ROBO TT NET

robot technology transfer network

Stuttgart, January 2020




Quelle: Fraunhofer IPA, Audi

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Fraunhofer IPA

Fraunhofer IPA

Technology consultant and innovation driver since 1959

- One of the largest institutes of the Fraunhofer-Gesellschaft
- 70.8 mil EUR budget, 25.8 from industry
- More than 1,100 employees (450 researcher)

New technical center "Gebäude D" in Stuttgart

Application Center Industrie 4.0

Motion laboratory

BioPoLis

Biomanufacturing laboratory

Factory planning cockpit

Electroplating laboratory

Intervention room

Coating technology center

Production laboratory

Cleanrooms & cleanliness rooms

Robotics experimentation area

Synthesis & reactor park

Note: key figures for 2016; IPA Stuttgart including locations in Rostock, Mannheim, Bayreuth and Vienna

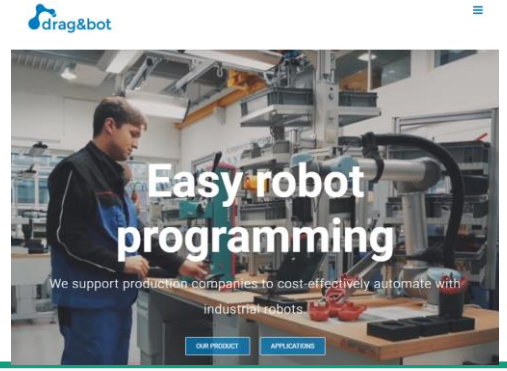
Fraunhofer IPA

Tech transfer in industrial robotics: examples of robot end-effector developments since 1973 (>150)

→"Milestones of robotics" exhibition at IPA

Fraunhofer IPA
Robot and Assistive Systems

- Department (320 - Dr. Werner Kraus) 7 groups, with focus on:
  - Handling and Intralogistics (321 – Richard Bormann)
  - Robot processes and kinematics (322 – Johannes Stoll)
  - Mobile Robotics (323 – Dr. Kai Pfeiffer)
  - Service Robotics (324 – Dr. Birgit Graf)
  - Robot Control (325 – Frank Nägele)
  - Software Eng. and System Int. (326 – Christoph Hellmann Santos)
  - Assembly Automation (327 – Ramez Awad)
- And a number of spin-offs, established and in the making, including Mojin Robotics and drag&bot



www.mojin-robotics.de

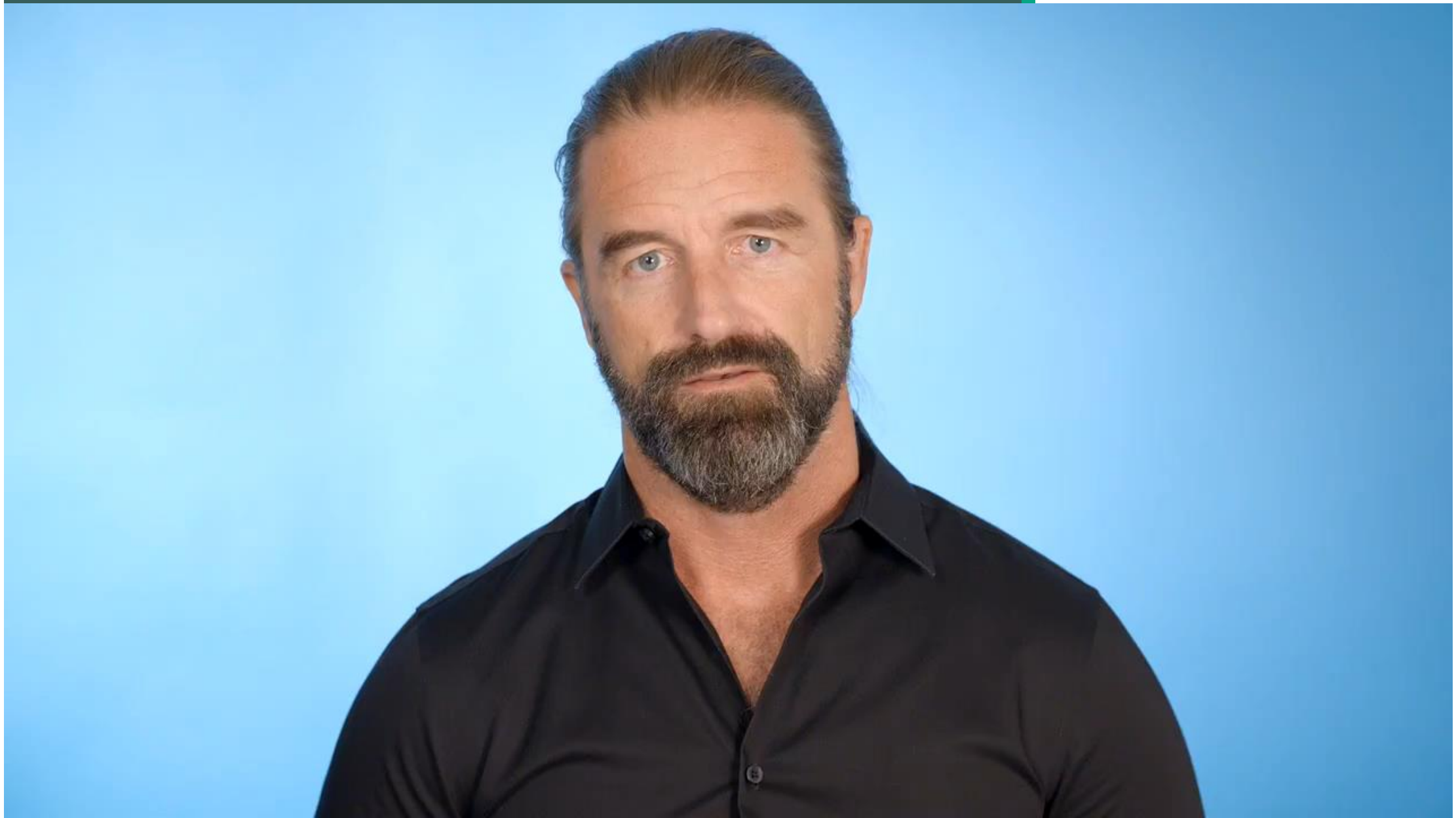
www.dragandbot.com

ROBO TT NET
robot technology transfer network

ROBOTT-NET

What is a ROBOTT-NET?

