

Next gen AI-robotics powered by dataspace tech: RoX

April 1, 2026, 10:00-11:00 CEST | Webinar

For NTT Docomo Business & RRI

From

Dr. Richard Bormann, Group Manager Robotics, Fraunhofer IPA

Dr. Lukas Sohlbach, Project Manager RoX, VDMA

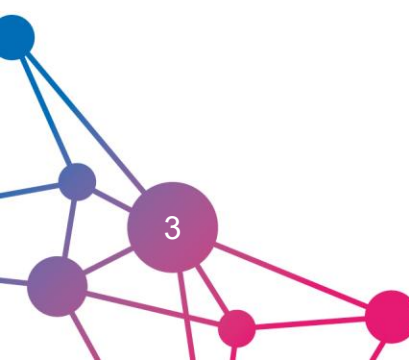
Nikhil Vinod Mallela, Product Engineer, T-Systems International



ROX
Enabling AI Robotics

Agenda

- 01 Project overview
- 02 RoX use cases
- 03 Dataspace-as-a-Service



Project overview

Dr. Lukas Sohlbach

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Internal use only



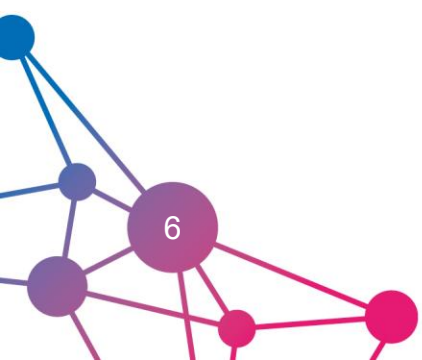
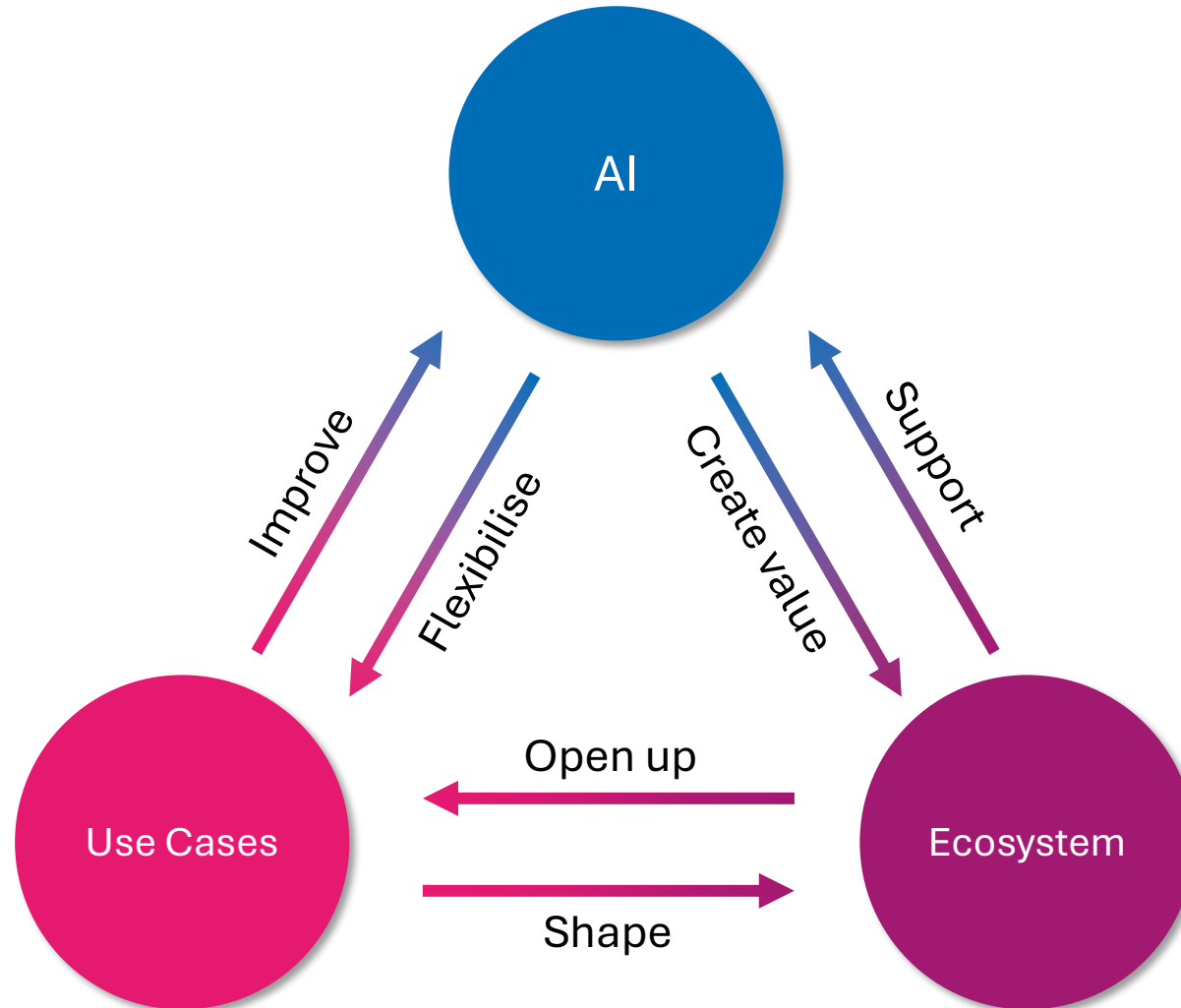
**We automate processes
where it has not been
possible - either technically
or economically.**



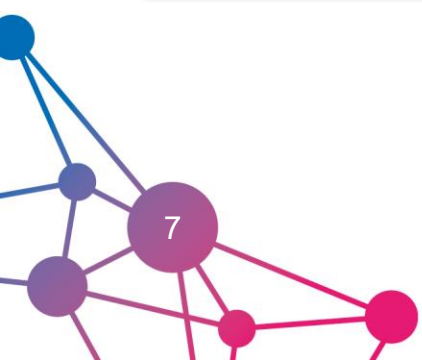
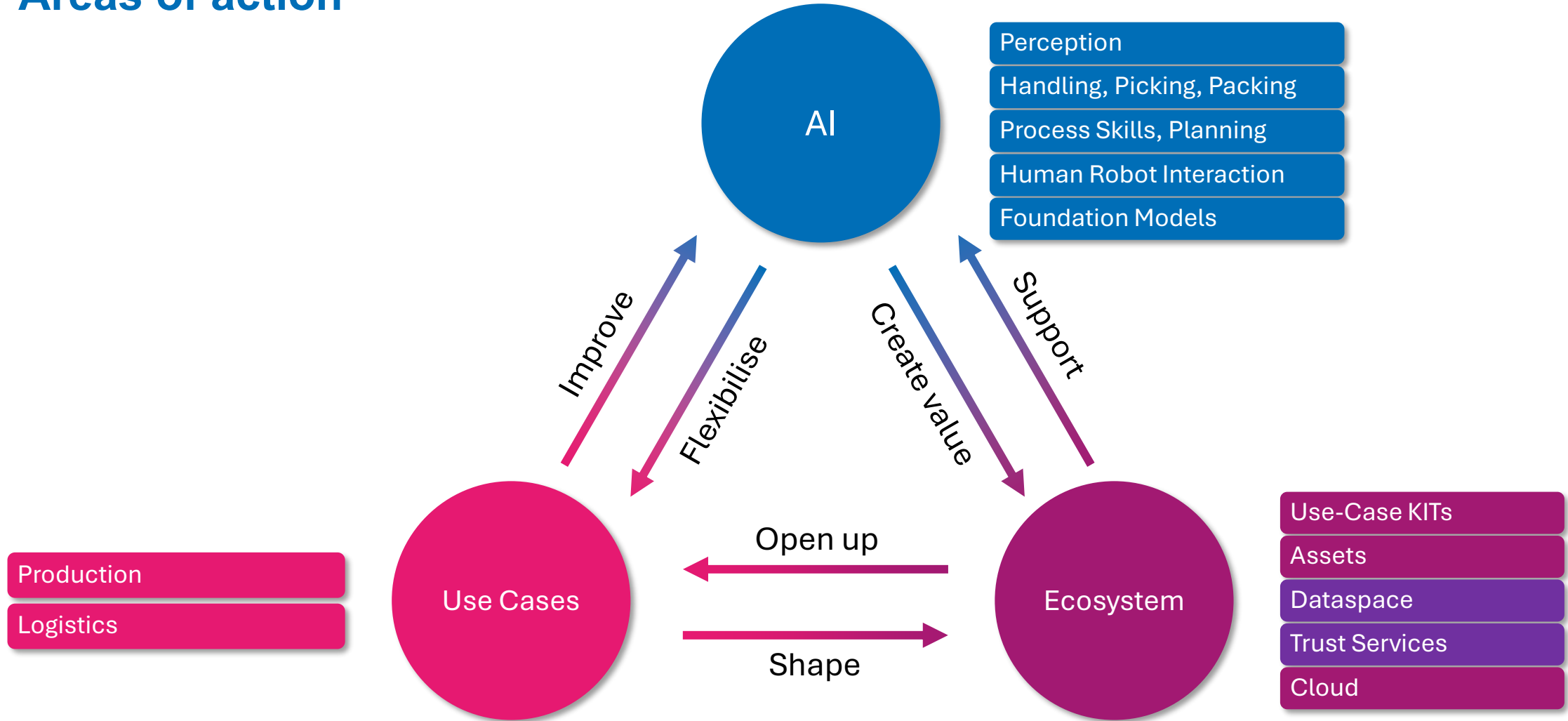
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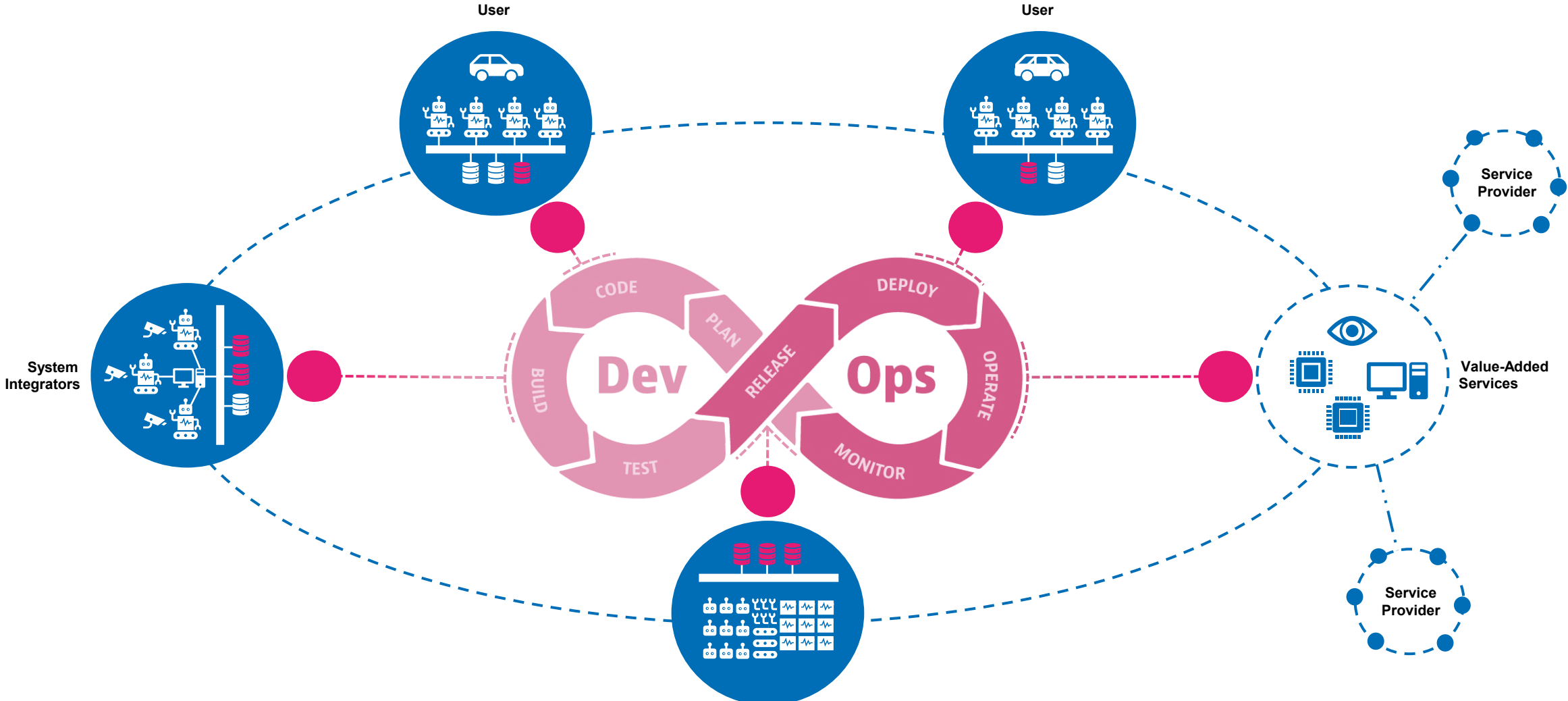
Areas of action



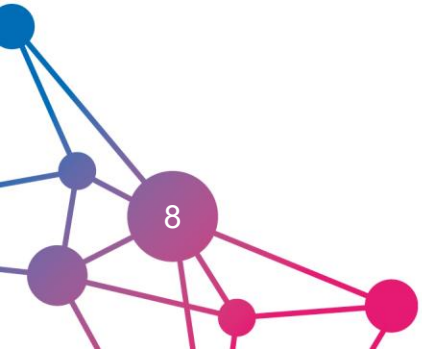
Areas of action



Digital Ecosystem for AI-based Robotics

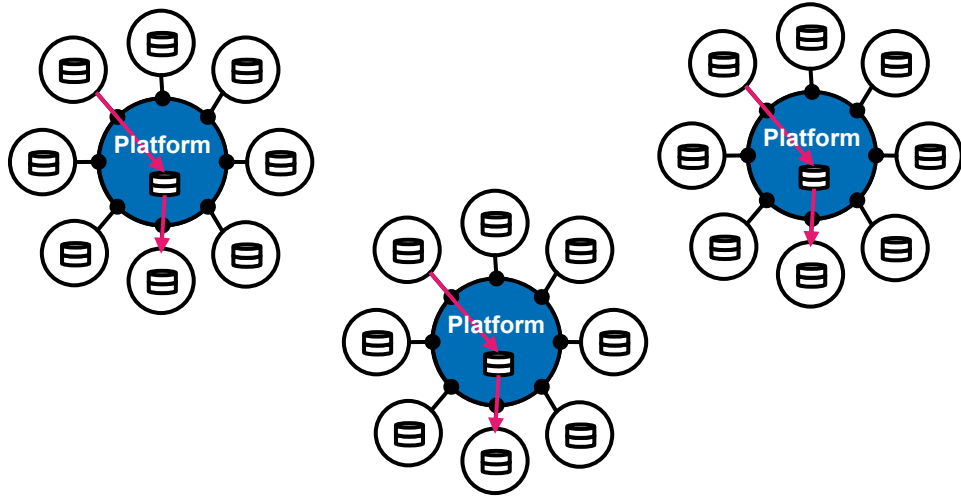


Manufacturer of Robotic Components
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Data Spaces And Digital Ecosystems – Improving Digital Collaboration

Platform or manufacturer orientated



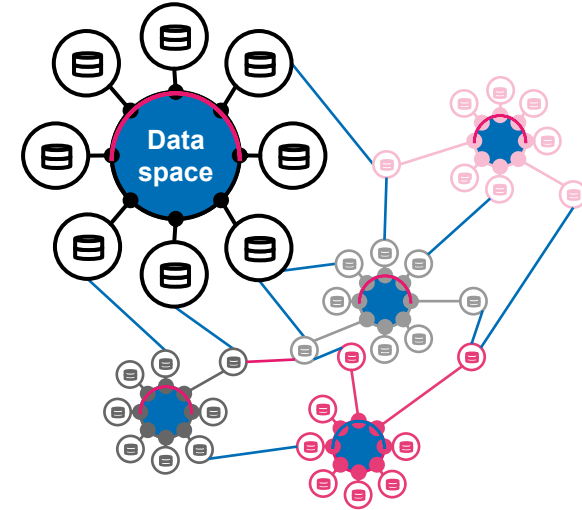
Central architecture

Central data storage

Silos, Lock-In, no trust, monopolies

VS.

User orientated or interoperable



Decentral and federated structure

No central data storage , control

Interoperability, sovereignty, trust

Source: VDMA

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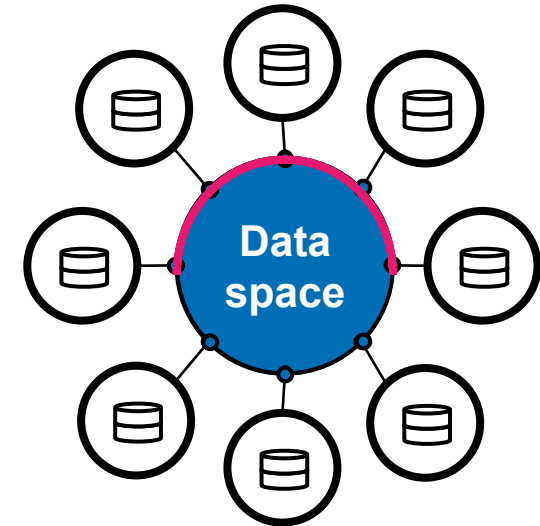
Internal use only

Data Spaces And Digital Ecosystems – Scalable peer-to-peer connections

A **data space** is a **trusted framework** in which **cross-industry and cross-company information** can be exchanged **automatically** and **sovereignly** in order to increase **efficiency** and **enable new value creation**.

A **clean interface** between companies through:

- ➔ Decentralisation
- ➔ Interoperability
- ➔ Market access for all companies
- ➔ Data sovereignty
- ➔ Shared infrastructure



Source: Scale-MX, VDMA

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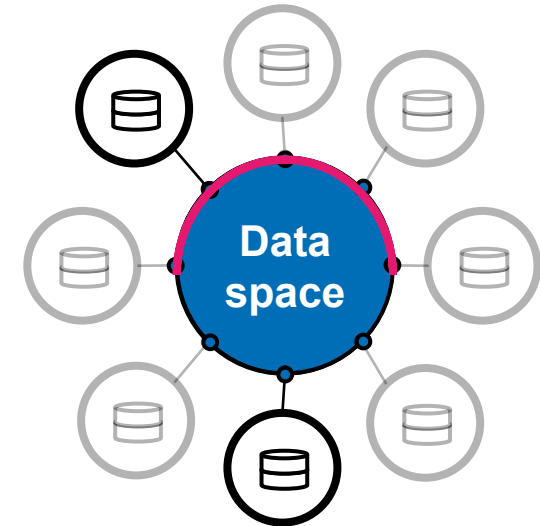
Internal use only

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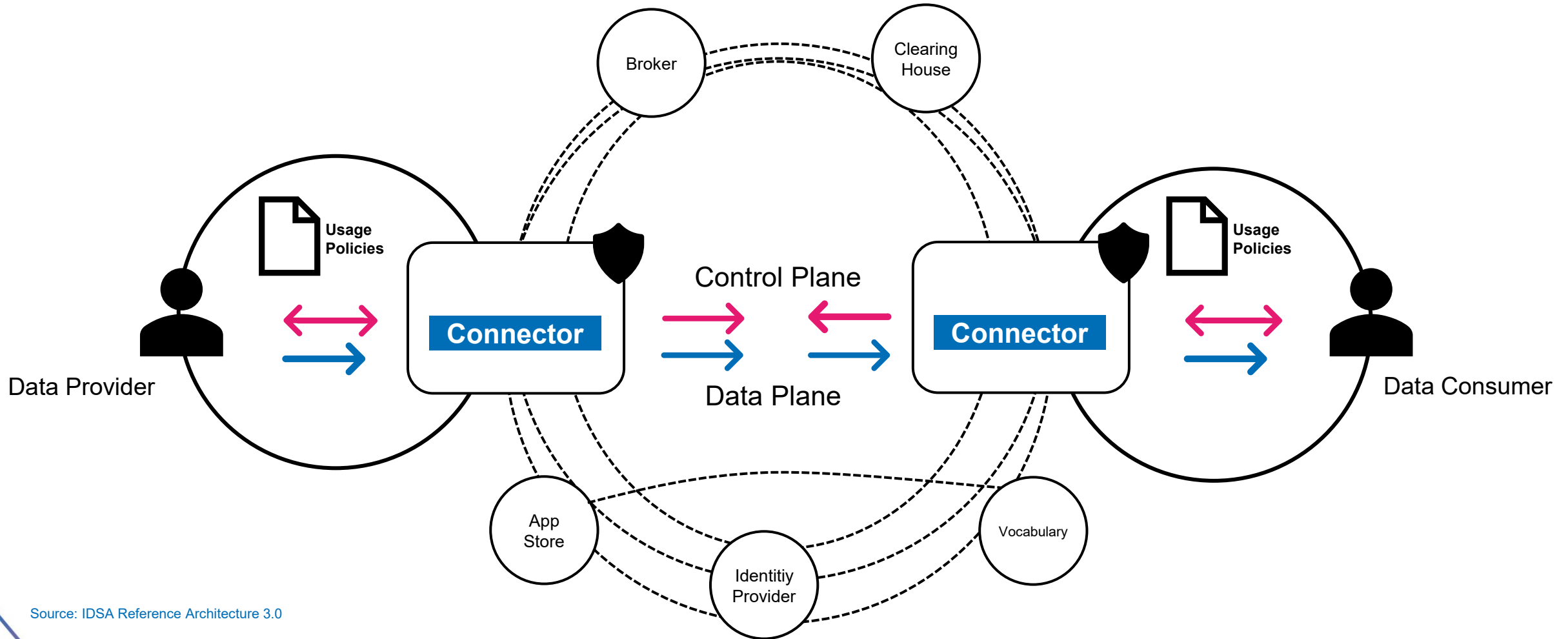


Source: Scale-MX, VDMA

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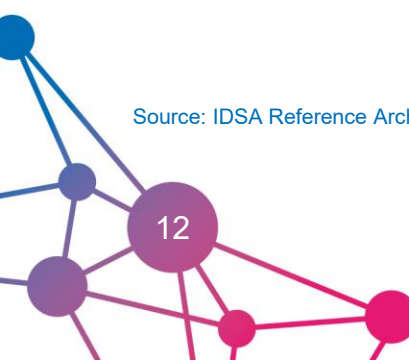
Internal use only

Data Spaces And Digital Ecosystems – Architecture

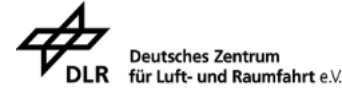


Source: IDSA Reference Architecture 3.0

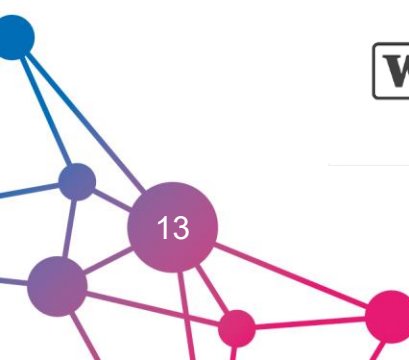
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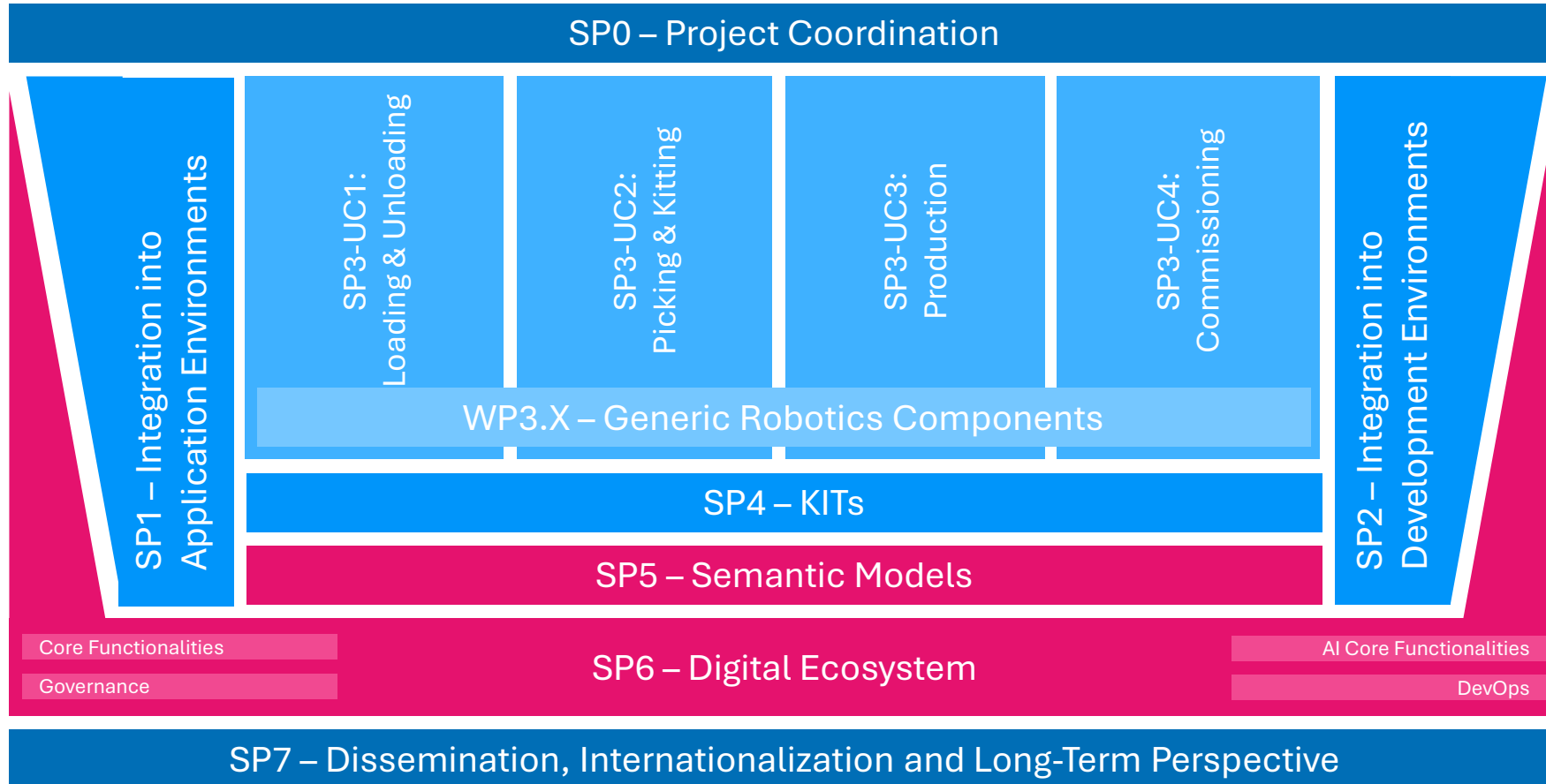
Digital Ecosystem for AI-based Robotics – Project Partners



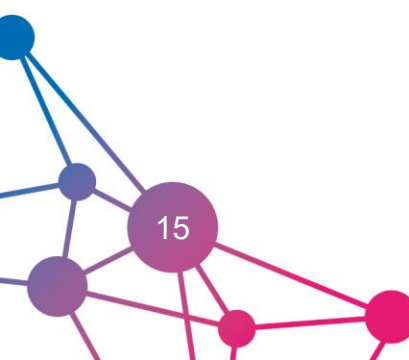
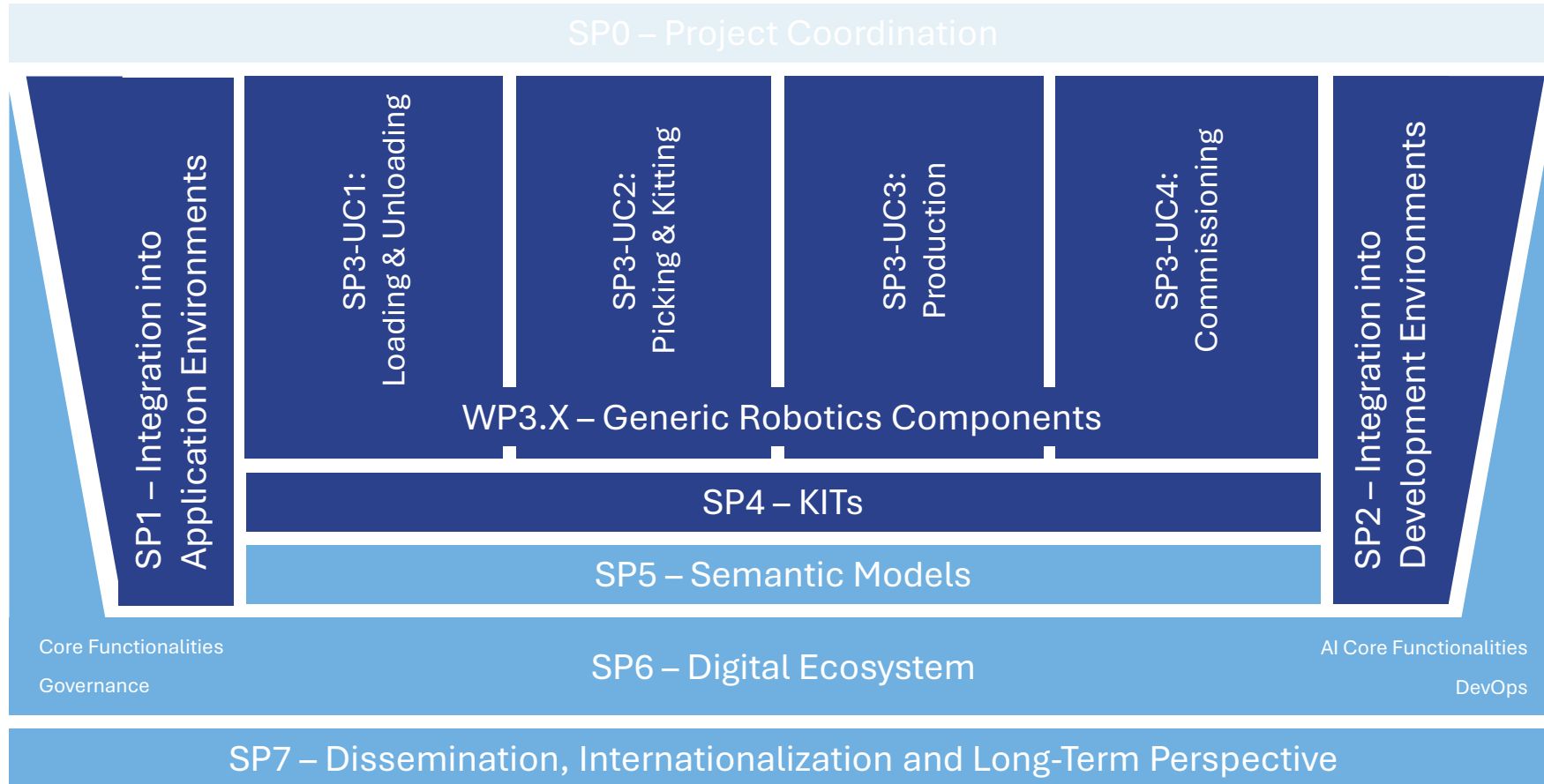
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Digital Ecosystem for AI-based Robotics – Project Structure



Digital Ecosystem for AI-based Robotics – Project Structure



Digital Ecosystem for AI-based Robotics – Connection to Use Cases



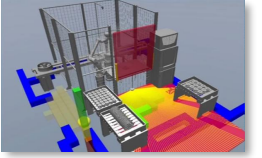
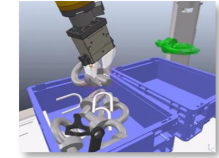
UC 1: Loading and Unloading



UC 2: Picking/Kitting



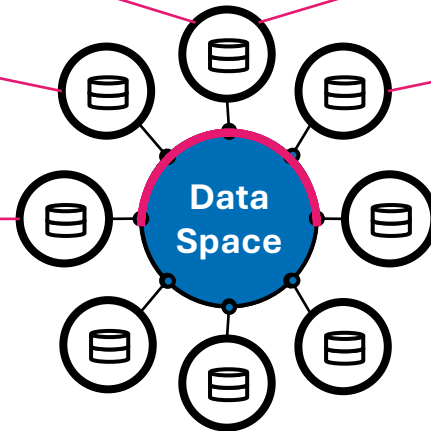
UC 3: Production Automation



UC 4: AI-Commissioning

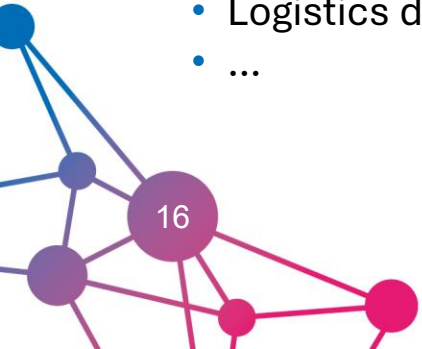
Missing information

- Workpiece data
- Material data
- Logistics data
- ...



Missing „Know-How“

- Development capabilities
- Simulation capabilities
- Update or retrain capabilities
- Optimisation capabilities
-



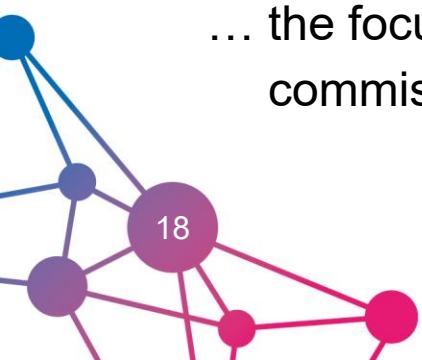
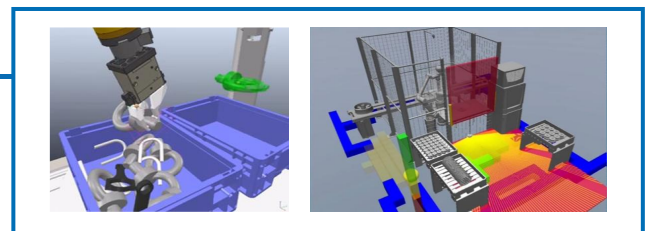
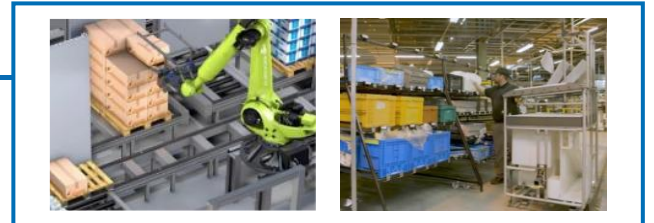
RoX use cases

Dr.-Ing. Richard Bormann

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Digital Ecosystem for AI-based Robotics – Use-Case Driven

- Loading & Unloading
... covers truck loading and unloading processes, load carrier stacking tasks and autonomous outdoor transport
- Picking & Kitting
... relates to single item picking and palletizing in order fulfilment processes in warehouses and in assembly fulfilment in production
- Production
... addresses the automation of (high-mix, low-volume) production using multifunctional robot assistants for various standard tasks
- Commissioning
... the focus is on using AI to speed up and reduce costs during the commissioning or reconfiguration of robotic systems and applications



Details – UC1 Loading & Unloading

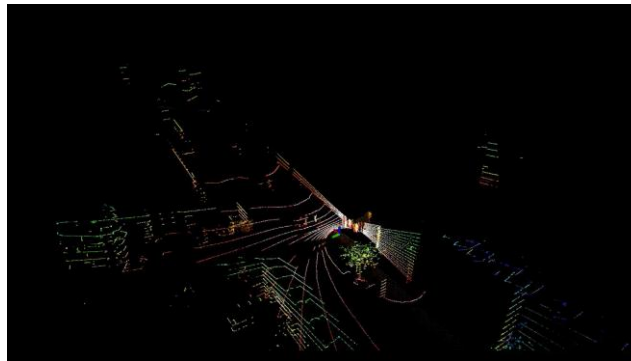


Loading and unloading pallets on trucks

- With autonomous mobile robots (AMR) or autonomous forklifts
- Challenges: moving pallets in very confined workspaces requires force-feedback control; ensuring personal safety

Autonomous outdoor transport in factory traffic

- Seamless outdoor and indoor operation by 3D mapping (no GNSS, no markers)
- Challenges: generalization capabilities of perception and navigation in unstructured or non-standardized and open environments



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Details – UC2 Picking, Packing, Palletizing in Warehouses ...



Mixed palletizing at distribution centers

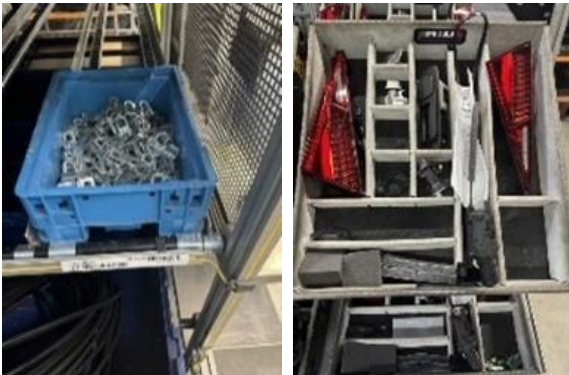
- Depalletizing of homogeneous pallets and creating mixed pallets e.g. for retail stores
- Goal: compact, mobile picking solutions to supplement large-scale systems
- Challenges: goods and package variety, package identification and pose estimation, grasp planning, planning of a stable and compact packing pattern

Order fulfillment in warehouses and for end-of-line packaging

- Model-free pick&pack process for order fulfillment in retail or end-of-line packaging in production
- Goal: single item picking from e.g. totes of an automated storage and retrieval systems (AS/RS) and packing into shipping carton for delivery
- Challenges:
 - Perception, gripper technology and corresponding grasp and packing planning for the extreme variety of goods
 - Short cycle times, missing master data, undefined delivery sequences



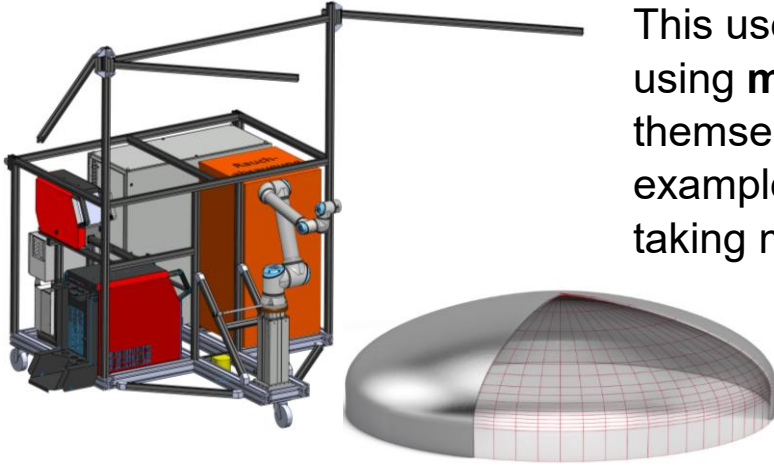
Details – UC2 ... Kitting in Production



Kitting in production

- Assembly pre-picking: required parts for an assembly step are compiled from the industrial warehouse
- Goal: establish a generic robotic picking solution for the broad range of parts
- Challenges
 - Exceptional generalization requirements for perception and gripping capabilities
 - Extreme variety of components and their delivery states, including packaging materials
 - Short cycle times for fulfilment
 - Simple setup or model-free operation required

