

SHOP4CF: KERs, Demonstrators and sustainability

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THE MANUFACTURING PARTNERSHIP DAY



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 873087. Neither the European Commission (EC) nor any person acting on behalf of the Commission is responsible for how the following information is used. The views expressed in this publication are the sole responsibility of the authors and do not necessarily reflect the views of the EC.

European Manufacturing in Numbers



Number of manufacturing enterprises:
2.1 million (9% of all EU enterprises)¹



Manufacturing sector's
turnover: 7'300 billion EUR¹



Employees in manufacturing: 30 million
(21.8% of all employees in EU)¹



Manufacturing sector's added value: 1'900
billion EUR (27% of total added value in EU)¹

¹https://ec.europa.eu/eurostat/statistics-explained/index.php/Archive:Manufacture_of_basic_metals_statistics_-_NACE_Rev._2

European Manufacturing Challenges



Digitization²: Less than 15% of all manufacturing companies are highly digitized, e.g.:

1. Only 20% of all companies are employing IoT solutions.
2. Only 16% of all companies automate their processes with robotics.



Europe's labor cost in manufacturing is not competitive (2019):

1. 27.7 EUR/hour in EU³
2. 5.2 EUR/hour in China^{*4}
3. 2.6 EUR/hour in Vietnam^{*4}

Implications: Is human labor too costly and will disappear in the long run?

These challenges in European manufacturing are directly addressed in SHOP4CF...

^{*}Exchange rate 1.12 Dollar/EUR

²[https://ec.europa.eu/growth/tools-](https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/Digital%20Transformation%20Scoreboard%202018_0.pdf)

[databases/dem/monitor/sites/default/files/Digital%20Transformation%20Scoreboard%202018_0.pdf](https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/Digital%20Transformation%20Scoreboard%202018_0.pdf)

³https://ec.europa.eu/eurostat/statistics-explained/index.php/Hourly_labour_costs

⁴<https://www-statista-com.eaccess.ub.tum.de/statistics/744071/manufacturing-labor-costs-per-hour-china-vietnam-mexico/>



In SHOP4CF, we ...

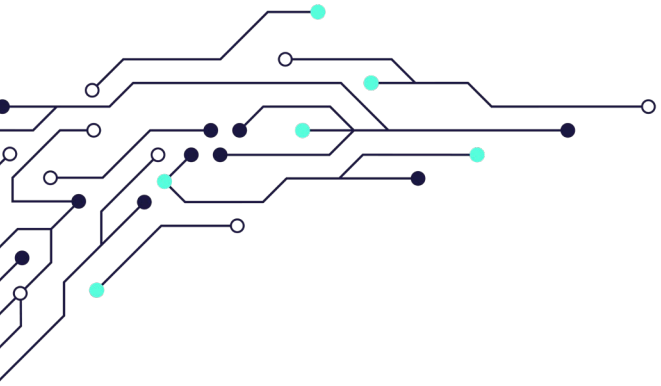


... create a **software platform** with a variety of **re-usable components** for the convenient deployment in manufacturing environments, thereby **increasing the degree of digitalization**.

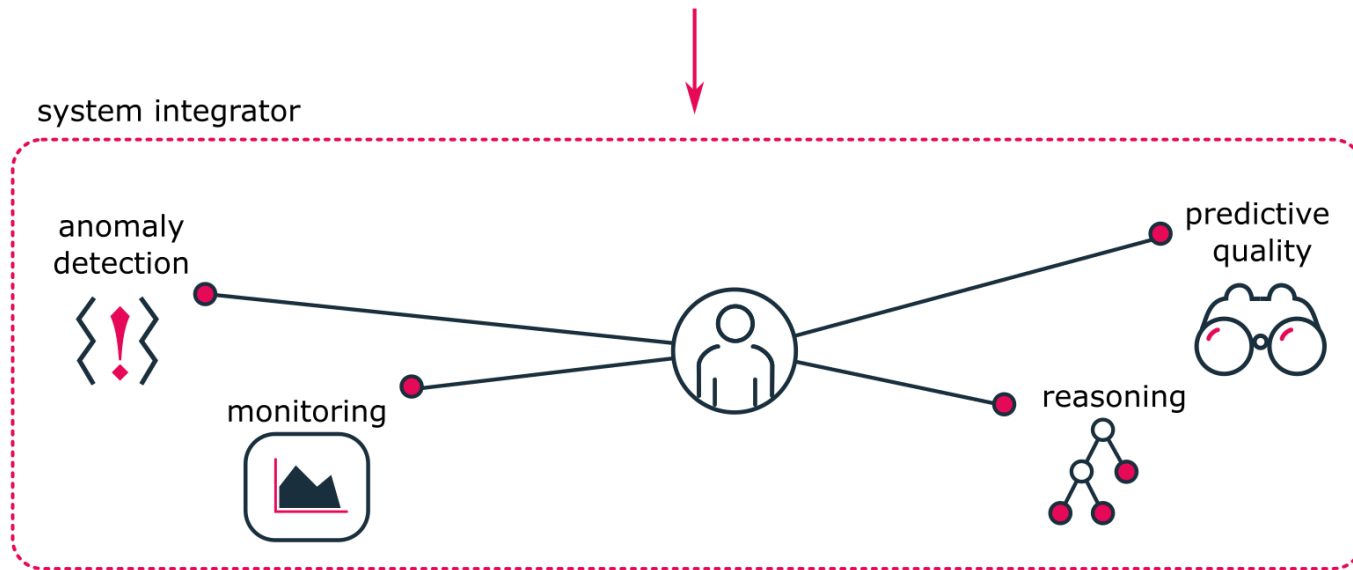
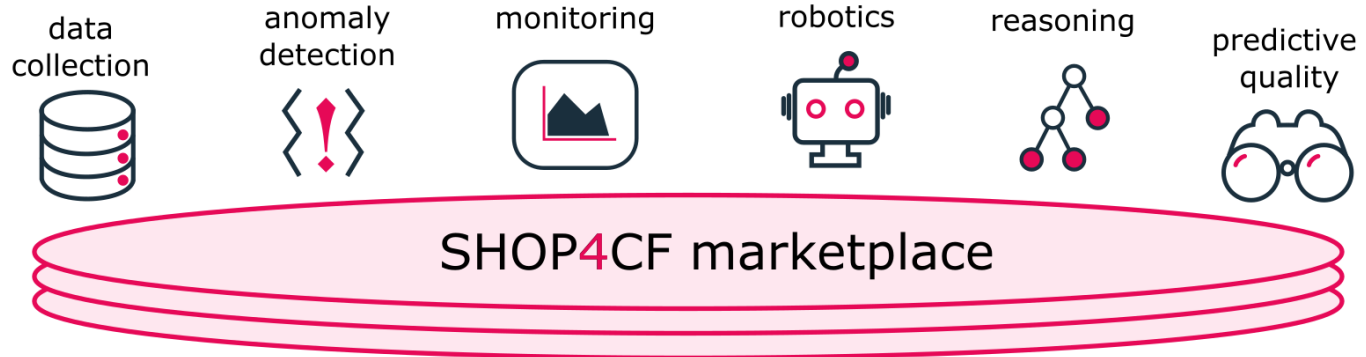


... believe that the project outcome will have a positive impact on the labor market, as **the human worker will not simply be replaced by automated processes, but will find new relevance**.