ROBO TT NET robot technology transfer network



https://youtu.be/9xZEJbhgwY0

ROBOTT-NET project

ROBOTT-NET exists to help make the best ideas in industrial robotics a reality; for the benefit of **technology developers** and **European manufacturing**.

ROBOTT-NET robot technology transfer network

www.robott-net.eu

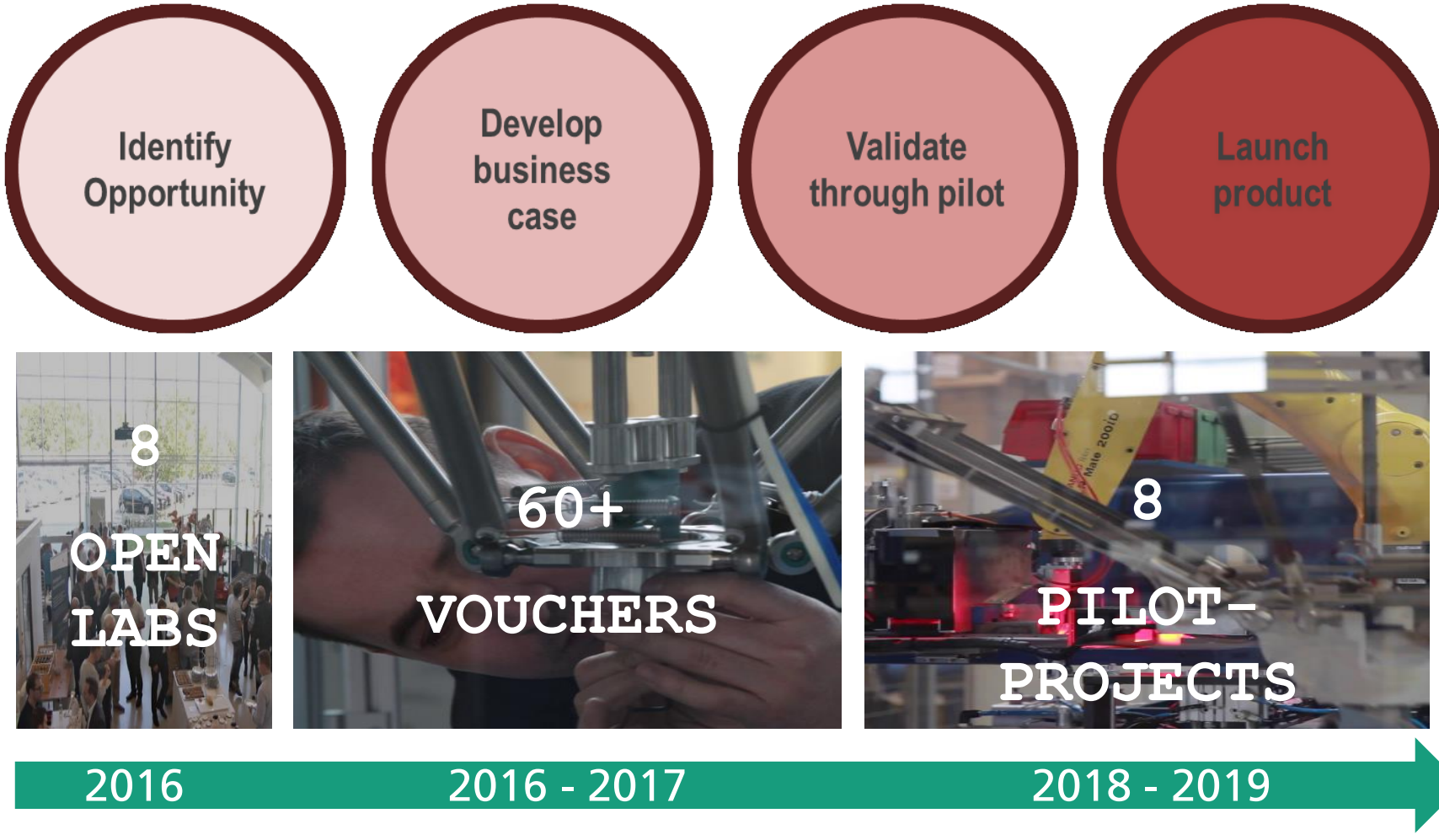
DANISH TECHNOLOGICAL INSTITUTE · Fraunhofer IPA · tecnalia · mtc Manufacturing Technology Centre

Project runtime: 01.01.2016 – 31.12.2019

What is ROBOTT-NET?

