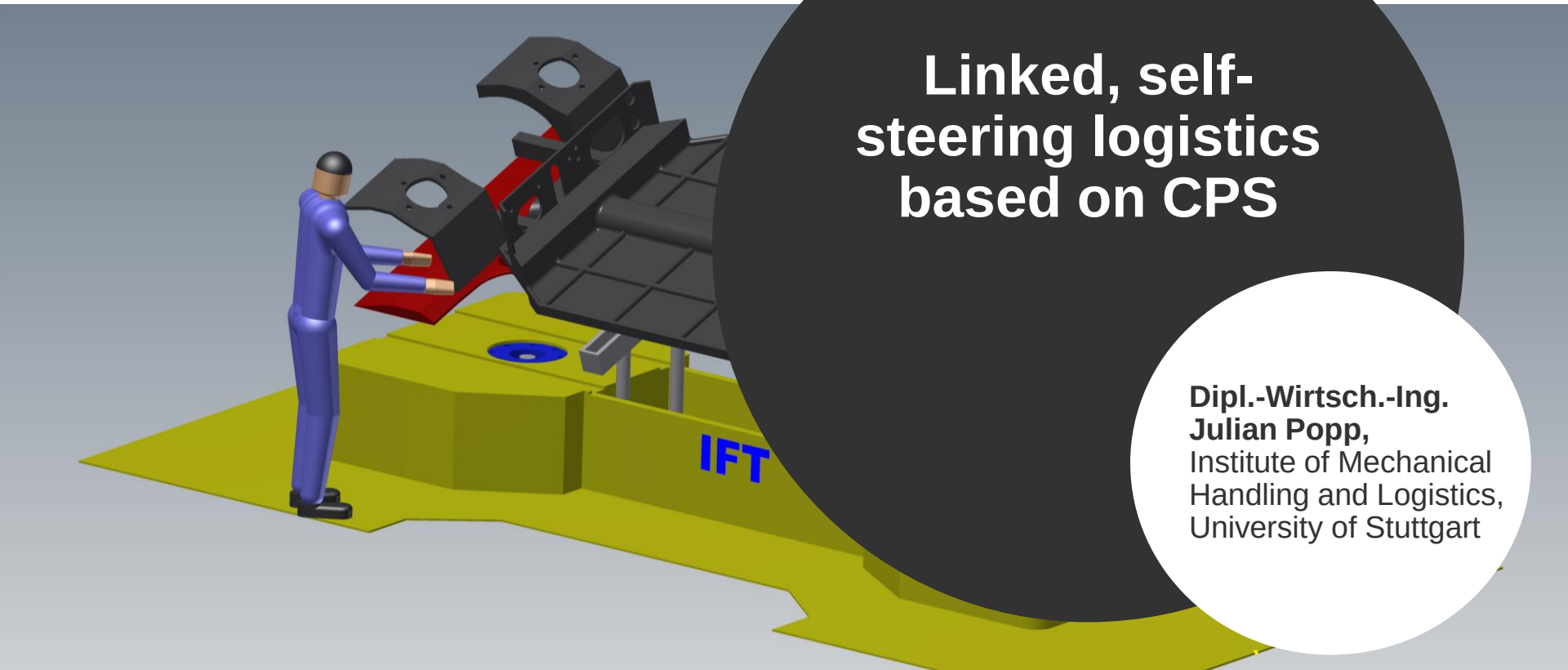


Linked, self-steering logistics based on CPS

Dipl.-Wirtsch.-Ing. Julian Popp,
Institute of Mechanical Handling and Logistics, University of Stuttgart

Automotive production changed (regarding product variation) over the last 40 years

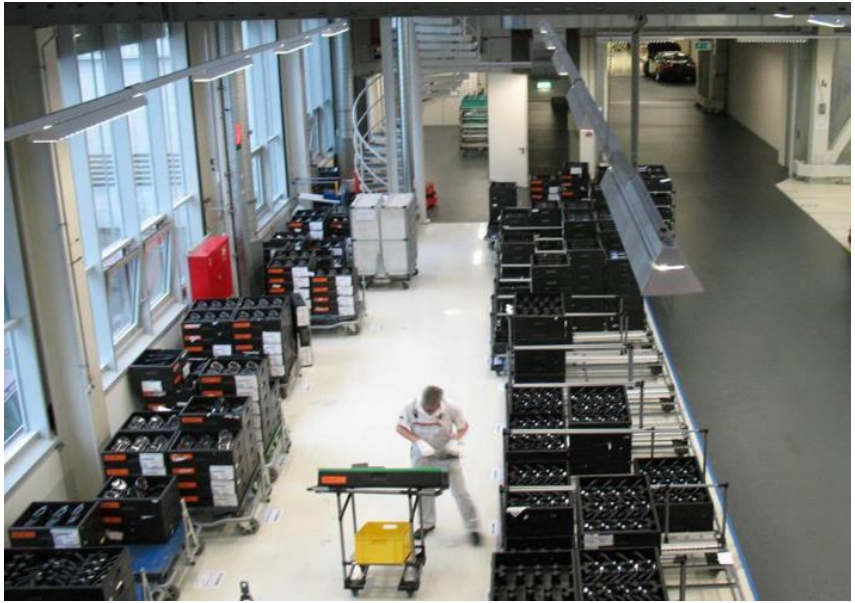
1970

2010

Material provision 20 years ago

Quelle: Porsche 1992

Material provision today using logistic supermarkets



Tugger trains connecting supermarkets and assembly

Lack of flexibility regarding routes!

Problem analysis for todays premium automotive production

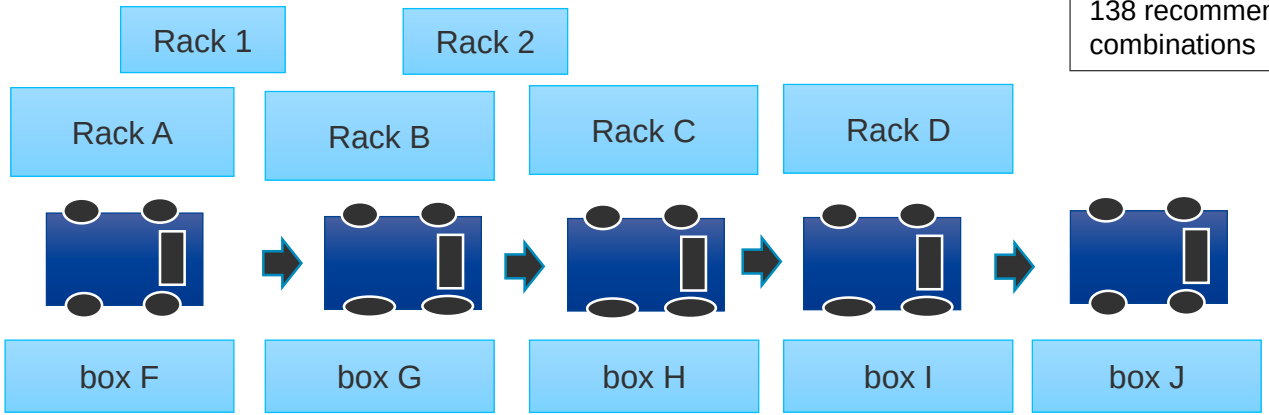
- Further rise in number of variants
- Expensive rework and little flexibility because of fixed conveyor lines
- Logistics need higher amount of space at the assembly lines

→ Logistics costs rising continously

Image source: Mercedes-Benz

2013 Mercedes A-class (W 176):

138 recommended paint & upholstery combinations



ARENA2036

Active Research Environment for the Next Generation of Automobiles

- 7500 m² testing hall in Stuttgart
- Flexibility and transformation ability
- Human machine interaction
- Partners: Daimler, Bosch, BASF, Faro, Kuka, Bär, Fraunhofer (IAO, IPA) and 6 Institutes of the University of Stuttgart

