Industry and Research Join Forces for Shaping Smart Manufacturing

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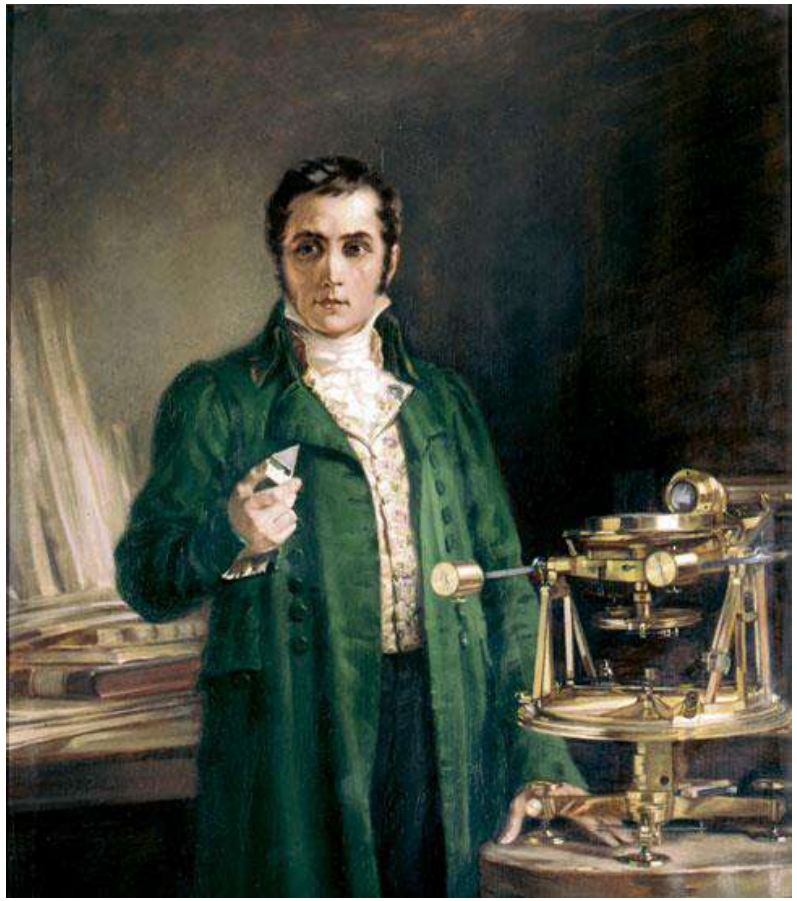
Fraunhofer Institute for Production Technology IPT

Fraunhofer ICNAP

International Center for Networked, Adaptive Production

Fraunhofer-Gesellschaft

The Fraunhofer-Gesellschaft researches for practice

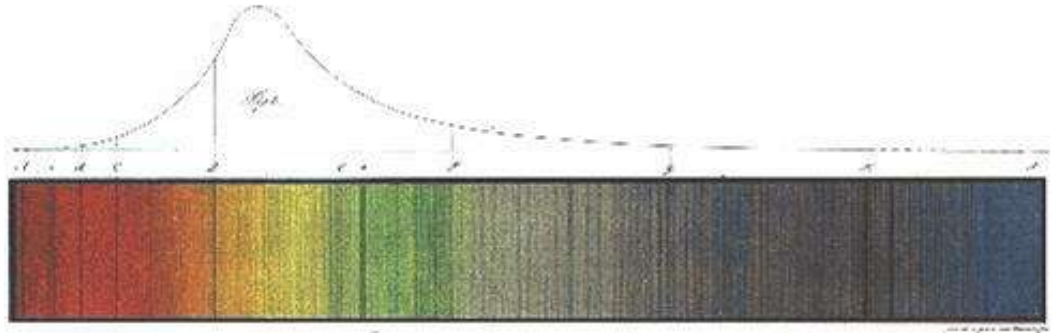


The Fraunhofer-Gesellschaft is Europe's largest organization for applied research

Named after the researcher, inventor and entrepreneur Joseph von Fraunhofer (1787-1826)

Aims of the Fraunhofer-Gesellschaft

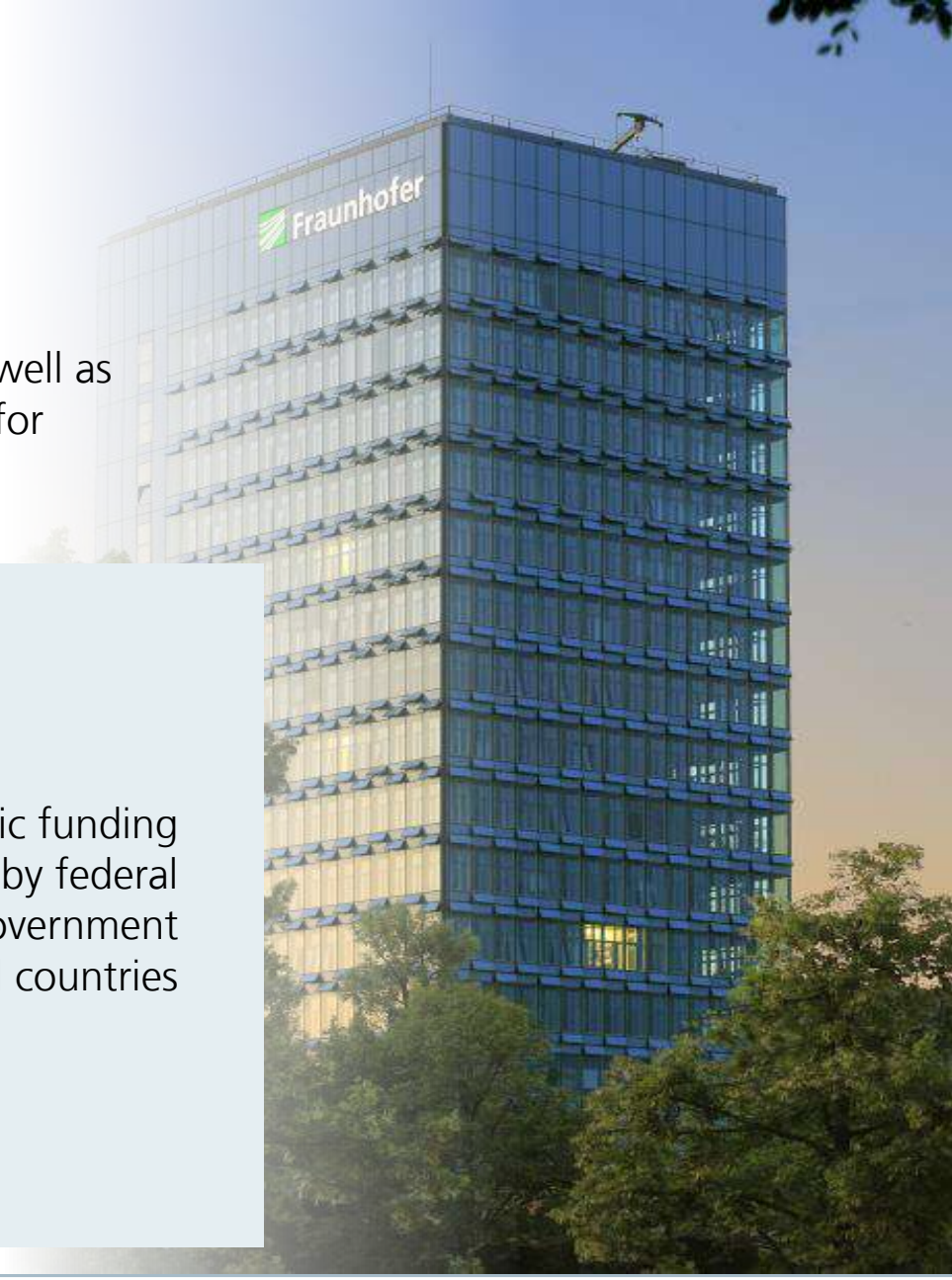
- Research and development on behalf of industry and government
- Basic research for practice



Fraunhofer-Gesellschaft

The world's leading applied research organization

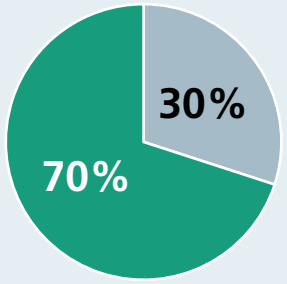
Application-oriented research with a focus on future-relevant key technologies as well as on the utilization of the results in business and industry. Pioneer and driving force for innovative developments.



30 000
employees

€2.9 billion financial volume
€2.5 billion contract research

76 institutes and
research institutes



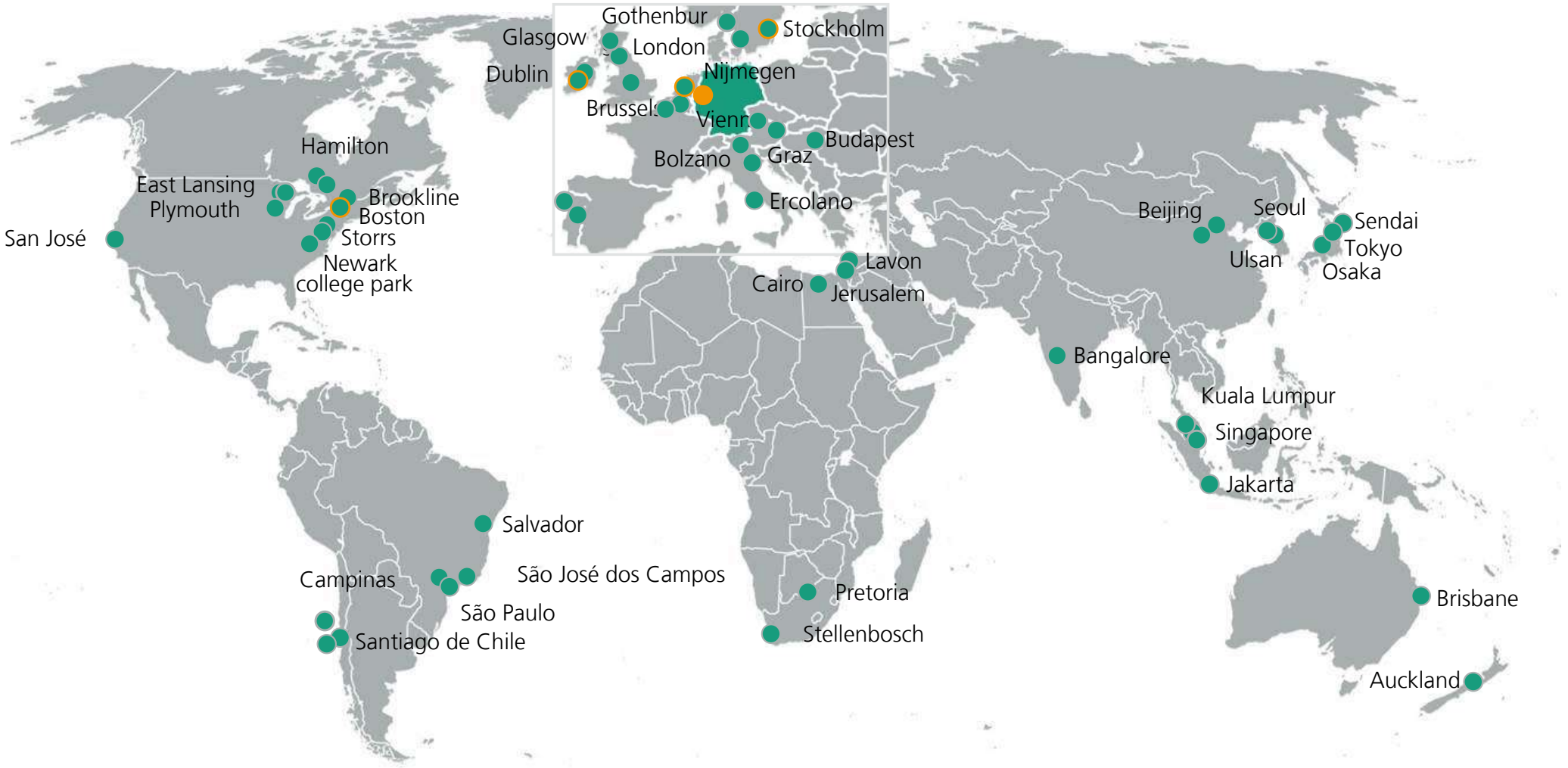
Industry-
orders
and public
funded research projects