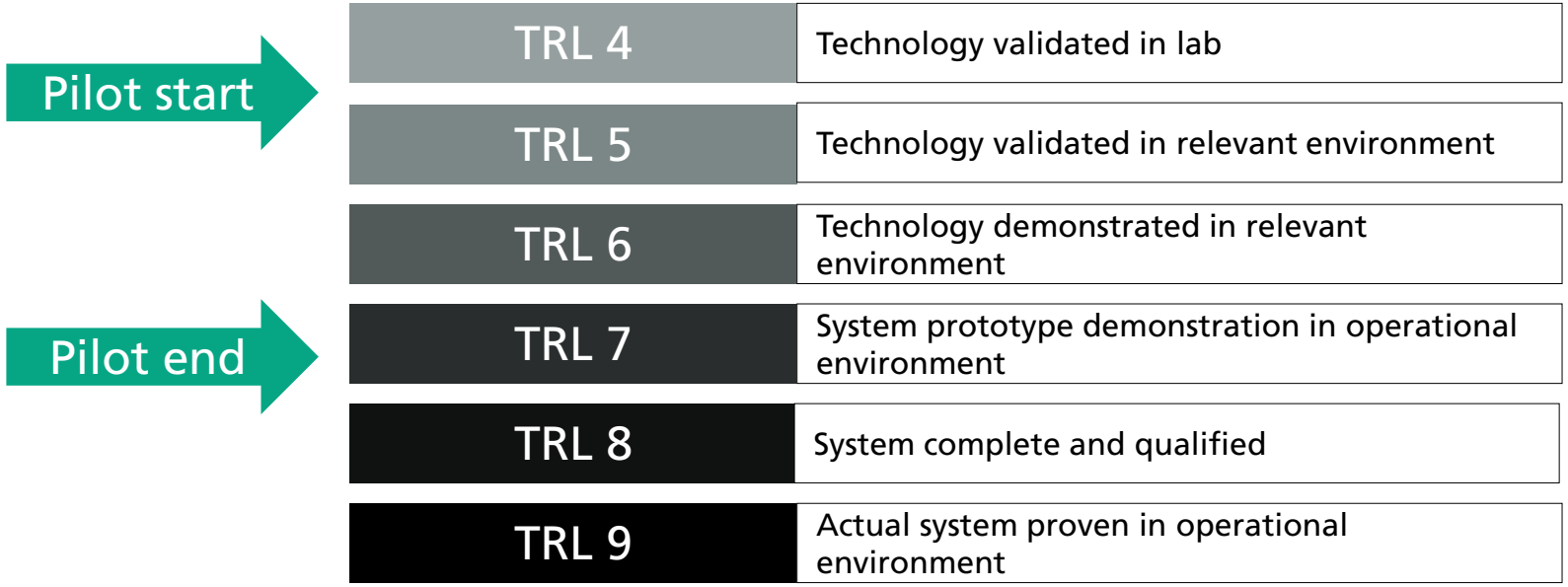
- ✓ **ROBOTT-NET offered consulting free of charge** to over 60 European companies that develop or deploy robot technology in industrial production.
- ✓ **ROBOTT-NET's mission** is to collect and share the latest knowledge about robot technology that can improve production, bring new ideas to market and ensure economic competitiveness.
- ✓ **ROBOTT-NET is driven by four Research Technology Organisations** in Denmark, Germany, Spain and England. Through hands-on consulting, business plan development and communication with investors, we help companies of all sizes bring their ideas to market and optimise production.
- ✓ **ROBOTT-NET works** with technology developers, startups, SMEs and established manufacturers as well as academics and investors.

ROBOTT-NET steps



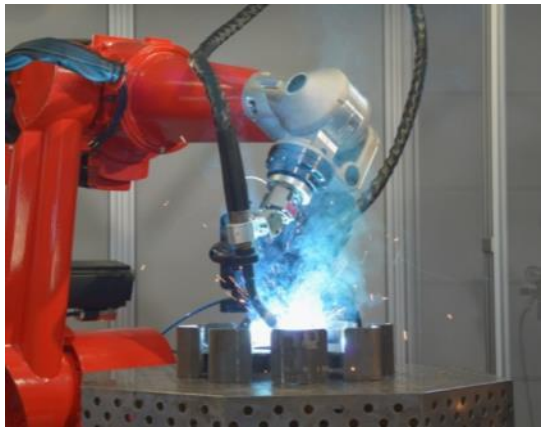
What is the goal of a ROBOTT-NET pilot?

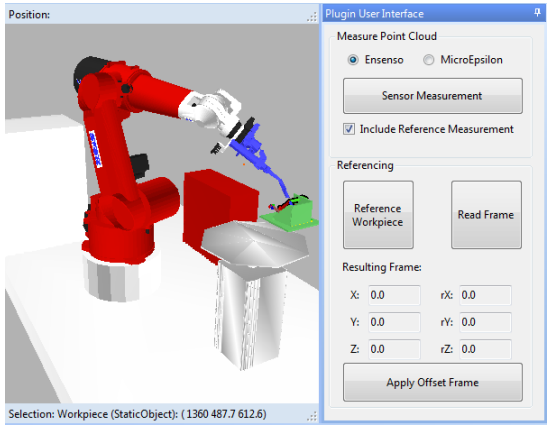
ROBOTT-NET goal: Achieve successful technology transfer from RTO lab to industry.