So far so good – But how are these goals addressed in SHOP4CF?



SHOP4CF marketplace



Component Catalogue

Software Solutions

Custom Search

 Compatible with the RAMP IoT platform

Search

Wi-POS Indoor Localization

The Wi-POS system is able to accurately determine the position of AGVs, robots or equipment on the shop floor.

More Info

Manufacturing Process Management System

MPMS includes the functionality to design processes and describe agents, and execute in automated way the processes by assigning activities to agents.

More Info

Dynamic Task Scheduling for H-R collaboration

<https://shop4cf.eu/marketplace/>



ROS2 Monitoring Tool



M202P: Multi-Modal Online and Offline Programming solution



VR-RM-MT: Virtual reality set for robot and machine monitoring and training



DT-CP: Digital Twin – for planning and control

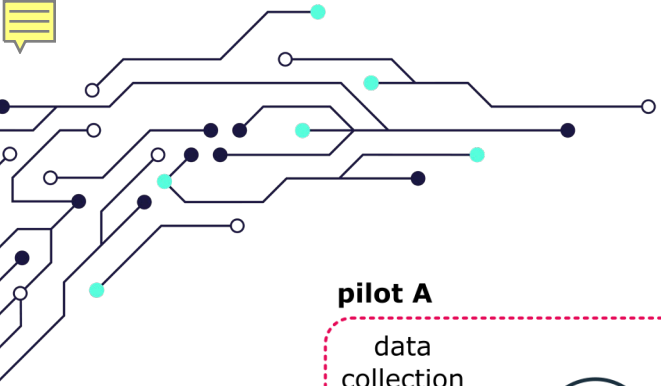


DCF: Data Collection Framework

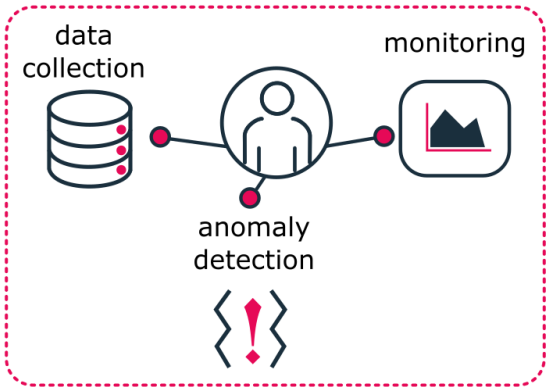


ADIN: Adaptive Interfaces

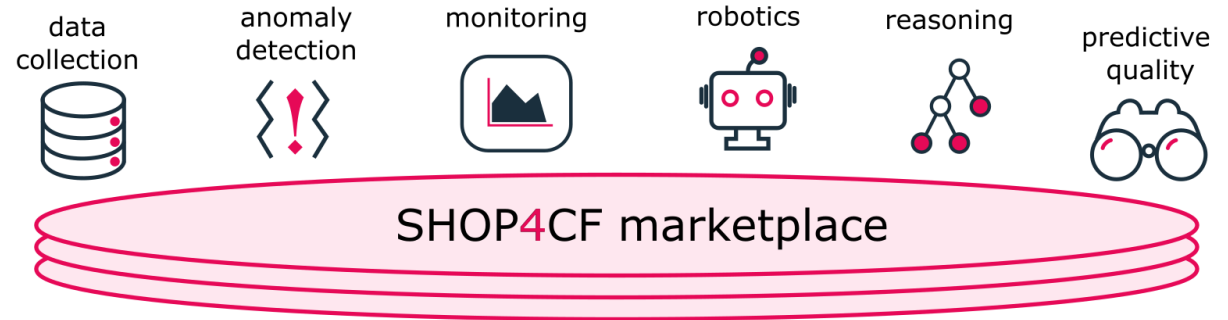
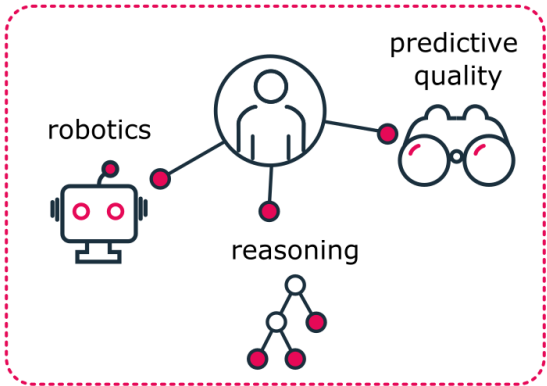
<https://ramp.eu>



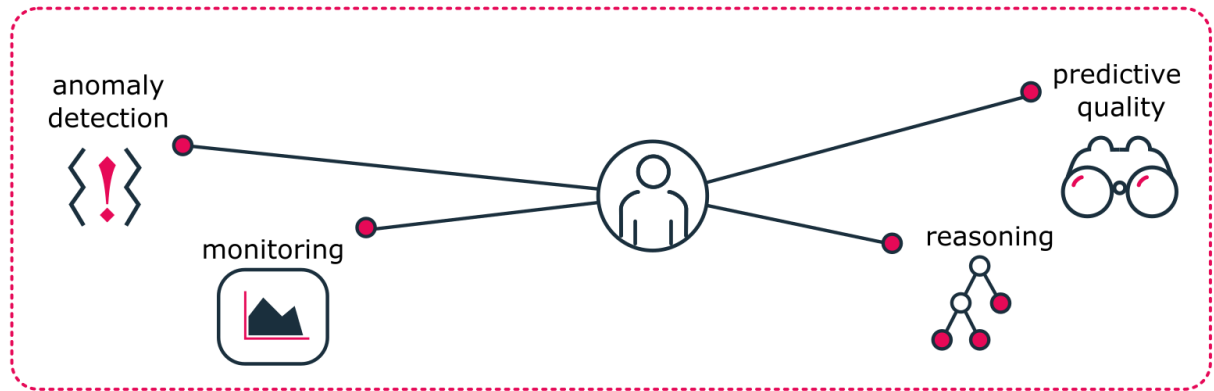
pilot A

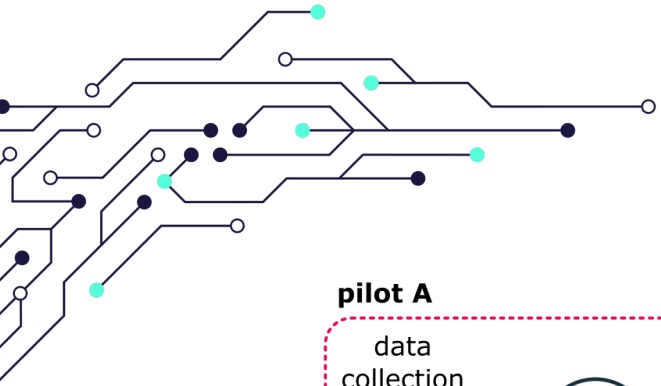


pilot B

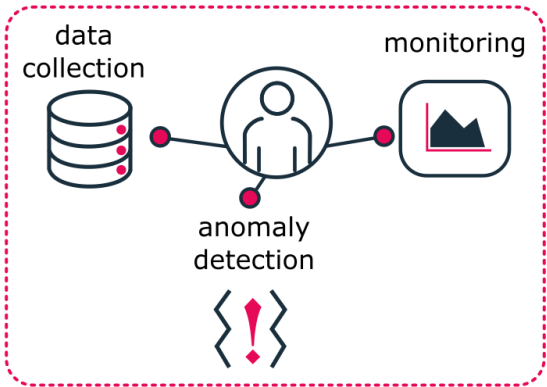


system integrator

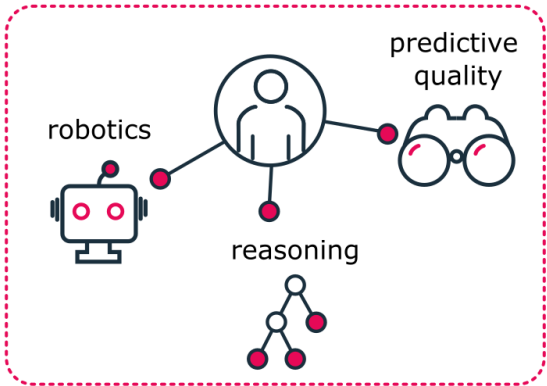




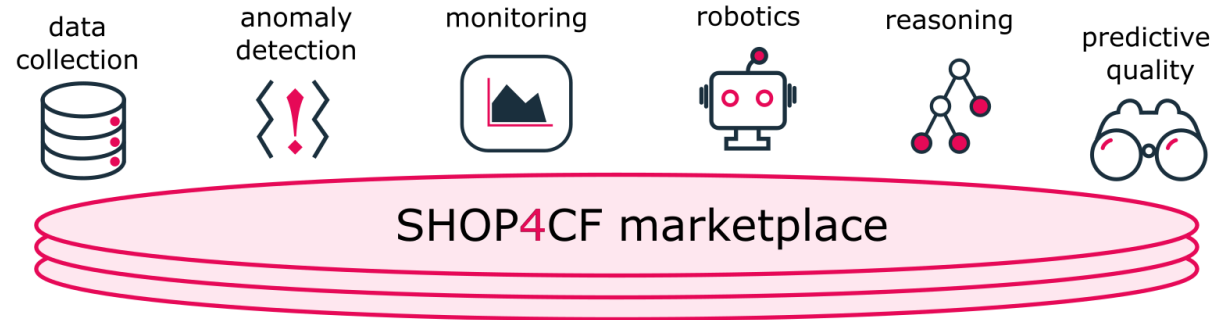
pilot A



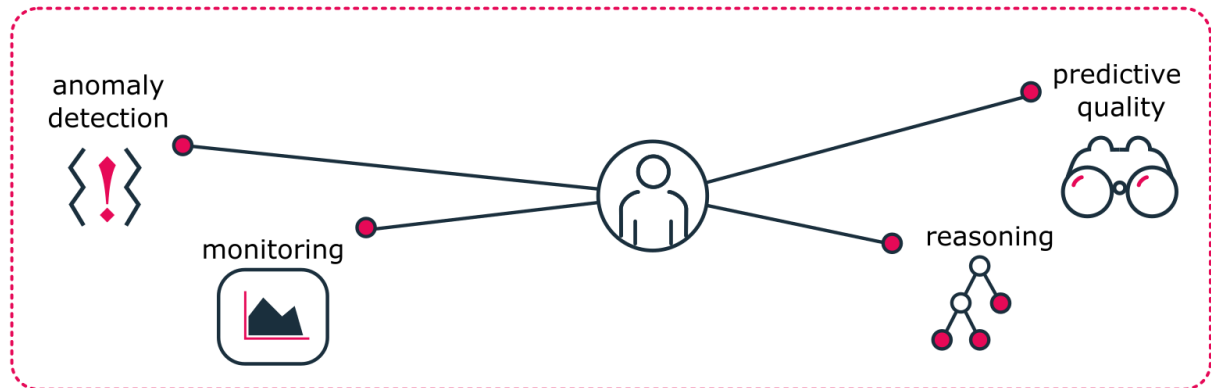
pilot B



<https://spaces.fundingbox.com/c/shop4cf>



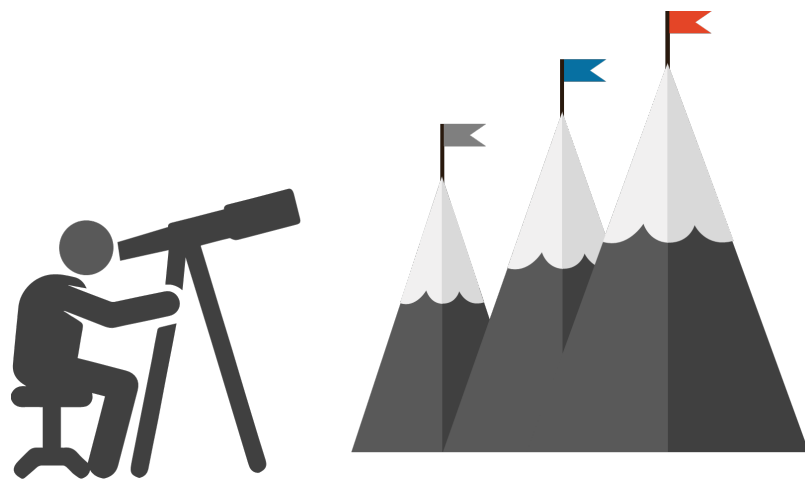
system integrator



A decorative graphic in the top-left corner consisting of a network of black lines with small circles at the nodes, resembling a circuit board or data flow diagram. Some nodes are highlighted in cyan.

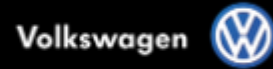
Objectives of pilots

- Identify real-world challenges
- Develop functionalities addressing real manufacturing needs
- Collect feedback, extend and improve



- *Human factors relevance and value*
- *Innovation and ambition*
- *Reusability of components*

Corporate Pilots



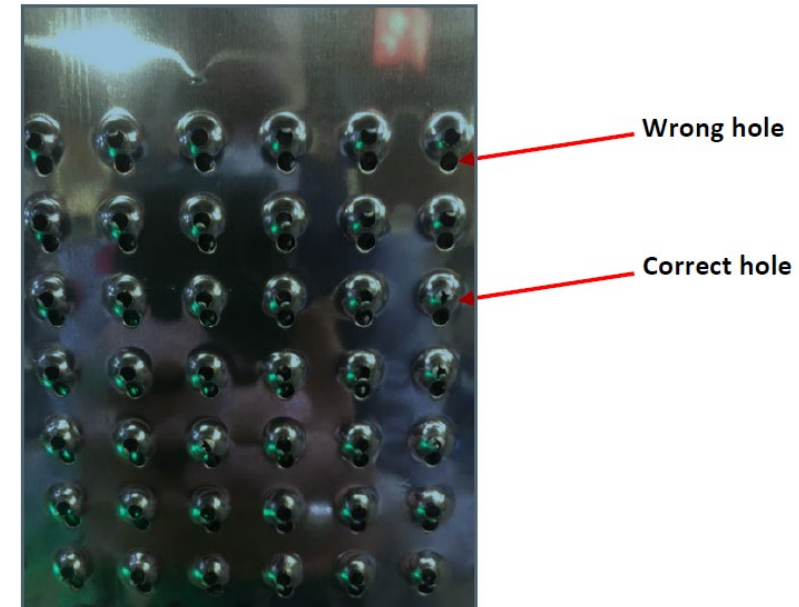
SIEMENS



Partner	Component	BOS #1	BOS #2	SAG #1	SAG #2	SAG #3	ARC #1	ARC #2	VWP #1	VWP #2
DTI	ROS2 Monitoring			X	X					
	Workcell Process Optimization based on Reinforcement Learning									
TUE	MPMS		X	X					X	
FZI	FBAS-ML			X						
	DTS			X						
	F-TPT	X		X						
JVERNE/FZI	Human-Aware Mobile Robot Navigation	X	X							
TECNAUJA	AR Content			X				X		
	VR Creator									
UPM	Interoperability Layer through Web of Things (WoT-IL)		X				X			
PSNC	Predictive Maintenance (PMADAI)								X	
	Visual Quality Check (VQC)	X								
	Digital Twin for Intralogistics									X
IMEC	OpenWIFI			X						
	FLINT (M3RCP)								X	
	Wi-POS	X		X		X				X
TAU	Virtual Reality Set for Robot and Machine Monitoring and Training									
	Multi-Modal Offline and online programming solutions				X					
	Adaptive Interfaces									
	Digital Twin						X			
IFF	C2NET Data Collection Framework						X			
	Review of Risk Analysis			X	X	X				
	Automated Safety Approval			X						
TUM	AR for Collaborative Visual Inspection	X		X		X				

Arcelic: AR TELEASSISTANCE FOR EQUIPMENT MAINTENANCE

- Problems description:
 - Hole punch on drum: During the production of the drum from metal sheet, punches do not center correctly to their determined positions. This results in mismatch of the holes and pockets.
 - Expert advice is needed to improve
- SHOP4CF Pilot:
 - WoT-IL component translates sensor data and posts to FIWARE context broker
 - AR TeleAssistance component visualizes sensor data while talking to an expert

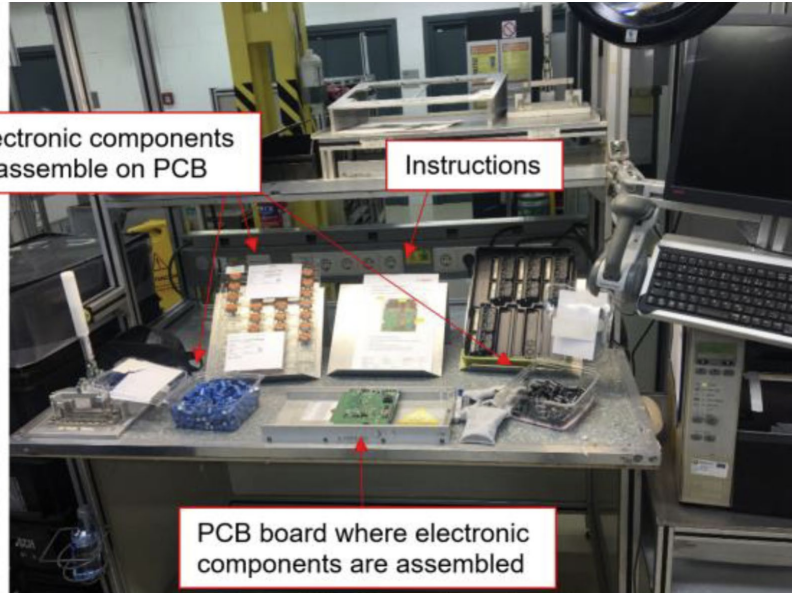


AR TeleAssistance

- Communication between workers and experts through video streaming
- Augmented with reality indications
- Users can use mobile devices and HoloLens



Bosch UC1



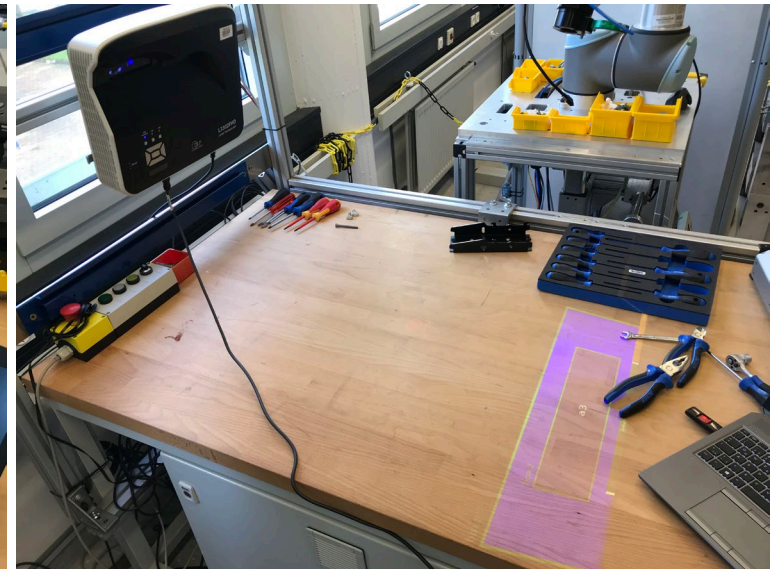
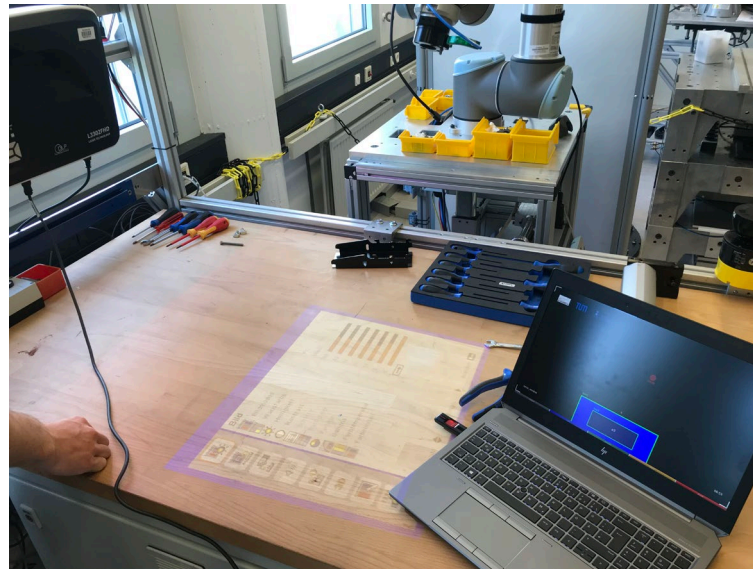
- Removing physical instruction manuals
 - AR-CVI(TUM)
- Visual Check of the Assembled PCB
 - Visual quality check (PSNC)



- Automatic transportation of the assembled PCBs
 - Human-Aware Mobile Robot Navigation (FZI/Jverne)
 - Wi-Pos(IMEC)

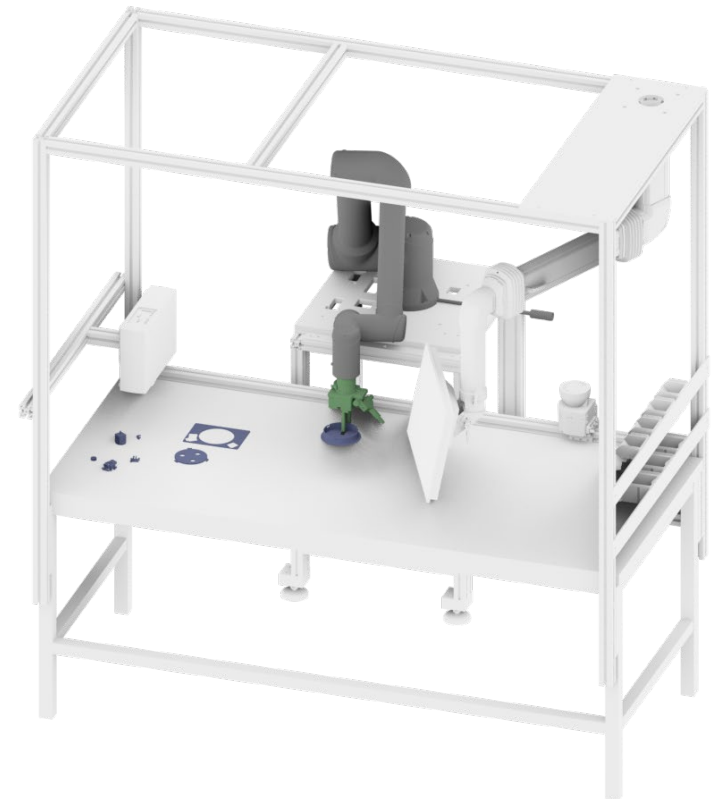
- Task orchestration
 - F-TPT (FZI)

AR-CVI

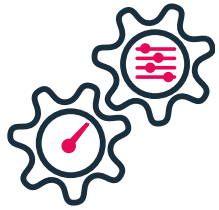


Siemens UC1: Gearbox Assembly

- Not a fully automated task: involves both the human operator and the robot in a collaborative workspace
- First tests:
 - The robot arm brings the different components of the gearbox to the operator
 - Operator does the assembly
 - Increases efficiency by approaching the necessary parts to the human
- Second tests:
 - The robot work in the same gearbox in parallel
 - Distribution of rolls according to both robot and human skills



In SHOP4CF, we are 20 Partners ...