Basic funding
by federal
government
and countries

Fraunhofer

Fraunhofer-Gesellschaft

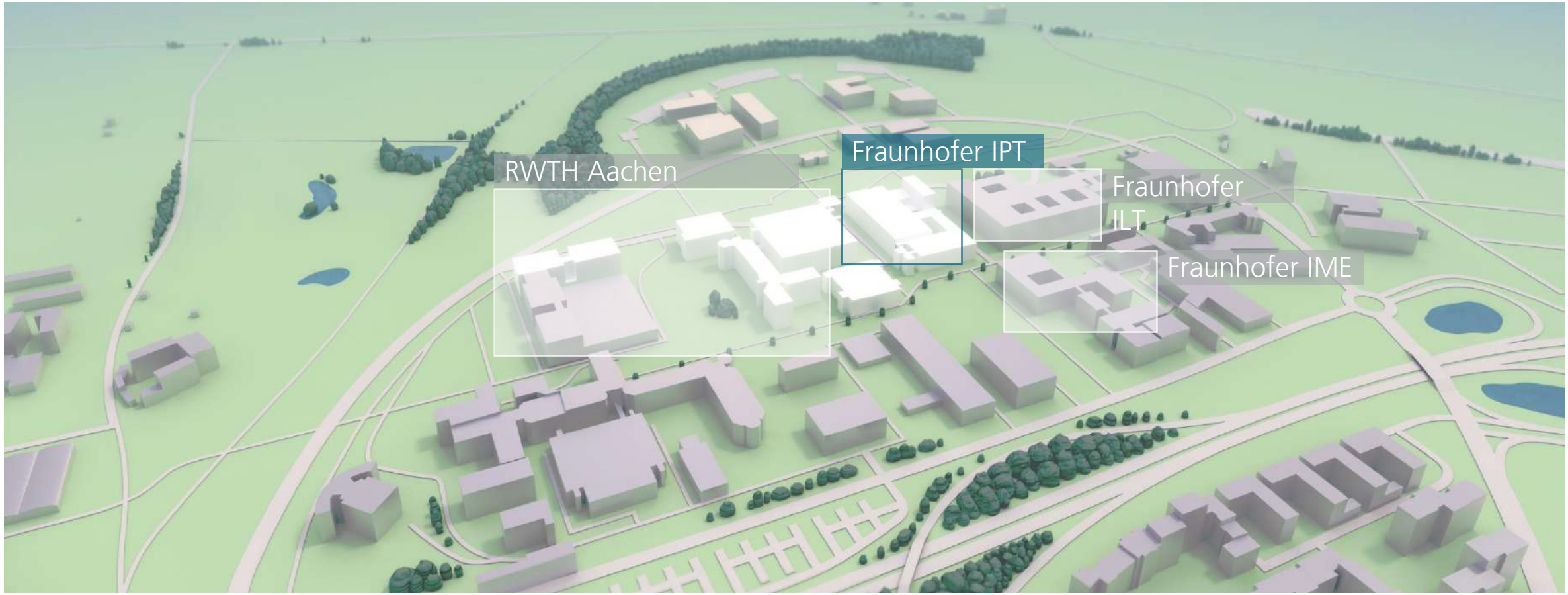
Fraunhofer Worldwide



Fraunhofer IPT

Our home

The RWTH Aachen Campus as a catalyst for cooperation between industry and science



Our institute

The challenges of industry as the nucleus of production technology research and consulting

Business areas

- *Energy storage*
- *Life science engineering*
- *Optics*
- *Lightweight production technology*
- *Tool & die making*
- *Turbomachinery*

Our profile

The Fraunhofer IPT develops system solutions for networked, adaptive production.

We offer our project partners and clients individual special solutions and immediately realizable results in all fields of production technology.

BOARD OF DIRECTORS

- Prof. Christian Brecher (Head of Institute)
- Prof. Thomas Bergs
- Prof. Robert Schmitt
- Prof. Günther Schuh

COMPETENCIES

- Process technology
- Production machinery
- Production quality and metrology
- Technology Management

INTERNATIONAL LOCATIONS

- Fraunhofer Center for Manufacturing Innovation CMI, Boston, USA
- Project Center Twente, NL
- Project Center Dublin, Ireland

»International Center for Networked, Adaptive Production«

ICNAP

Industry 4.0

Smart Devices

Internet of Things

Big Data

Innovation

Data Analytics

Robot

Digitalization

High-Tech

Automation

Smart Production

Edge Computing

Cloud Computing

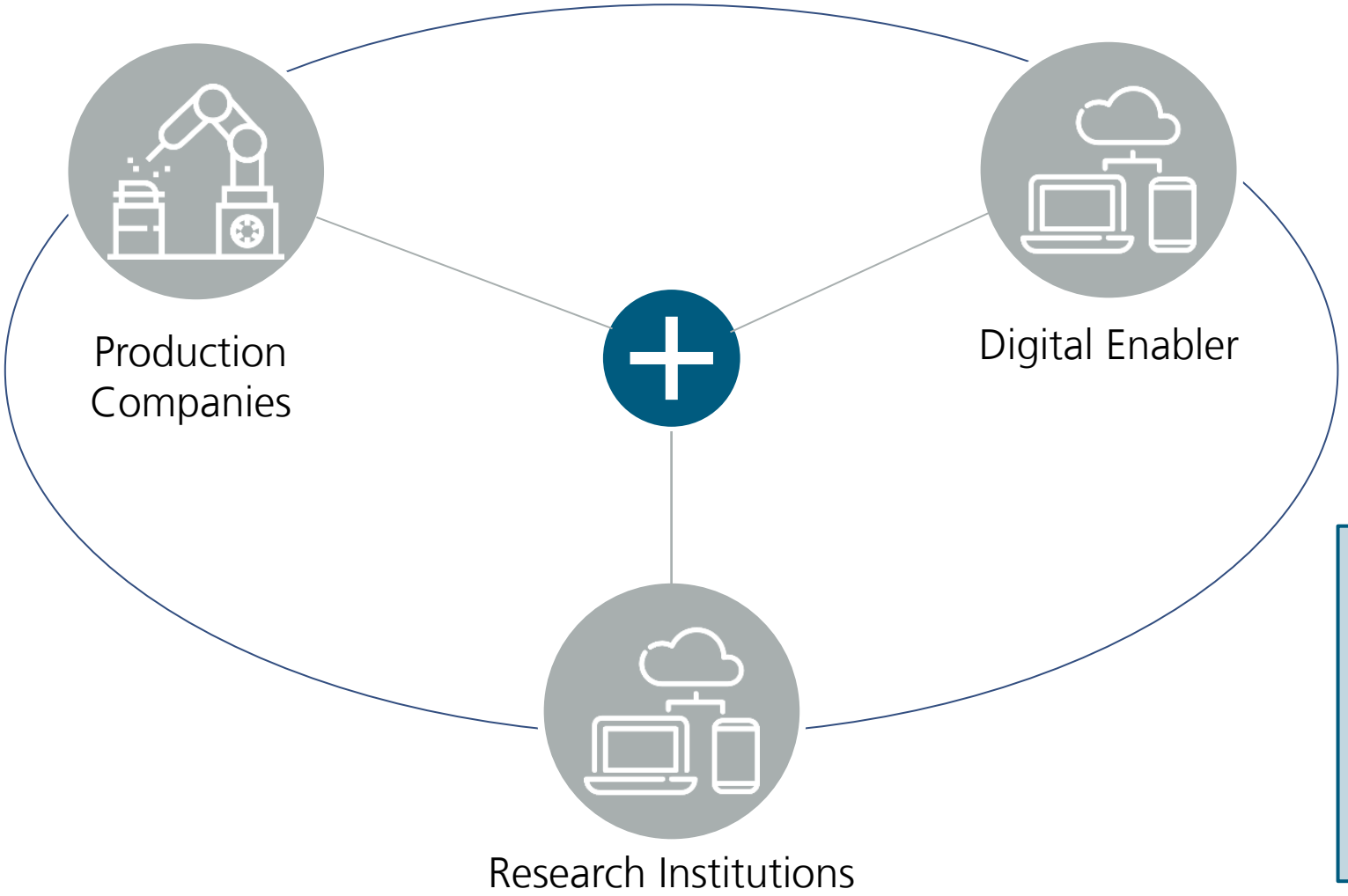
Human-Machine-Interaction

5G

Connectivity

How can we tackle the various challenges in smart manufacturing?