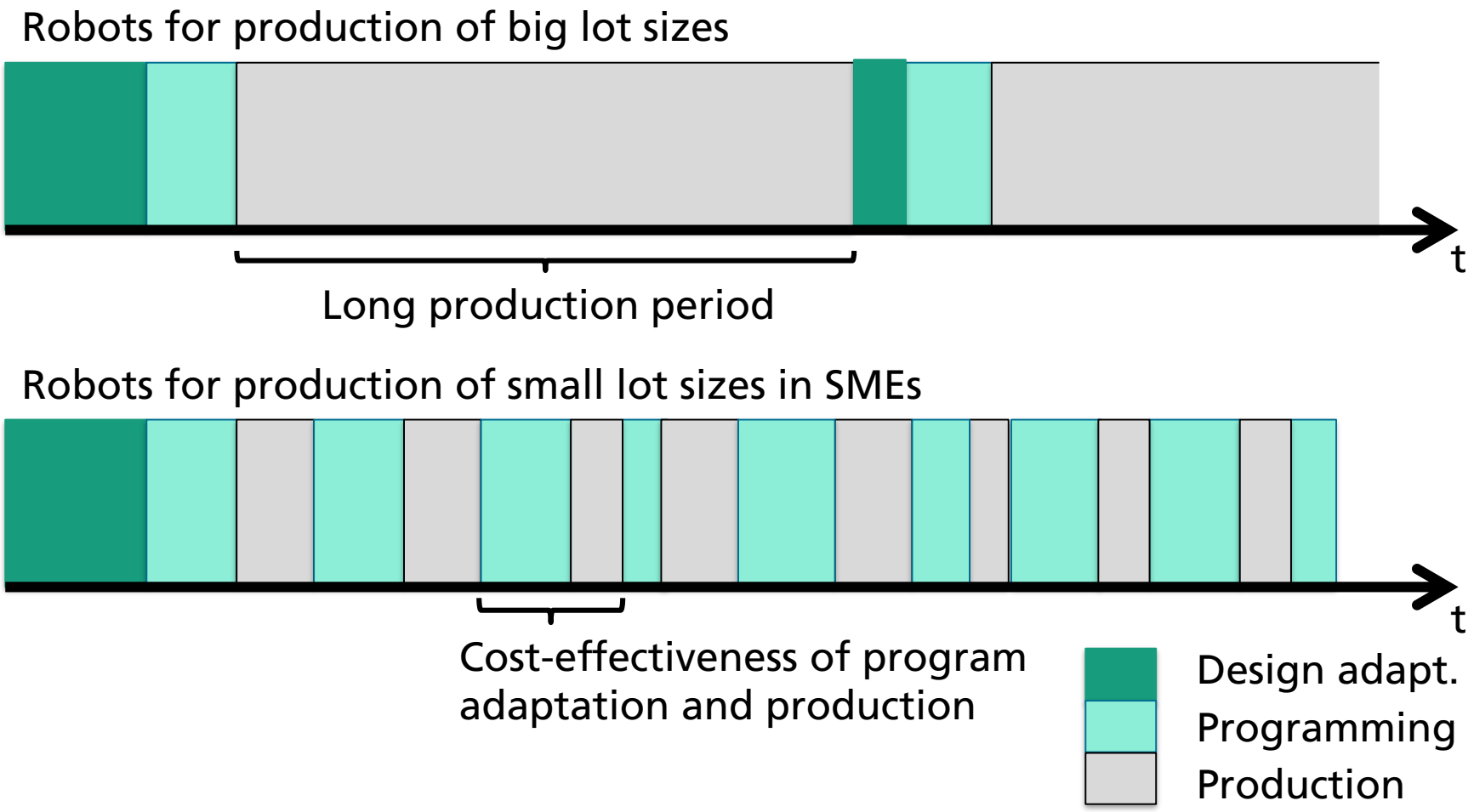
Goals of the pilot project AutoWELD

- The project „AutoWELD“ focusses on **cost-effective robotic welding for small lot sizes**
- In the pilot a well-established offline **programming software is combined with latest research results** in the area of cognitive functions and algorithmics
- Reduced programming time of welding robots will lead to a higher degree of automation in welding production sites, **especially in SME productions, due to a faster ROI**