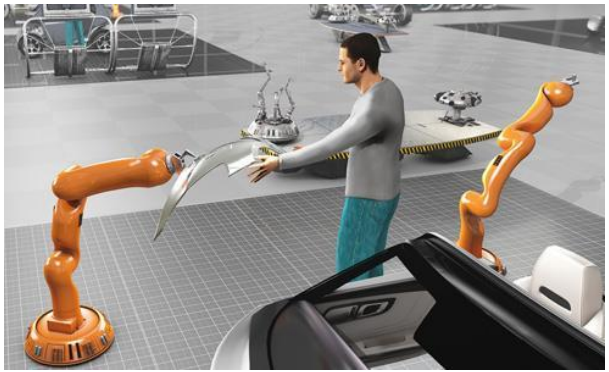
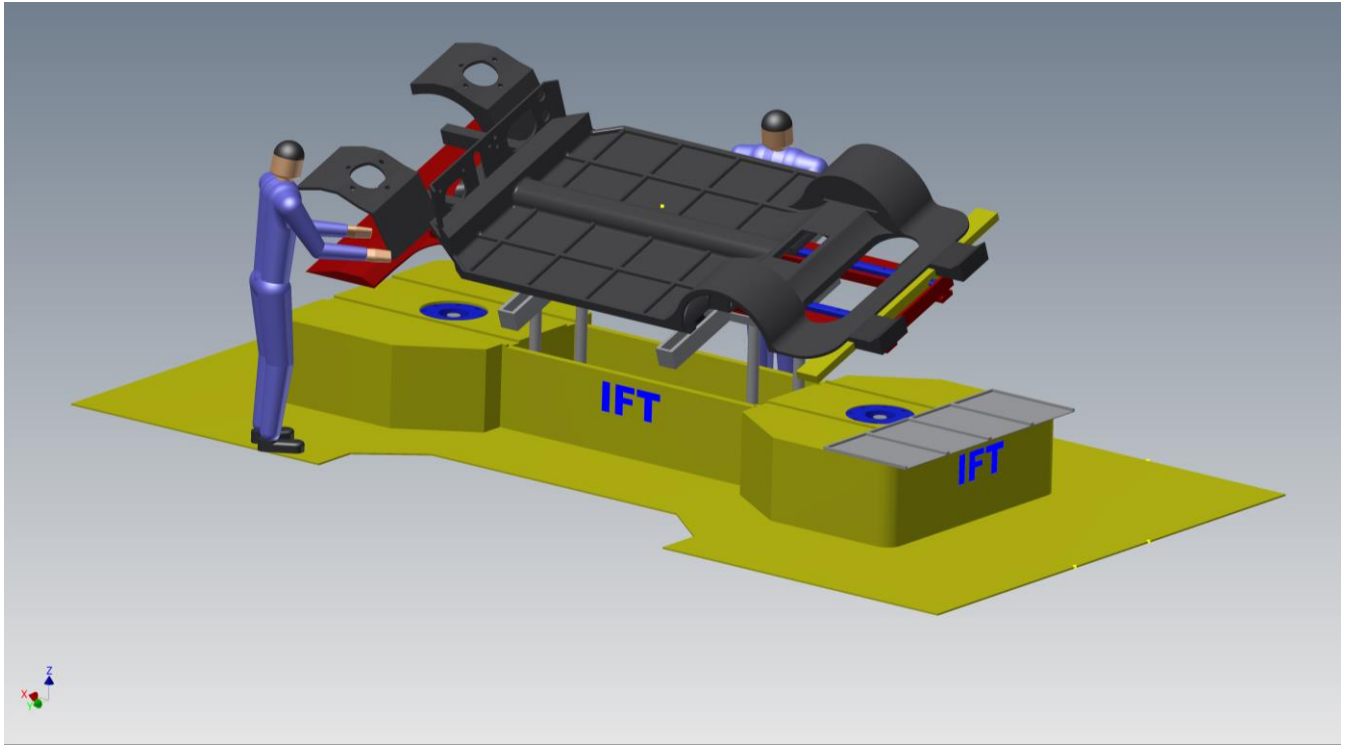
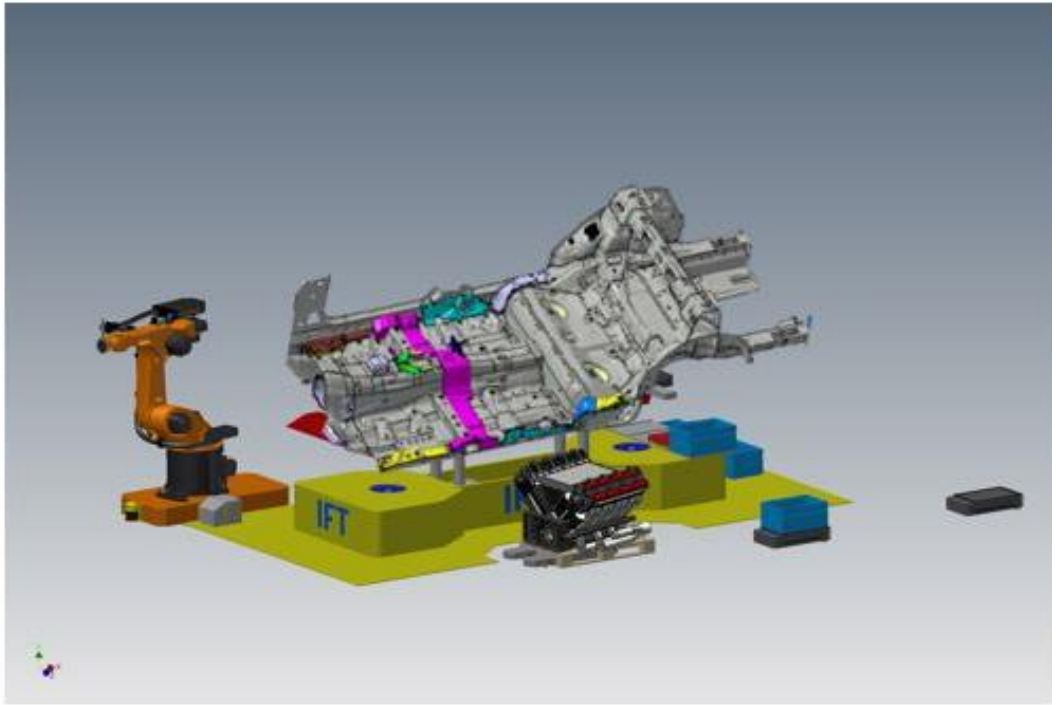


Image source: arena2036.de

Innovative worker platform (AGV) to replace conveyors



Material supply for worker platform (AGV)



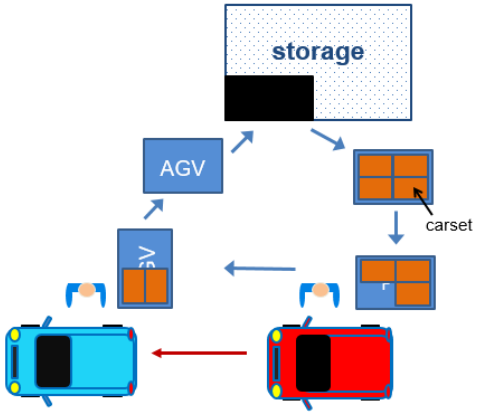
Connection points:

- Roboter
- Wire mesh boxes
- Universal bins
- Additional manual worker space
- …

Three innovative logistics concepts

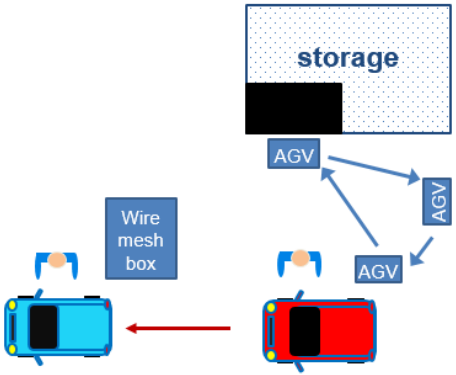
Car-set concept:

Main criteria:
High number of variant parts at following stations



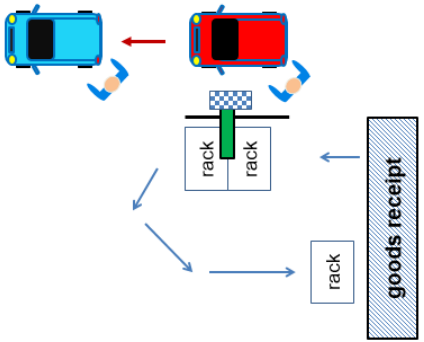
AGV-concept

Main criteria:
Parts for small percentage of cars

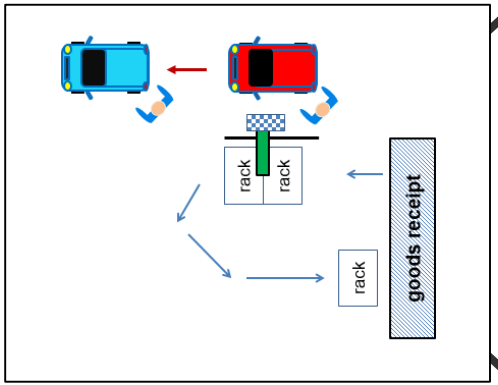


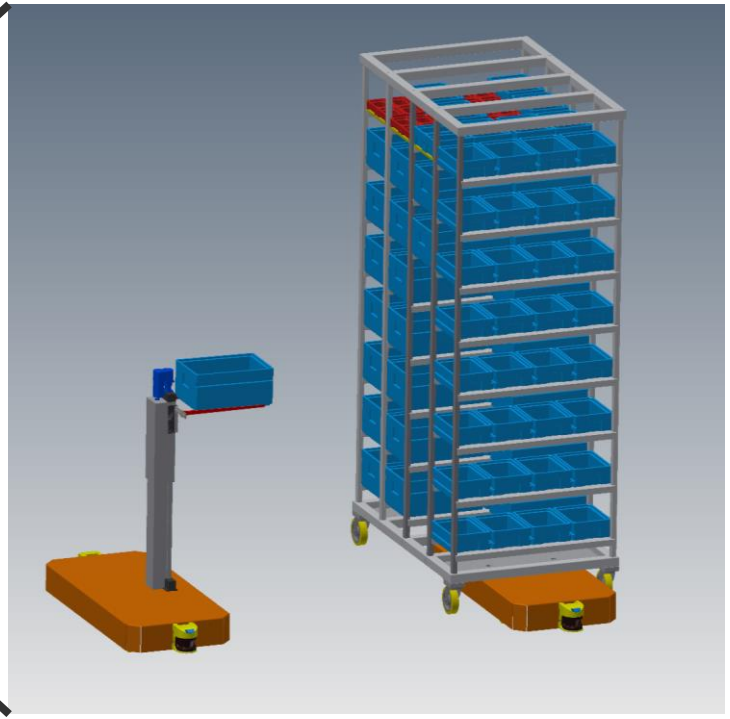
Rack-concept

Main criteria:
High number of variant parts at a certain station

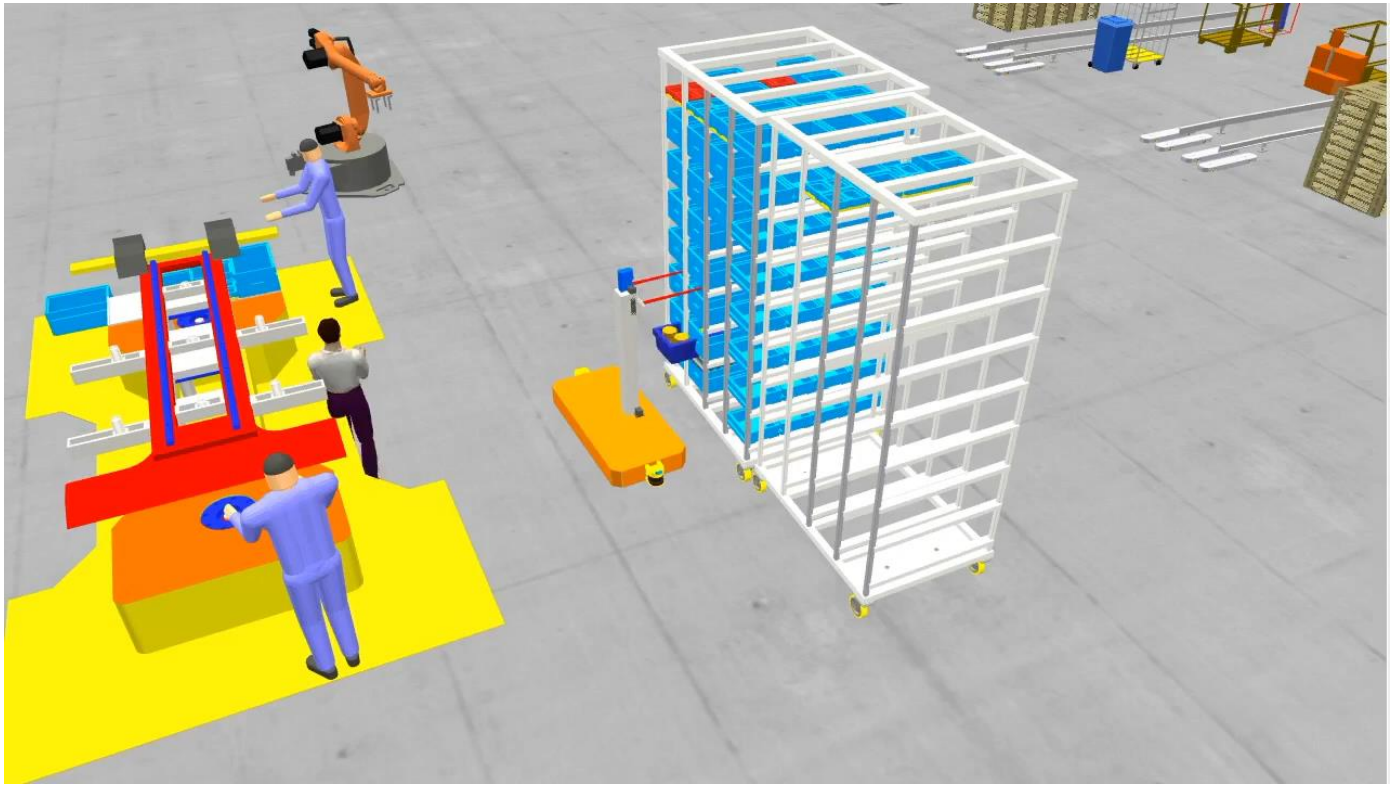


Rack-concept

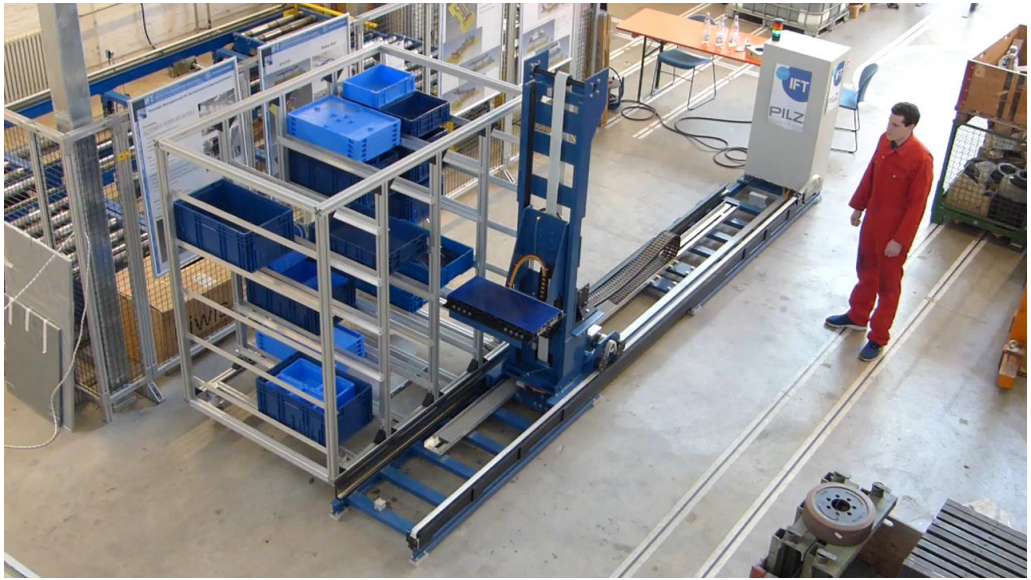




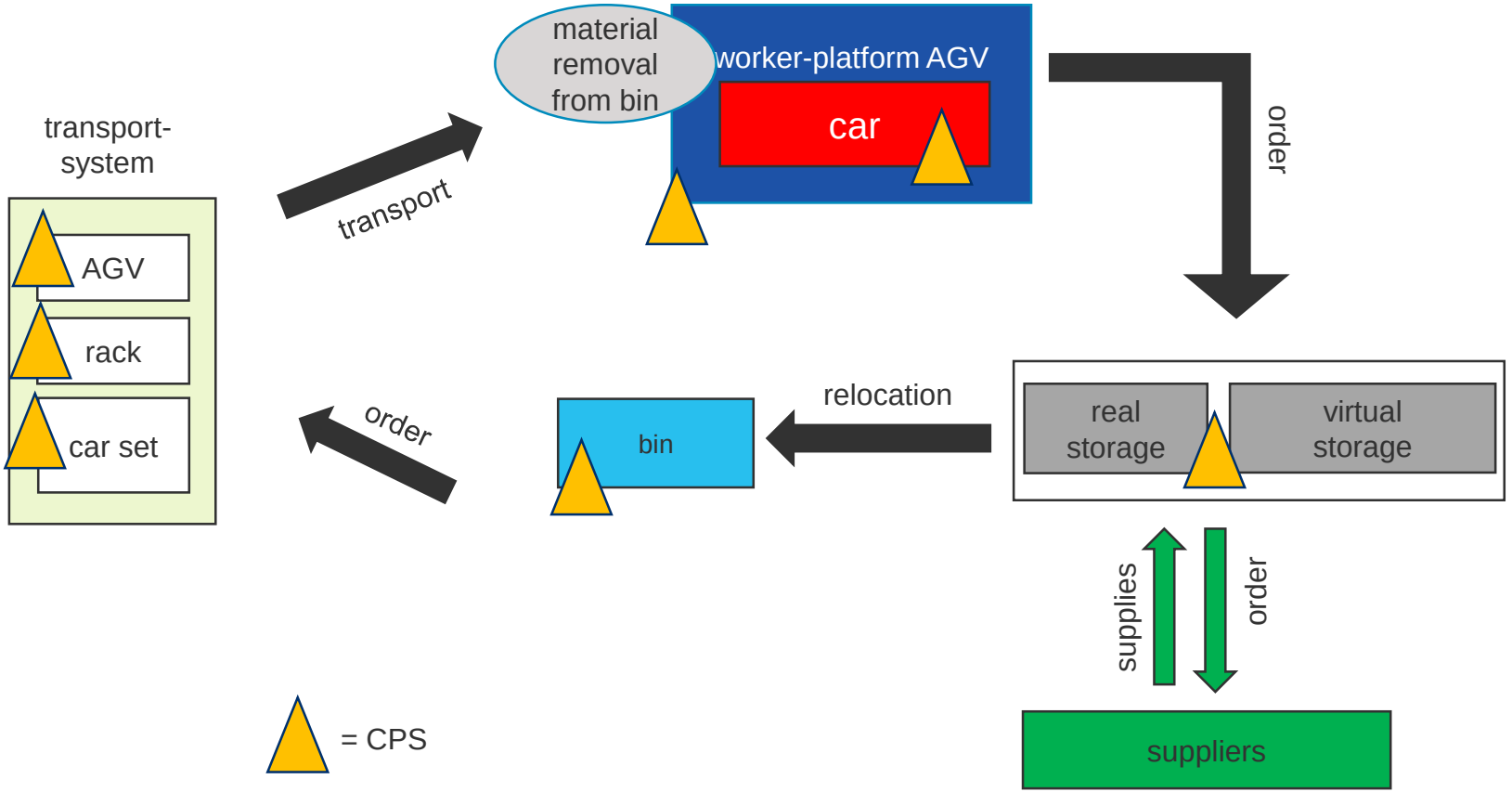
Simulation rack-concept



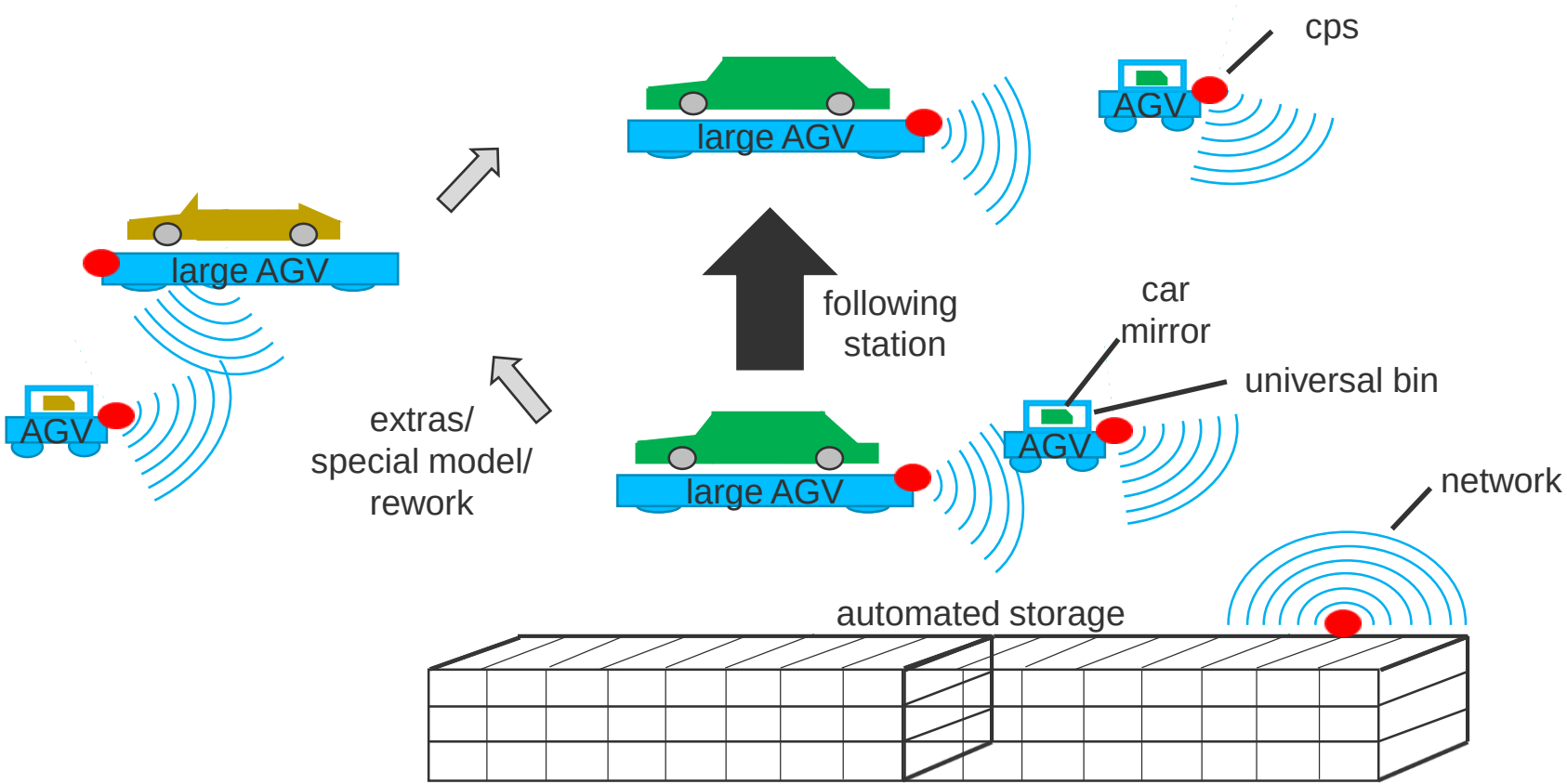
Prototype rack concept



Linked logistics for the new production



Linked logistics for the new production



Summary and Outlook

- Analysis of today‘s situation
- Development of new logistics concepts