Users and Enablers of Industrie 4.0 Join Forces in the ICNAP Community

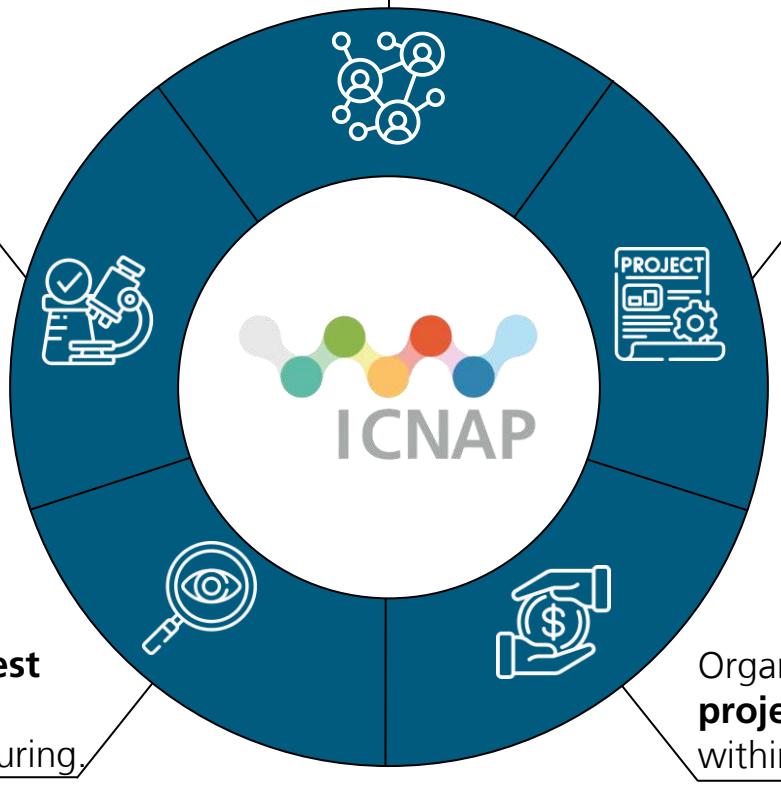


Open Innovation, concentration on core competencies and bundling of know-how in a network!

What Are the Goals of Our Community?

Provide a **platform for collaboration and networking** on the development of new technologies for **smart manufacturing**.

Join forces between **cutting-edge research institutes** and **industrial expertise**.



Tackling **common challenges** in **joint projects**.

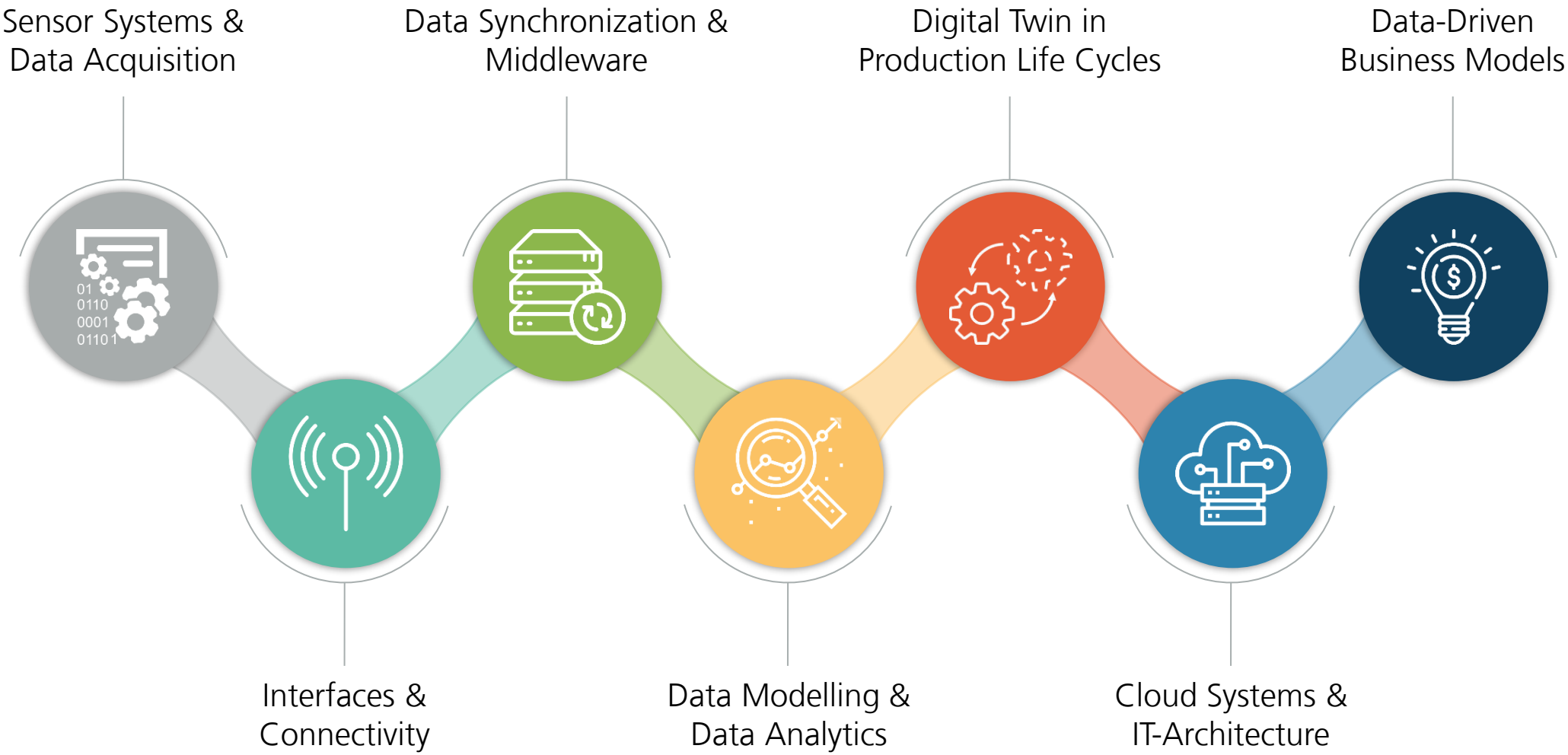
Continuously provide the **latest insights** into the research landscape of smart manufacturing.

Organization of **publicly funded projects** on smart manufacturing within the consortium

What topics are needed to implement smart production?

The Fields of Action: From Data Acquisition to Business Model Design

ICNAP



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The Fields of Action: From Data Acquisition to Business Model Design

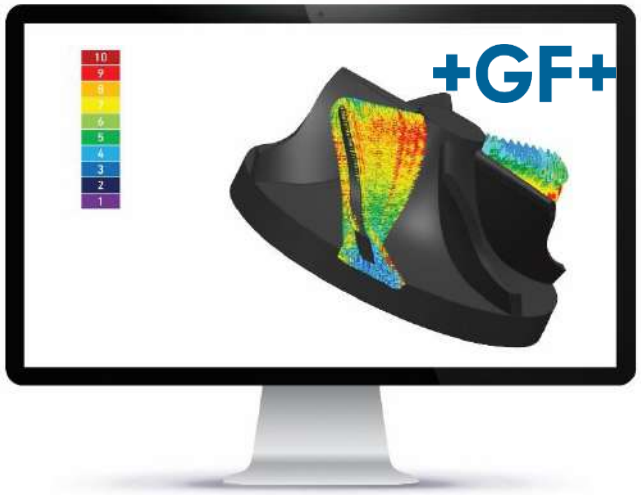
Use Case with Georg Fischer Machining Solutions
Real-time 5G-based smart manufacturing