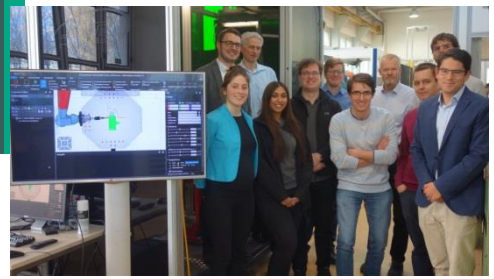




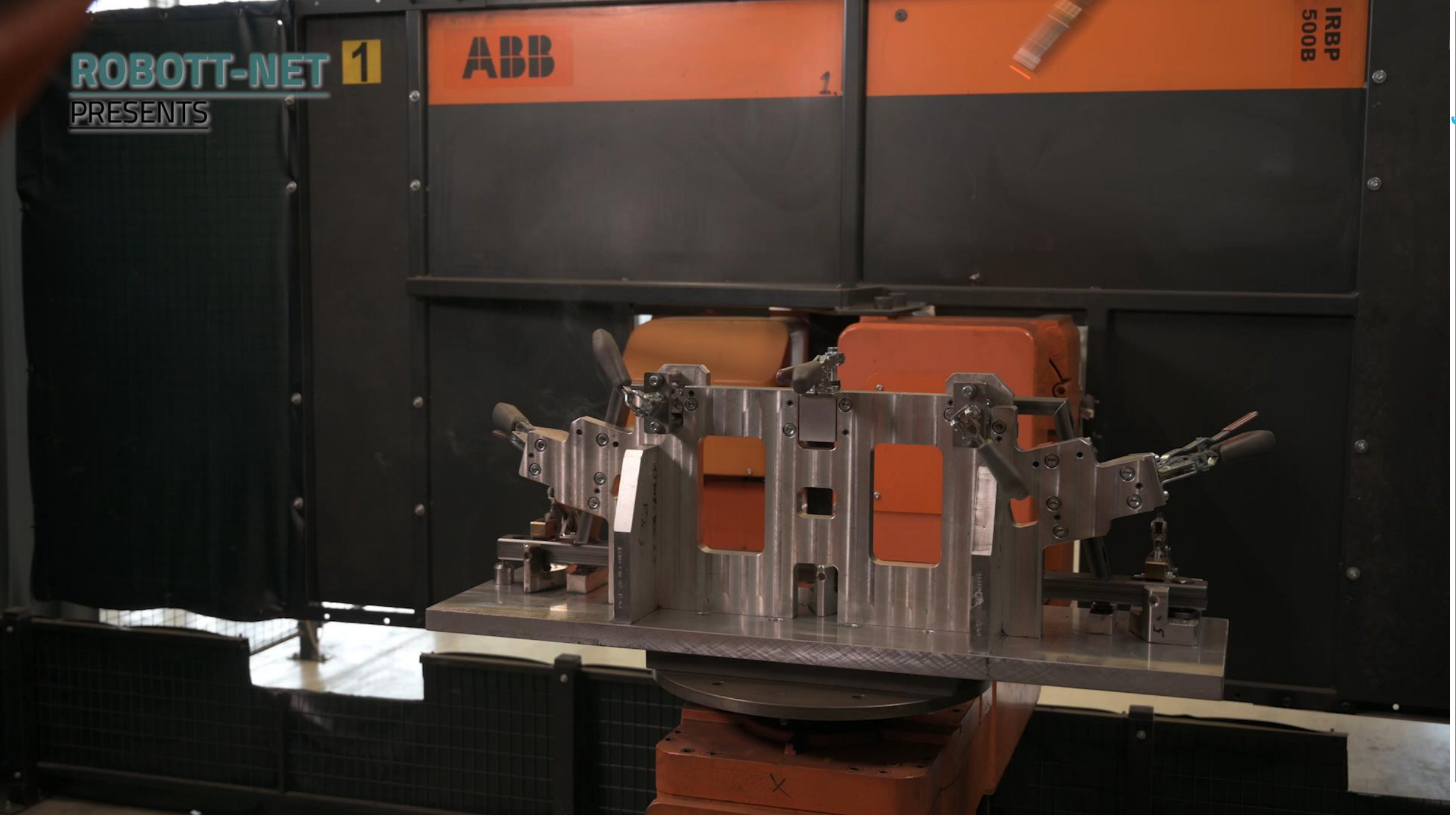
Challenges in Robotic Welding



AutoWELD Consortium



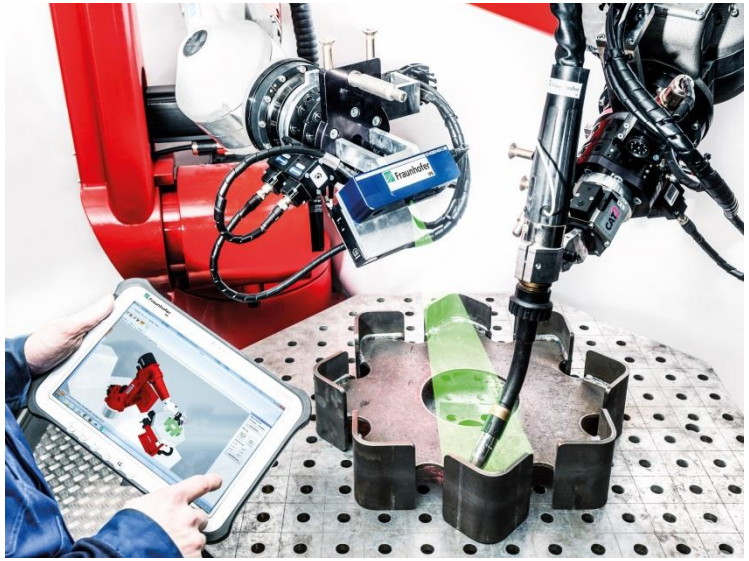
Partner	Country	Role
Piccolo K + L Behältertechnik GmbH (SME)	GER	End user, **project coordinator**
CEDIS Components GmbH (SME)	GER	End user
Systemworkx PLM GmbH (SME)	GER	Exploitation manager
Delfoi (SME)	FIN	Technology developer
Fraunhofer IPA	GER	Coordinating RTO
Manufacturing Technology Center	UK	Supporting RTO



www.youtube.com/watch?v=KQzKuOPTza0

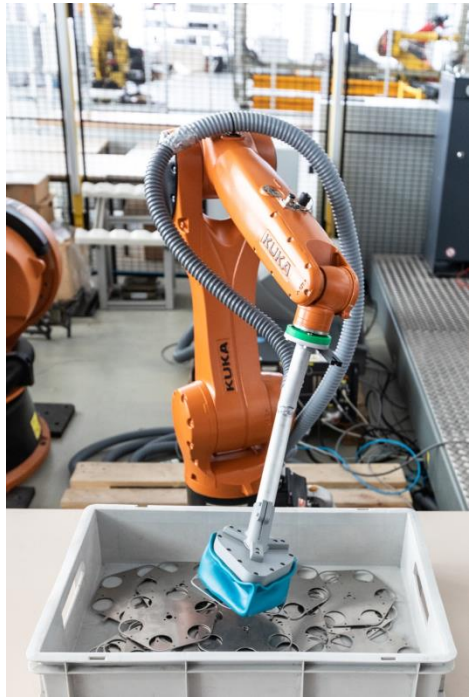
AutoWELD
Conclusions

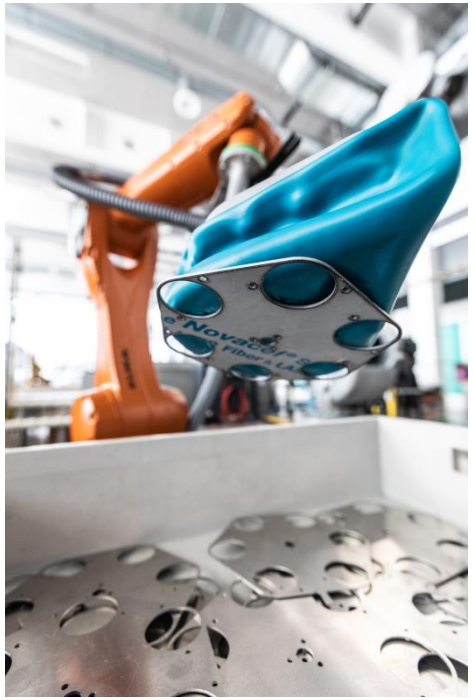
- **Automatic robot programming for small lot size welding production**
- Reduction of programming efforts with new Plugins in Delfoi Arc Software
  - 3D sensor-based detection of workpiece deviations and automatic program adaptation
  - Collision-free path planning considering optimal weld parameters (e.g. from WPS documents)
- 3D sensor Kit for integration in existing welding robot cells



SOSTA

Easy to use multi-purpose **So**rting and **Sta**cking robot for sheet metal parts





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Intro
Situation in the industry

- Work pieces after transport or treatment often undefinied
  - Unknown position on conveyor belt
  - Unsorted delivery in bins

