

CREATE the Next Generation IoT eXperience for the Future

European Industry Partnership Collaborative Event

Strategic Directions and Research Priorities. Amsterdam, April 17th 11:20



EFFRA Roadmap and Connected Factories 2025 pathways materialization

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POLITECNICO
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SCHOOL OF MANAGEMENT
Manufacturing Group

European Factories of the Future Research Association (EFFRA)

Who We Are

- **Industry-led association** representing private side in the 'Factories of the Future' Public-Private Partnership with **European Commission**
- **170+** members from across Europe (a network of experts)
- Members include **large**, **small** & **medium** industrial enterprises, research organisations, universities, industrial associations and clusters
- **Full time secretariat**: Connecting with members, coordinating research agenda & liaising with the European Union
- Support wider Factories of the Future community



The Factories of the Future PPP - Some figures...

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Nr of projects	Cumulative total
FoF-2010		25 projects																	25	25
FoF-2011			36 projects																36	61
FoF-2012				37 projects															37	98
FoF-2013					53 projects														53	151
FoF-2014						29 projects													29	180
FoF-2015							28 projects												28	208
FoF-2016								37 projects											37	245
FoF-2017									23 projects										23	268
FoF-2018										15 projects									15	283

- 283 Projects to date.
- > 2,000 organisations participating
- High involvement of SMEs:
>30% of funding
- Projects feature demo activities
- >1000 results have been reported on EFFRA Innovation Portal (portal.effra.eu)

From FoF 2020 roadmap to Factories 4.0 & Beyond

Building on the vision of the FoF 2020 roadmap and public consultation in 2016

*Vision of the factories of the future:
the challenge perspective*



*Vision of the factories of the future:
the technology perspective*

→ Key priorities for FoF 18-19-20

Agile value networks: Lot-size one - distributed manufacturing

Excellence in manufacturing: Advanced manufacturing processes and services for zero-defect processes and products

The human factor: Human competences in synergy with technological assets

Sustainable value networks: Manufacturing in a circular economy

Interoperable digital manufacturing platforms: connecting manufacturing services

1 I4MS

BE in CPPS MIDIH
MANUFACTURING • INDUSTRY
DIGITAL • INNOVATION • HUBS

2 ZERO DEFECTS Manufacturing Platform ZDMP eFactory

QUALITY

Open DEI
Aligning Reference Architectures, Open Platforms and Large-Scale Pilots in Digitising European Industry

CONNECTED FACTORIES
Supported by the European Commission through the Factories of the Future PPP

I4MS Programme: ICT Innovation for Manufacturing SMEs

1

I4MS



Phase II BEinCPPS,
Success Stories
Industrial Cases

Phase III MIDIH, DIHs
Networks, Reference
Architecture, Open Calls

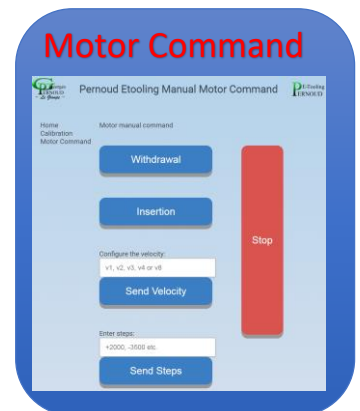
Phase IV DT-ICT-03-
2020 Uptake digital
game changers



TECHNOLOGY AREAS COVERED BY I4MS UNTIL NOW

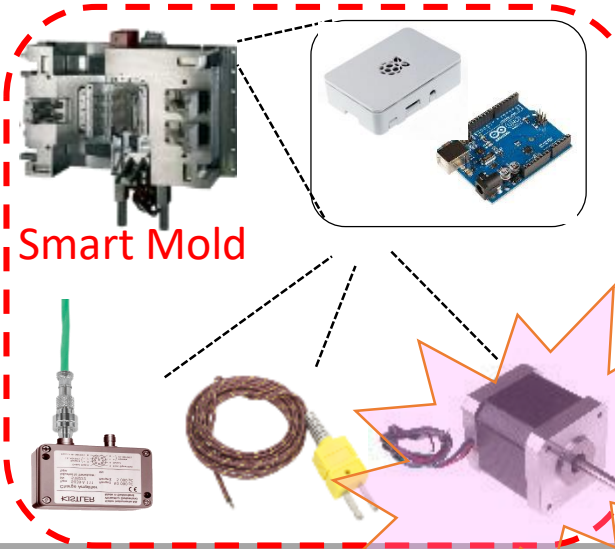
HPC CPS ROBOTICS LASER SENSORS

Smart Moulds in Plastic Industry



Injection Machine

EUROMAP67



Smart Mold

Factory Gateway

OPC-UA

Local Fiware Components

NGSI

Data analysis

Cloud

Data storage

Data visualization

Sensor data

T1 (°C)	122,5	T2 (°C)	125
P1 (bar)	860		

Motor following

I1 (A)	3,4	I2 (A)	2,7
C1 (mm)	17	C2 (mm)	67

Injection machine data

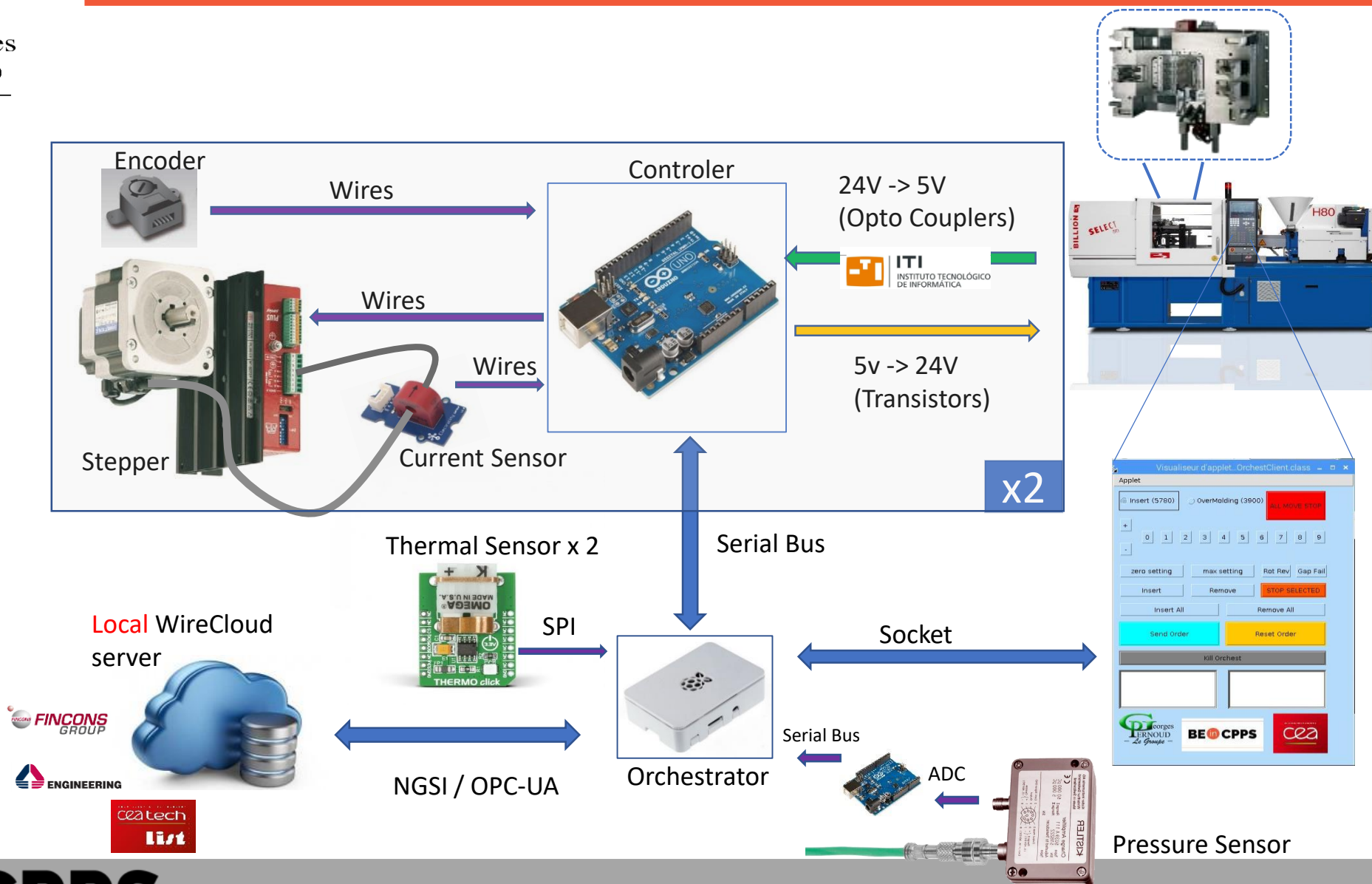
- Top closing mold A6 ● ●
- Pull out ejection B4 ● ●
- Pull in ejection B3 ● ●

Alerts

Date	Time	Alert
25/04/16	14h56	A1
25/04/16	08h45	A1
26/04/16	15h12	A2

<http://www.beincpps.eu/>

On-field Experimentation

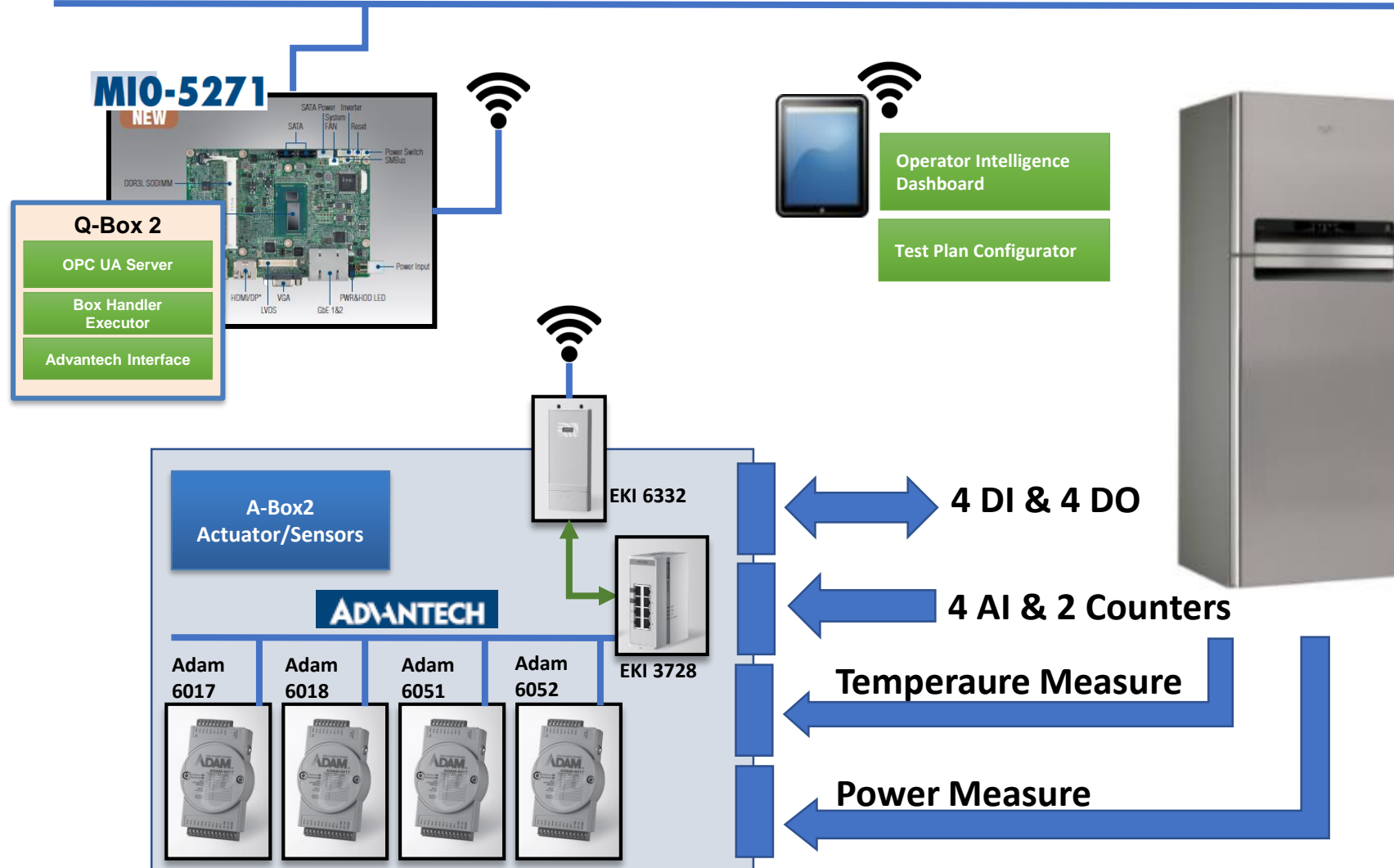


NPE 2018: Orlando OCCC



White Goods Zero Defect Quality process

WH Network



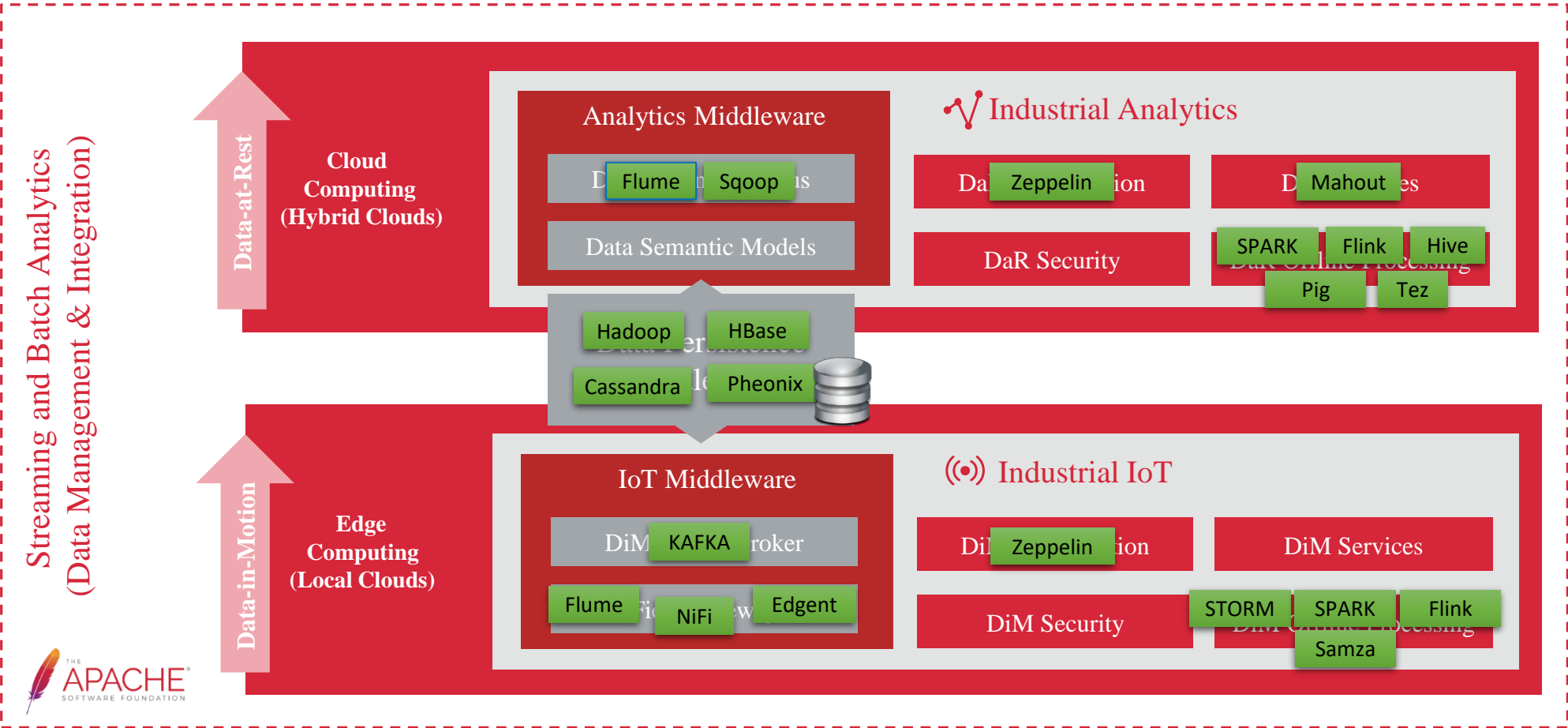


- Appliances Under Test
- Type Built-in
- Testing Time duration from 20 to 120 minutes in according with the model and the specific procedures

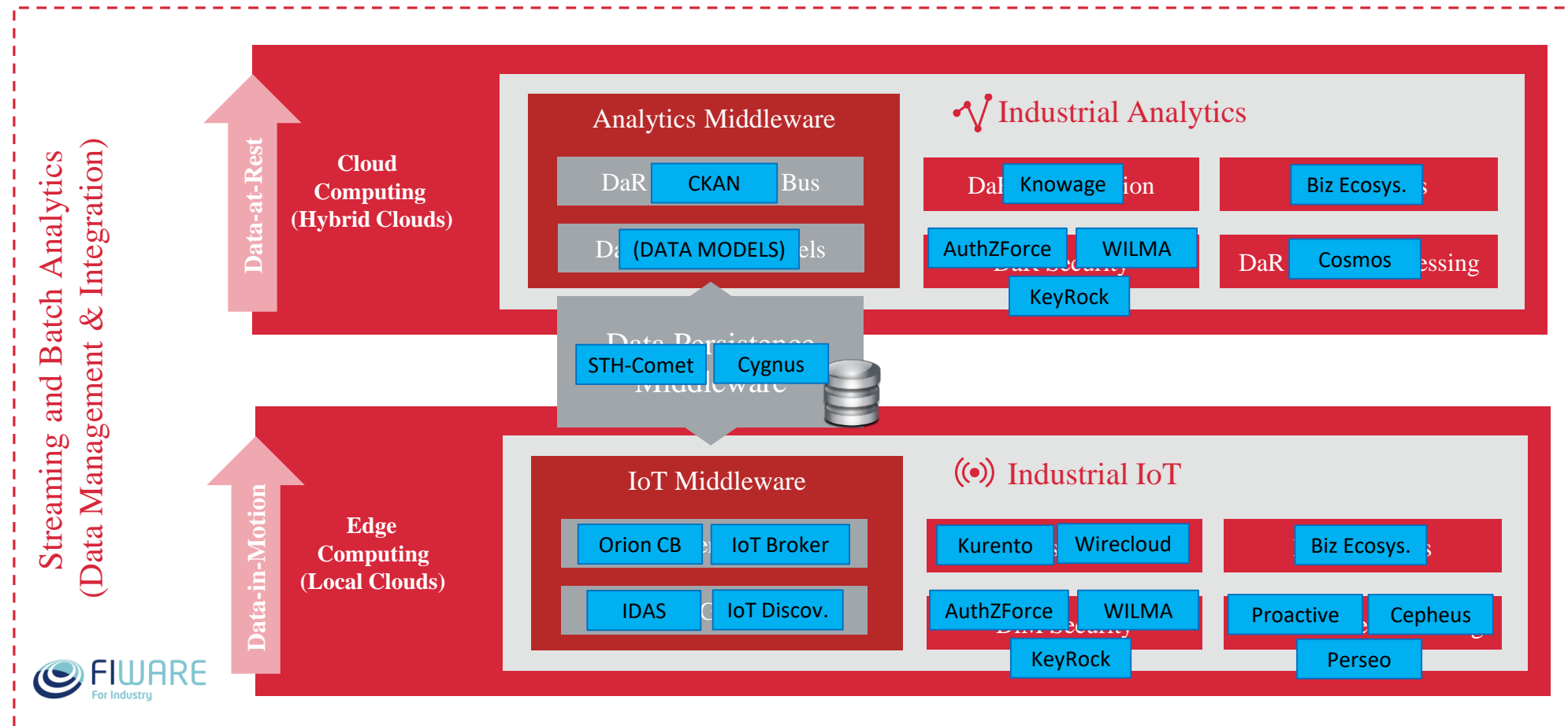


- Appliances in preparation for testing
- 4 Temperatures in cooling areas
- 2 Temperatures in warm areas
- Electrical Parameters

MIDIH Analytics Framework- Apache Implementation



MIDIH Analytics Framework- FIWARE Implementation



MIDIH Second Wave OPEN CALLS: from May 6th 2019

Digital Manufacturing Platforms in DT-ICT-07-18/19



2

Roles of digital industrial platforms



Network/Marketplace/Community

- Explicit connections between users
- Network is key value



Technology infrastructure

- Complementary applications
- Development platforms



Data

- Unlock data
- Integration

eFactory is the Marketplace for Agile Value Networks in Lot Size 1 Production

ZDMP is the Operating System for developing ZDM systems of systems

Examples of how different platforms fill in roles in different ways and to varying



"Marketplace"

Network/Marketplace/Community

Technology infrastructure

Data



"Operating system"

Network/Marketplace/Community

Technology infrastructure

Data

webMethods

"Middleware"

Network/Marketplace/Community

Technology infrastructure

Data

ZERO DEFECTS
Manufacturing Platform

ZDMP

QU4LITY is the cross-platforms Middleware for operating ZDM systems of systems

QU4LITY

Adapted from <http://platformed.info/platform-stack/>

OPEN DEI CSA in DT-ICT-13



Open DEI

Aligning Reference Architectures, Open Platforms and Large-Scale Pilots in Digitising European Industry

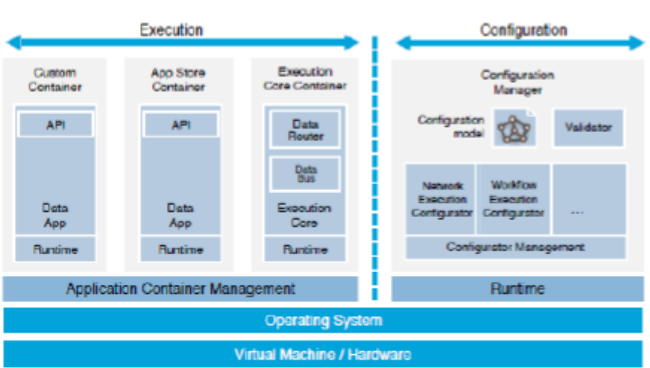
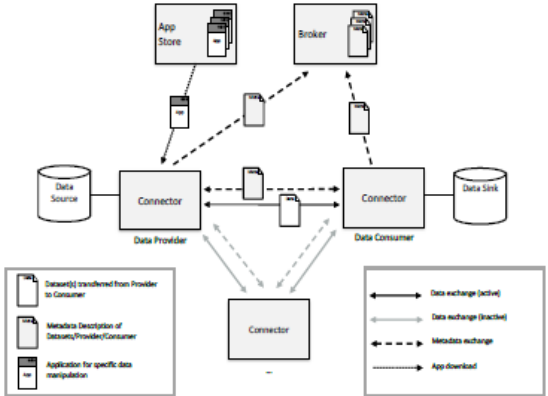
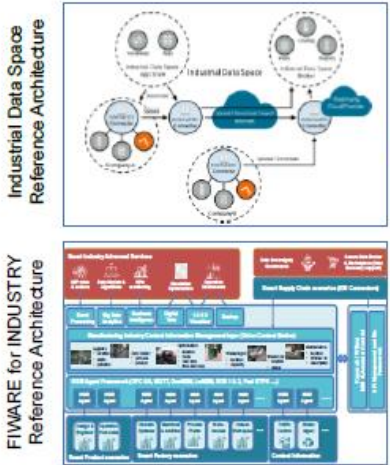
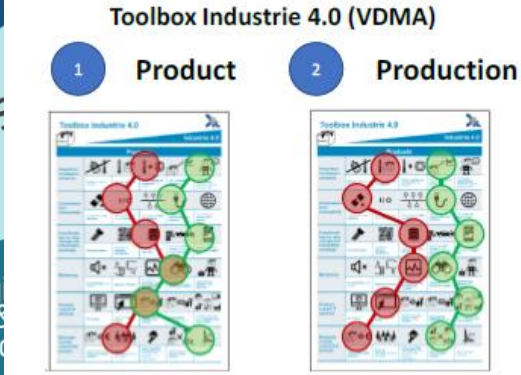


Figure 3.46: Reference Architecture of Connector



BE in CPPS
3 People

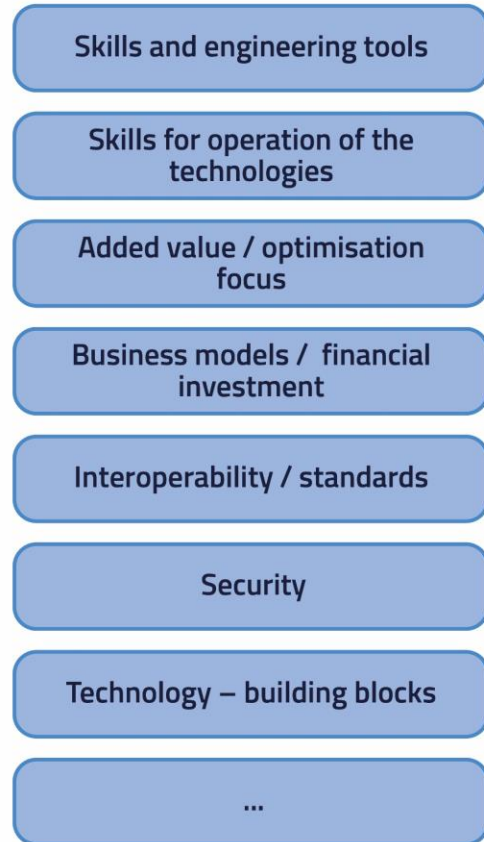


- 4 Platform
- 5 Partners
- 6 Performance

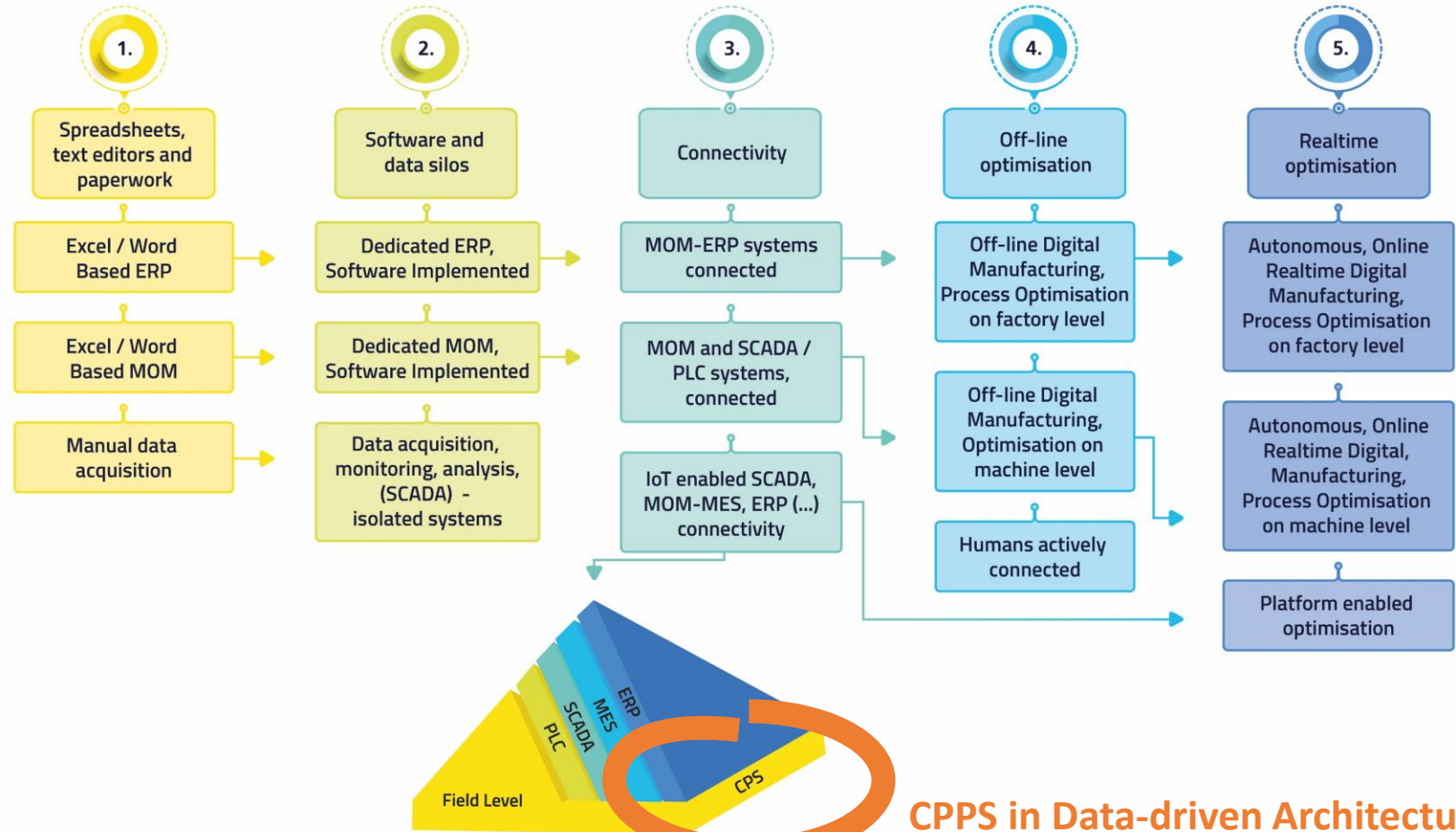
Pathways to digital manufacturing + enablers and critical success factors

Video on <https://www.connectedfactories.eu/pathways-digitalisation-manufacturing>

KEY ENABLERS AND CROSS-CUTTING FACTORS



PATHWAYS



CPPS in Data-driven Architectures

Industrial state of play in manufacturing

Cases that illustrate advanced state of the art

Approaches & cases from research & innovation projects

Three major pathways towards Digital Manufacturing

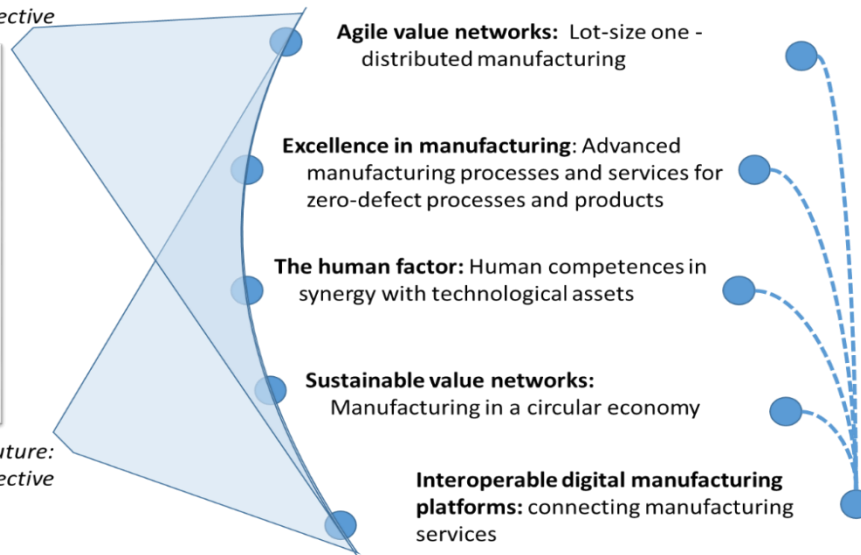
Building on the vision of the FoF 2020 roadmap and public consultation in 2016

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Vision of the factories of the future:
the technology perspective

Key priorities for FoF 18-19-20



Collaborative Product-Service Factories: Interoperability of Personal and Industrial IoT Data Spaces along the Product / Material lifecycle for Sustainable Value Networks (Circular Economy)

Autonomous Smart Factories: Collaborative Intelligence between humans and IoT-driven Autonomous Systems (Collaborative Robots, Humans in the Loop) considering Human Factors and Skills gaps

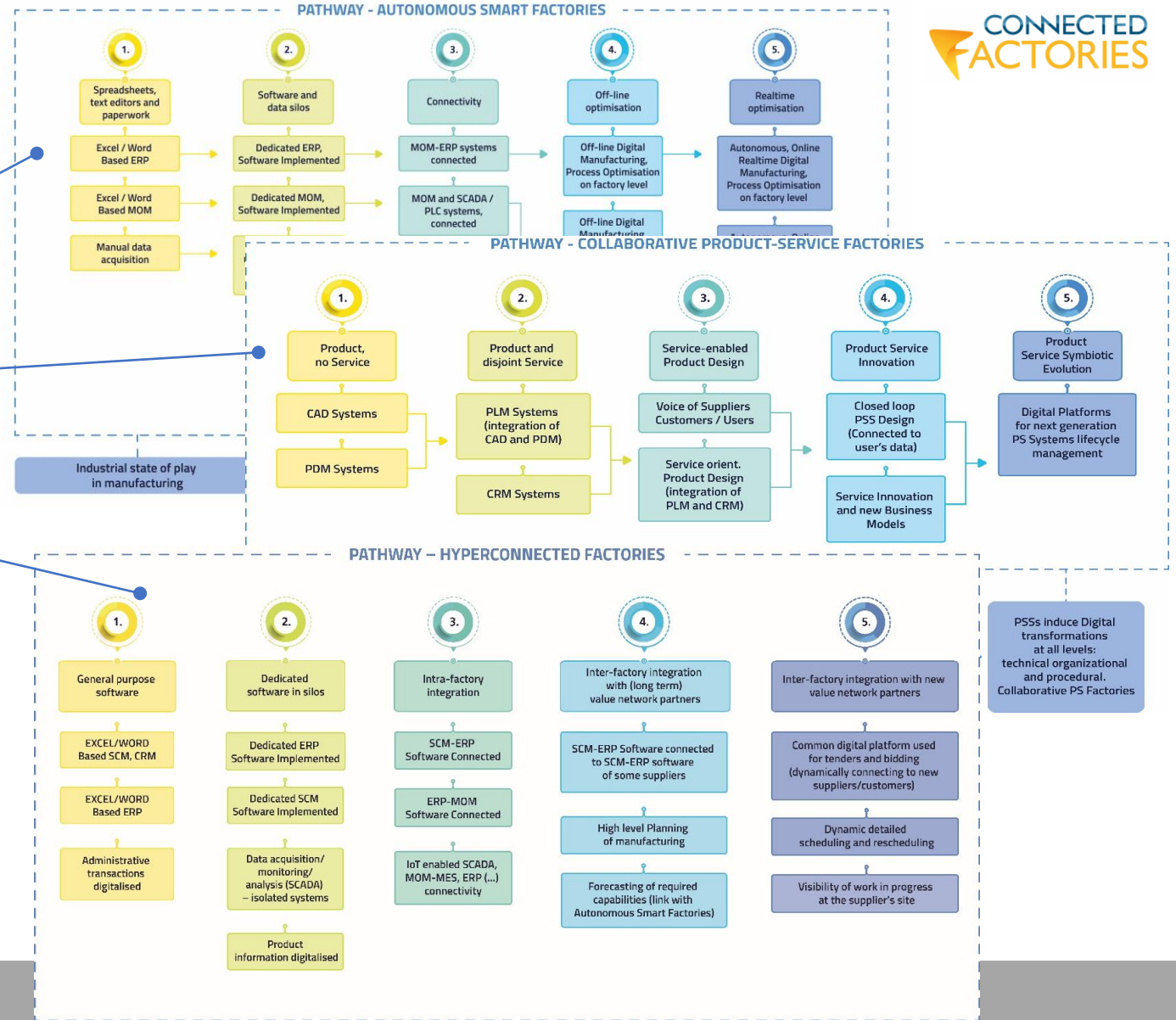
Hyper-connected Factories: Interoperability between IoT Open Platforms and Proprietary Systems through pan-EU Data-Service Marketplaces (IoT Catalogue)

The SMI Discussion Paper 1.0: FoF background

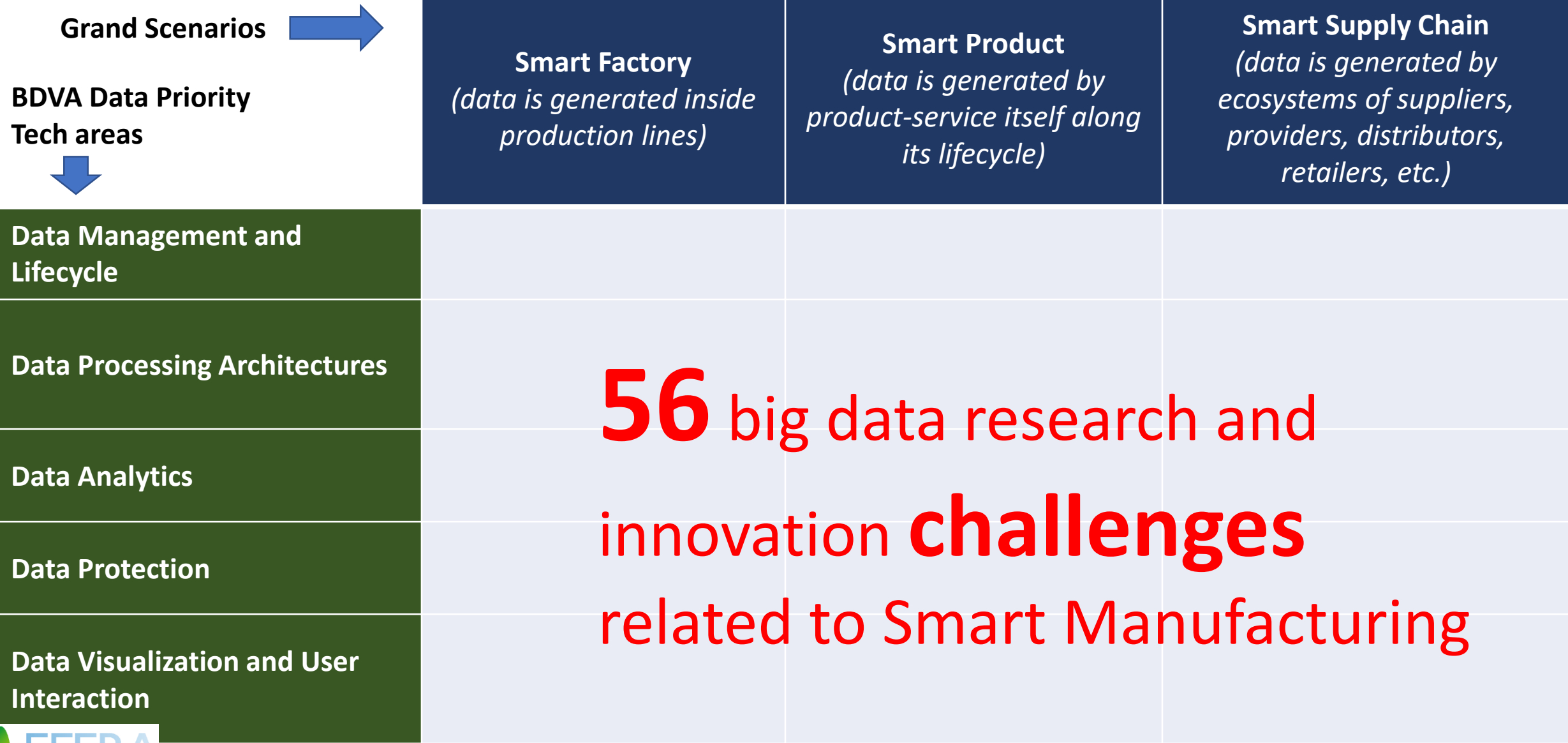
The **FoF** background is materialised by its validation business scenarios of **Smart Factory**, **Smart Product** and **Smart Supply Chains** as projected to 2025 by the pathways

- Autonomous Smart Factories,
- Collaborative Product-Service Factories
- and
- Hyperconnected factories

FoF is also providing its **reference architectures**, originated e.g. from **RAMI 4.0** Plattform Industrie 4.0 and the Industrial Internet Consortium, and data-driven implementation guidelines such as the **layered data-buses architecture** of **IIRA 1.8**.



SMI Reference Framework



Towards a Manufacturing Partnership under Horizon Europe (2021 – 2027)



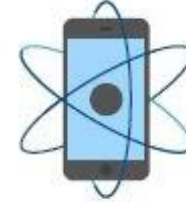
Impact

- ◆ People
- ◆ Planet
- ◆ Competitiveness
- ◆ Products of the Future



Co-creation through Manufacturing Eco-systems

- ◆ **Excellent, responsive and smart factories**
Scalable first-time right manufacturing
Agile and robust optimal manufacturing
- ◆ **Low environmental footprint, customer-driven value networks**
Demand and consumer driven manufacturing networks
Circular economy (symbiotic manufacturing networks)
- ◆ **Parallel product and manufacturing engineering**
Concurrent, holistic and collaborative product-service engineering
Virtual end-to-end life-cycle engineering from product to production lines, factories and networks
Manufacturing smart and complex products
- ◆ **Human-driven innovation**
Co-creation in European knowledge networks
Managing constant change
Human & technology complementarity



Enabling Technologies & Approaches

- ◆ Advanced and smart material processing technologies and process chains
- ◆ Smart mechatronic systems, devices and components
- ◆ Intelligent and autonomous hand and robotics, assembly and logistic technologies
- ◆ De-manufacturing and recycling technologies
- ◆ Energy and power supply technologies
- ◆ Simulation and modelling (digital twins)
- ◆ Robust and secure industrial communication technologies, distributed control architectures
- ◆ Data analytics, artificial intelligence and deployment of digital platforms
- ◆ New business and new organisational approaches

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Thank You

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