2 SMEs



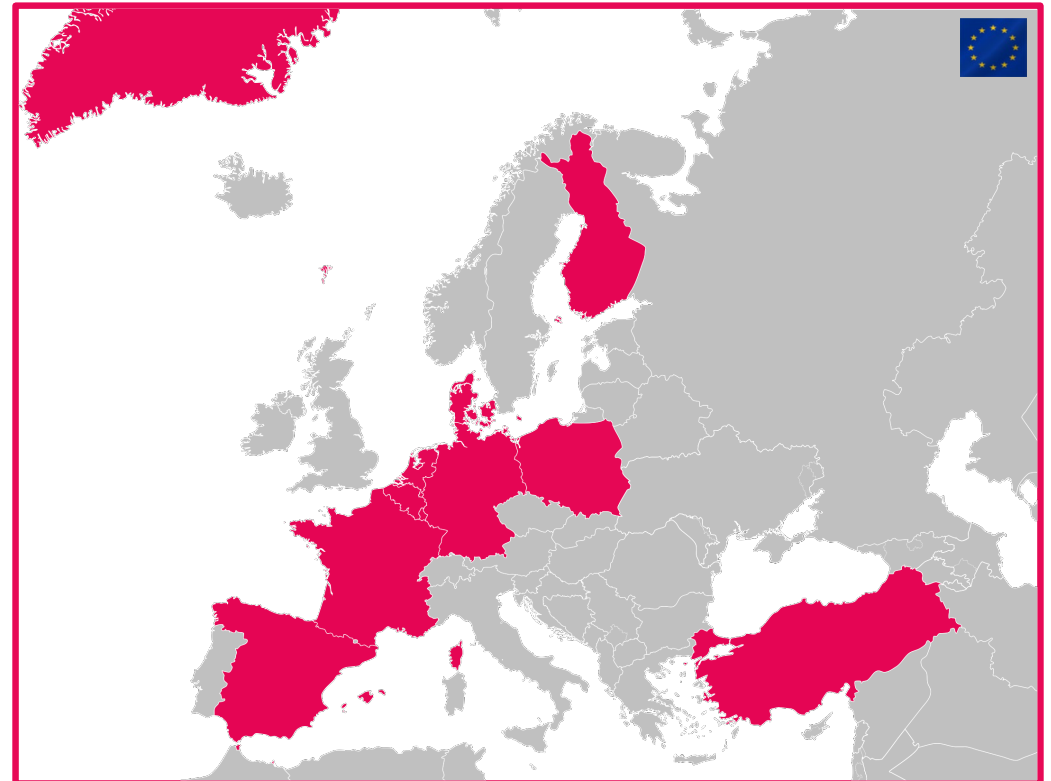
5 Universities



5 Industry partners



8 Research organisations





Project Coordinator

TUM



Technical Manager

DTI



Innovation Manager

IMEC



Quality Manager

TECNALIA



Coordination Manager

UPM



POLITÉCNICA



Samochody Użytkowe



UNIWERSYTET
OPOLSKI

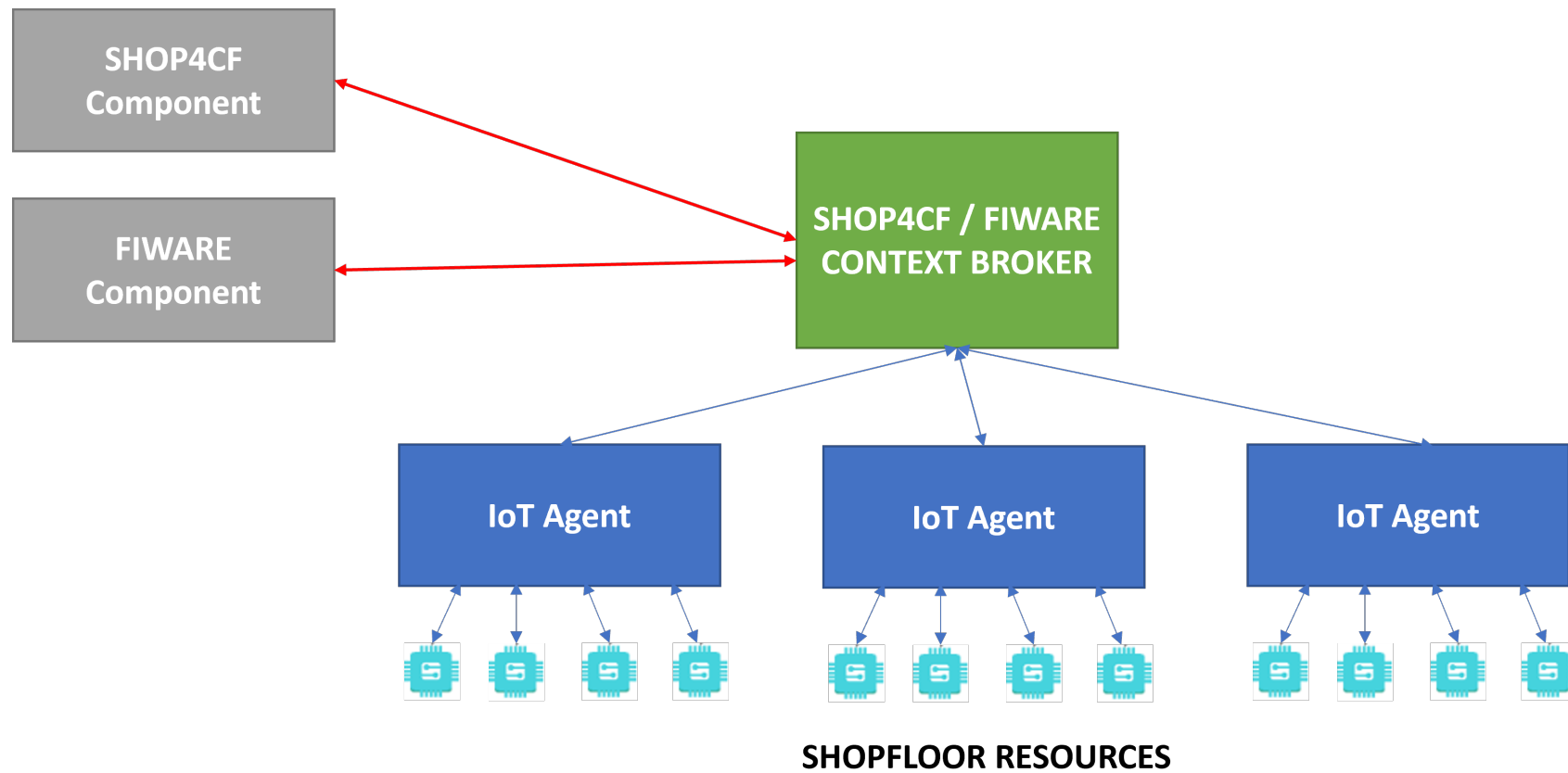


FundingBox

Key exploitable results

- 25 interoperable components and rising
 - Solving a human challenge on the SHOP floor
- Marketplace
 - Easy to access & deploy components
- Support
 - Trainings and MOOCs are available (<https://learn.shop4cf.eu/>)
 - SHOP4CF Community for tailored support
- Architecture & Data model
 - Interoperable with FIWARE Smart Industry

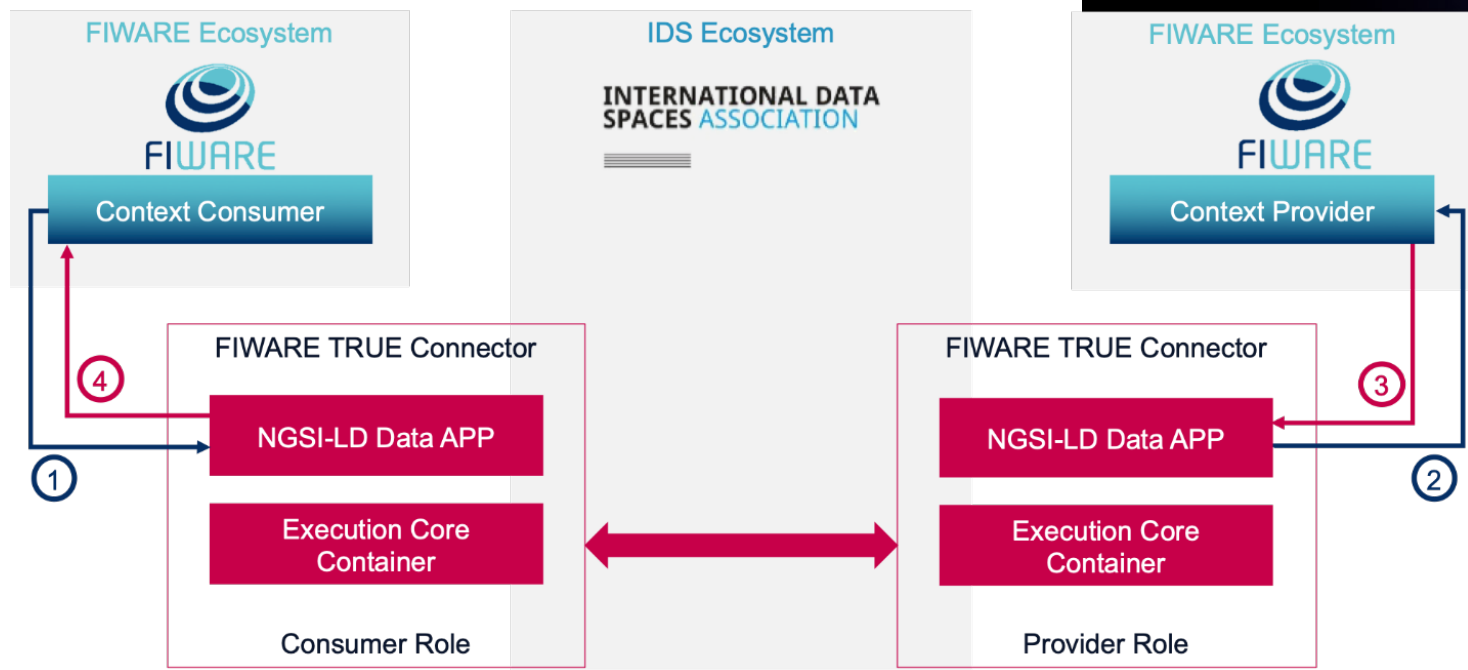
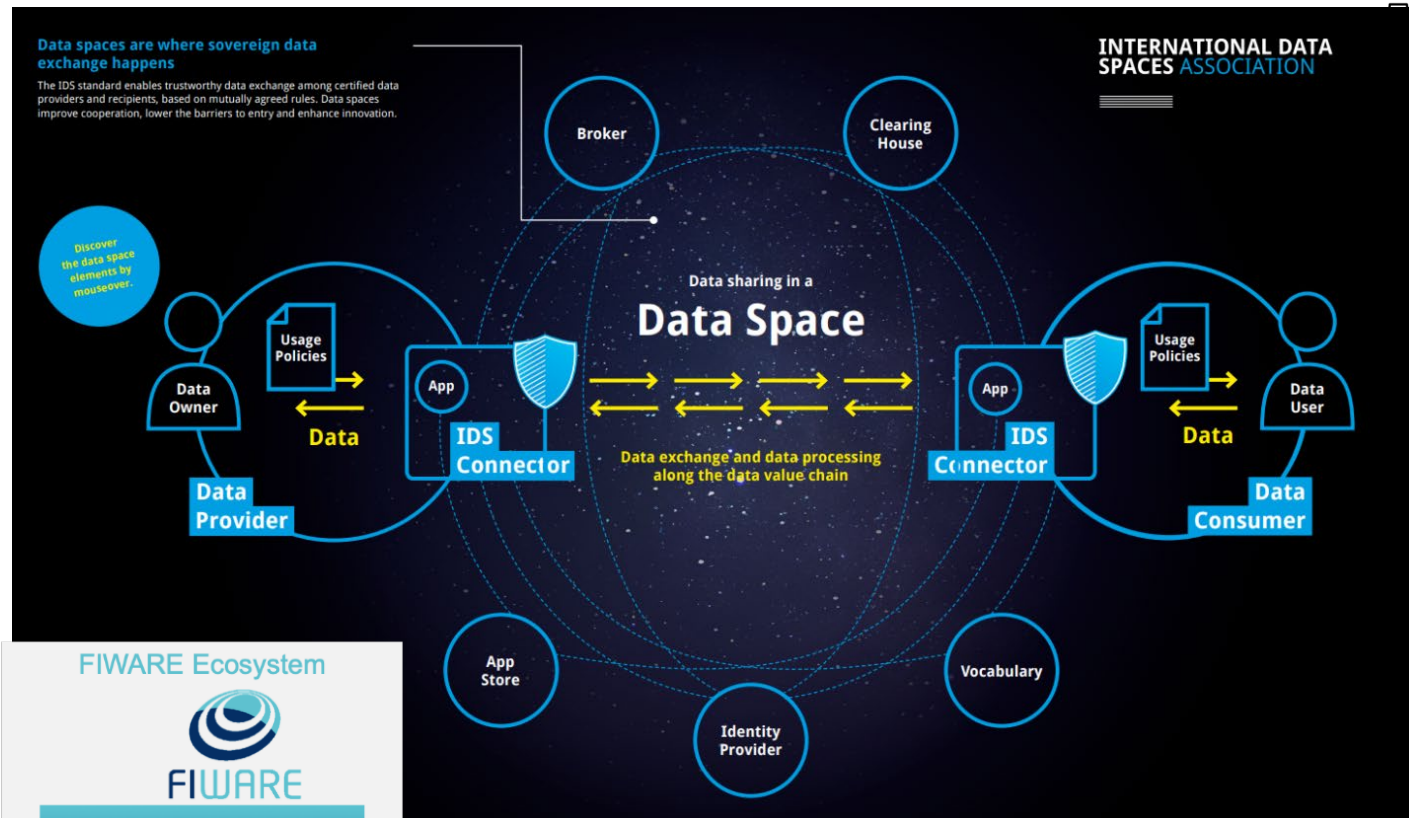
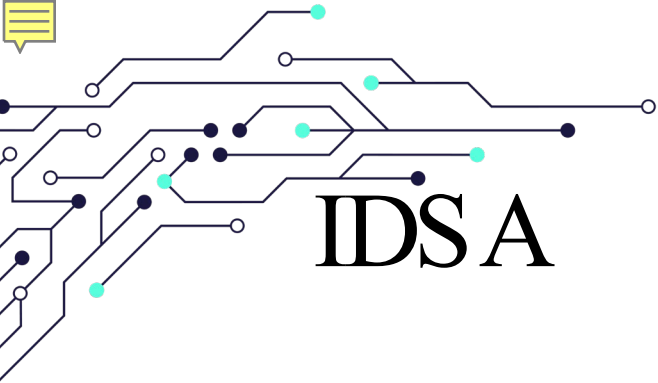
FIWARE SHOP4CF