- Small lot sizes

Intro
Consortium

Technology provider

Fraunhofer IPA

DANISH TECHNOLOGICAL INSTITUTE

FORMHAND

Exploitation manager

TRUMPF

End-user

ARNOLD

www.youtube.com/watch?v=4NfFhSoZQJo

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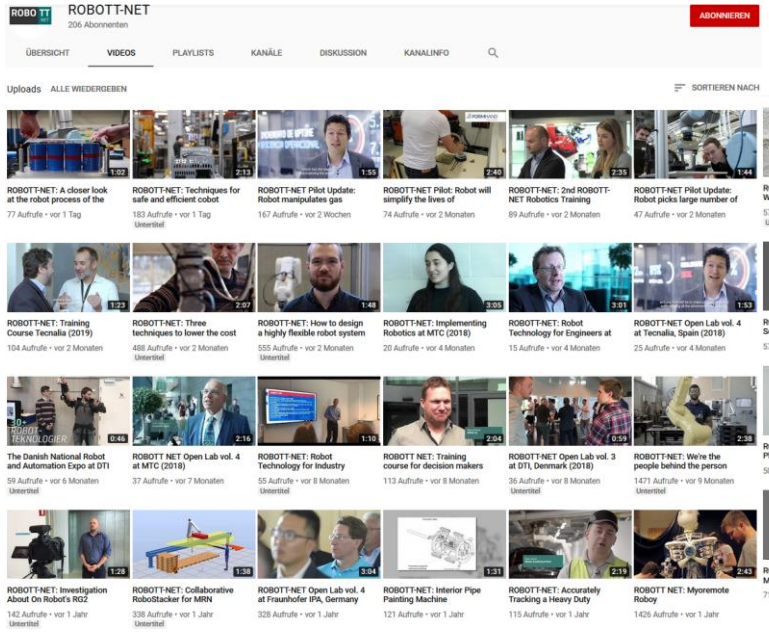
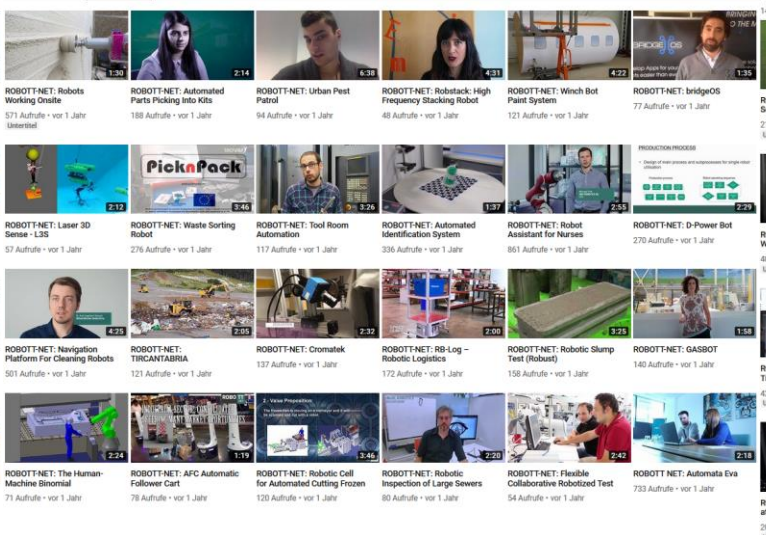
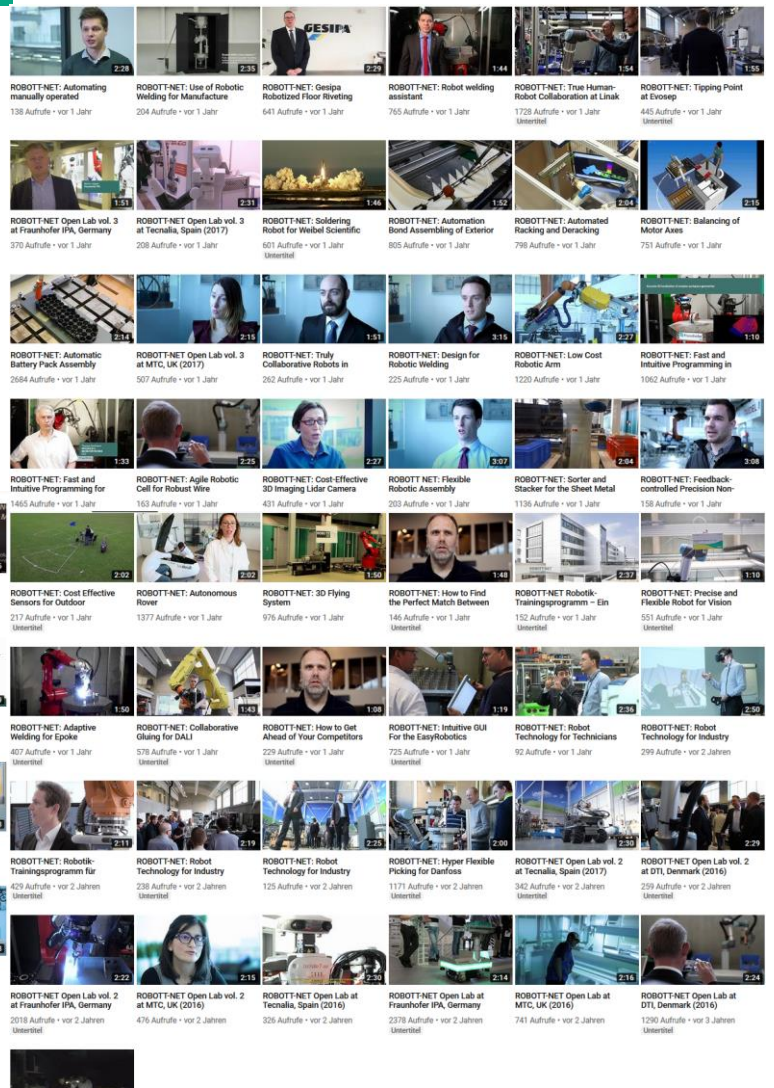
Let‘s stay in contact and visit our website!