- Concept for connected logistics supporting future of production

- Development of a selection tool for automated rating of logistics concepts

Thank you

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KNAPP

Modularization in Warehouses

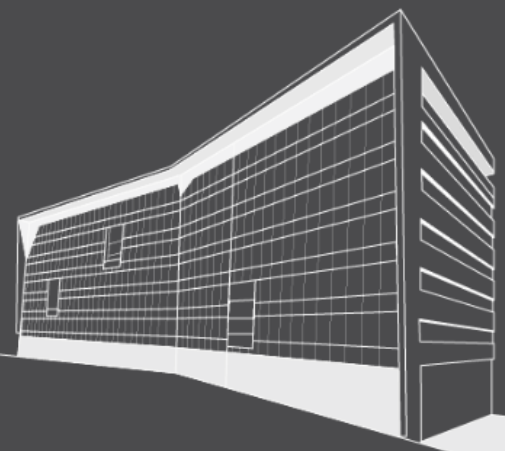
Roman Schnabl

roman.schnabl@knapp.com

KNAPP AG

Company

KEY DATA



Headquarter

KNAPP AG
Hart bei Graz

Founded: 1952
Company premises: 120,000 m²
Employees at the headquarters: 2,000

Employees worldwide: 3,000
Locations and offices: 33
Turnover 15/16: 582 million euros
Export quota: 98 %

Production in numbers

Screws/year: 7.8 million
Shuttles/year: 3,100
Lifts/year: 210
Switch cabinets/year: 1,700
Powder coating/year: 44 t
Coated surface/year: 181,000 m²