Interoperability



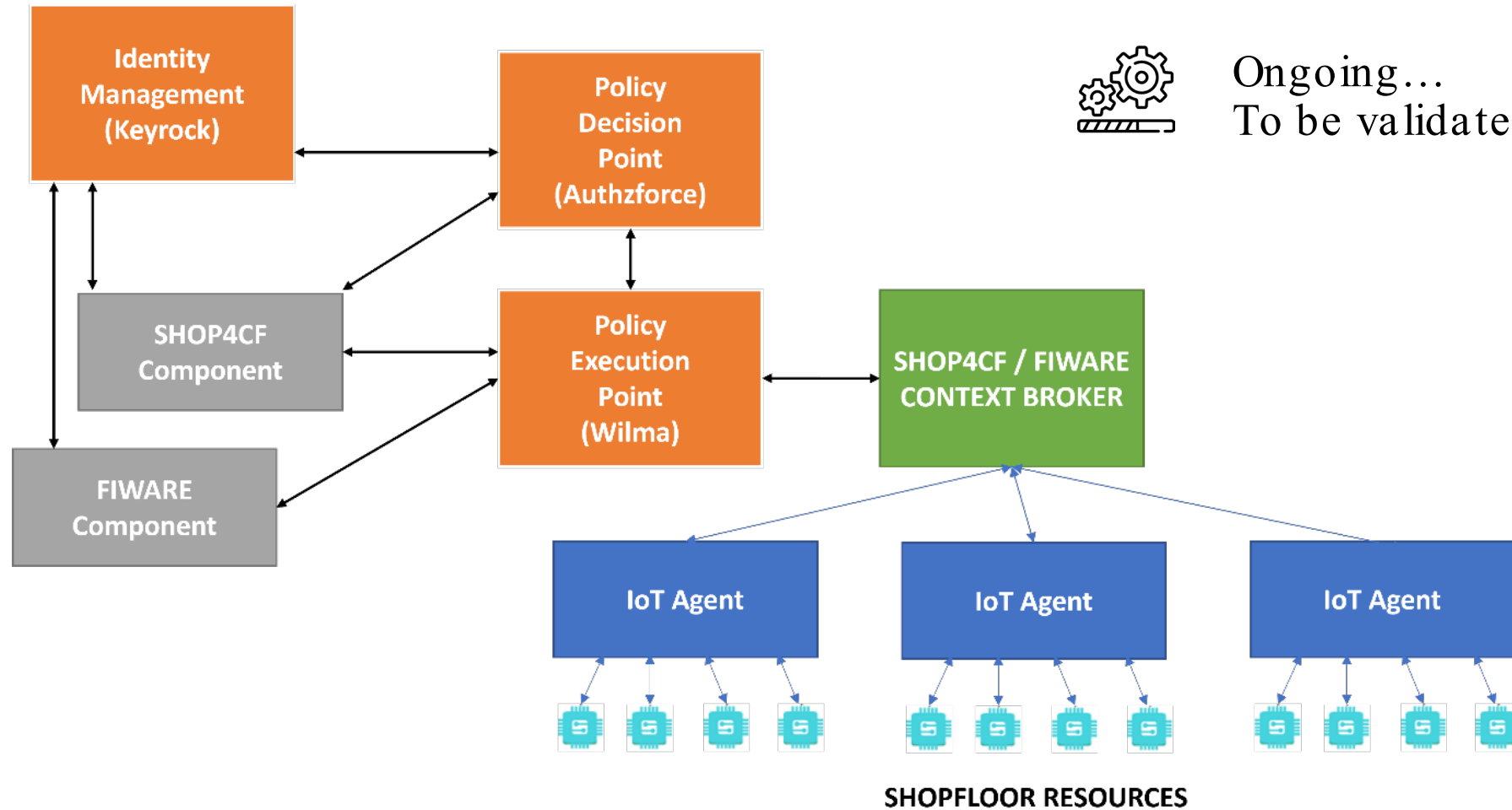
Limit learning curve



 Siemens pilot test case

 List available data at industrial partners

Secure communication



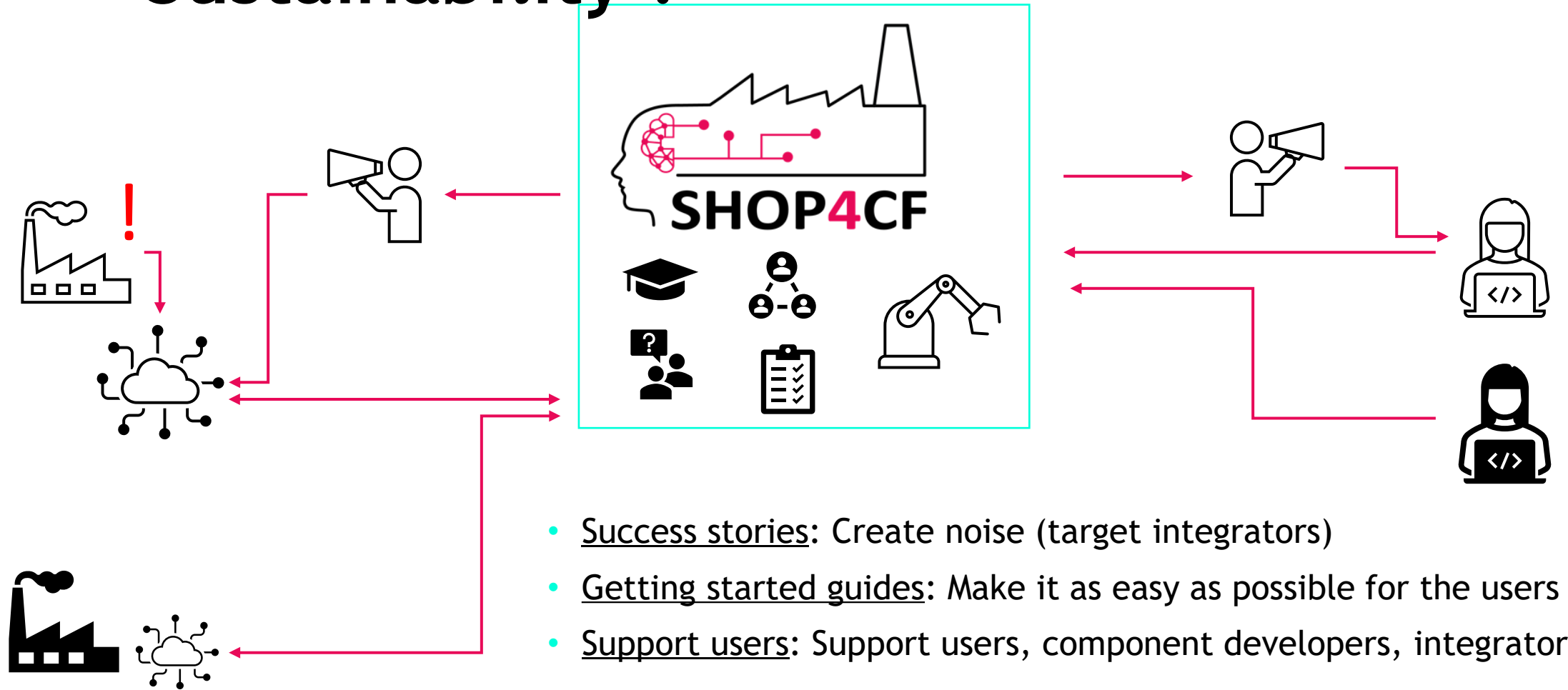
Ongoing...
To be validated by industrial partners

A platform to enable Industry5.0



- **Digital marketplace**
 - Offering software components (easy access)
 - Allowing direct communication developer - customer
 - Selecting the best solution for customers based on their requirements
- **Reference Architecture**
 - To ensure interoperability and future proofing
- **A Human-centered focus**
 - Asses the impact of the technology on employers & employees

Sustainability ?



- Success stories: Create noise (target integrators)
- Getting started guides: Make it as easy as possible for the users
- Support users: Support users, component developers, integrators

ALL partners agreed to continue to offer support for their components on RAMP (min. 2 years)
 European Dynamics will continue to develop & support RAMP



Questions?

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Project Coordinator



SMEs



Research Organisations



DANISH
TECHNOLOGICAL
INSTITUTE



Universities



POLITÉCNICA



Industry Partners



Nutzfahrzeuge