- Website robott-net.eu
- LinkedIn linkedin.com/company/robott-net
- Twitter twitter.com/ROBOTT_NET
- YouTube youtu.be/gFnMi-Y-5c8



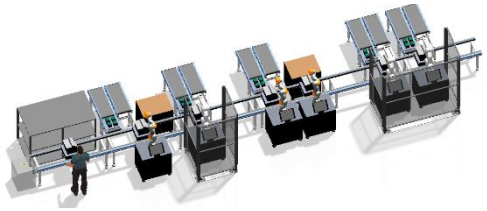




IPA/326

Software Engineering and System Integration

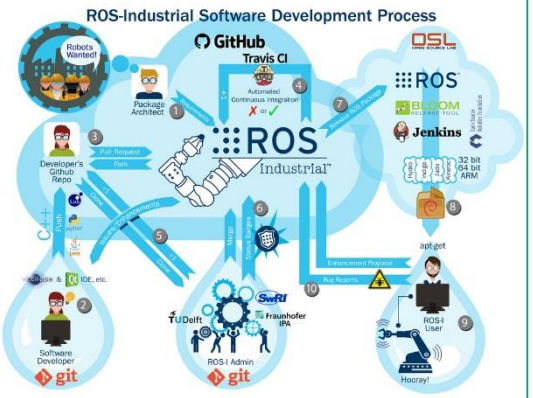
Robot control architectures



Focus on system <u>building</u>

"programming"

System & app. lifecycle

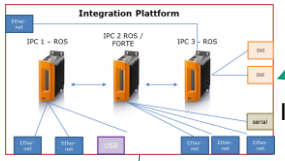


Focus on system <u>testing</u>, <u>maintenance</u>, <u>improvement</u>

"DevOps / tech stacks"

Info. & runtime modeling

App-Store



Integration- platform

Hardware

Focus on system <u>composition</u>

"ecosystems"

Open Source Robotics

Platform efforts merging community-based (*bottom-up*) and industrial (*top-down*) approaches

ROS-Industrial: porting to the industrial realm ROS, Open-Source effort *with critical mass*

Fraunhofer IPA

Open-Source Robotics at Fraunhofer IPA

Relevant expertise

- Early adopters of ROS (the Robot Operating System) in EU (since 2009)
- Developers of service robotics platforms (Care-O-bot lineage), with spin-off commercialization efforts leveraging Open-Source




THE PRIVATE ACTION: ROS-INDUSTRIAL

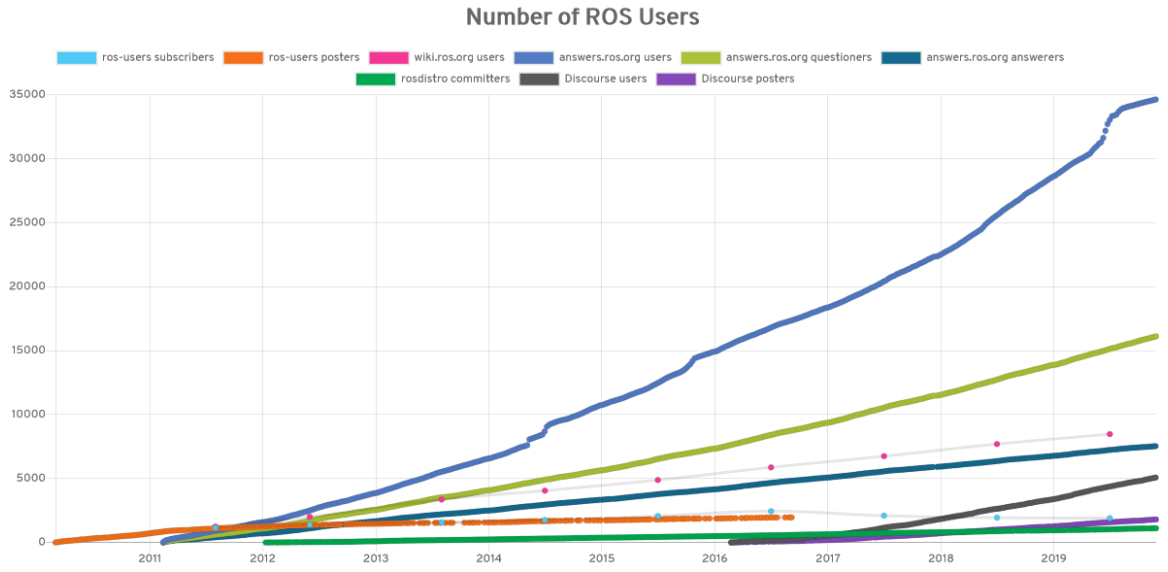
What is ROS?

a **robot framework**

- ROS is an **open-source**, **meta-operating system** for your robot.
- providing the **services** you would expect from an operating system, incl. **hardware abstraction, low-level device control,** implementation of commonly-used **functionality**, message-passing between processes, and package management.
- providing **tools** and **libraries** for obtaining, building, writing, and running code across multiple computers.

wiki.ros.org/ROS/Introduction

a **ecosystem & de-facto standard**



metrics.ros.org/

What is ROS-Industrial?

an **initiative**

promoting **software innovation in industrial manufacturing** by:

- leveraging **open-source** software, a key factor in the growth of (service) robotics
- collecting **industry-specific needs**
- combining the strengths of community-based and contract development
- identify and clear **non-technical obstacles**, such as regulatory and legal issues