Fraunhofer IPT +GF+

The Solution

5G multi-sensor platform by Fraunhofer IPT & Marposs

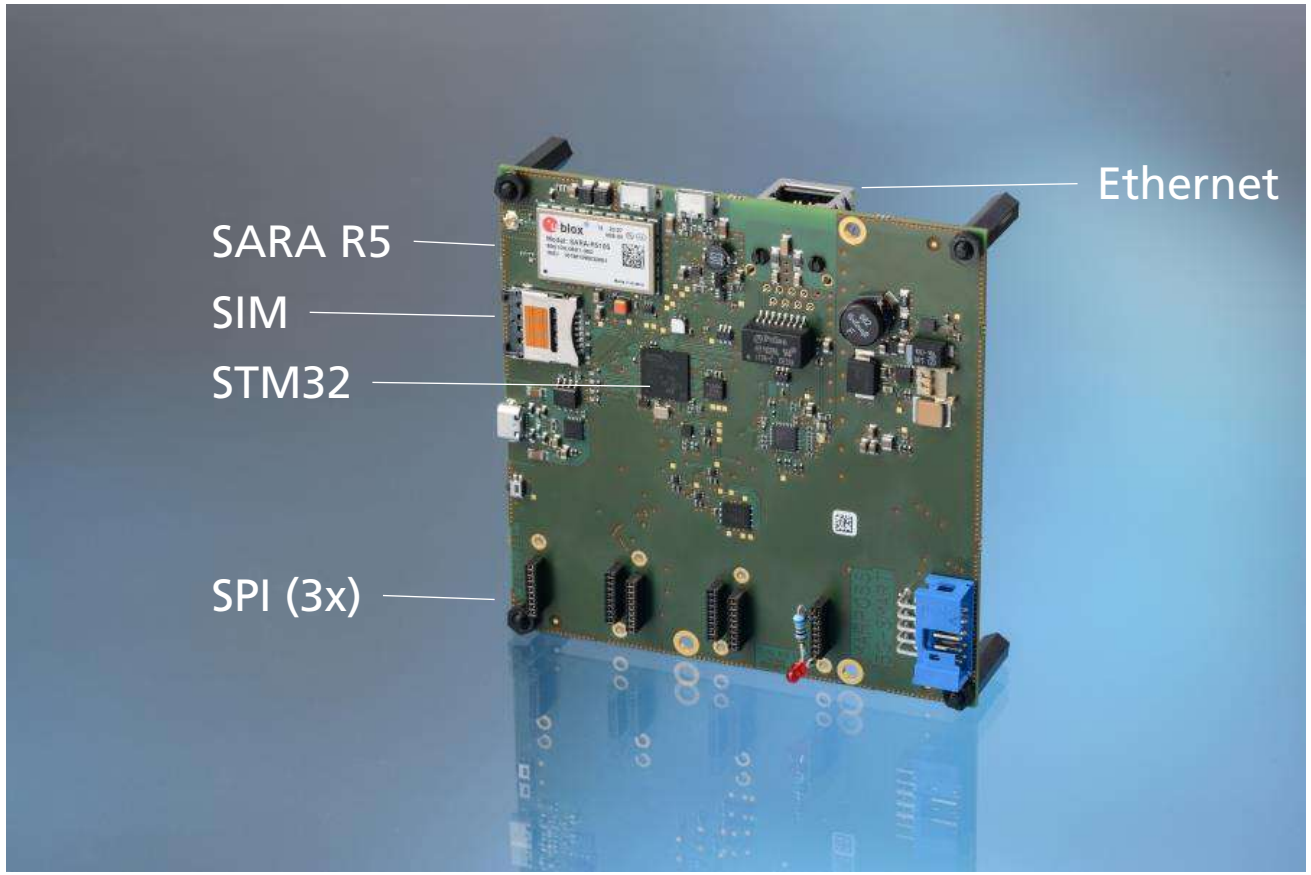
measurement signals

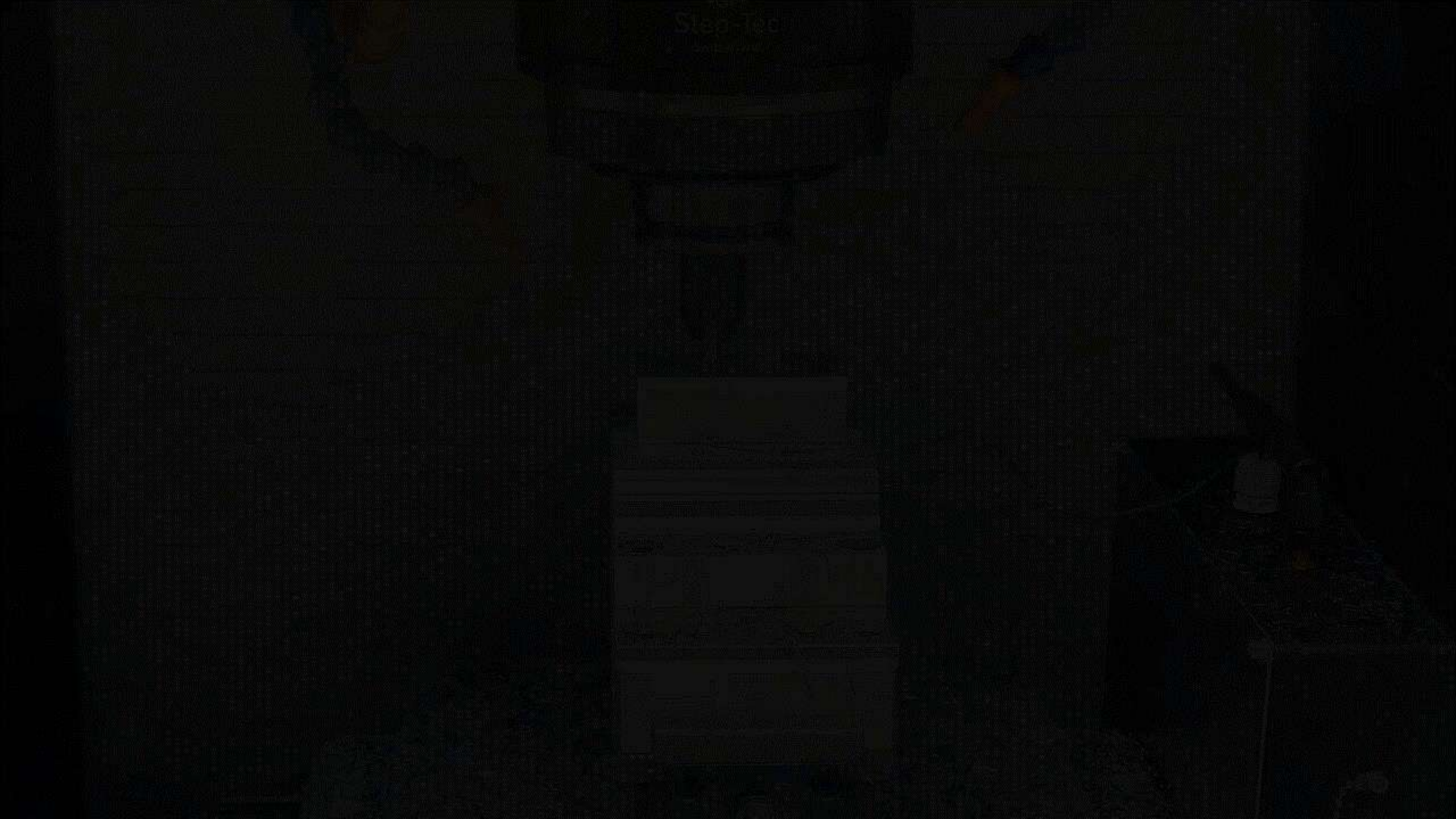


position-synchronized digital twin processing

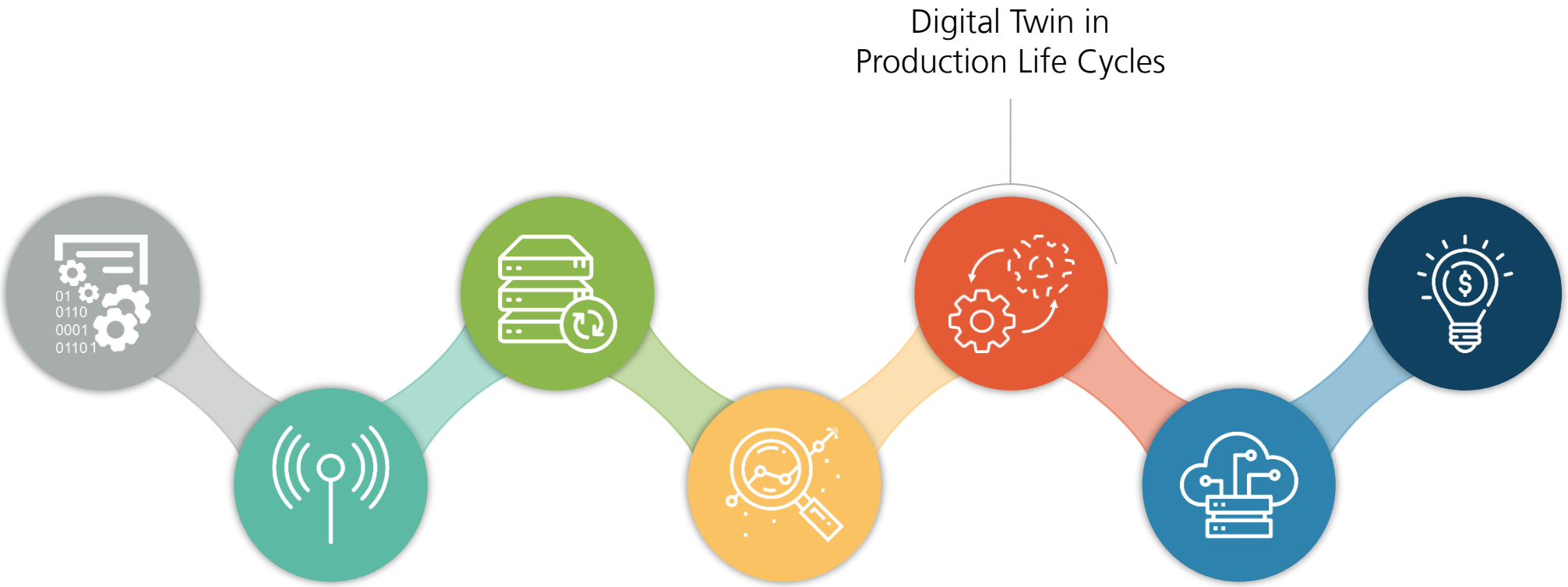
Use Case: Multi-sensor platform

- outboard sensors
  - accelerometer
  - temperature sensor
  - strain gauge
- onboard sensors
  - accelerometer
  - temperature sensor
  - humidity sensor
  - gyroscope
- STM32 as processing core
- u-blox SARA R5 for time sync
- 5G communication module (via Ethernet)
- powerbank ready





The Fields of Action: From Data Acquisition to Business Model Design



The Digital Twin Demonstrator – Bringing the Concept to Life

Challenge and Motivation

- Digital Twins are considered to have great potential for various problems
- Numerous definitions but few use cases are available
- Implementing a Digital Twin Demonstrator to understand the potential and challenges

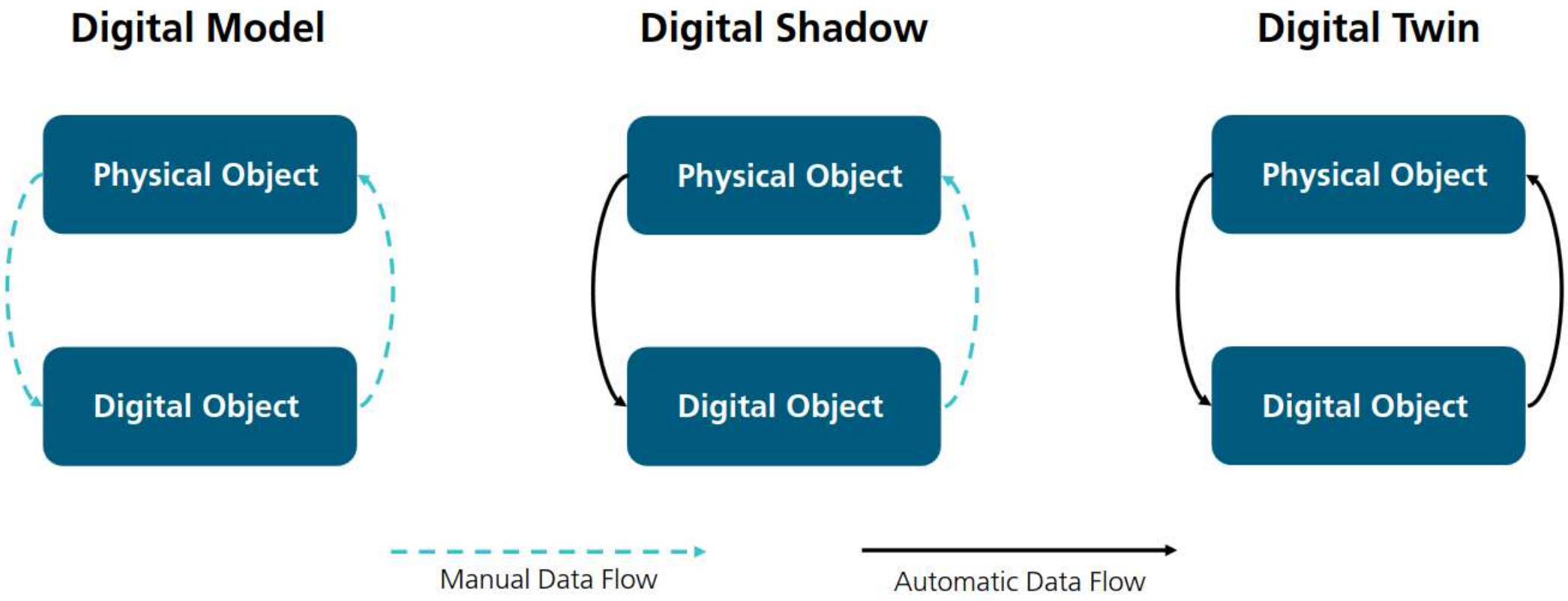
Objective

- Gaining practical experience with the associated technologies
- Implementation of a Digital Twin

Making the Digital Twin tangible: How can a hands-on implementation of a digital twin be transferred to production?