Certifications

Quality management
ISO 9001

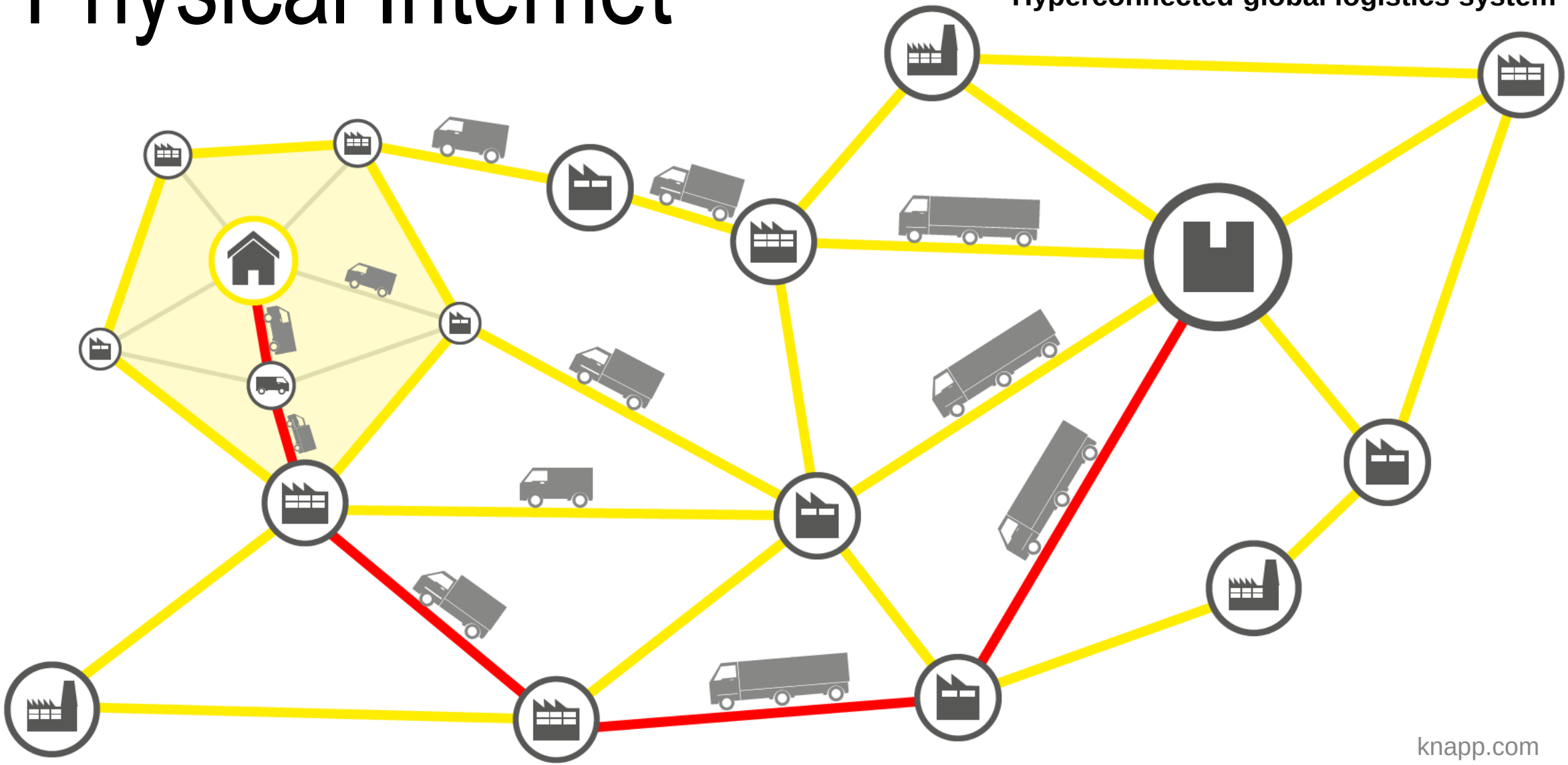
Occupational Health and Safety
OHSAS 18001

Environmental management
ISO 14001

Physical Internet

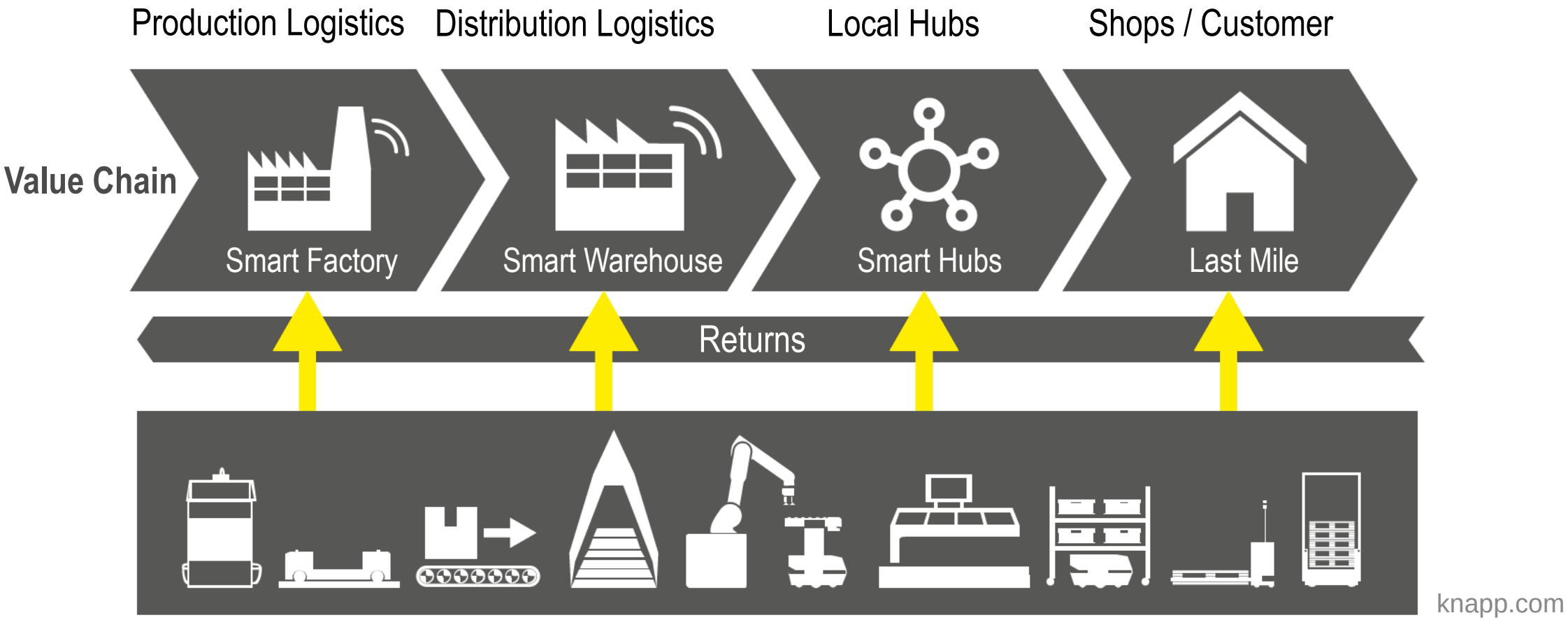
Super Grid Logistics

Hyperconnected global logistics system



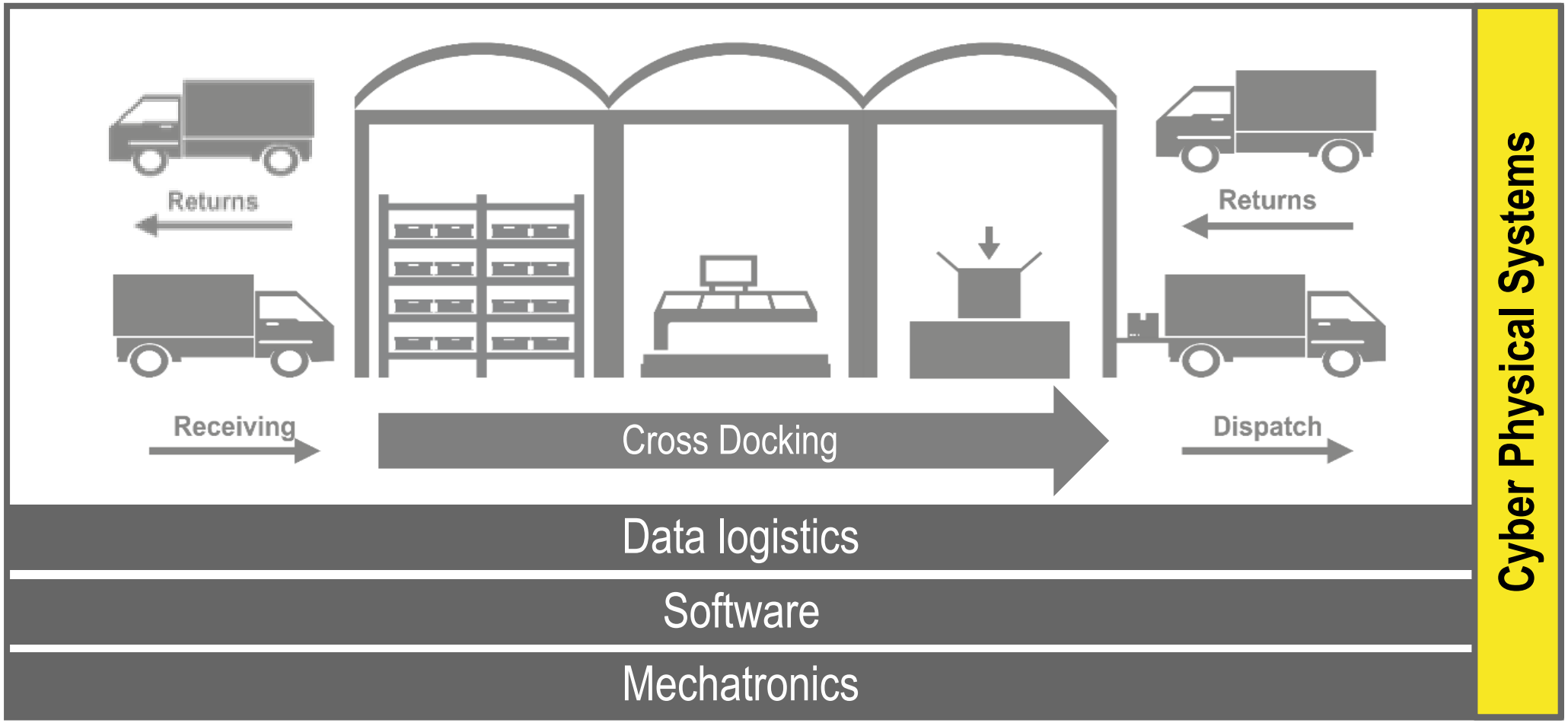
knapp.com

PI Value Chain

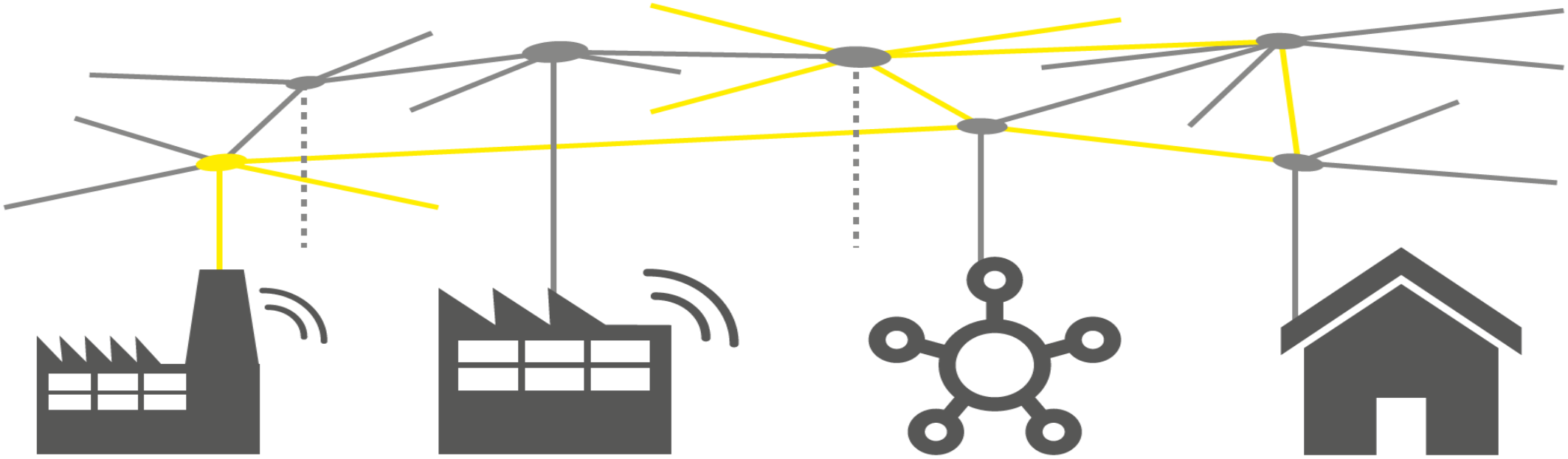


Industrial Revolutions

Smart PI Hub (Hyperconnected Mixing Center)



Cyber Physical Systems



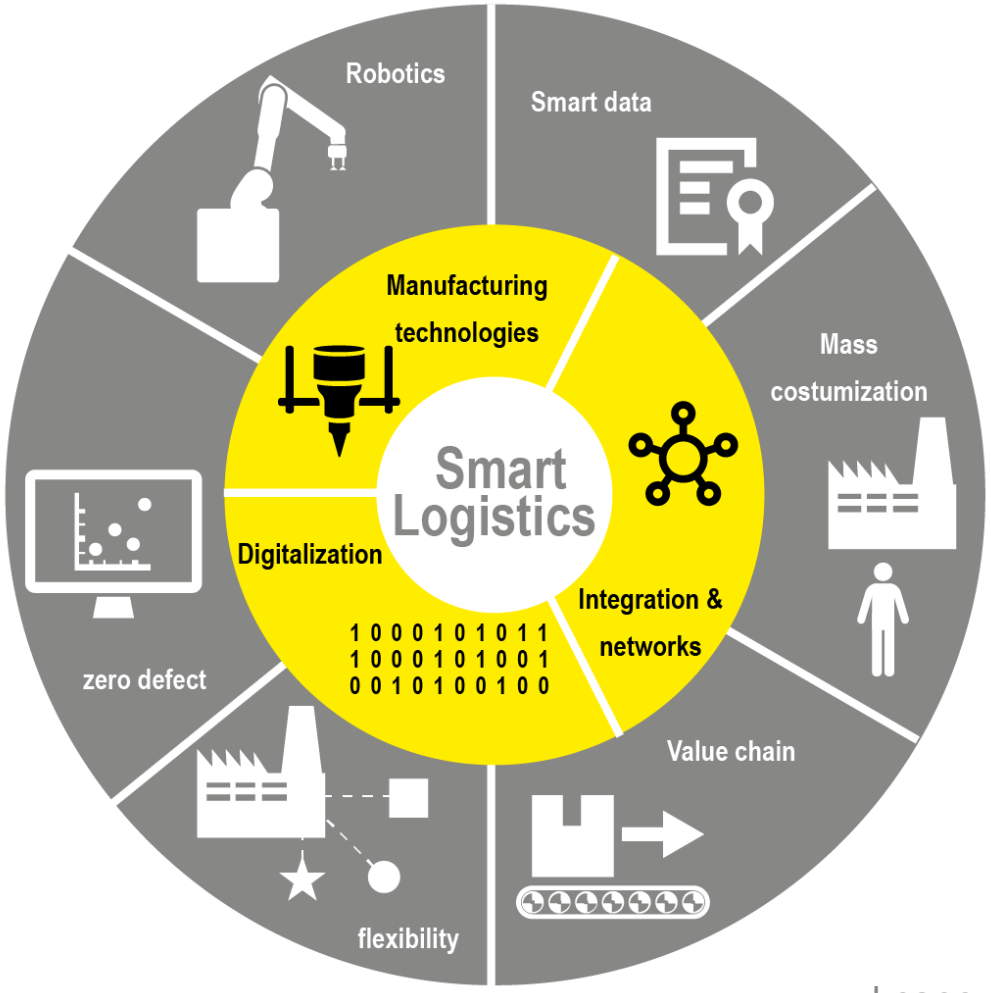
Data logistics

Software

Mechatronics

Smart PI Hub (Hyperconnected Mixing Center)

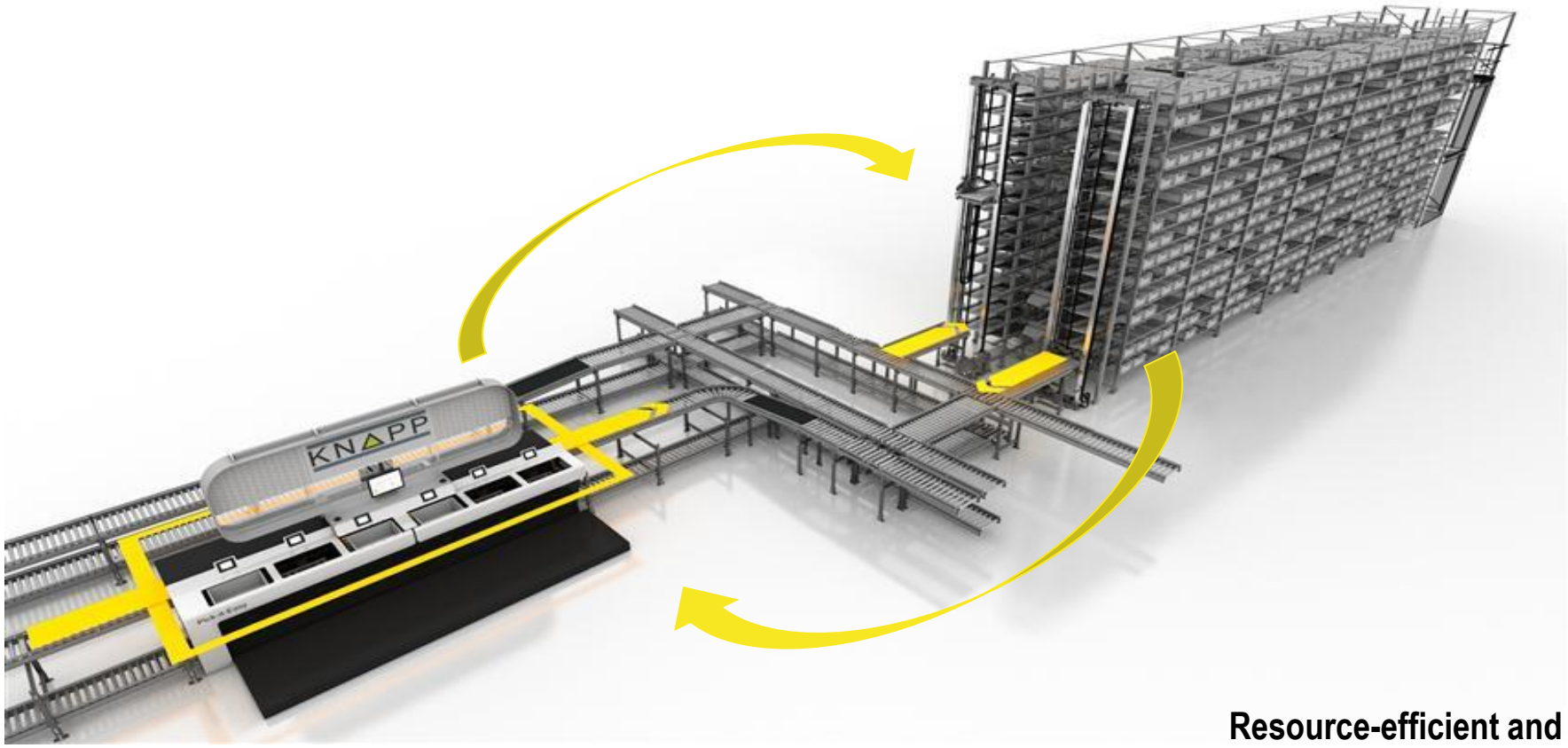
- **Zero Defect**
- **Flexibility**
- **Resource efficiency**
- **Automation**
- **Ergonomics**
- **Business partners integrated into processes**



PI Hub - Modularization

Example Goods-to-Person Picking

Goods-to-Person Picking



Resource-efficient and ergonomic

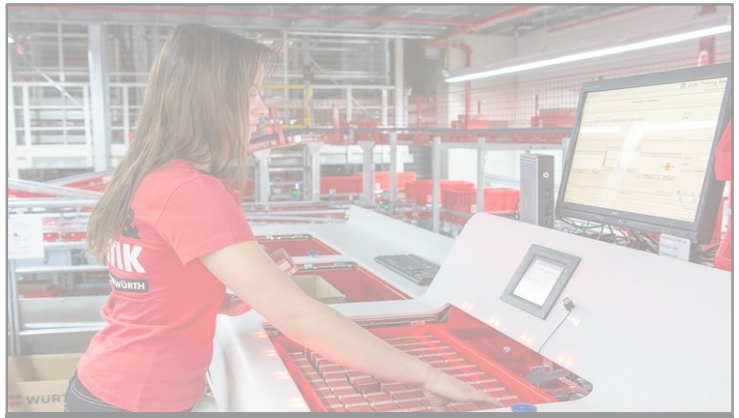
Goods-to-Person Picking

Work stations

Conveying system

Storage System

Goods-to-Person Picking



Work stations

Conveying system

Storage System

Storage systems

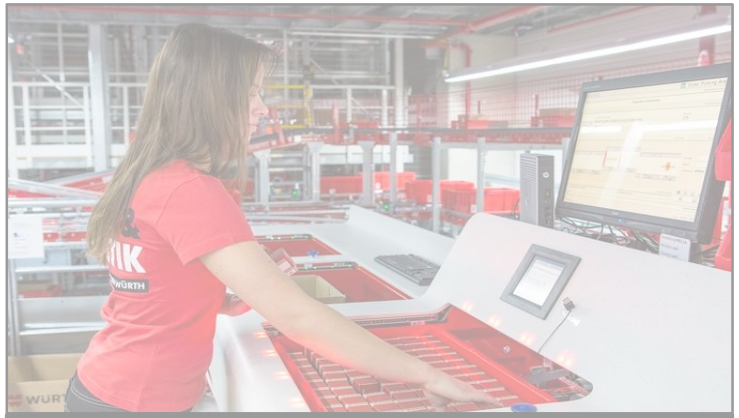
Selecting a suitable storage system

- Load carriers: pallets, cartons, single item…
- Weight: 1,000kg, 50kg, 10g…
- Spatial requirements (height, floor space)
- Storage and retrieval capacity
- Sequence requests
- Storage Locations
- **Necessary flexibility of the system**

Smart Shuttles

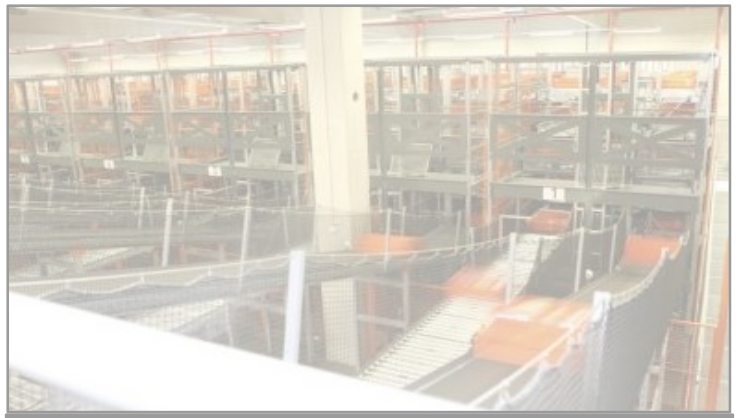
Smart Shuttles

Goods-to-Person Picking



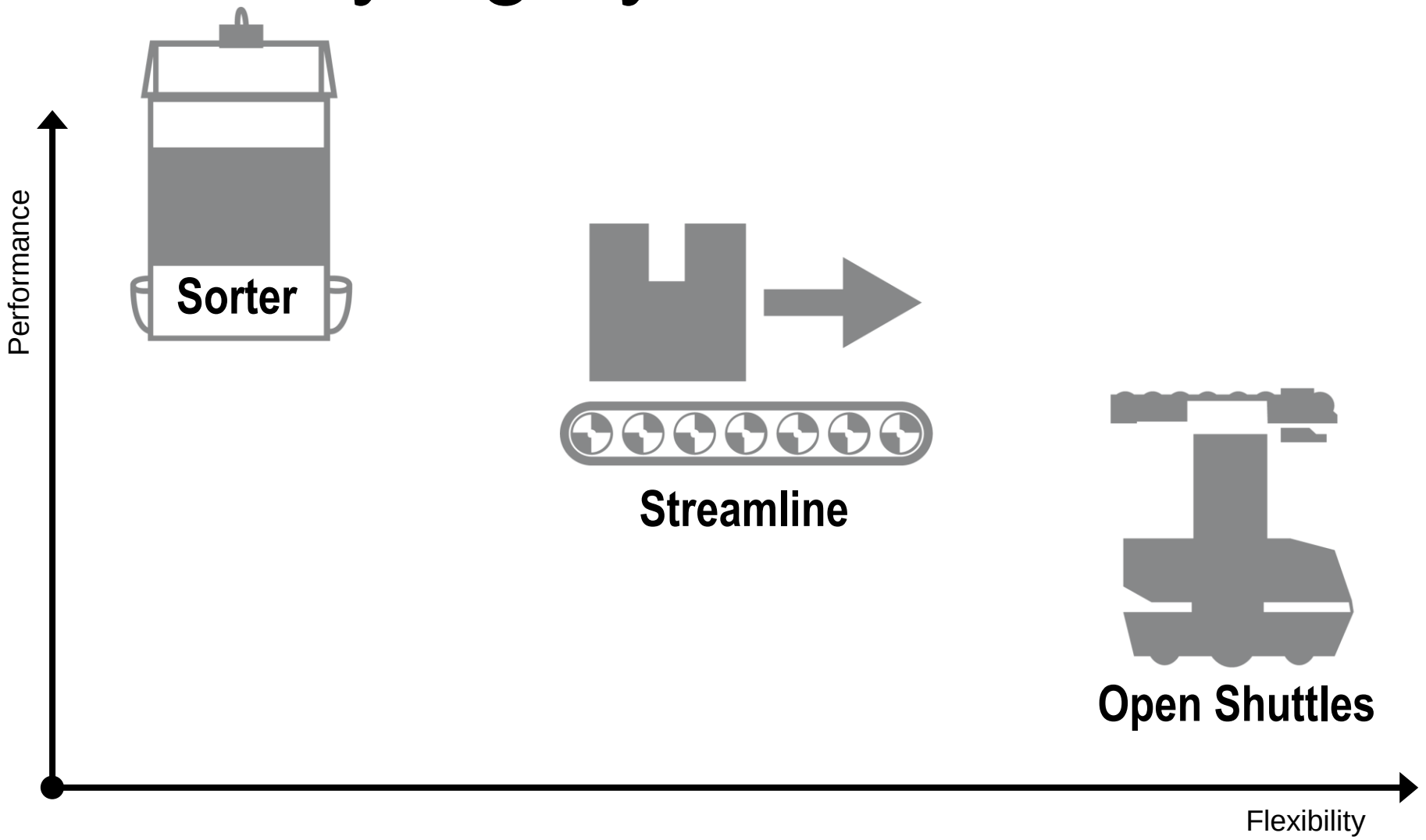
Work stations

Conveying system



Storage System

Conveying system



Pocket System

Open Shuttles

Open Shuttle

Open Shuttle Fork

Open Shuttle for pallets

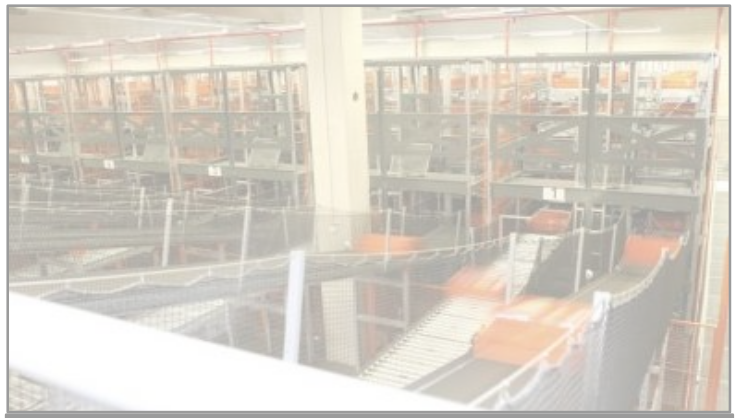
Open Shuttles

Open Shuttle for pallets

Goods-to-Person Picking

Work stations

Conveyor system

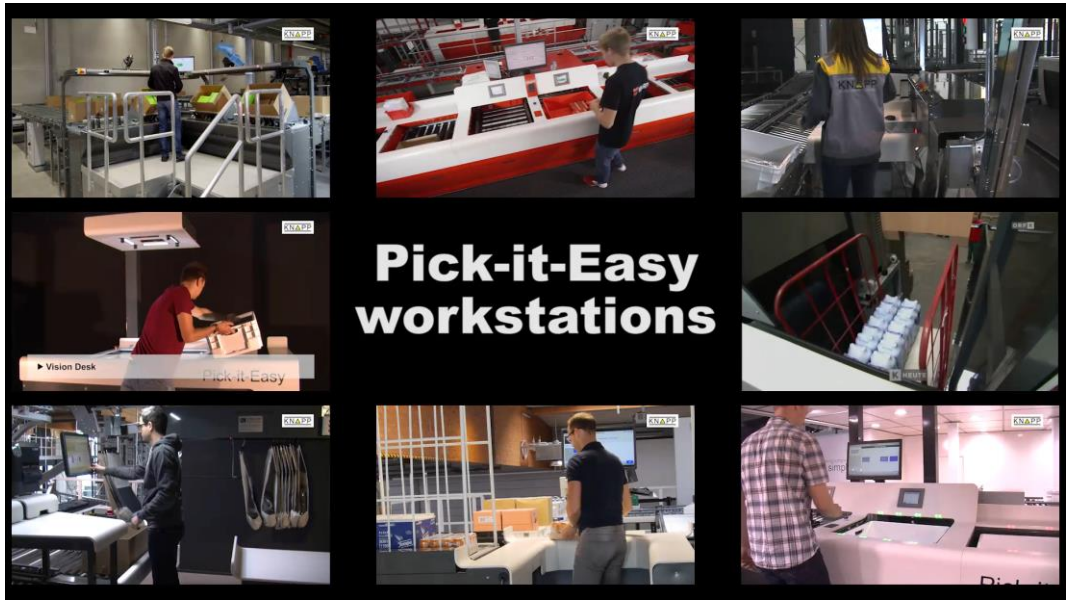


Storage System

Pick-it-Easy work stations

Pick-it-Easy work stations

- Pick-it-Easy series
- Different types of work stations for different requirements and sectors
- Future-oriented design: Ergonomic KiDesign
- Multifunctional; optimized for main tasks
- Benefit: Flexibility, performance, ergonomics, economics and design unified in one concept



Pick-it-Easy Robot

Pick-it-Easy Robot

Fully Automated Bin Picking

References

Dynamics

Pick-it-Easy Robot

PLAY

Goods-to-Person Picking

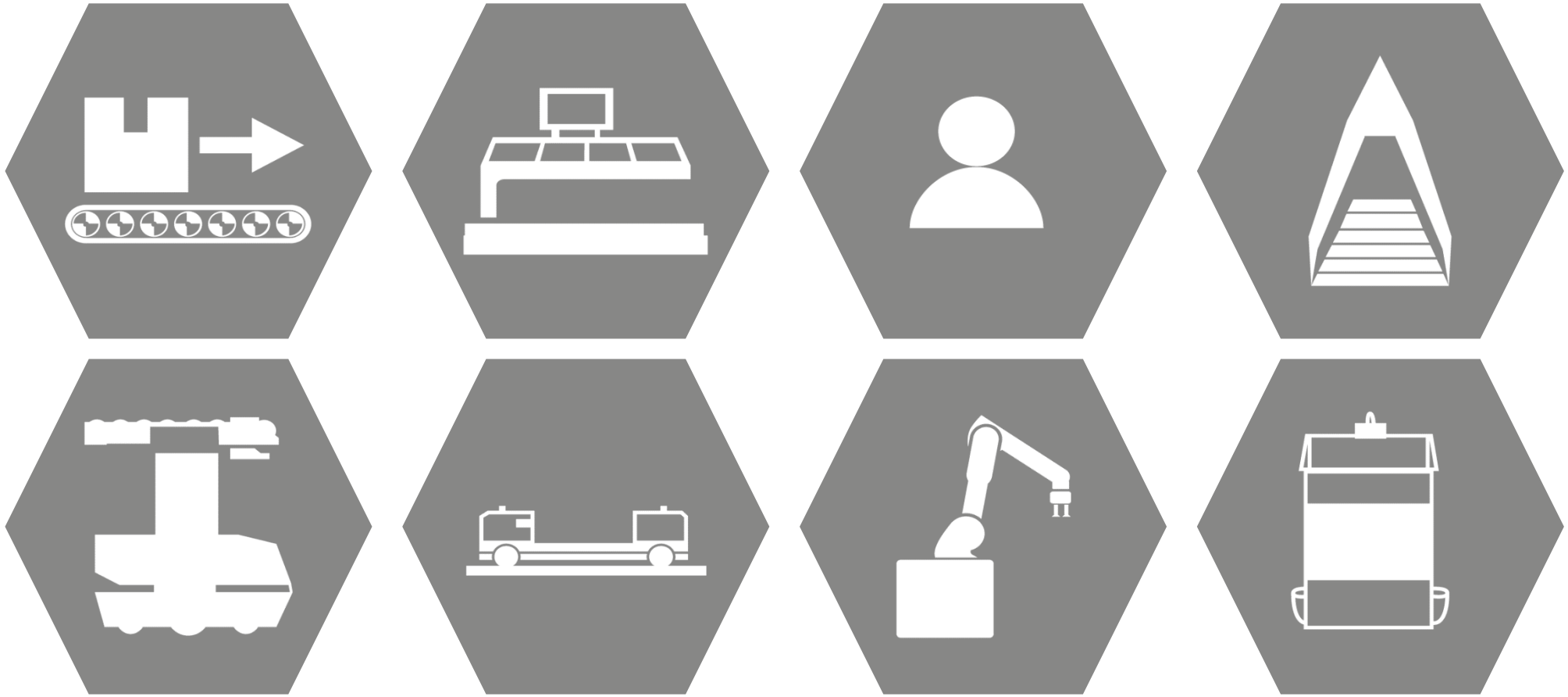
Work stations

Conveying system

Storage System

Software

PI Hub - Smart Logistics Modules



making complexity simple

Questions?

Thank you.

Vielen Dank.

Merci beaucoup.

Muchas gracias.

Mille grazie.

Short Break