a **software suite**

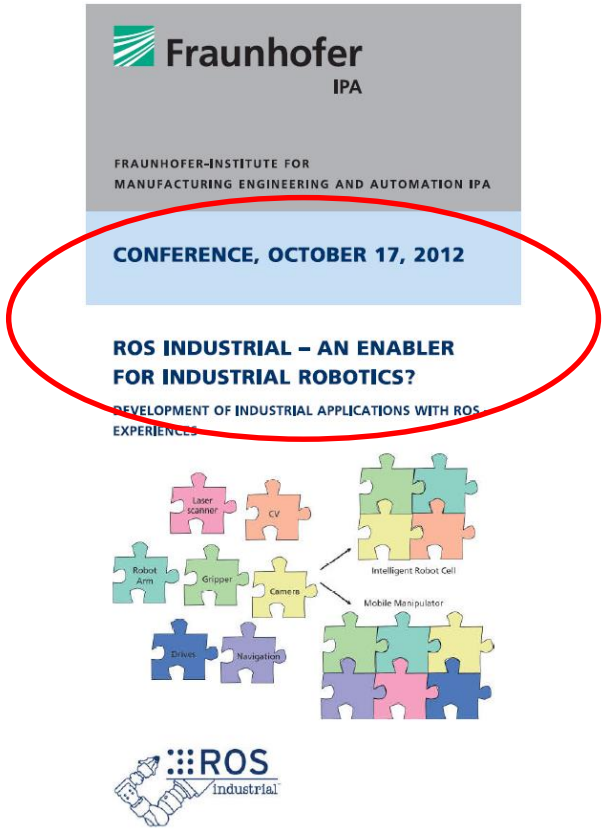
becoming **an established platform for robotics and automation** as it:

- reduces vendor lock-in for **users**
- provides a rich infrastructure for application development by **system integrators**
- allows **OEMs** to complement their hardware with a vibrant software ecosystem, similarly to Android OS and apps on smartphones

ROS-Industrial from 2012 - 2019

Relevant audience

- Piloting with SwRI the ROS-Industrial concept (2012)
- Managing ROS-I EU (~80 organizations worldwide)



rosindustrial.org

What is ROSin ?

rosin-project.eu

- Horizon2020 EU-project ROSIN supports EU's strong role within ROS-Industrial
- Fostering Europe's expertise in advanced manufacturing
- **4 years, ~ 8 million EUR funding (01.01.2017 – 31.12.2020)**
  - Builds upon what exists; sustainable results after its completion
  - Key actions to make ROS **better**, business **friendlier**, more **accessible**
  - (Extra goal:) cluster other publicly funded activities using ROS like RobMoSys, OFERA, or SeRoNet

This project has been funded by the European Union's Horizon2020 research and innovation programme under grant agreement No 732287

Key actions to make ROS:

better

Software Quality

ROS-I best practices and tools: continuous integration, unit testing, code reviews

ROSIN further improves on them with code scanning, automated test generation, model-in-the-loop testing

rosin-project.eu/software-quality-assurance

business friendlier

New components + path for exploitation

3.5 Million € available to third parties for ROS-Industrial development

Develop missing components or improve existing ones

Commercial release template (licensing, etc)

rosin-project.eu/ftps

more accessible

Education

Educate students: **summer schools**

Train professionals: **ROS-I academy**

Open Call to fund your ROS education initiative

rosin-project.eu/education

Results of ROSIN in Turkey

Three projects have been funded at Inovasyon Muhendislik Ltd. Sti.

- **Virtual Robotic Laboratory and Learning Materials for ROSin (Education Project)**
  https://rosin-project.eu/ftp/virtual-robotic-laboratory-and-learning-materials-for-rosin-ep
  - addressing the need of ROS trained qualified persons in the region of Turkey by using training center and Virtual Robotic Laboratory
  - establishing a ROS training center, development of Virtual Robotic Laboratory for learning ROS and preparation of ROS learning materials in Turkish and English Languages. Thus, ROS knowledge will be disseminated in our region (Eskişehir City).
    Read: https://rosin-project.eu/ros-training-turkey
- **ROS Industrial Indoor Positioning System (Focused Technical Project)**
  https://rosin-project.eu/ftp/rosinps
- **Prognostics and Health Management Tool for ROS**
  https://rosin-project.eu/ftp/prognostics-and-health-management-tool-for-ros

ROS-Industrial dates & events in 2020

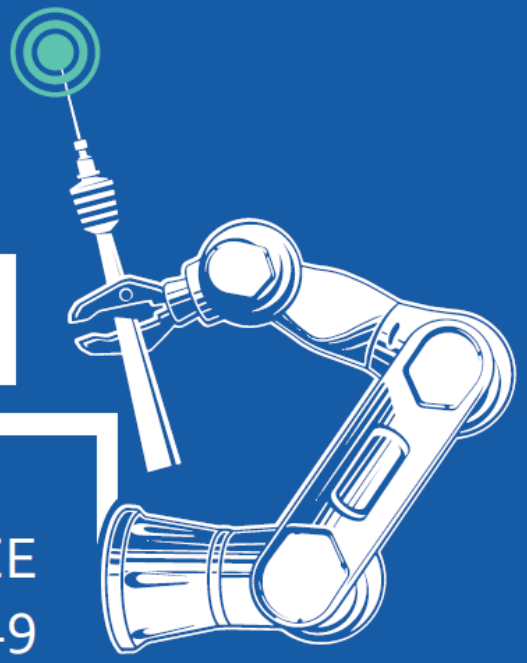
- Presentations & videos of ROS-Industrial Conference 2019 online
  https://rosindustrial.org/riceu2019
- News on our ROS-Industrial blog
  https://rosindustrial.org/news
- Next events worldwide
  https://rosindustrial.org/events-summary

- Coming up in Europe
  - Five complete new ROS2 training in 2020 (pre-register for 3-4 day training in Feb. May July Sept. Nov.) www.ipa.fraunhofer.de/de/veranstaltungen/messen/ros_industrial_trainings2020.html
  - Two ROS-I Tech Workshops with hands on latest developments
  - AUTOMATICA 2020 in June
  - ROS-Industrial Conference #RICEU2020 in Q4 /2020
    rosin-project.eu/events

ROS-Industrial Conference 2019

ROS-I

CONFERENCE 2019



Fraunhofer IPA

ROS industrial

7th ROS-INDUSTRIAL CONFERENCE

December 10-12, 2019
Fraunhofer IPA
Stuttgart, Germany

http://s.fhg.de/riceu2019

Video of #RICEU2019

youtube.com/watch?v=Vd38e6Ly5cY

Contact Information

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Fraunhofer IPA

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www.ipa.fraunhofer.de
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Future is our product

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Giving you a competitive edge

Sustainable. Flexible. Cost-effective.

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