Topic Fields:

Digital Twins, a definition



Interface description frameworks

ICNAP

- Supported by the **World wide web consortium (W3C)**
- Recent focus on digital twin applications
- Not that established in the industry

- Supported by Plattform Industry 4.0 and the Industrial Digital Twin Association e.V. (IDTA)
- Covers the **complete lifecycle** of products, devices, machines and facilities
- Steep learning curve

- Well established communications protocol
- Offers data semantics through the companion specifications
- Locks us into a single technology

- Specifically designed for Azure Digital Twin, but interoperable with RDF
- Required for Azure Digital Twins

- Well established in chemical industry
- Offers unique technology benefits
- Information is hard to come by

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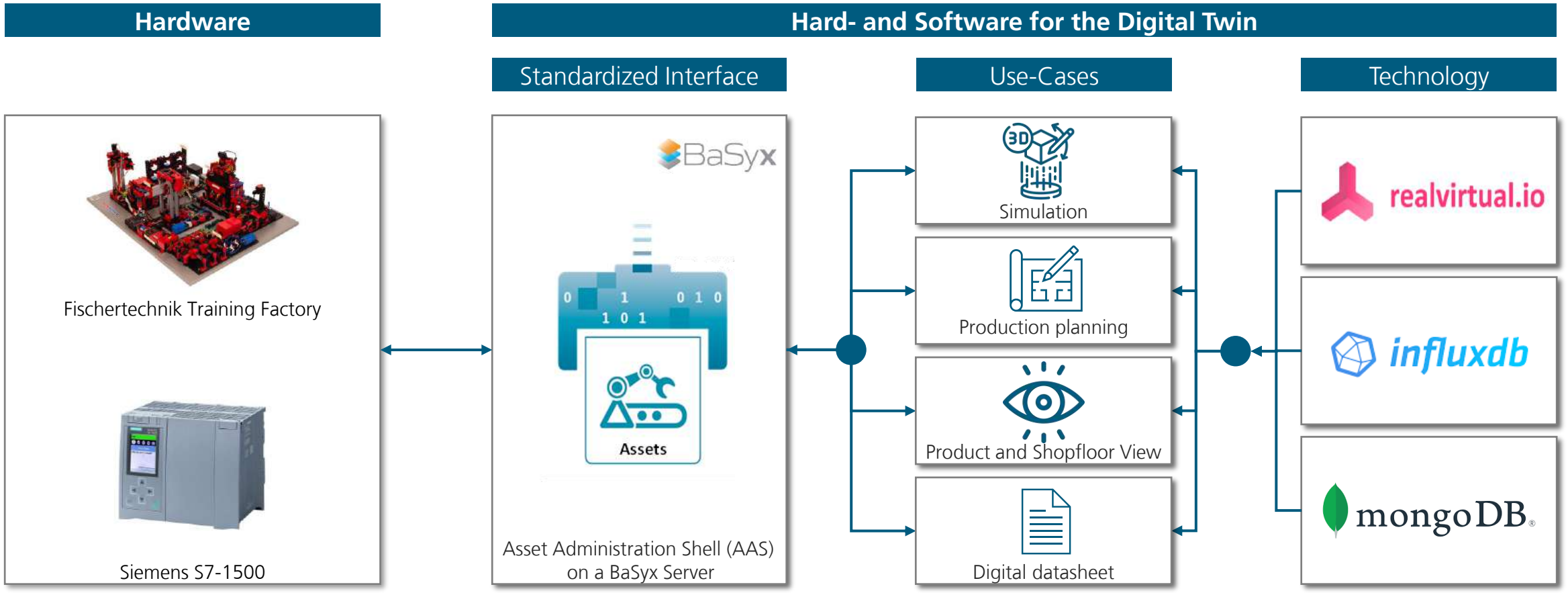
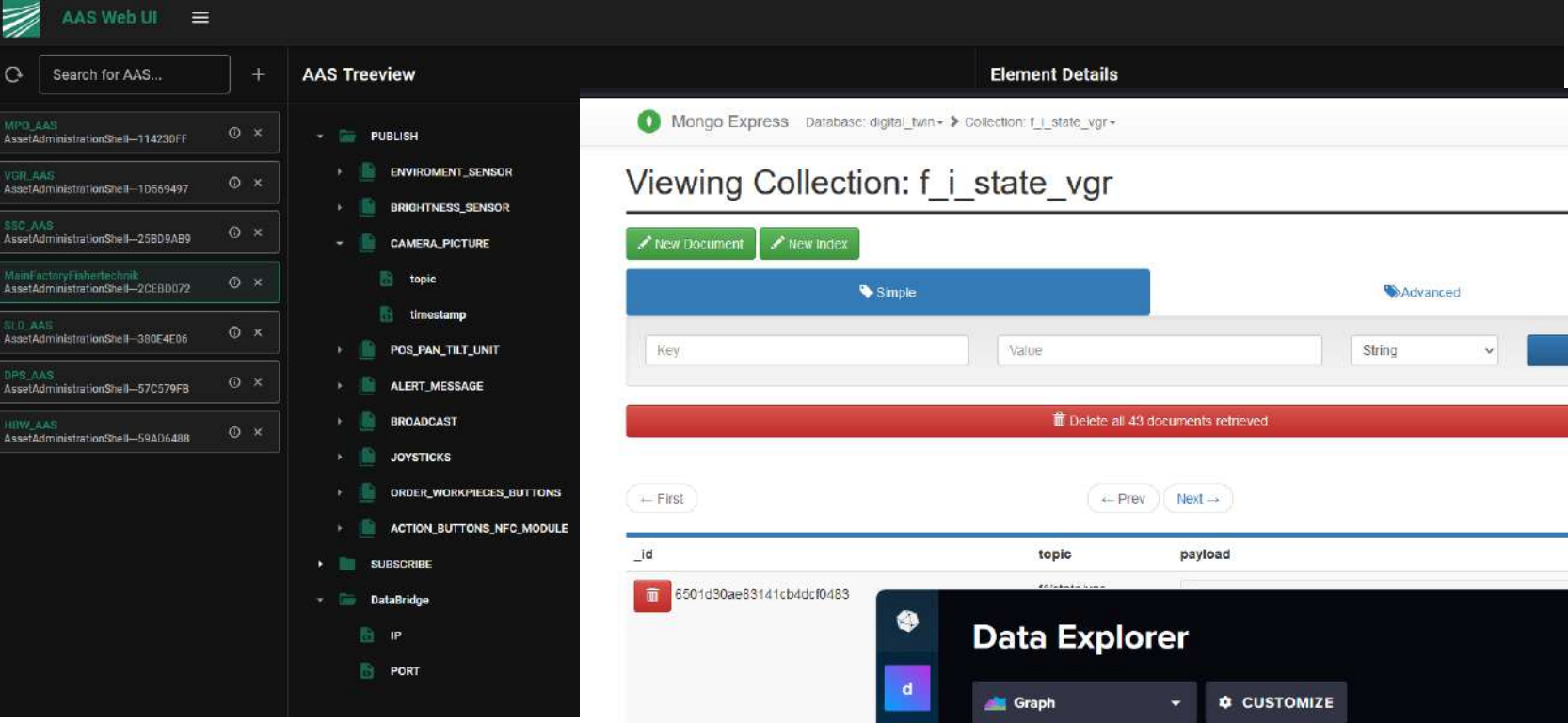
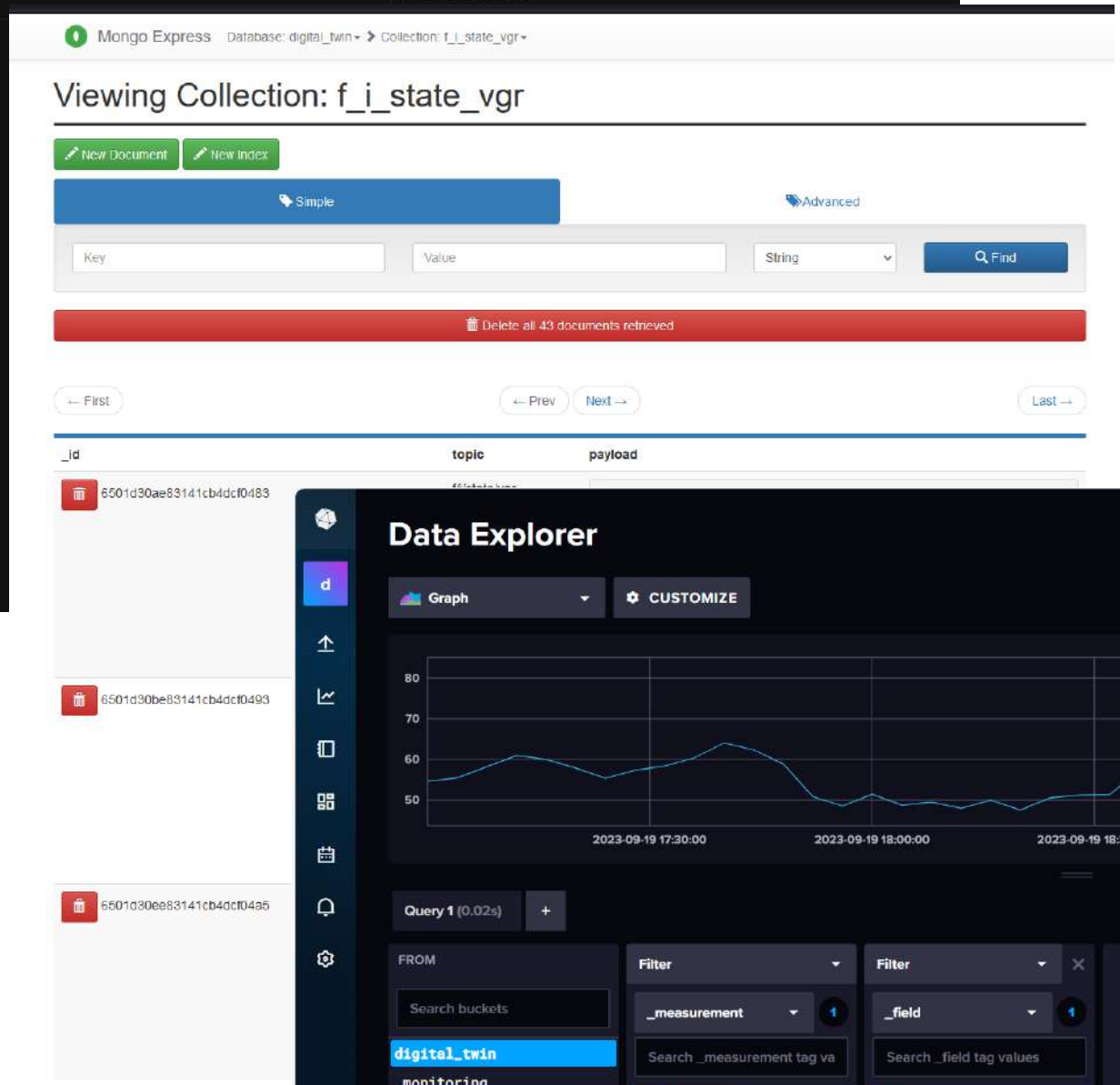
Architecture and Set-Up of the Digital Twin