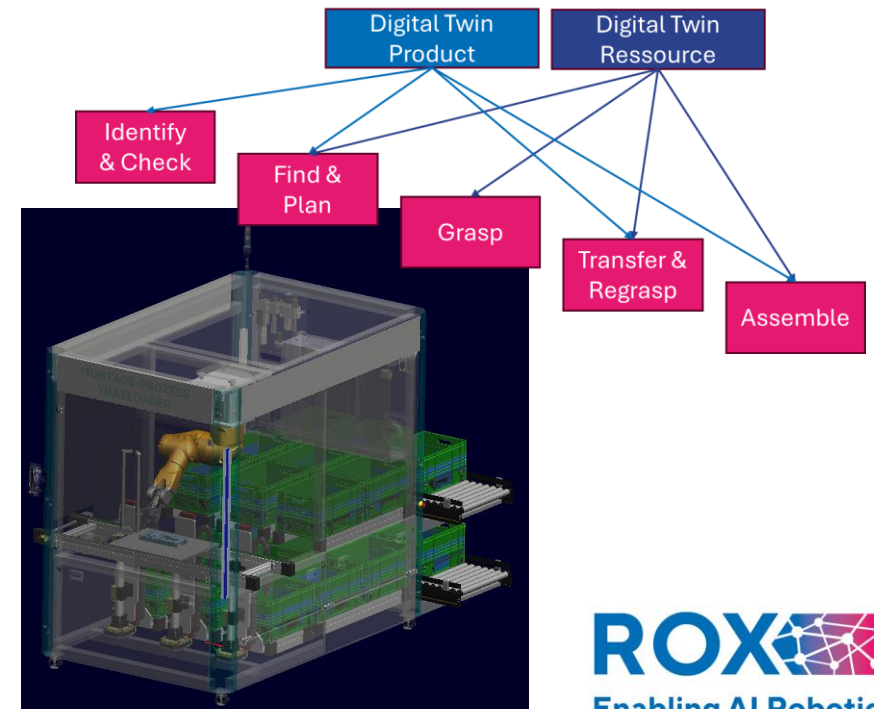
Details – UC3 Production Automation (1/2)



This use case addresses the **automation of (high-mix, low-volume) production** using **multifunctional robot assistants and robot cells** that can learn new tasks themselves without programming or are instructed by natural interaction, for example. By providing sufficiently intelligent and generic basic robot functions and taking meta-tasks into account, these **robot solutions can be used flexibly and economically** in previously non-automatable fields of application (e.g. disassembly), even in existing systems.

Multifunctional robot cells for precision assembly and for welding processes

- Development and application of generic robot skills for complex assembly and welding processes
- Sensor-guided intelligent robot behaviors and simple instructing
- Challenges: modelling, generalization and provision of the specific process knowledge; robot capabilities such as sensor guidance, control via force-torque feedback, force teaching or sensor-supported welding tasks in batch size 1



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Details – UC3 Production Automation (2/2)



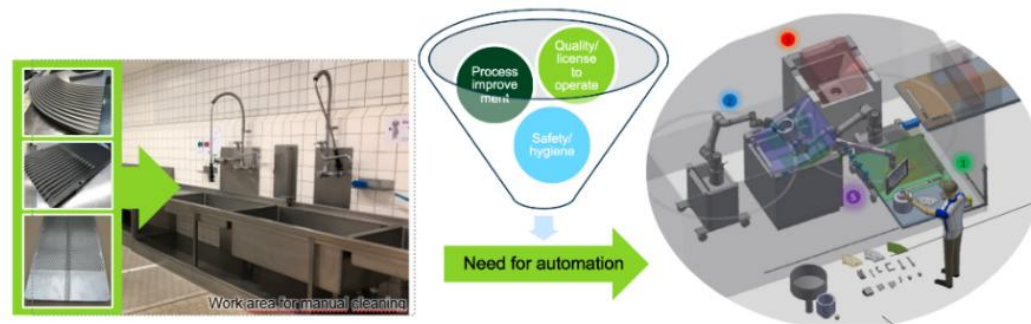
Multifunctional robots for handling tasks in industrial and logistics processes

- Universally applicable robot solutions for various logistics tasks in different settings, such as
 - Universal logistics robot for **transportation tasks**
 - Flexible handling robot for **machine tending** in production
 - Multifunctional robot for handling and operation in **laboratory environments**
- Challenges: universal task comprehension, world and process modelling; adequate perception, gripping, handling and placing skills



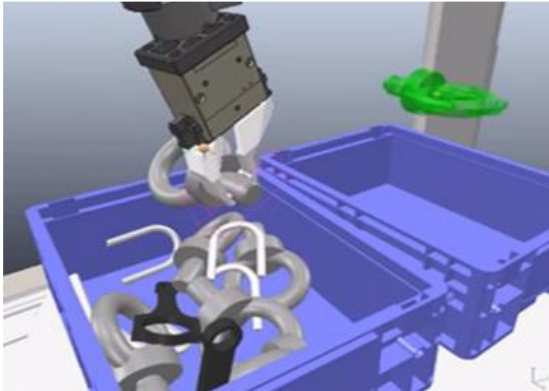
Robot system for cleaning production equipment in the pharmaceutical industry

- Automation of the periodical cleaning of pharmaceutical production parts by universal handling and cleaning solutions

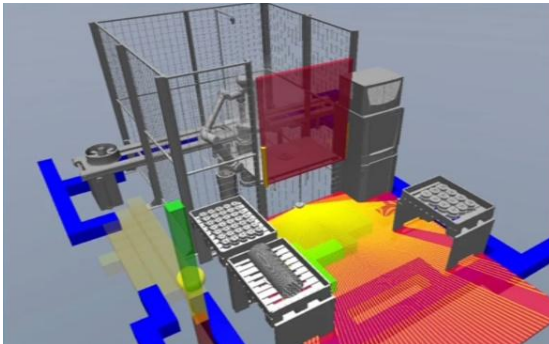


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Details – UC4 Commissioning



In this application aspect, the focus is on using **AI to speed up and reduce costs during the commissioning or reconfiguration of robotic systems and applications**, which is what makes **variant-flexible** and **economical automation** possible in the first place. Depending on the application, the process also includes the commissioning of automatic tool changers, human/robot collaboration (HRC) or robot/robot interaction (RRI).



AI-supported design and commissioning: system configuration and safety

- AI-based assistants for simplifying and accelerating solution design, programming, commissioning, safety design and validation, and documentation of robotic solutions



Commissioning/teaching new use cases for production & logistics

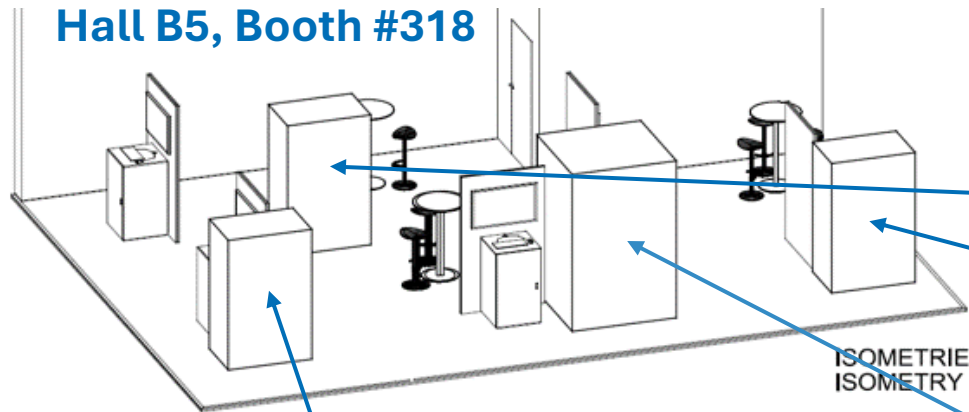
- Techniques like simulation, imitation learning, transfer learning and foundation models for swift and simple setup or adaptation of novel applications

Commissioning and optimization of motion processes in static multi-robot systems

- Tools and methods for efficient search and transfer of previous solutions to novel multi robot setups, e.g. for painting robot lines

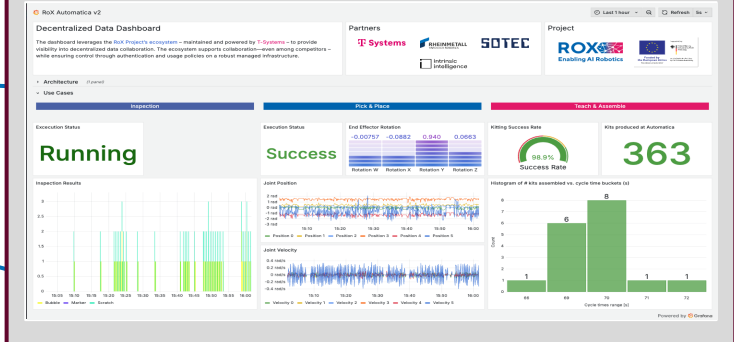
Automatica 2025: Three live demos plus ecosystem dashboard

Hall B5, Booth #318



Ecosystem Dashboard

First ecosystem app visualizes new data for symptom and diagnostics analytics



Teach & Assemble

AI-powered robot learns kitting layouts by observation, enabling autonomous assembly based on user-defined examples



Dynamic Pick & Place

AI-powered robot uses CAD models for dynamic object recognition and pick & place in unstructured environments



Quality Inspection

AI-powered robot performs quality inspection, enabling automated path planning and an intuitive user interface



See me at
Hannover
Messe 2026

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See me at
Hannover
Messe 2026

ROX
Enabling AI Robotics

Internal use only

Decentralized Data Dashboard

The dashboard leverages the [RoX Project's ecosystem](#) – maintained and powered by [T-Systems](#) – to provide visibility into decentralized data collaboration. The ecosystem supports collaboration—even among competitors – while ensuring control through authentication and usage policies on a robust managed infrastructure.

Partners



Project



Architecture (1 panel)

Use Cases

Inspection

Pick & Place

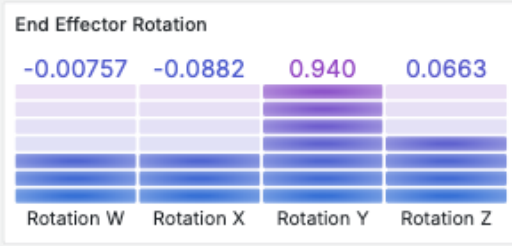
Teach & Assemble

Execution Status

Running

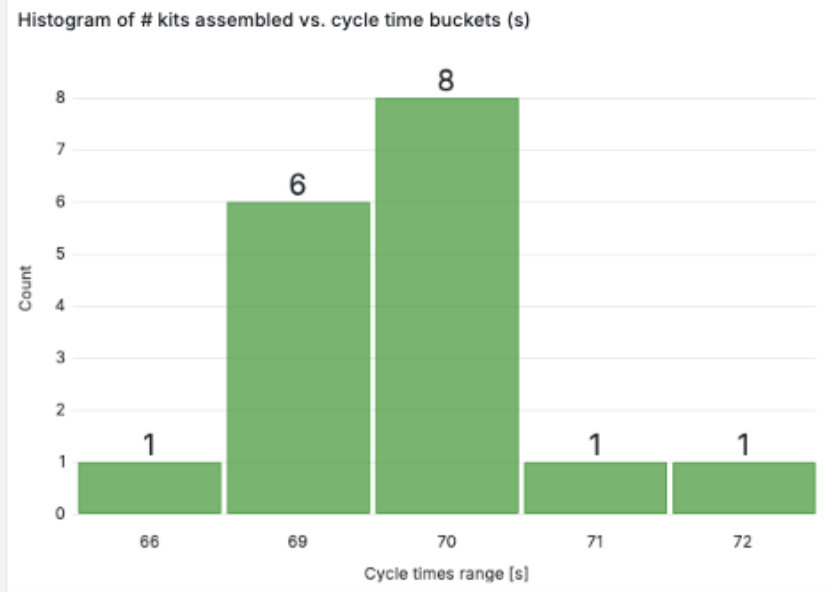
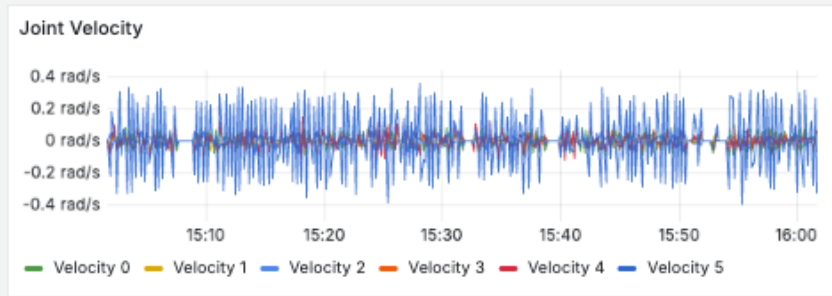
Execution Status

Success



Kits produced at Automatica

363



Properties

Details

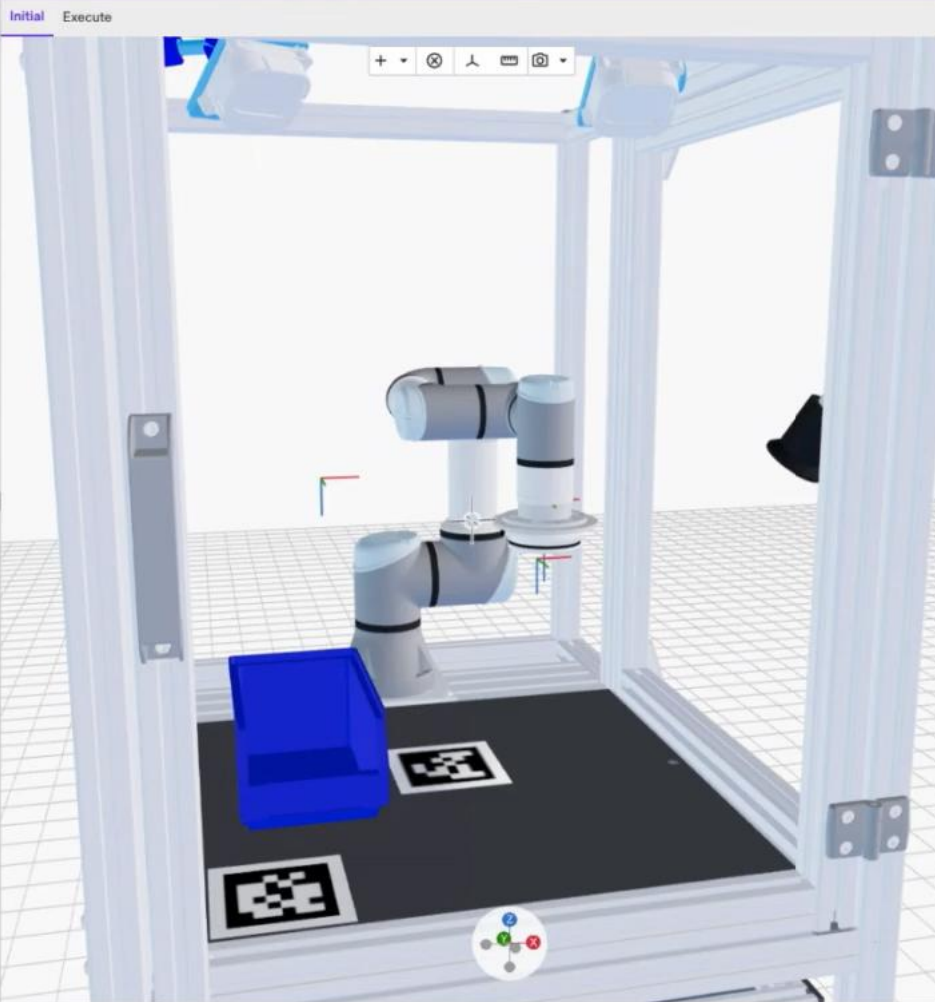
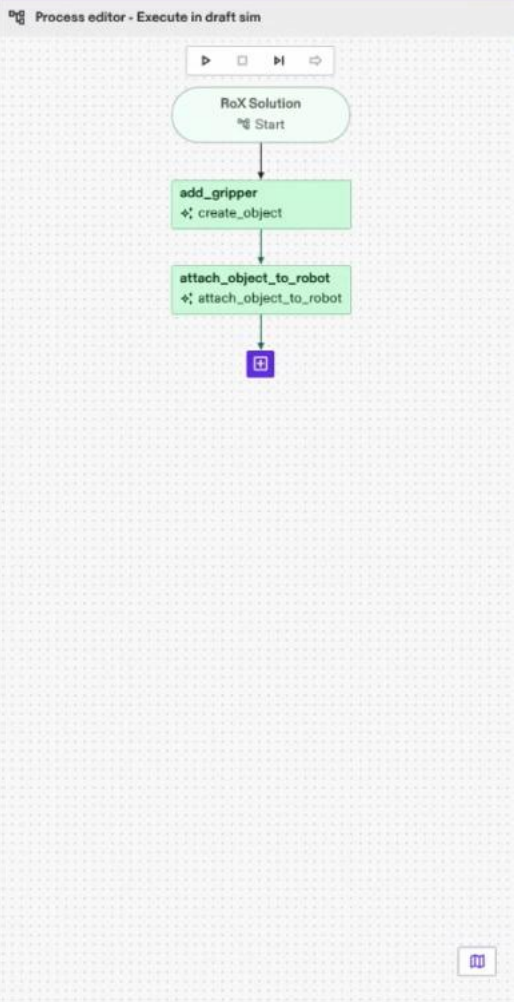
Metadata

Name: RoX Asset Service
Version: 0.0.1+2375b28cec91075d4f5c37235e06634f3d715628ead1b76f3ad7381a28
Type: Service
Tag: None
ID: rox.intrinsic.rox_asset_service

Description
A flowstate service that connects to the RoX dataspaces to download new assets and install them in a Flowstate solution. Install assets via the provided HMI at /ext/services/rox_asset_service.

History

- Created asset rox_asset_service Not undoable
- select node
- deselect node
- Created asset rox_asset_service Not undoable



Scene Services

Search

- Scene
 - adaptor_plate
 - box
 - enclosure
 - my_camera
 - ur3e_robot
 - validation_marker1
 - validation_marker2
 - start_frame
 - move_target

Installed assets

Back

Refresh

Search by asset name...

- Basic object spawner
- RoX Asset Service**
- Universal Robots real-time control service

Output

Variables Recordings

Current Run

6/16/25, 6:29 PM

Execution Time 00h 00m 00.126s

Executive state Succeeded

Process name RoX Solution

Sequence List

The sequence list contains all skills executed during the current run, in order. It may take a while to load on long runs.

Load sequence list

Errors

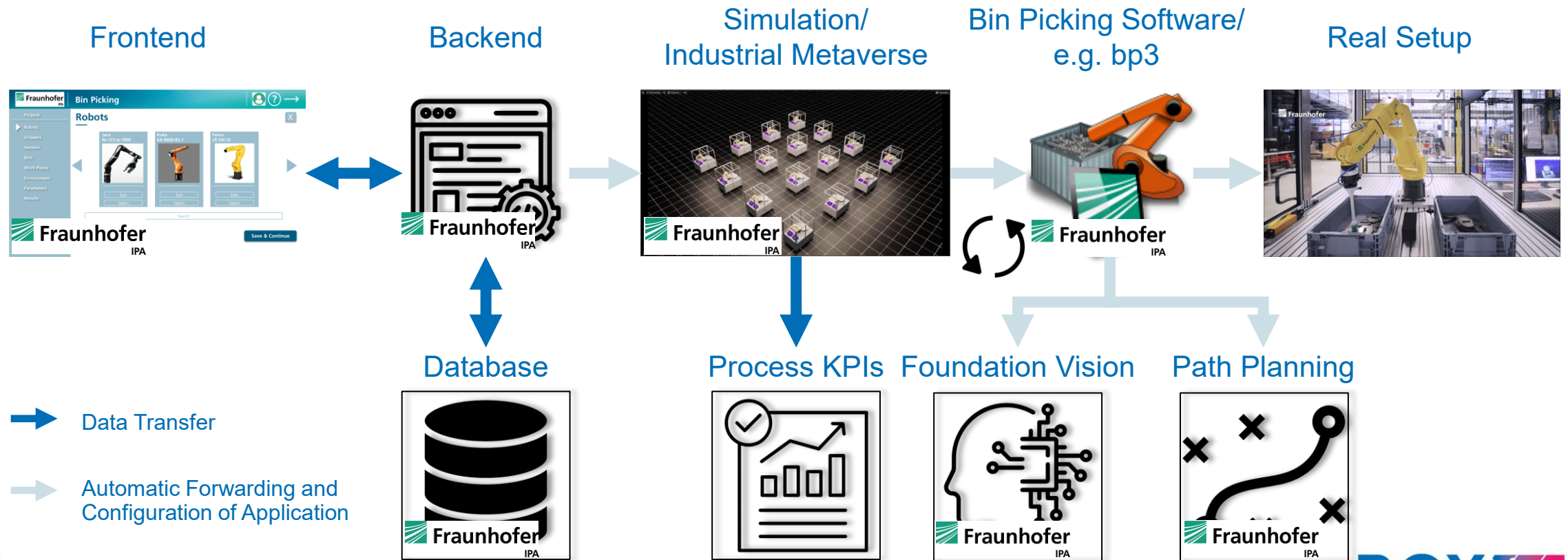
No errors to display

Fraunhofer IPA Pipeline for Bin Picking Projects

Step 1: Intuitive Setup of Bin Picking Task via Web Client

Step 2: Automatic Bin Picking Configuration in Physics Simulation and Setup of Programs

Step 3: Application of Results



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Connection to Data Ecosystem

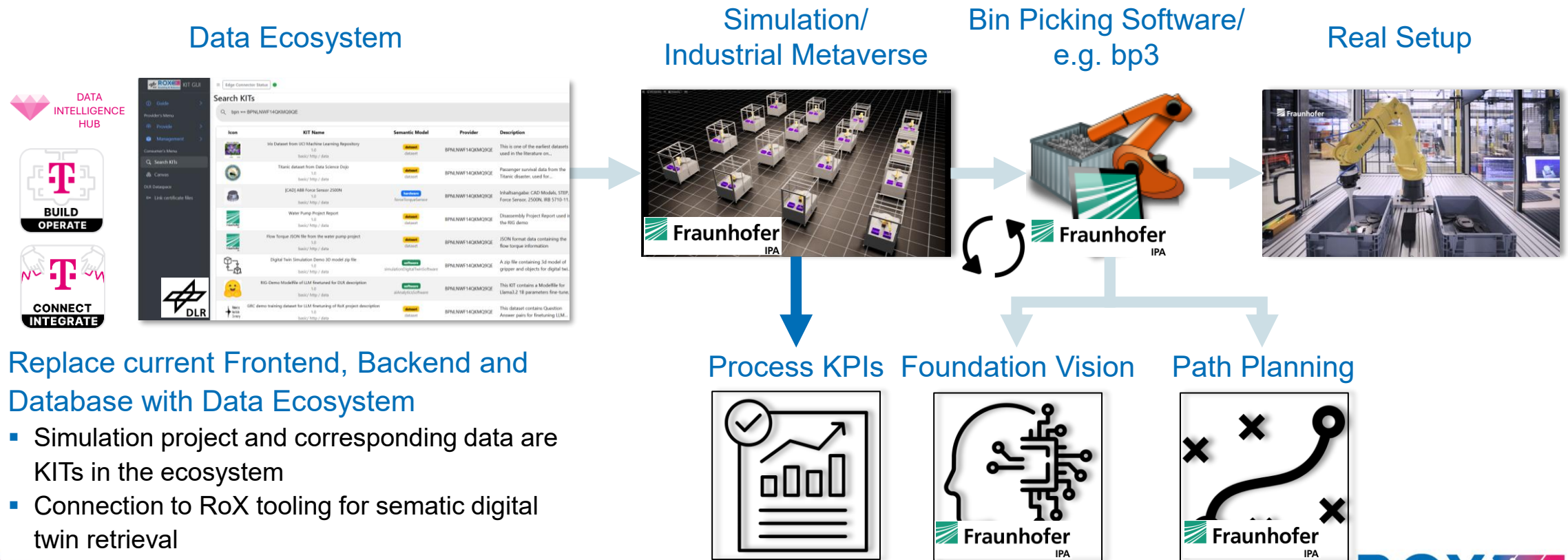
Step 1: Get Data from Data Ecosystem



Step 2: Automatic Bin Picking Configuration in Physics Simulation and Setup of Programs



Step 3: Application of Results



Connection to Data Ecosystem

Icon	KIT Name	Semantic Model	Provider	Description	Actions
	Iris Dataset from UCI Machine Learning Repository 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	This is one of the earliest datasets used in the literature on...	
	Titanic dataset from Data Science Dojo 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	Passenger survival data from the Titanic disaster, used for...	
	[CAD] ABB Force Sensor 2500N 1.0 basic/ http / data	software forceTorqueSensor	BPNNLWF14QKM9QE	Inhaltsangabe: CAD Models, STEP, Force Sensor, 2500N, IRB 5710-11...	
	Water Pump Project Report 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	Disassembly Project Report used in the RIG demo	
	Flow Torque JSON file from the water pump project 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	JSON format data containing the flow torque information	
	Digital Twin Simulation Demo 3D model zip file 1.0 basic/ http / data	software simulationDigitalTwinSoftware	BPNNLWF14QKM9QE	A zip file containing 3d model of gripper and objects for digital tw...	
	RIG-Demo Modellfile of LLM finetuned for DLR description 1.0 basic/ http / data	software aiAnalyticsSoftware	BPNNLWF14QKM9QE	This KIT contains a Modellfile for Llama3.2 1B parameters fine-tune...	
	GRC demo training dataset for LLM finetuning of RoX project description 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	This dataset contains Question Answer pairs for finetuning LLM...	
	CFAR-10 dataset 1.0.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	Famous CFAR-10 dataset binary version specifically prepared for C...	
	[3D Model] Beast by Autodesk 1.0 basic/ http / service	dataset	BPNNLWF14QKM9QE	This is a 3D model of a Gorilla-looking-like beast provided by th...	
	CFAR dataset testing 1.0.0 basic/ http / data	-	BPNNLWF14QKM9QE	asdf	
	GRC demo training dataset for LLM finetuning of DLR info 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	This dataset contains Question Answer pairs for finetuning LLM...	
	WLO Water Pump Image 0 basic/ http / data	dataset	BPNNLWF14QKM9QE	This is a water pump image as an example of the data acquisition...	
	Screw Curve description in JSON format 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	JSON file that contains the physical attributes of a screw	
	Optimization_4_S7_2026-02-26_13-24-42.zip 1.0 basic/ http / data	software simulationDigitalTwinSoftware	BPNNLWF14QKM9QE	A zip file containing 3d model of gripper and objects for kitting us...	
	RIG-Demo GGUF file LLM finetuned for DLR description 1.0 basic/ http / data	software aiAnalyticsSoftware	BPNNLWF14QKM9QE	This KIT contains a GGUF file for Llama3.2 1B parameters fine-tune...	
	[RIG-Demo] Llama3.2 LLM finetuned for RoX Modellfile 1.0 basic/ http / data	software aiAnalyticsSoftware	BPNNLWF14QKM9QE	This KIT contains Modellfile for the finetuned Llama3.2 for the RoX...	
	Wine Quality Dataset for Red Wine 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	The two datasets are related to red and white variants of the...	
	Wine Quality Dataset for White Wine 1.0 basic/ http / data	dataset	BPNNLWF14QKM9QE	The two datasets are related to red and white variants of the...	



KIT GUI (Asset Explorer) can connect to RoX-Dataspace deployed by T-Systems Data Intelligence Hub.



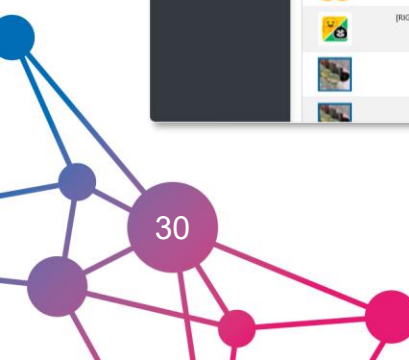
Infrastructure where the KIT GUI from DLR can be deployed.



Secure exchange of the KITs between the partners is done via the managed connectors deployed on Data Intelligence Hub.

KIT Includes

- Model environment
- Model bin
- Model gripper
- Model robot
- Model workpiece
- Configuration application
- Configuration simulation

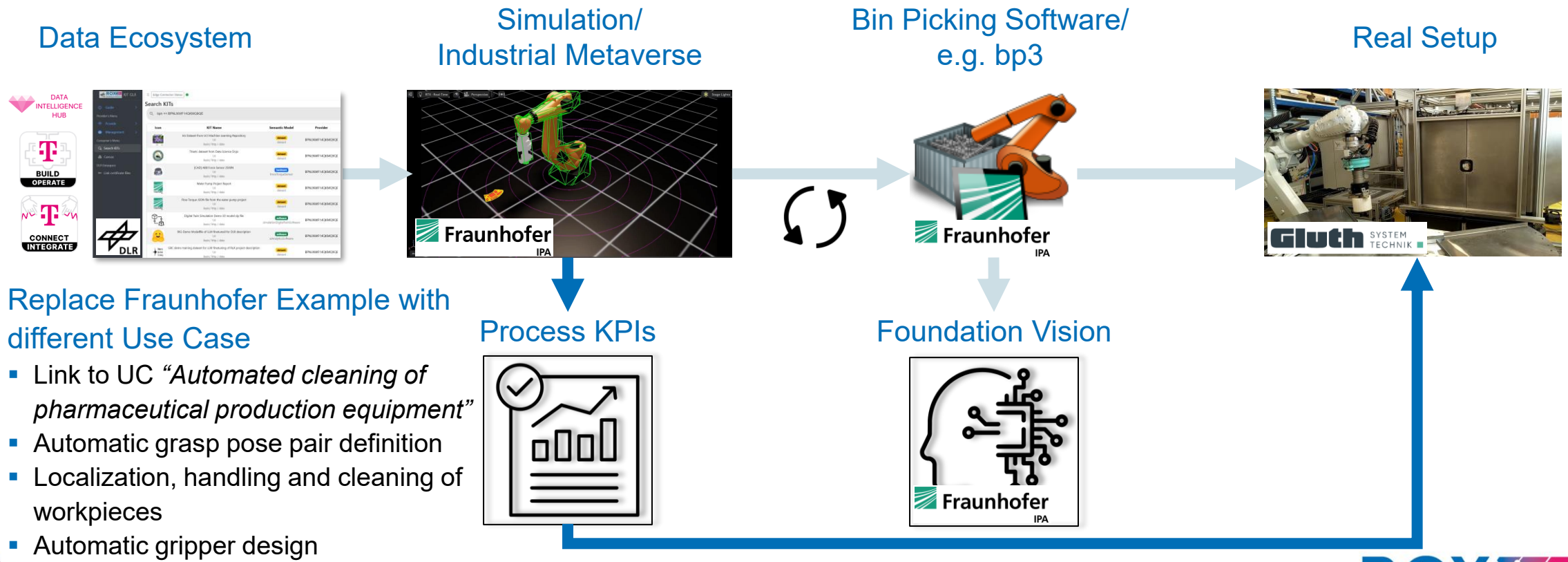


Connection to Robot Application Design

Step 1: Get Data from Data-Ecosystem

Step 2: Automatic Bin Picking Configuration and Testing of Path Planner

Step 3: Application of Results

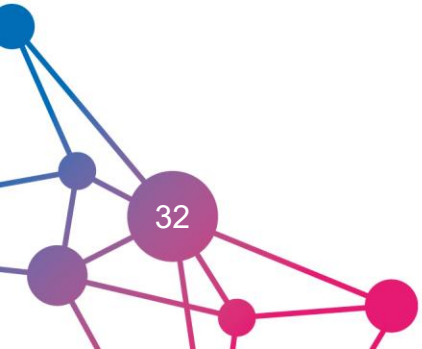
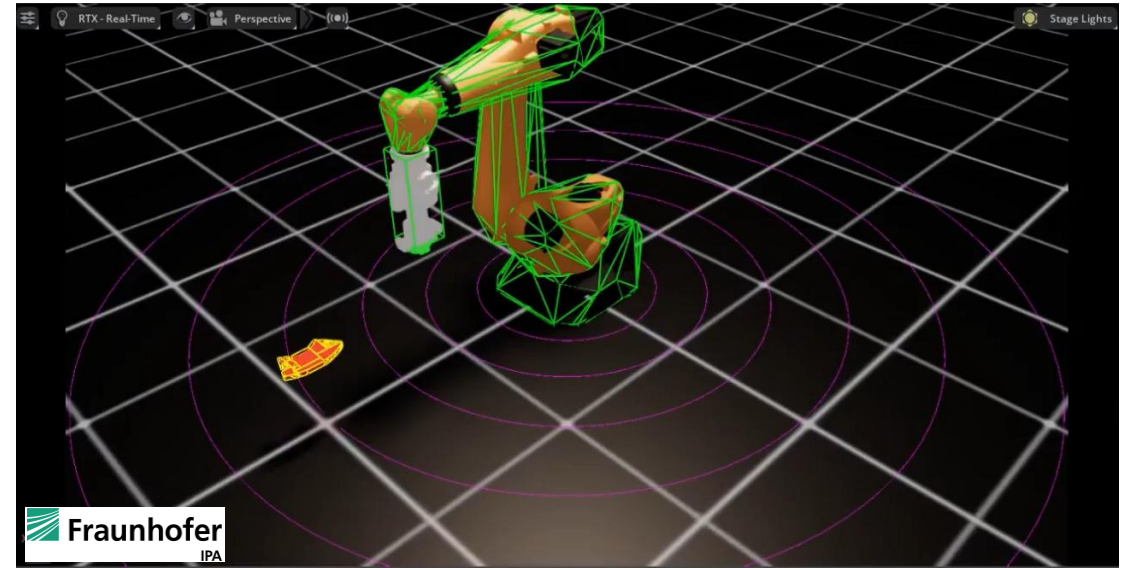
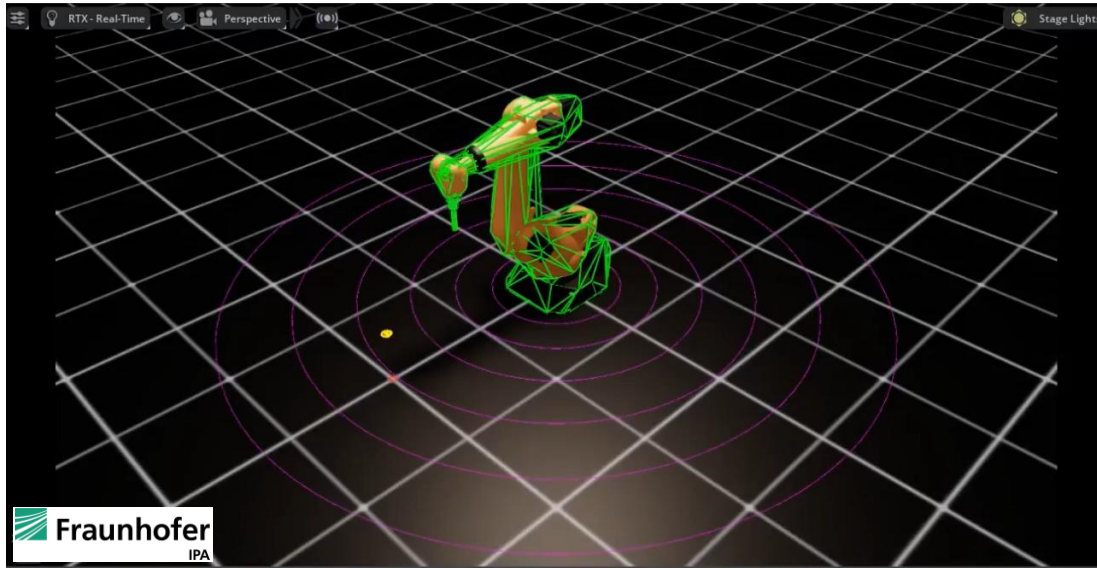


Replace Fraunhofer Example with different Use Case

- Link to UC “Automated cleaning of pharmaceutical production equipment”
- Automatic grasp pose pair definition
- Localization, handling and cleaning of workpieces
- Automatic gripper design

Connection to Robot Application Design

Physical simulation of grasp pose definition optimization:

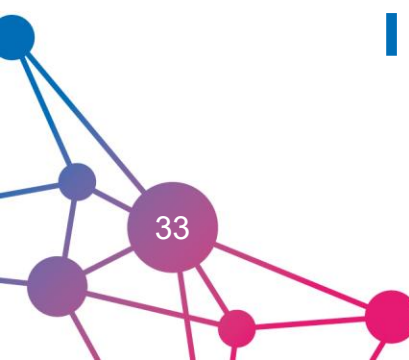
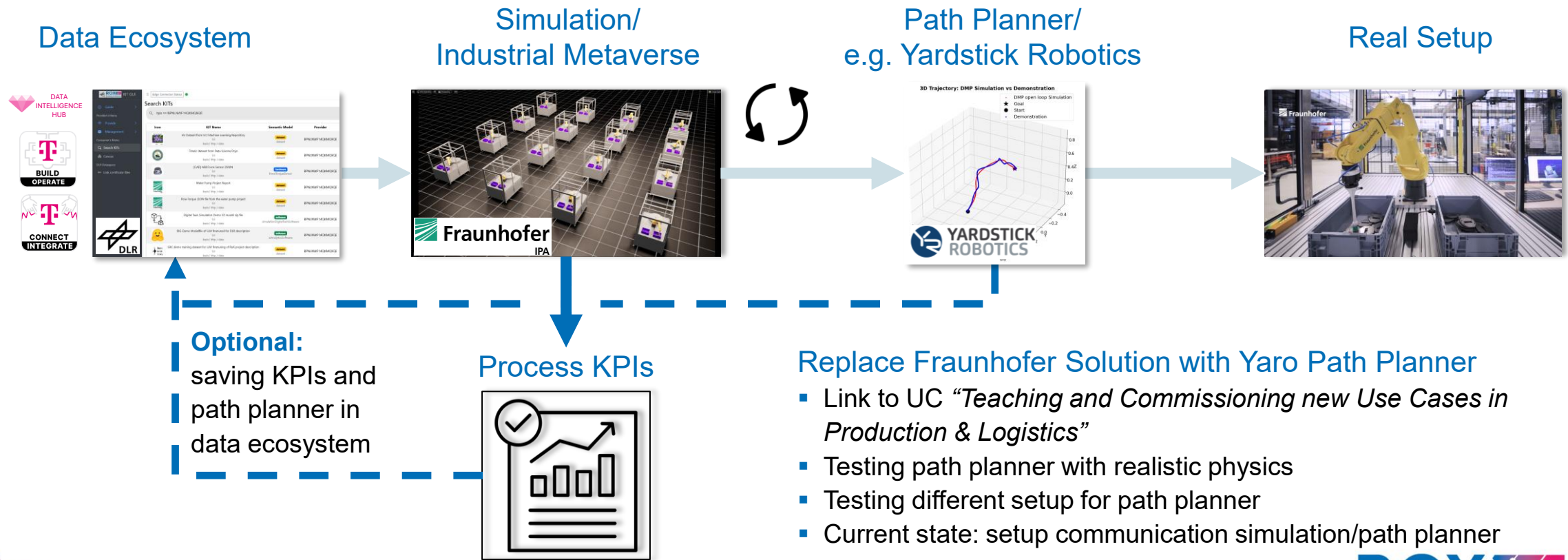


Connection to Path Planning and Controlling

Step 1: Get Data from Data-Ecosystem

Step 2: Automatic Bin Picking Configuration and Testing of Path Planner

Step 3: Application of Results



Model-free Item Picking and 3D Bin Packing for Arbitrarily-Shaped Objects - Pick&Pack with up to 1300 cycles per hour

See me at
Hannover
Messe 2026

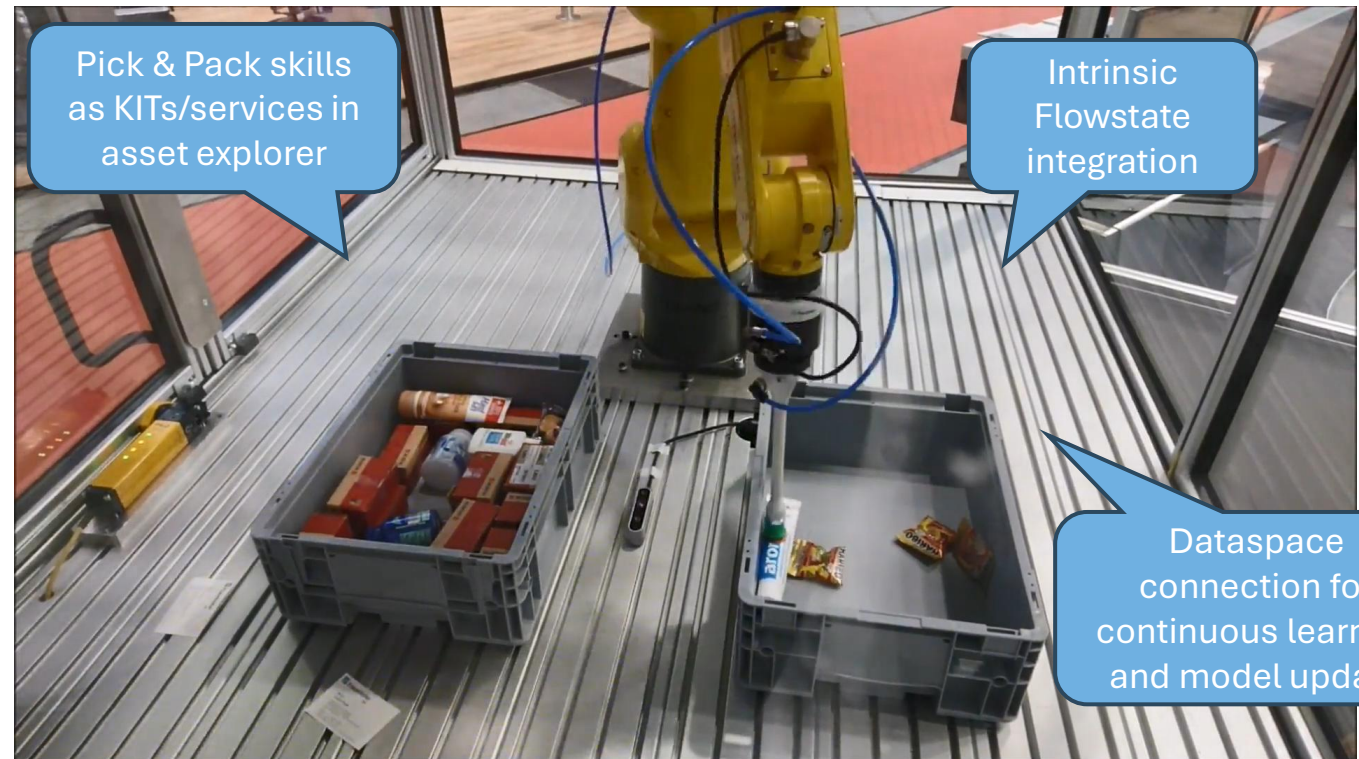
Flexible planning for model-free 3D Bin Packing Applications of arbitrarily shaped unknown objects

- Ad-hoc planning (**no master data**) within ~50ms
- **6-DoF planning** in all rotations, **stability checks**
- **Ready-to-use**, supports individual or learned placement rules

Global planning for known 3D free-form objects

- Static planning for **globally optimized packing patterns** and **packing sequences** in **6 DoF**

- **Order fulfillment, restocking, palletizing, end-of-line packaging, truck and container loading, aircraft loading, roll cage loading, ...**



Pick & Pack skills as KITS/services in asset explorer

Intrinsic Flowstate integration

Dataspace connection for continuous learning and model update

<https://youtu.be/eJ3iknylJ3o>

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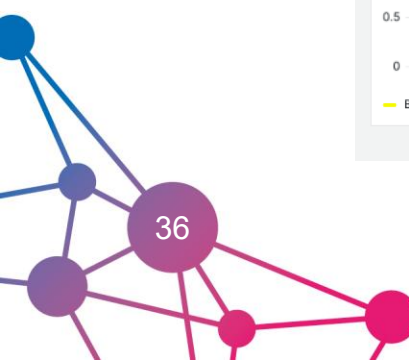
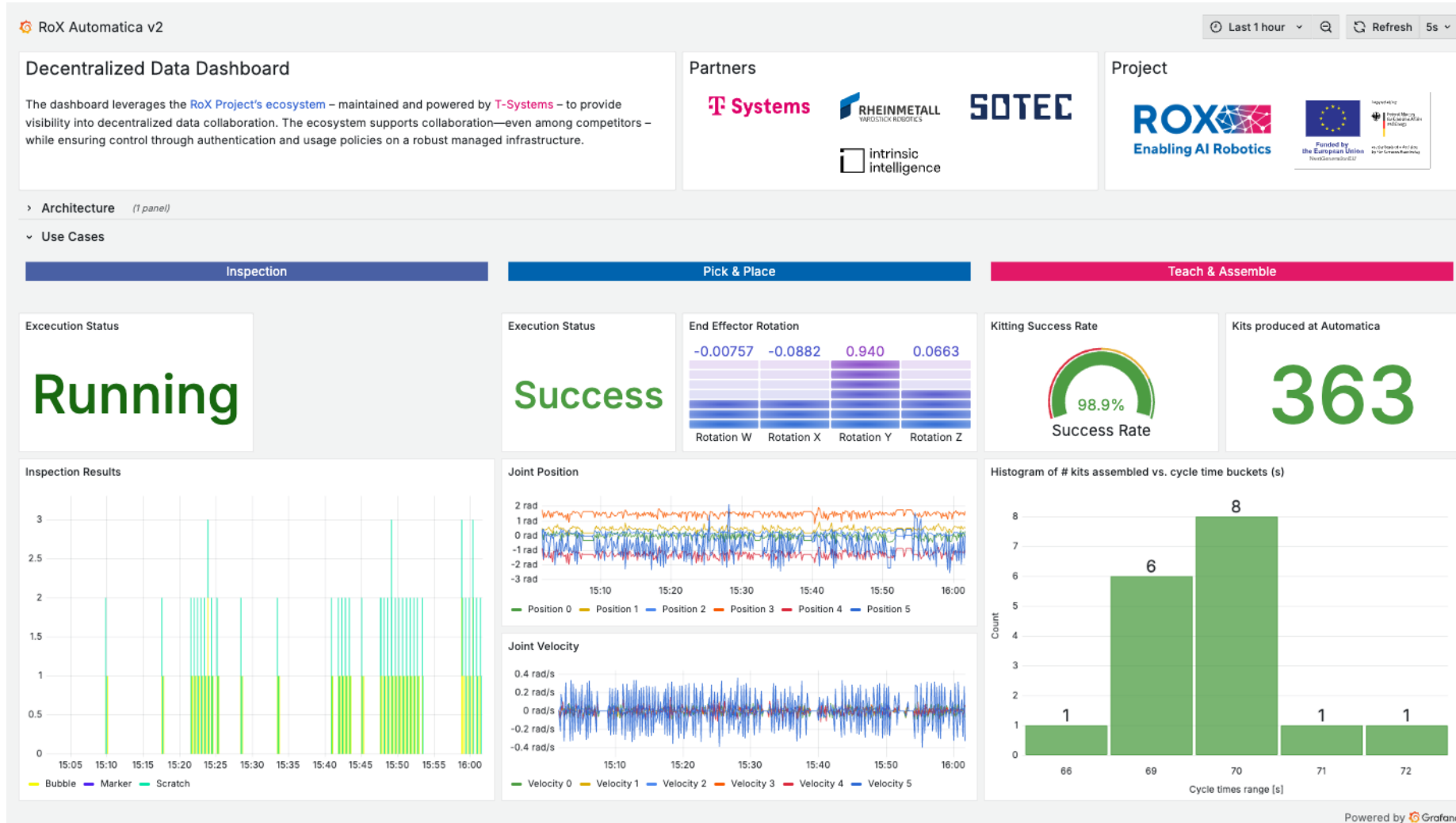
Dataspace-as-a-Service

Nikhil Vinod Mallela

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Internal use only

Automatica 2025: Decentralized data dashboard



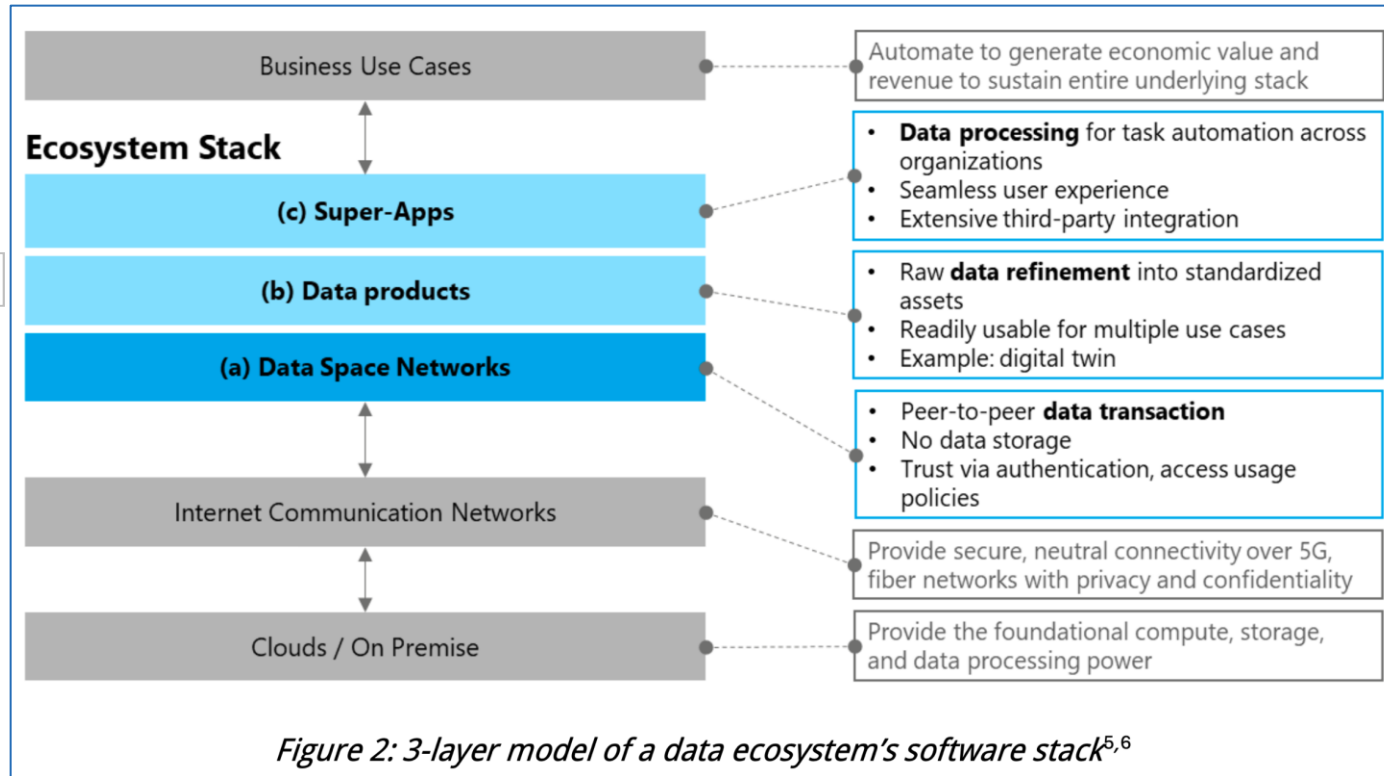
36

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Data ecosystem: Advantages, software stack, how to prepare to participate

Data ecosystems are built on game-changing infrastructure for secure, trustful cross-organizational data sharing at scale. They fuel digital transformation—not just with ‘Big Data,’ but better data—for Gen AI and modern apps.



ECOSYSTEM properties

1. An economic community where the whole exceeds the sum of its parts
2. Cooperation with competitors
3. Distributed system with flexibility and resilience

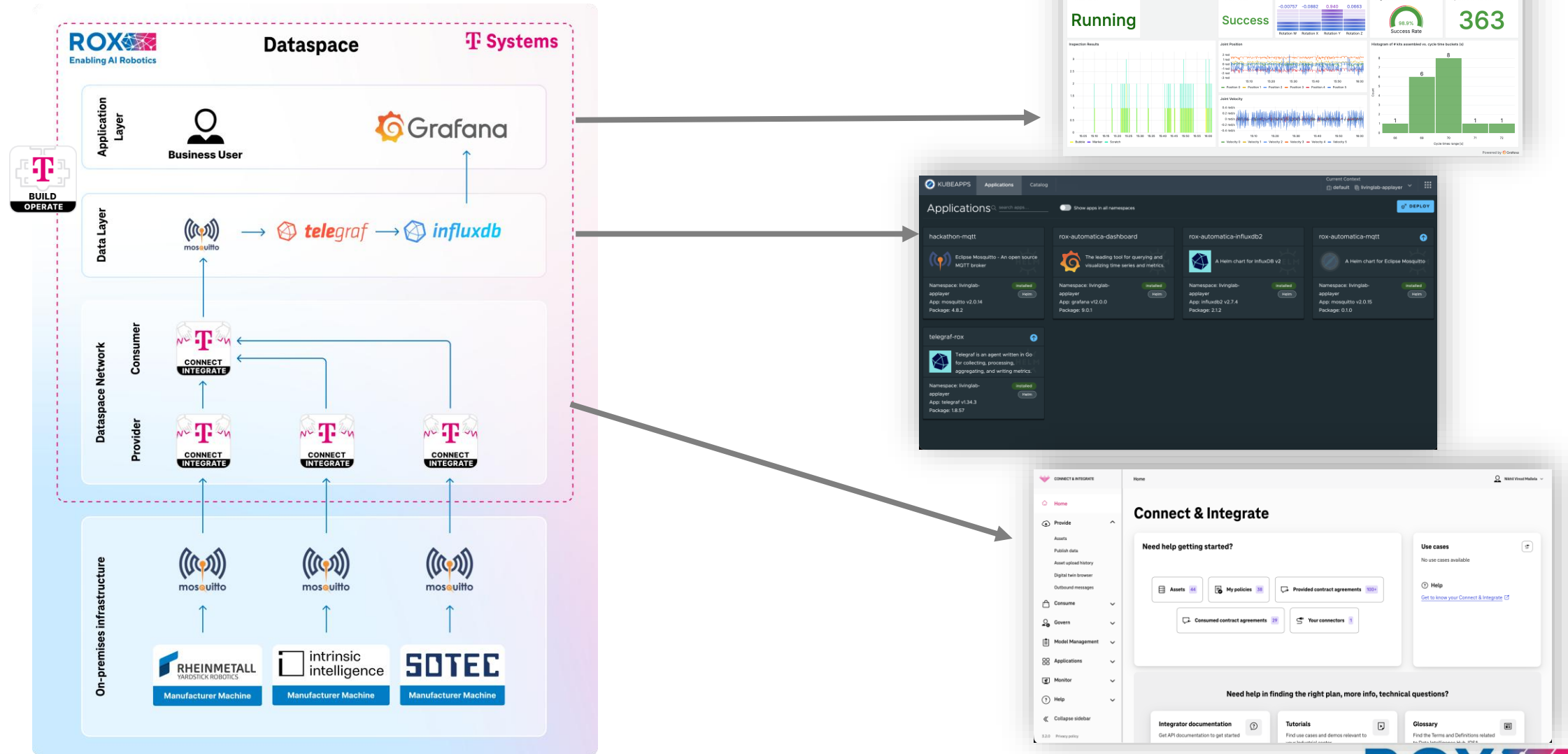
Data SOVEREIGNTY mechanisms

1. Authentication → Passport, verification ...
2. Access control → White/ blacklist
3. Usage policy → Legally binding contract

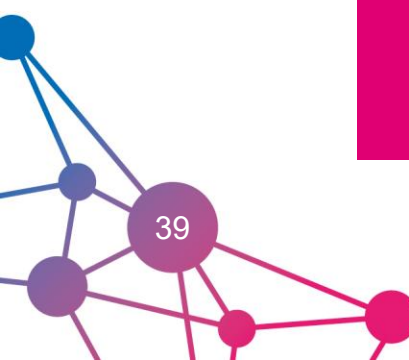
⁵ Mertens C. 2025. *Establishing a Unified, Sovereign, and Open Digital Infrastructure. Position Paper (March)*, International Data Spaces Association, Dortmund, [link](#), Fig. 2, p. 10

⁶ Guggenberger, T. M., C. Schlueter Langdon, and B. Otto. 2025. "Data Spaces as Meta-Organisations." *European Journal of Information Systems*, January: 1–21, [link](#)

Automatica 2025: Data flow & Architecture



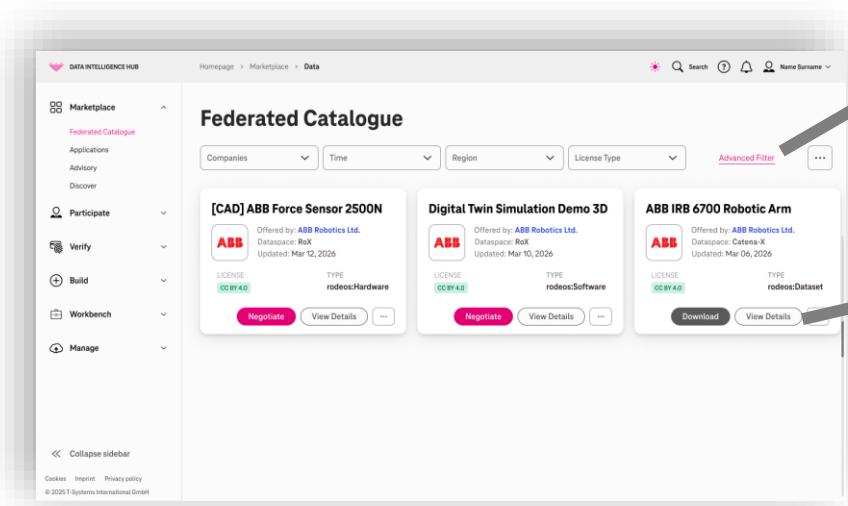
Build & Operate: Demo



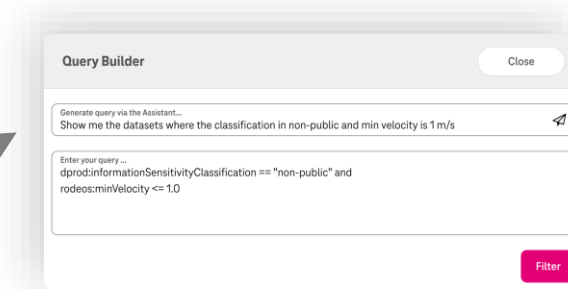
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HMI2026: Sneak peek

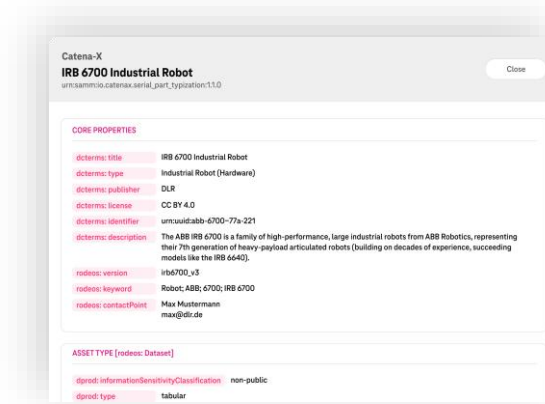


DIH Federated Catalogue
DIH Federated Catalogue displays the assets across all the Dataspaces and across all semantic models.



Accurate Asset Retrieval

Asset creation with standardized semantic models enables accurate asset retrieval using LLMs.

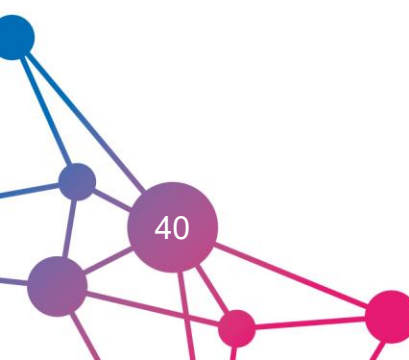


Asset Details

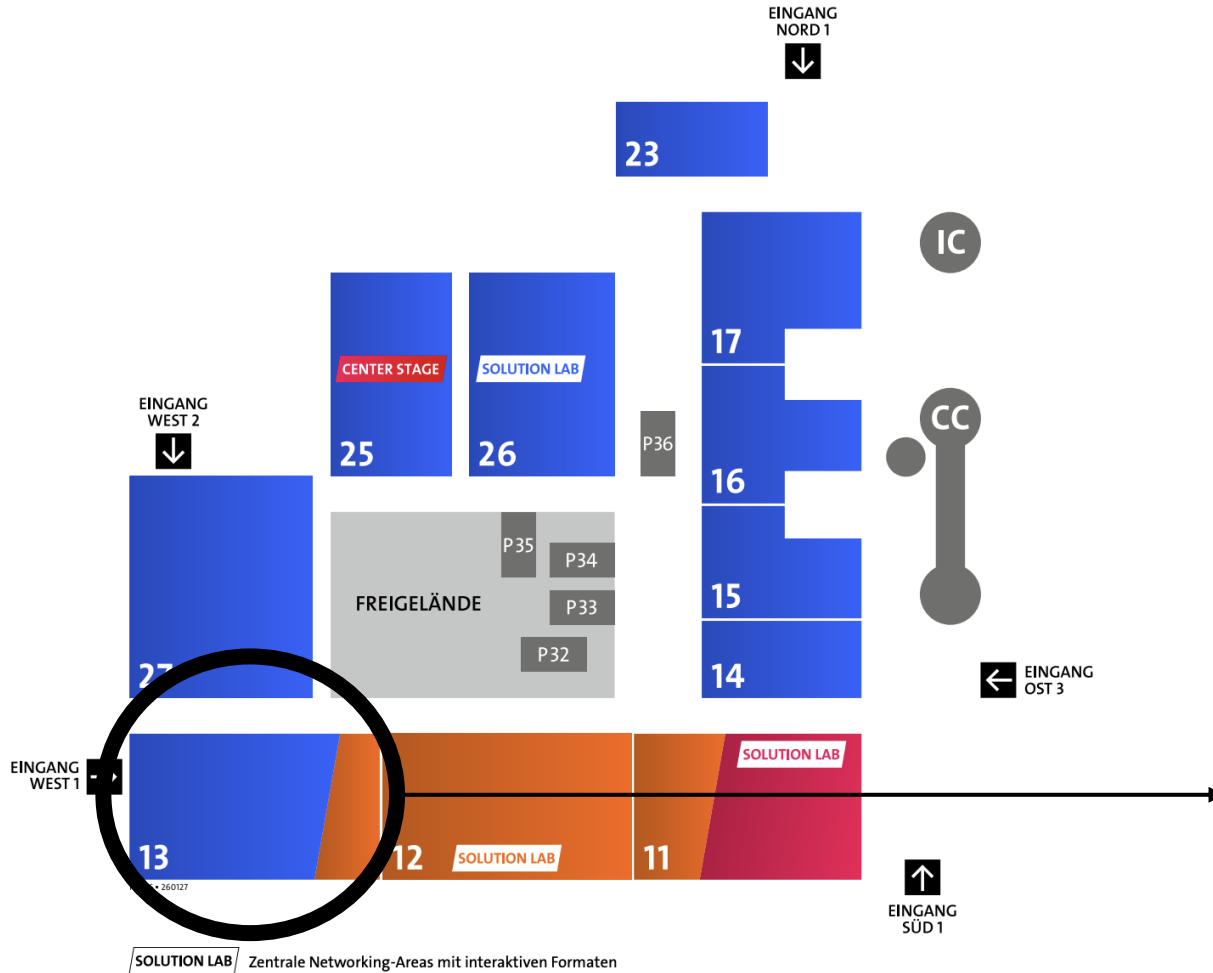
Asset details represented with appropriate ontology terms as seen in the DIH Federated Catalogue.



Physical Deployment



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Thank you

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