AAS Web UI
Search for AAS...
AAS Treeview
Element Details
MPO_AAS
AssetAdministrationShell--114230FF
VGR_AAS
AssetAdministrationShell--1D569497
SSC_AAS
AssetAdministrationShell--25BD9AB9
MainFactoryFischertechnik
AssetAdministrationShell--2CEBD072
SLD_AAS
AssetAdministrationShell--380E4E06
DPS_AAS
AssetAdministrationShell--57C579FB
HBW_AAS
AssetAdministrationShell--59AD6488
PUBLISH
ENVIROMENT_SENSOR
BRIGHTNESS_SENSOR
CAMERA_PICTURE
topic
timestamp
POS_PAN_TILT_UNIT
ALERT_MESSAGE
BROADCAST
JOYSTICKS
ORDER_WORKPIECES_BUTTONS
ACTION_BUTTONS_NFC_MODULE
SUBSCRIBE
DataBridge
IP
PORT


Mongo Express
Database: digital_twin
Collection: f_i_state_vgr
Viewing Collection: f_i_state_vgr
New Document
New Index
Simple
Advanced
Key
Value
String
Find
Delete all 43 documents retrieved
First
Prev
Next
Last
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payload
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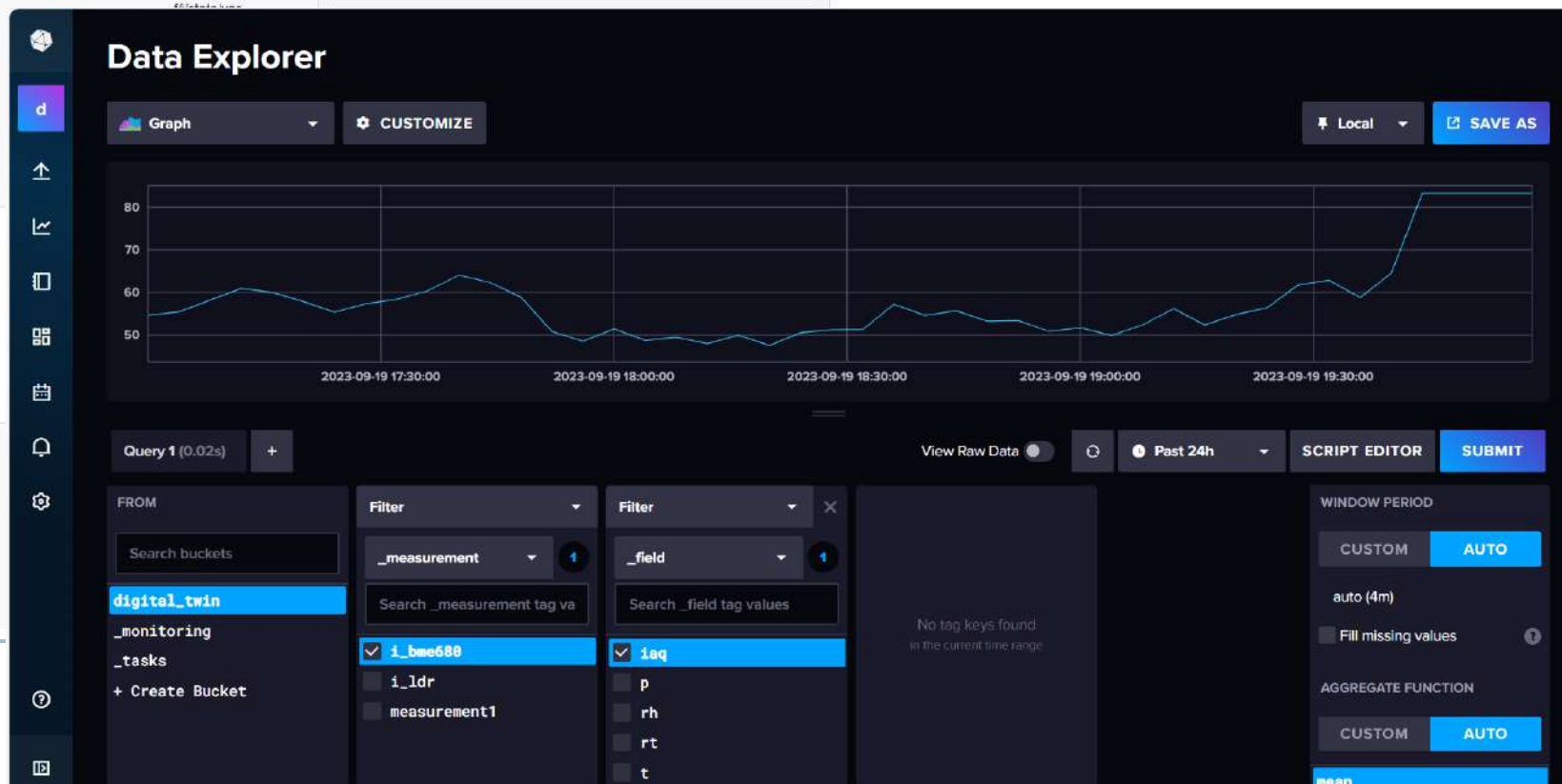
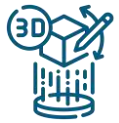

Data Explorer
Graph
CUSTOMIZE
Local
SAVE AS
80
70
60
50
2023-09-19 17:30:00
2023-09-19 18:00:00
2023-09-19 18:30:00
2023-09-19 19:00:00
2023-09-19 19:30:00
Query 1 (0.02s)
View Raw Data
Past 24h
SCRIPT EDITOR
SUBMIT
FROM
Search buckets
digital_twin
_monitoring
_tasks
+ Create Bucket
Filter
_measurement
Search _measurement tag va
i_bme680
i_ldr
measurement1
Filter
_field
Search _field tag values
iaq
p
rh
rt
t
No tag keys found
in the current time range
WINDOW PERIOD
CUSTOM
AUTO
auto (4m)
Fill missing values
AGGREGATE FUNCTION
CUSTOM
AUTO

Use-Case Implementation

ICNAP



Simulation

Status:

- ✓ 3D Integration of Fischertechnik Plan
- ✓ 3D movement of robotic arm and pick up of product
- ✓ Corresponding movement to physical counterpart
- ✓ 3D Simulation of Machine and product interaction possible

Future Industrial Benefit:

- Remote machine monitoring
- Virtual Production Testing

Production planning

Status:

- ✓ Ordering and queuing of parts possible
- ✓ Current state of plant and available materials is saved in the database

Future Industrial Benefit:

- Automatic plant optimization based on simulation results and order situation

Product and Shopfloor view

Status:

- ✓ Standardized access to live machine data
- ✓ Standardized interface to other applications possible
- ✓ Digital Access of Historic Machine Conditions and Data
- ✓ Tracking and Tracing of machine and product data

Future Industrial Benefit:

- Standardization for Machine Data Access

Digital datasheet

Status:

- ✓ AAS for products implemented
- ✓ Database for product datasheets implemented
- ✓ Recording of production parameters implemented

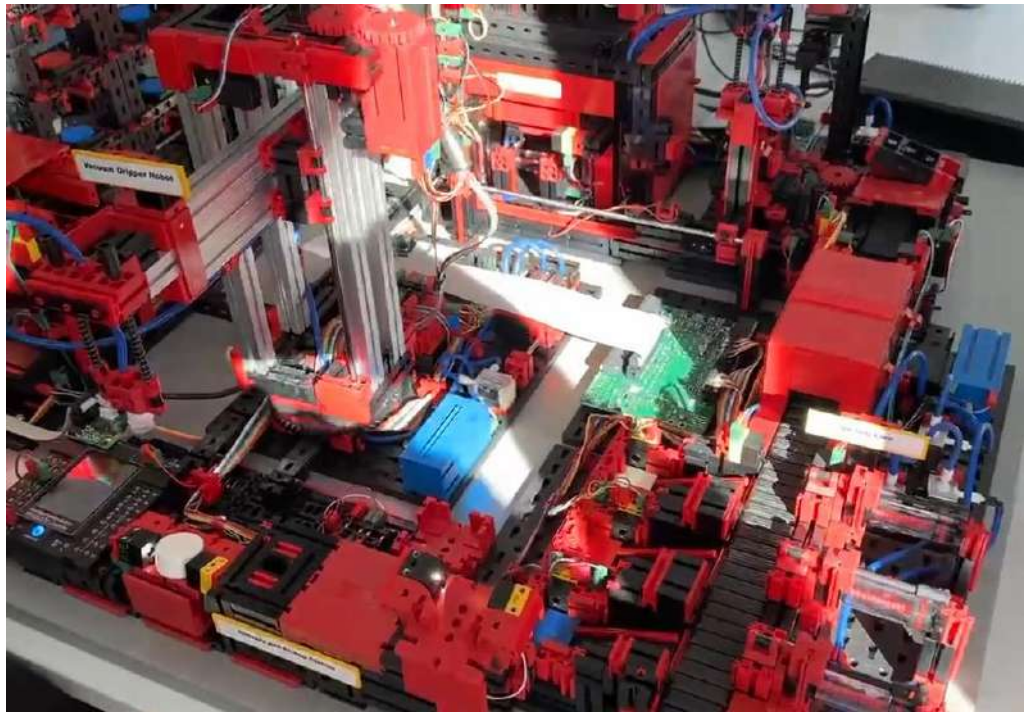
Future Industrial Benefit:

- Machine readable digital datasheet that can be supplied to customers

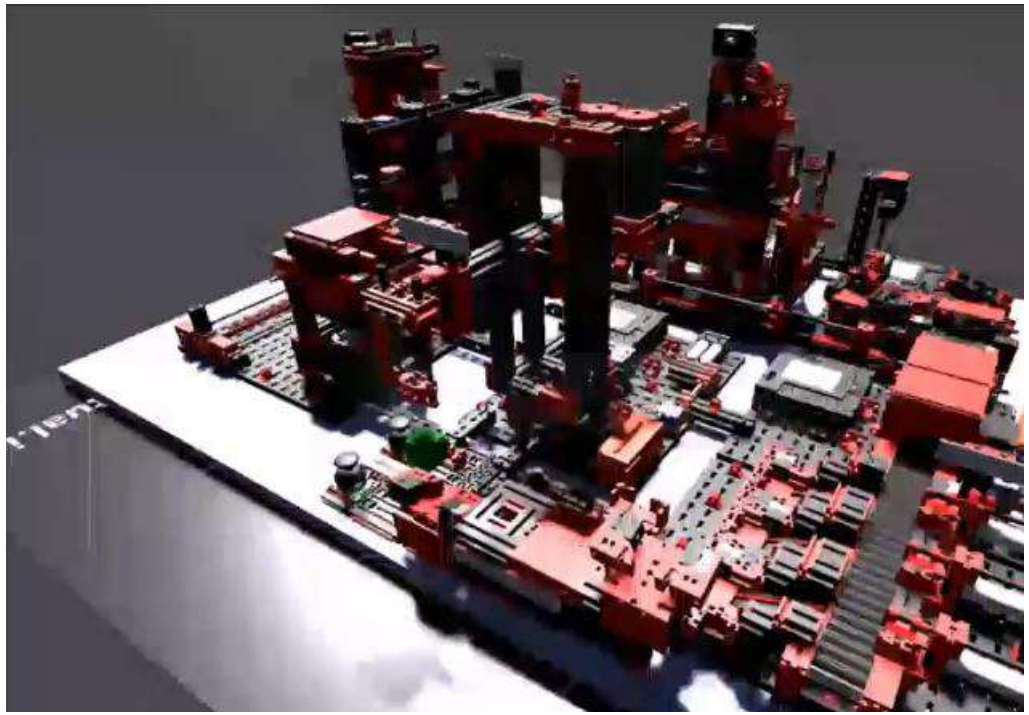
3D Visualization of the Digital Twin

ICNAP

Physical Movement



3D Visualization



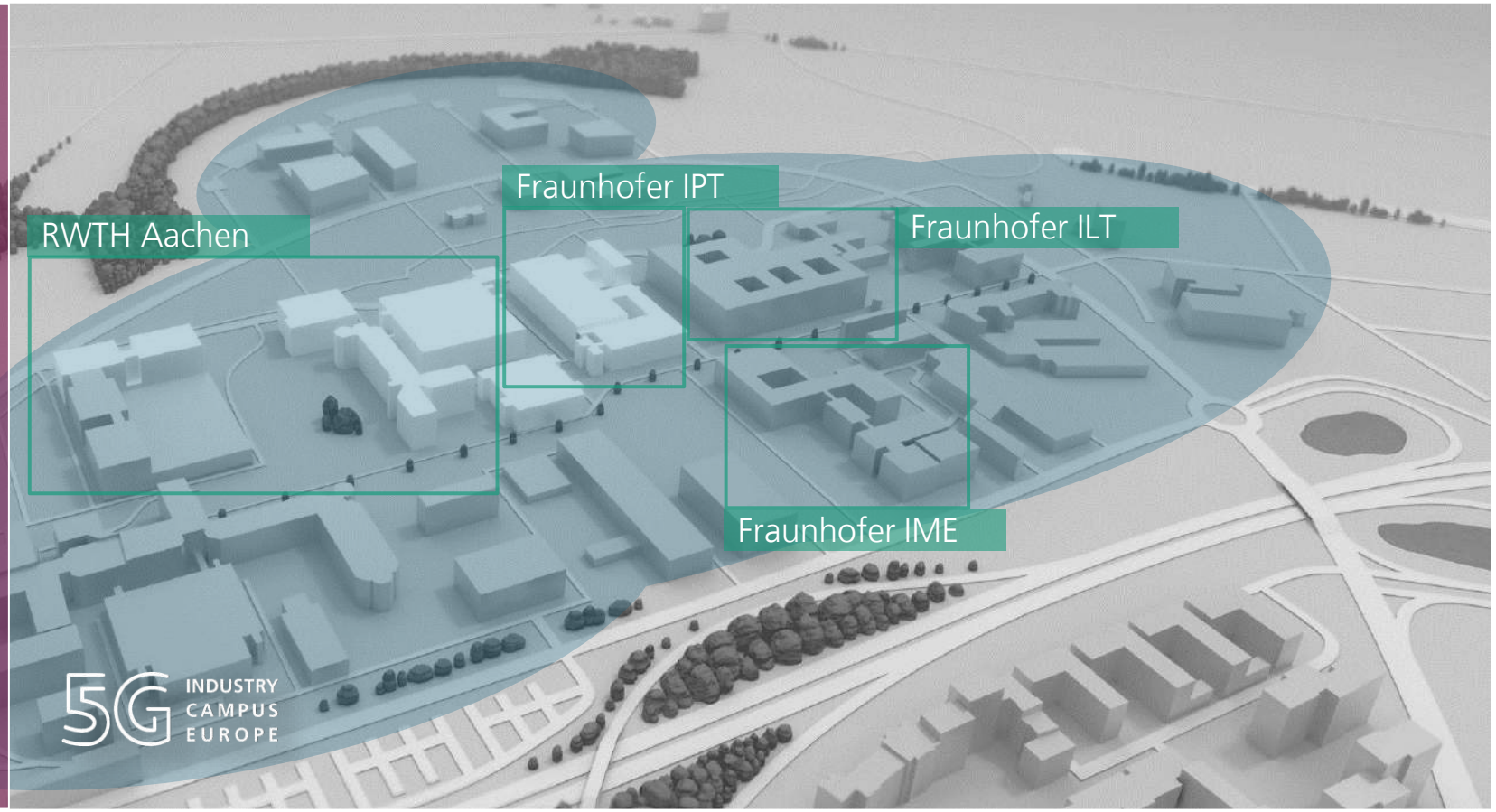
What are the pillars of successful collaboration between industry and research in ICNAP?

Our home

The RWTH Aachen Campus as a catalyst for cooperation between industry and science

Key factors for innovation

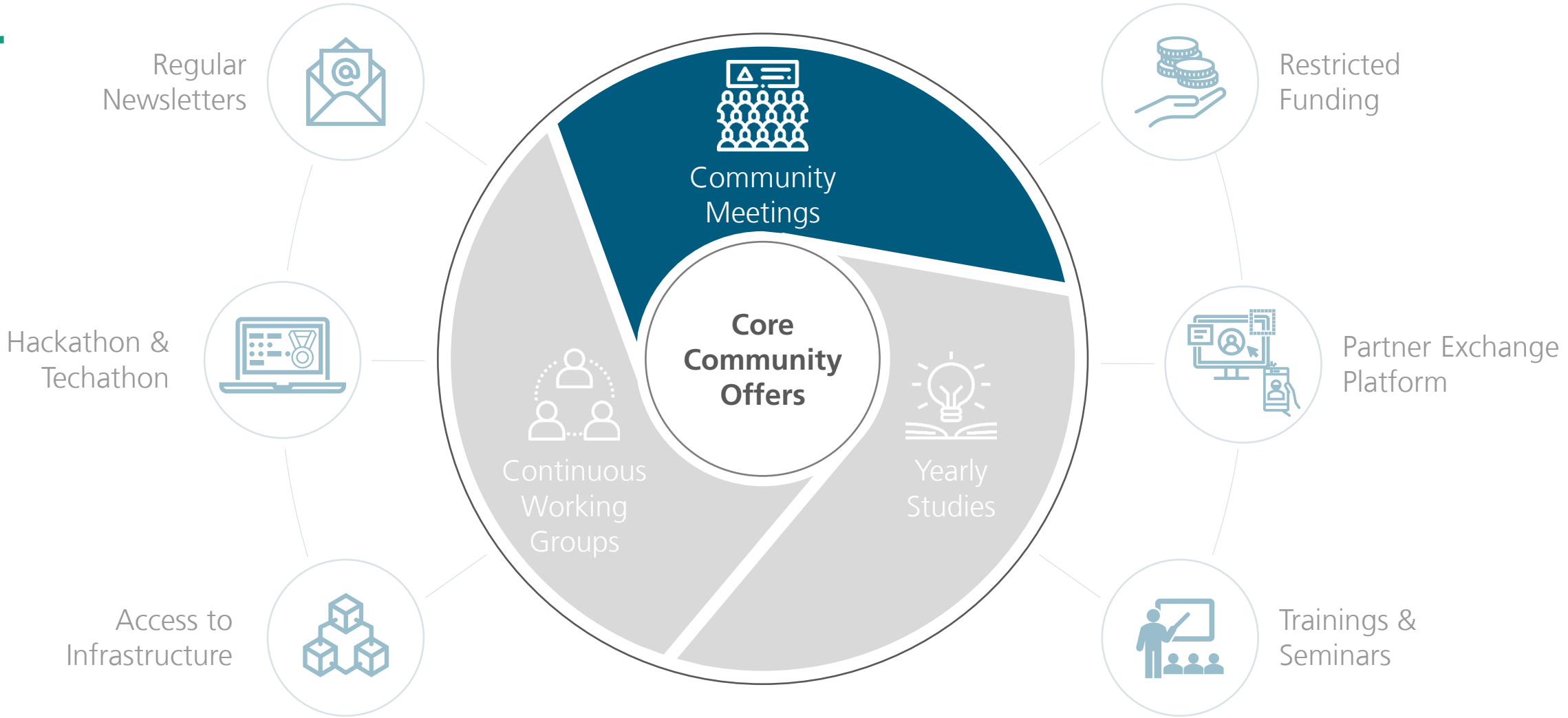
- Excellence cluster in production technology since 2006
- Part of Fraunhofer Society with more than 75 institutes
- 2400 employees in the field of networked, adaptive production
- First mover in 5G on the shopfloor



Overview of the Current 24 ICNAP Community Members

ICNAP Community – Our Pillars for Shaping Smart Manufacturing

Community Meetings



The ICNAP Year – Impressions of Community Meetings

Organized at our partners!

Study Kick-Off

Spring Meeting

Summer Meeting

Additional Workshops

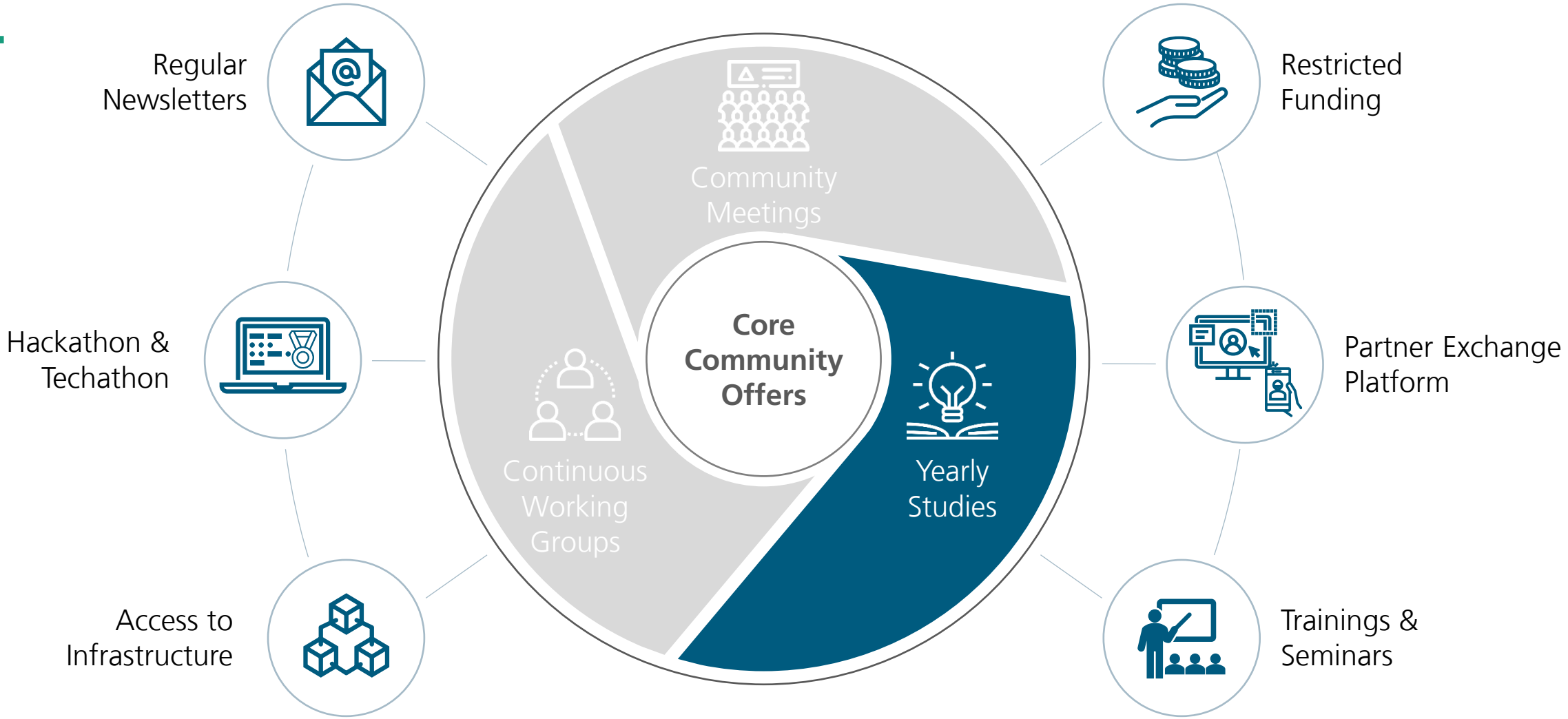
Autumn Meeting

Annual Meeting

Deep dive on specific topics!

Aachen

Studies & Researches



Past and Current Studies

ICNAP

2019

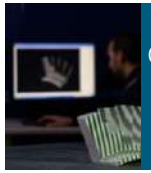

Merging Data from Different Manufacturing Sources in One Digital Twin

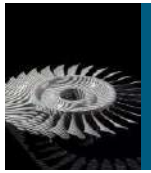

Development of a Reference Architecture for 5G-Enabled Production


Middleware Software for Industrial Internet of Things (IIoT)

2020


Artificial Intelligence in Production – In Seven Steps to a Successful AI-Project


Digital Twin Overcoming Borders Data Exchange Between Different Stakeholders


How to Take Advantage of Digitized Manufacturing

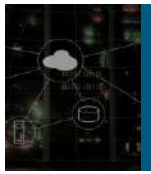
2021


Monetizing Industrial Data


5G for Closed-Loop Manufacturing


Extended Reality Applied for Production Line Industrialization


Deployment of ML and AI Solutions in the Manufacturing Environment


Virtualization for Hardware Independent Deployment

2022


Real-Time Digital Twin - Making the Digital Twin ready for Industrial Use


Pricing Models for Industrial Data


Digital Infrastructures for Sustainable Production


Cybersecurity Lab


Industrial Data Spaces for a Flexible Data-Driven Production

2023


Energy Monitoring System for Industrial Manufacturing


Industrialization of Artificial Intelligence in Production


Innovative Power Solutions for Wireless Sensor Networks

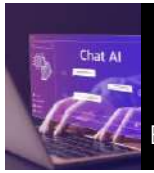

Realizing Plug & Produce on the Shop Floor


The Digital Twin Demonstrator – Bringing the Concept to Life

2024


Zero-Trust Architectures for Interconnected Industry


The Digital Twin Demonstrator – Bringing the Concept to Life (Vol. 2)



AI Everywhere – Generative AI for Production and Business Operations


Seamless AI Integration through Plug & Produce Approach

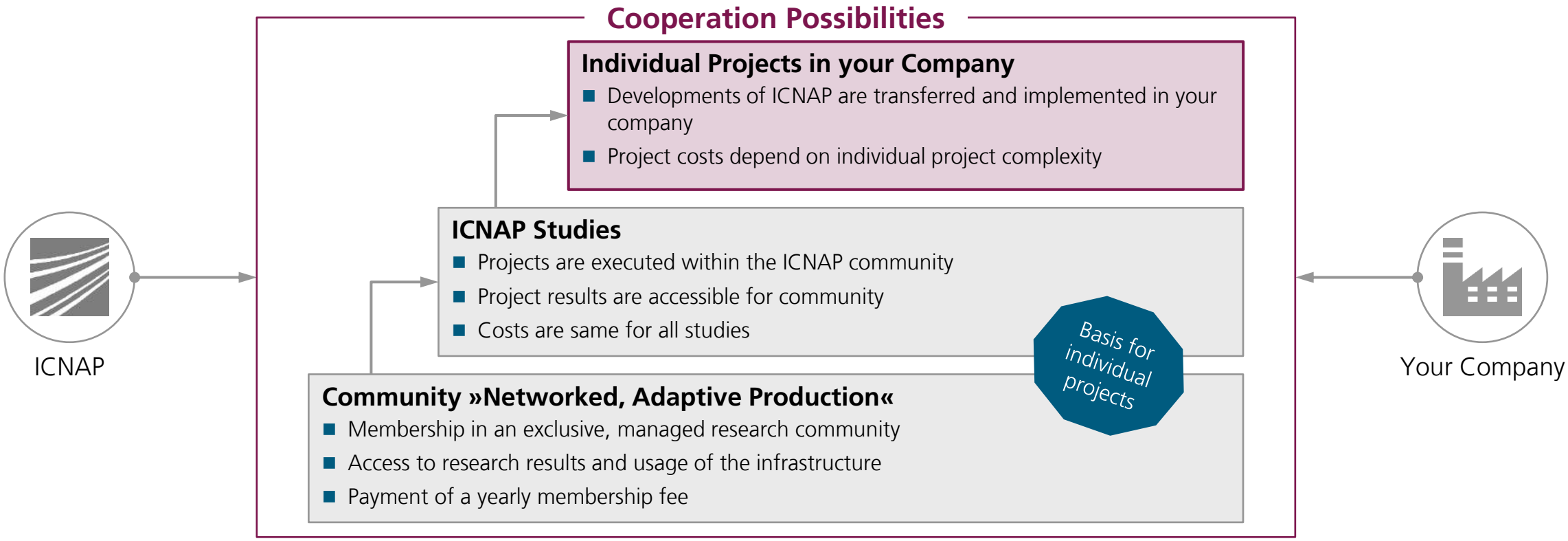

Towards a Dark Factory – Leveraging Multidimensional Twins in a Manufacturing Metaverse

Please download our ICNAP Study Reports here:

Fraunhofer

Benefits & Membership

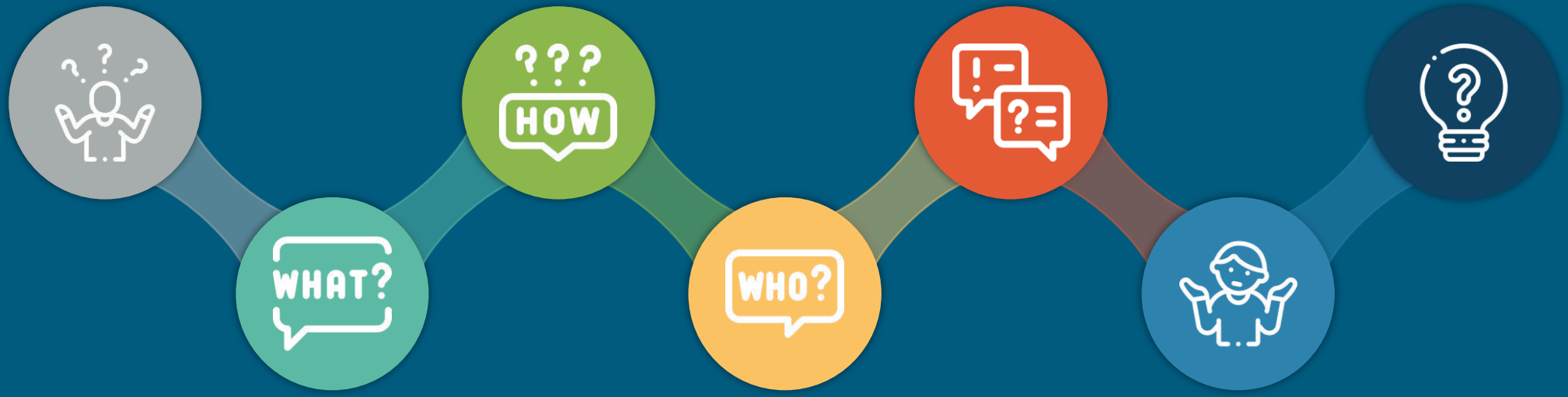
Overview of Our Cooperation Possibilities



ICNAP Contract & Membership Structure

* <5 years since est.
<2 Mio. € turnover/year
Startups are required to support the ICNAP
e.g., hackathon, workshops

	 **Standard** Category A	 **Extended** Category B	 **Startups*** Category C
Participate in ICNAP community offers	●	●	●
Decide on ICNAP study topics	●	●	
Sublicense results to affiliated companies		●	
Membership Fee	***12,500.- €/year***	***15,000.- €/year***	***4,500.- €/year max. 3 years***



インダストリー4.0を一緒に作りましょう！ご一緒できることを楽しみにしています。

Please find ICNAP infos here: www.icnap.de/en

Please download our ICNAP Study Reports here: