



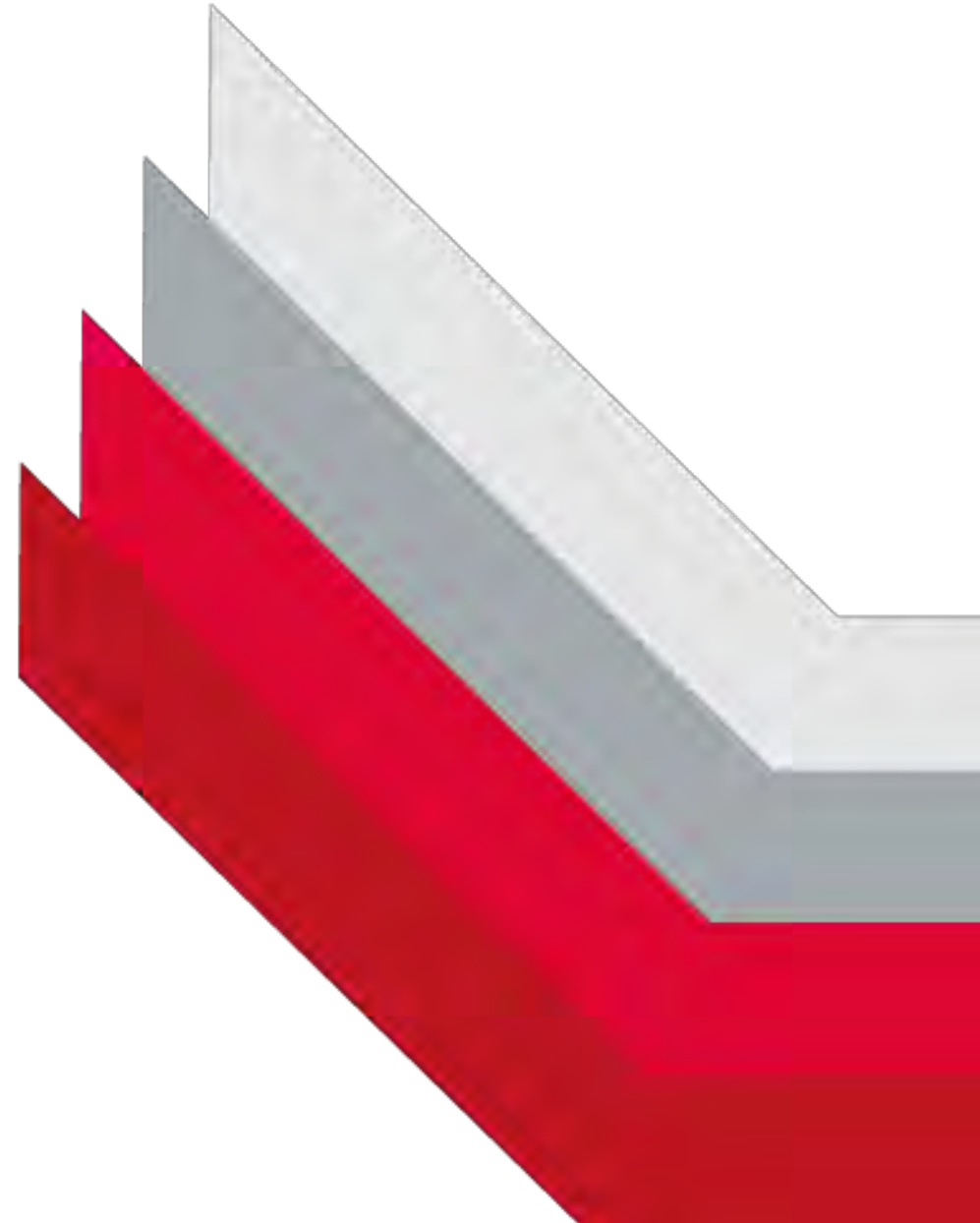
MIDIH

MANUFACTURING · INDUSTRY
DIGITAL · INNOVATION · HUBS



MIDIH – the Scope

Susanne Kuehrer, Sergio Gusmeroli



PROJECT BACKGROUND



EC Communication April 19th 2016



Brussels, 19.4.2016
COM(2016) 180 final

**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**Digitising European Industry
Reaping the full benefits of a Digital Single Market**

{SWD(2016) 110}

The purpose of this Communication is **to reinforce the EU's competitiveness in digital technologies and to ensure that every industry in Europe, in whichever sector, wherever situated, and no matter of what size can fully benefit from digital innovations.**

Facilitated by a dynamic framework for coordination and experience sharing between public and private initiatives at EU, national and regional level, the proposed actions are expected to mobilise close to **50 B€** of public and private investment in the next 5 years, explore and adapt when needed the legislative framework and reinforce coordination of efforts on skills and quality jobs in the digital age.



DEI Communication Four PILLARS



Background and Motivations



I4MS Initiative, where we are now?



PHASE 1
2013 – 2015
74M€

PHASE 2
2015-2017
32M€

PHASE 3
2017-2019
33M€

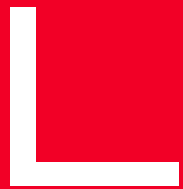


TECHNOLOGY AREAS COVERED BY I4MS UNTIL NOW

HPC CPS ROBOTICS LASER SENSORS



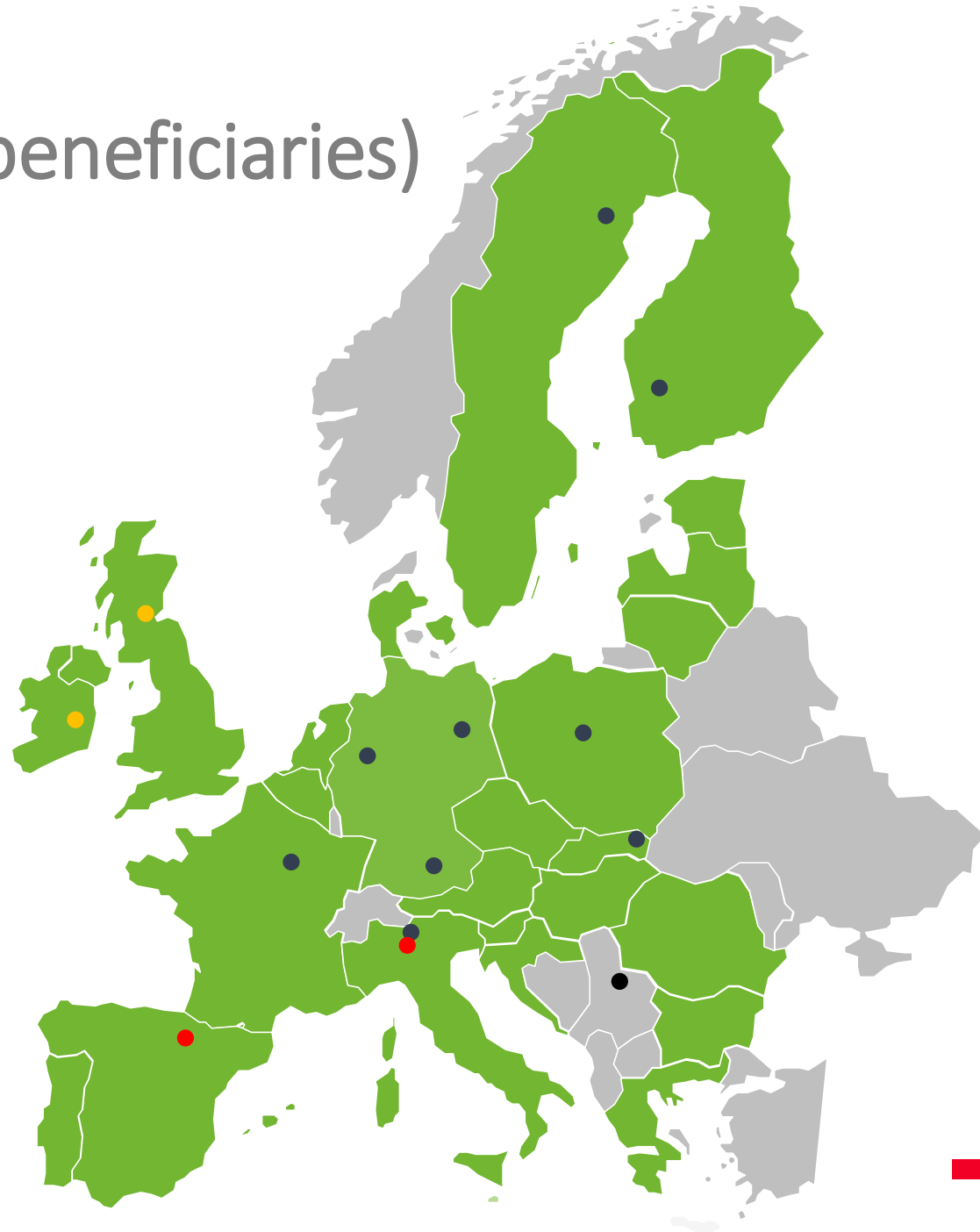
THE MIDIH ECOSYSTEM



Strong Partnership (23 beneficiaries)

- 9 CPS/IOT Competence Centers
- **2 Teaching Factories**
- **2 Regional Manufacturing Digital Innovation Hubs**

- 3 Pan –European Digital Innovation Hubs
 - **EIT Digital, IDS, FIWARE**
- 3 Industrial case-study providers
 - **FIAT, IDS, NECO**
- 2 Open source digital platform providers
 - **ATOS, Engineering**
- 2 IoT specialized SMEs
 - **NISSA (Serbia) and HOPU (Spain)**



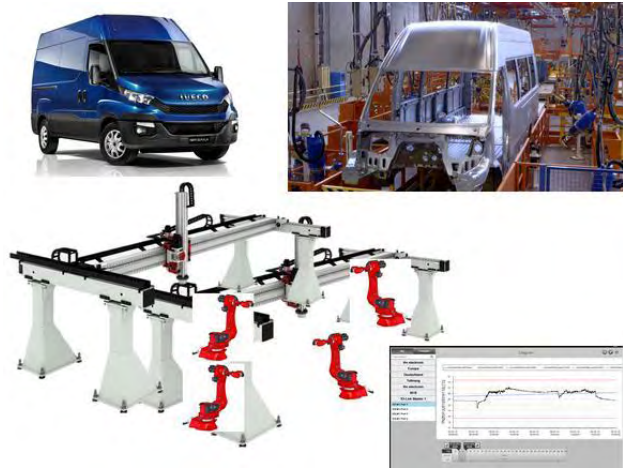
The MIDIH Network of CCs

- CC1 **CPS/IoT Networks and M2M Communication c/o FhG FOKUS (Berlin CC)**
- CC2 **CPS/IoT Trust Management and Cybersecurity c/o IMT (France CC)**
- CC3 **CPS/IoT Modelling and Simulation and Digital Twin of CPS-enabled Production Systems c/o fortiss (Munich CC)**
- CC4 **CPS/IoT Real Time Streams Analytics c/o VTT (Finland CC)**
- CC5 **CPS/IoT in Smart production systems and services c/o TUKE (Slovakia CC)**
- CC6 **CPS/IoT in Cloud Industrial Analytics Architectures and Tools c/o CEFRIEL (Italy CC)**
- CC7 **CPS/IoT based Edge Computing and Local Clouds c/o LTU (Sweden CC)**
- CC8 **CPS/IoT Data Value Chain Sovereignty in FhG IML (Dortmund CC)**
- CC9 **CPS/IoT HPC-based Cloud Manufacturing in PSNC (Poland CC)**



MIDIH Innovation Boosters: the Experiments

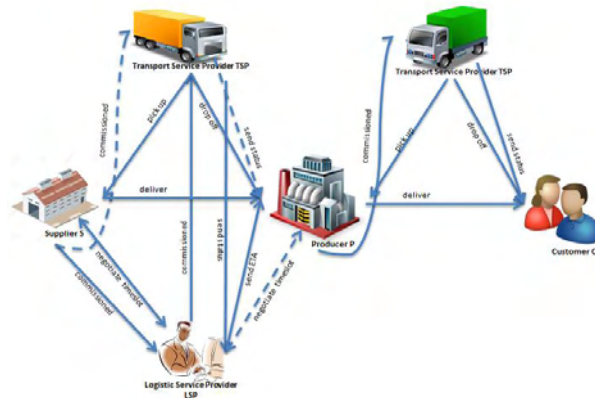
Predictive Maintenance in Automotive



Product-Service Systems in Cutting Tools



Cross-border Logistics Interoperability in Steel



INDUSTRIAL DATA
SPACE ASSOCIATION



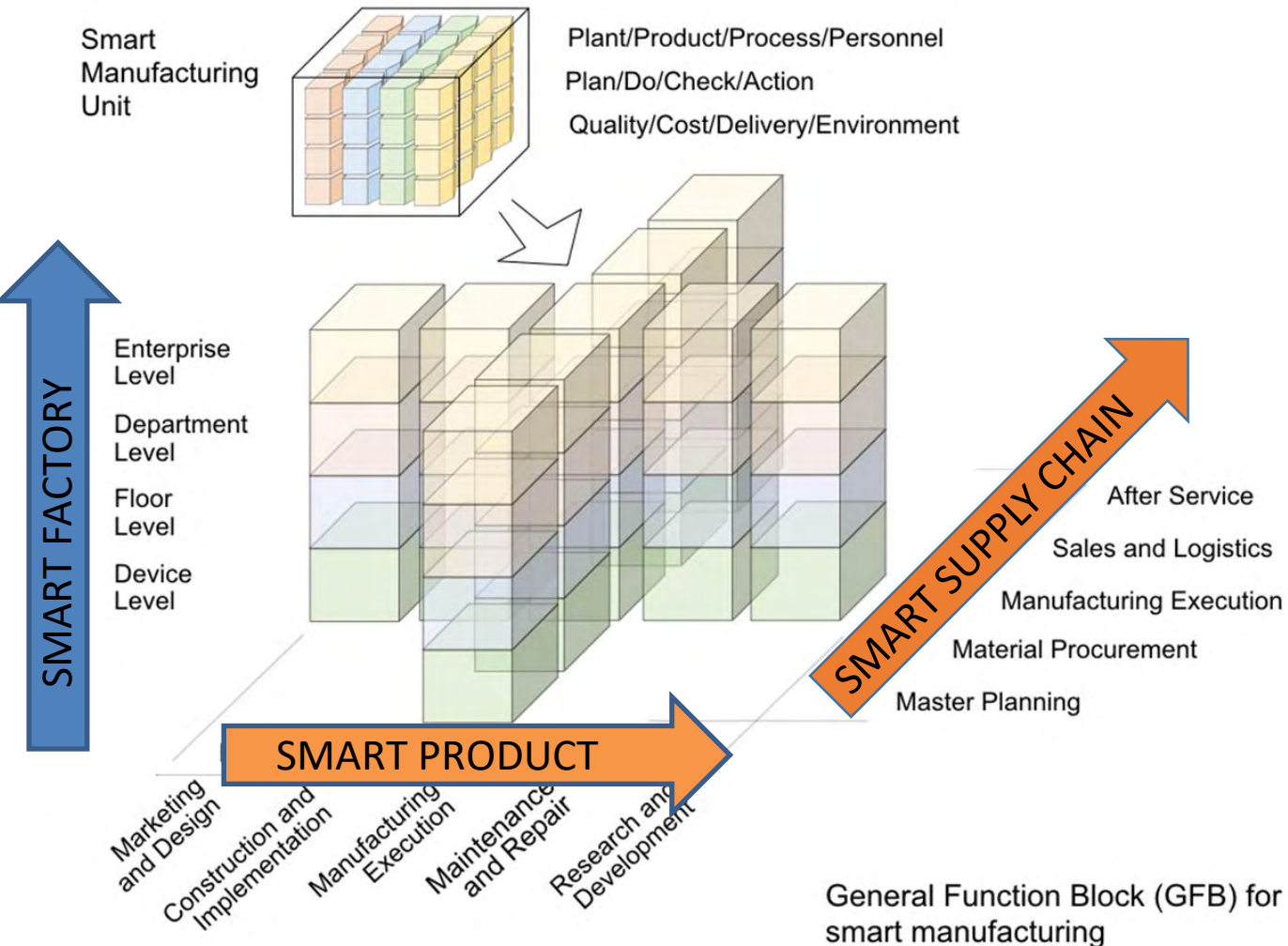
ThyssenKrupp



Industrial Reference Models and Architectures for IIoT



Industrial Value Chain Reference Architecture (IVRA)

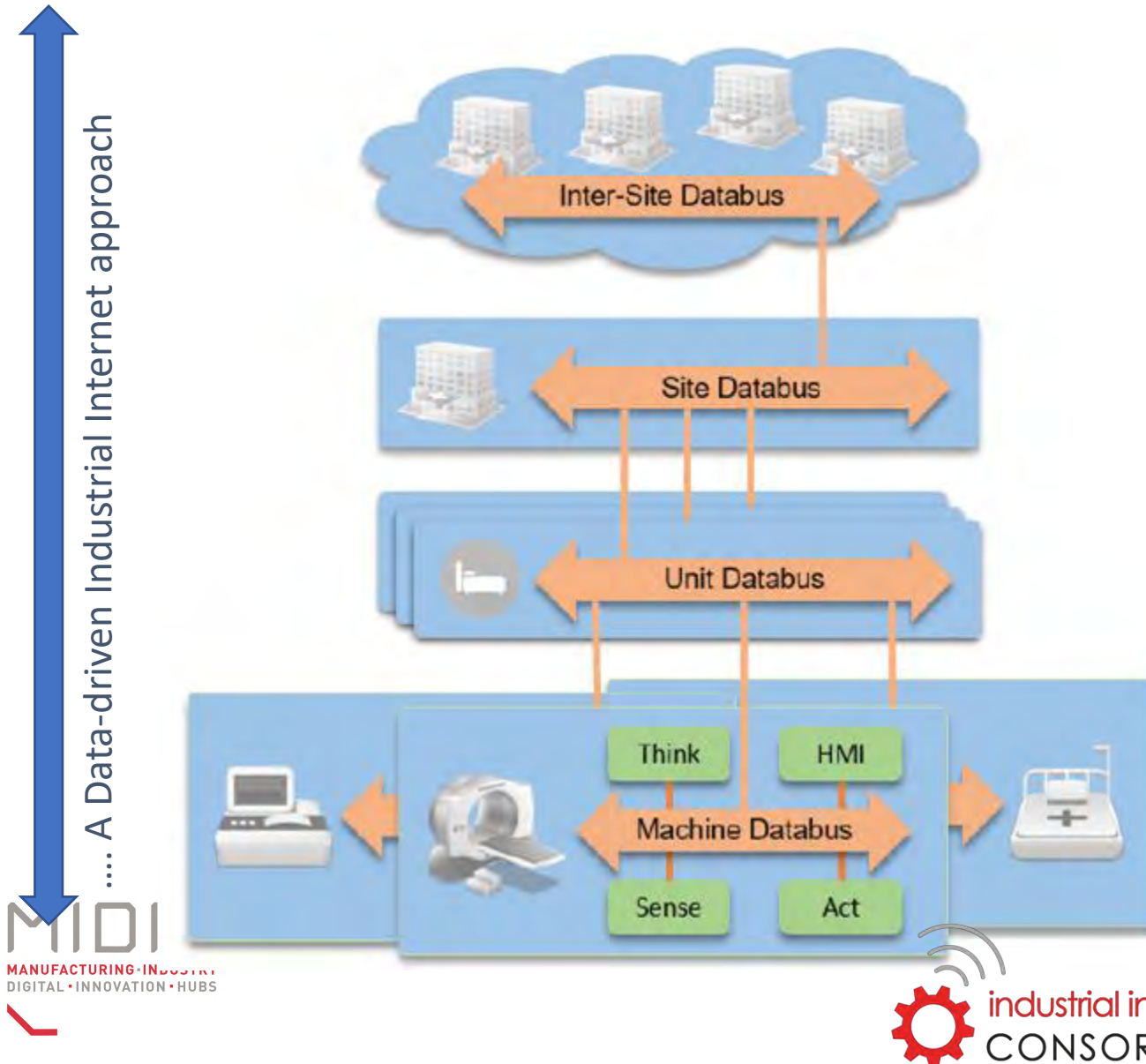


The IVRA provides three perspectives to understand manufacturing industry as a whole: The knowledge/engineering flow, the demand/supply flow and hierarchical levels from the device level to the enterprise level.

A key element is the introduction of Smart Manufacturing Units (SMUs) in a way that allows to smoothly integrate human beings as elements with their autonomous nature – paying tribute to the fact that it is the human being who discovers a problem, defines a problem, and solves a problem in many cases not only in the past, but also in the foreseeable future.

Links with RAMI and IDSA are also available

IIRA Layered Databus: A Data-Driven approach



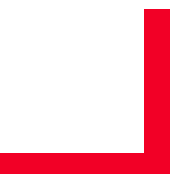
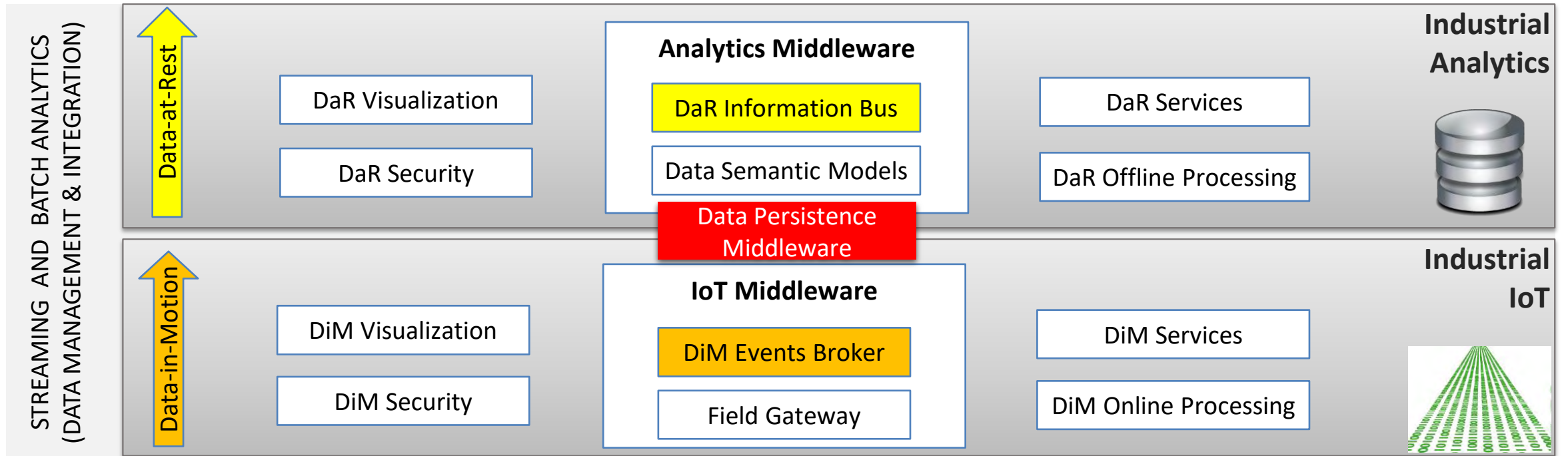
The Inter-site Databus encompasses cross-site interactions, so typically cross-Factory, cross-Enterprise value chain interactions

The Site and Unit layers could also be coincident, but we can identify the Unit layer with Edge-Cloud layers in Production Line vs. Factory, Department Assets vs. Enterprise.

This is the level of Real World Sensors, Objects, Devices, Machines, Products. Often, this Databus is embedded as Smart System (e.g. a CPPS, a Robot, a Car, a Truck, a Container).



The MIDIH Reference Architecture






Condition Monitoring Diagnosis	Predictive Preventive Maintenance	Pedigree and Origin	Product Modelling Simulation	End of Life De- Re- Manufacturing	Human Remote Maintenance	SMART PRODUCT APPS ECOSYSTEM
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Diagnosis Predictive Analytics	Production Logistics Optimisation	Sustainable Energy & Waste	Digital Twin Modelling Simulation	Zero Defect Manufactur	Remote Training Maintenance	SMART FACTORY APPS ECOSYSTEM
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STREAMING AND BATCH ANALYTICS FRAMEWORK


Data-at-Rest ↑

DaR Visualization	Analytics Middleware	DaR Models
DaR Security	DaR Information Bus	DaR Offline Processing
	Semantic Interoperability	
	Data Persistence Middleware	

Industrial Analytics 

Data-in-Motion ↑

DiM Visualization	IoT Middleware	DiM Models
DiM Security	DiM Events Broker	DiM Online Processing
	Field Gateway	

Industrial IoT 

Discrete Manufacturing Machine Tools	Factory PLC 61499 Au- tomation	Process Industry Plants	Robots Cobots Systems	Internal Logistics AGVs	Warehouse Management Systems	VR / AR Human Workspace	Industrial Shop floor
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Fleet of Vehicles	Point of Sales Retail	Product Service Systems	Sharing Economy Systems	Circular Economy Systems	People in open closed Spaces	Products in the Real World
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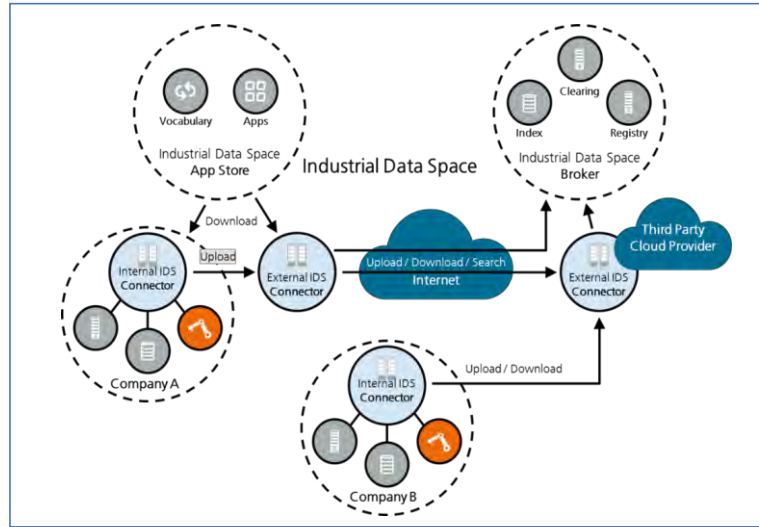


THE MIDIH ARCHITECTURE & COMPONENTS

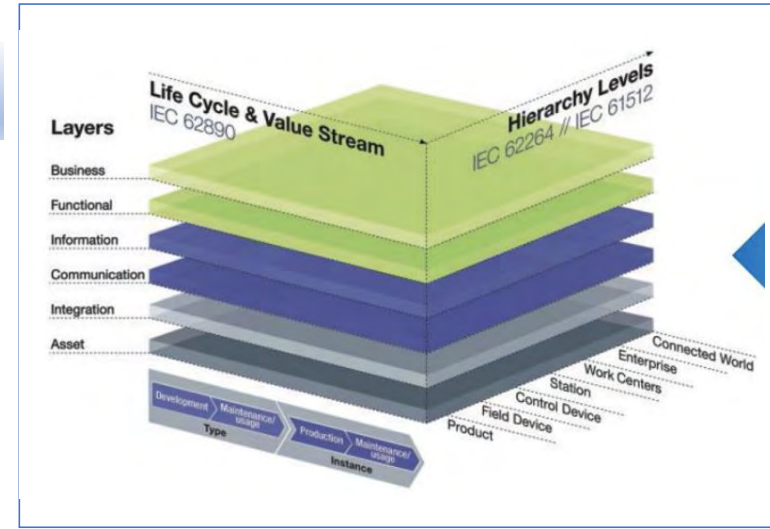


MIDIH: Alignment of main RAs in Smart Manufacturing

Industrial Data Space Reference Architecture



RAMI 4.0



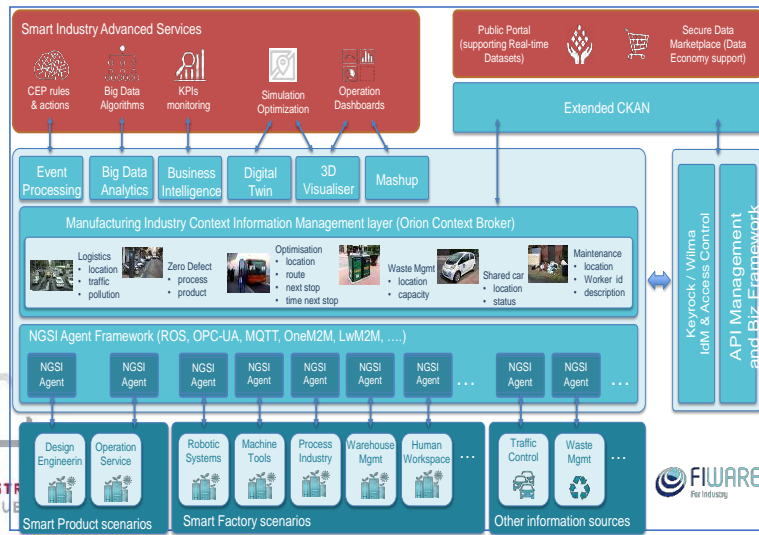
Reference Architecture Model Industrie 4.0

IDS

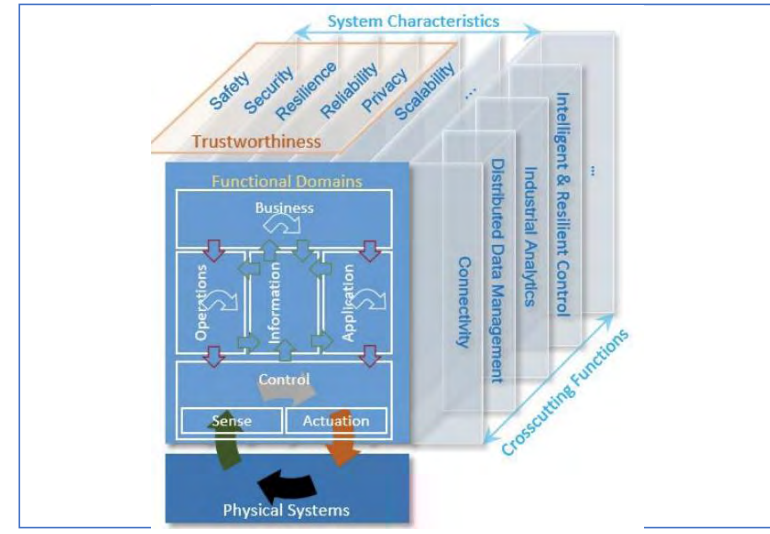


FIWARE

FIWARE for INDUSTRY Reference Architecture



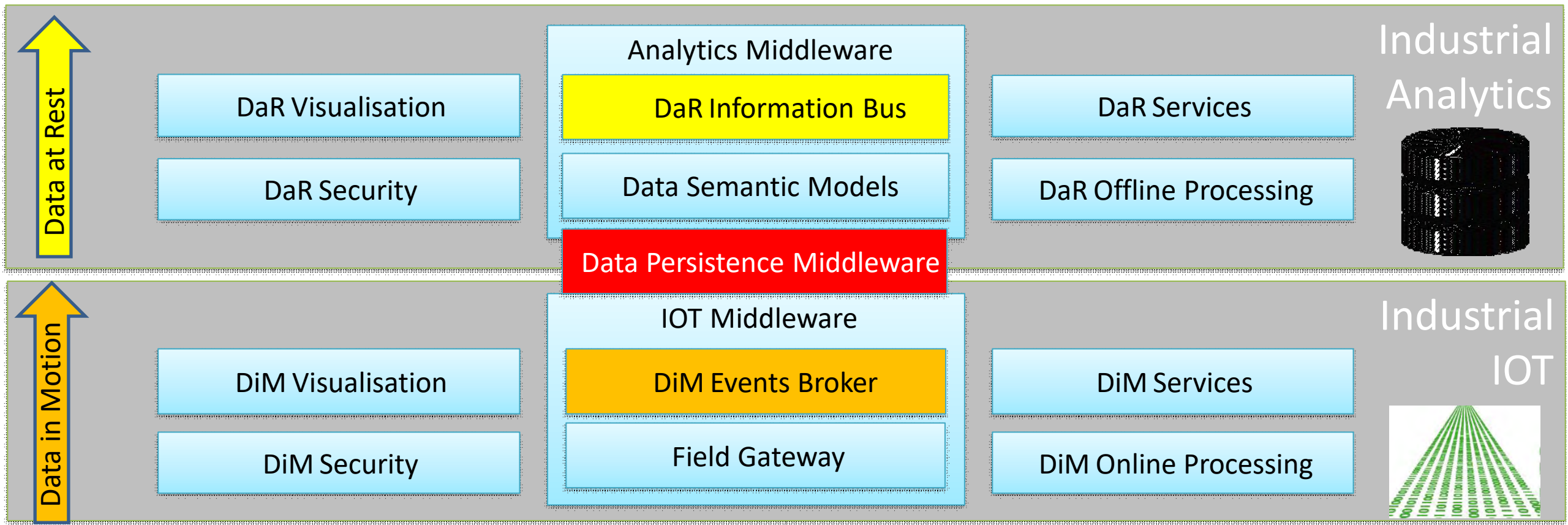
IIRA



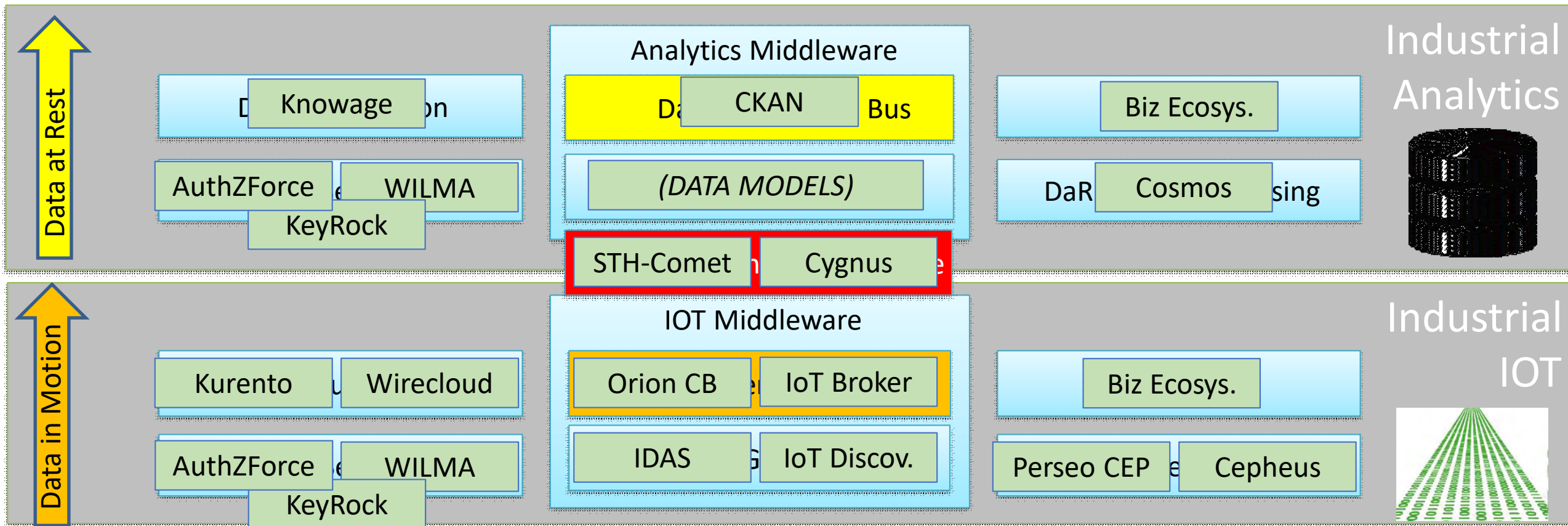
Industrial Internet Reference Architecture



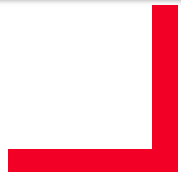
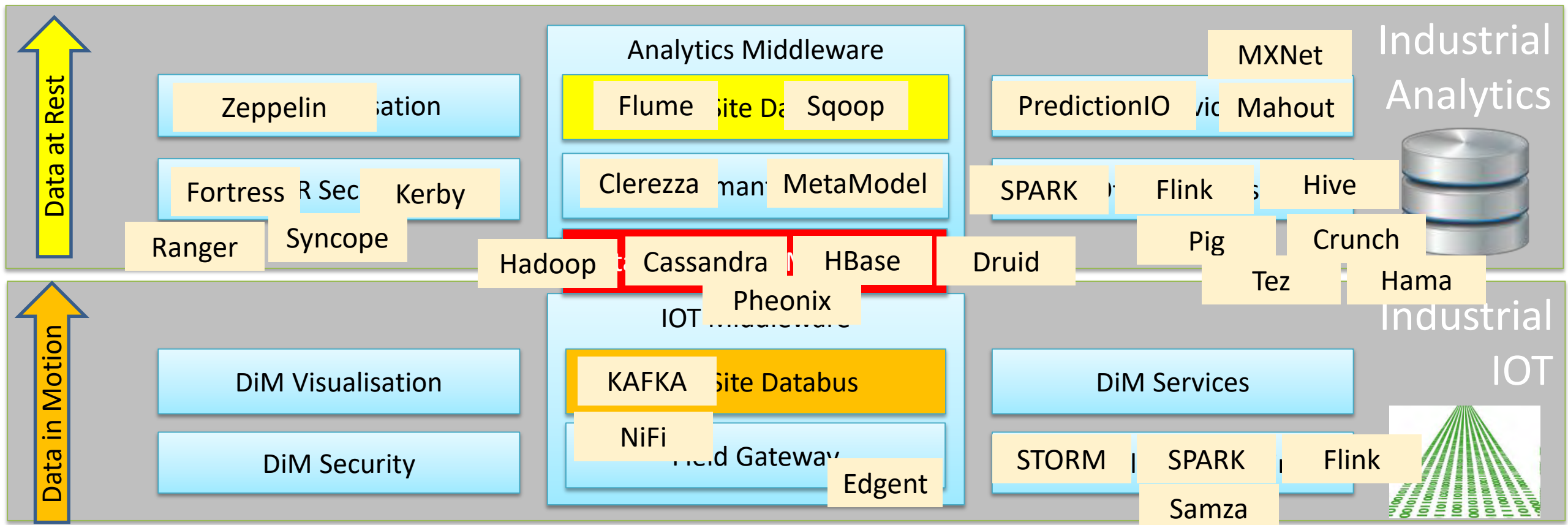
MIDIH Data-driven Reference Architecture



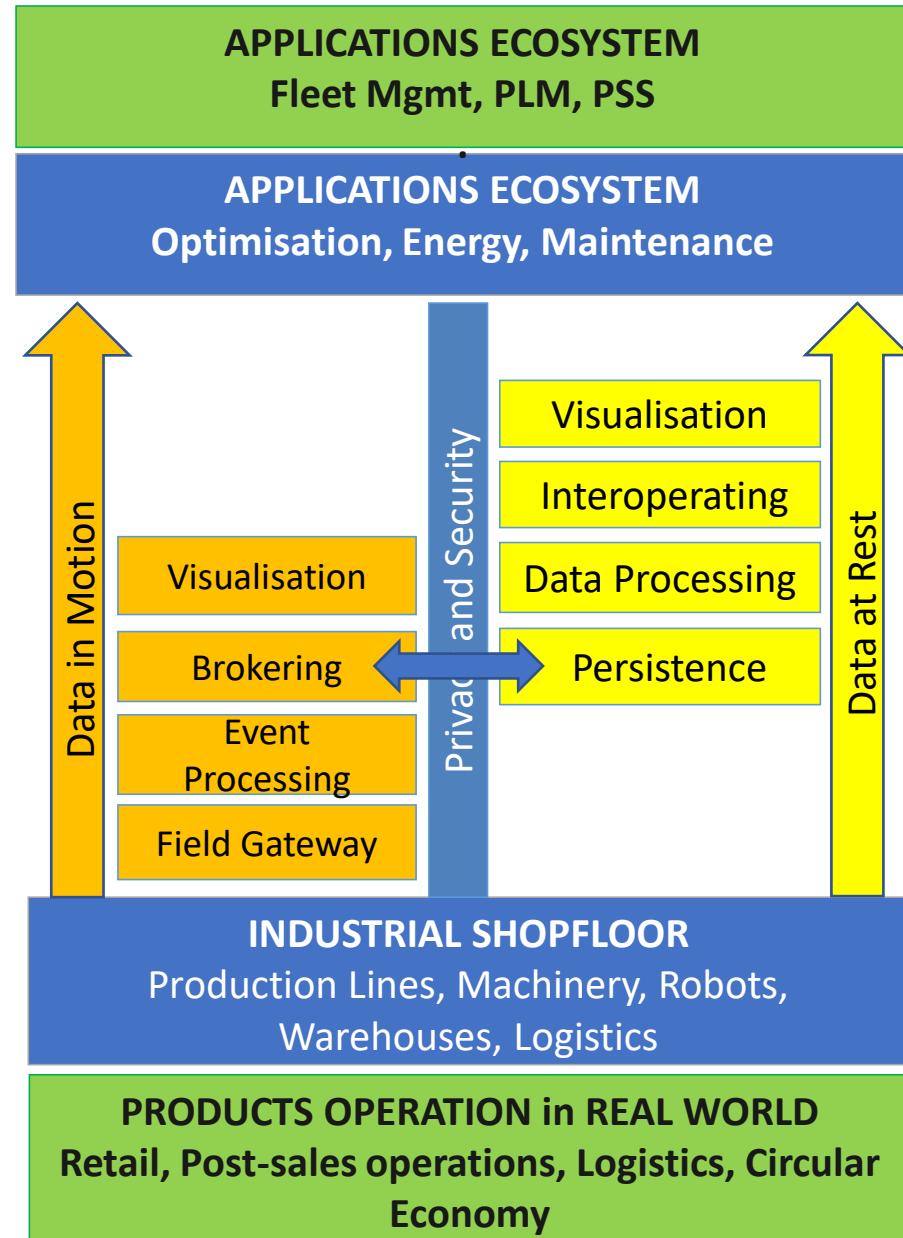
Mapping FIWARE Components into MIDIH RA



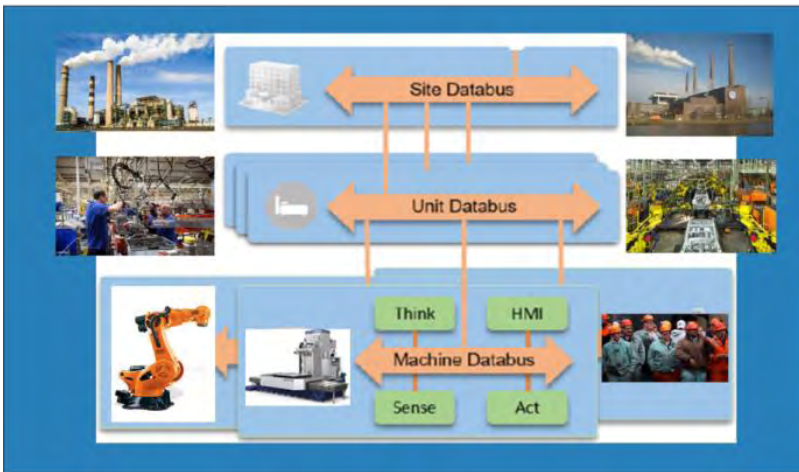
Mapping APACHE Components in MIDIH RA



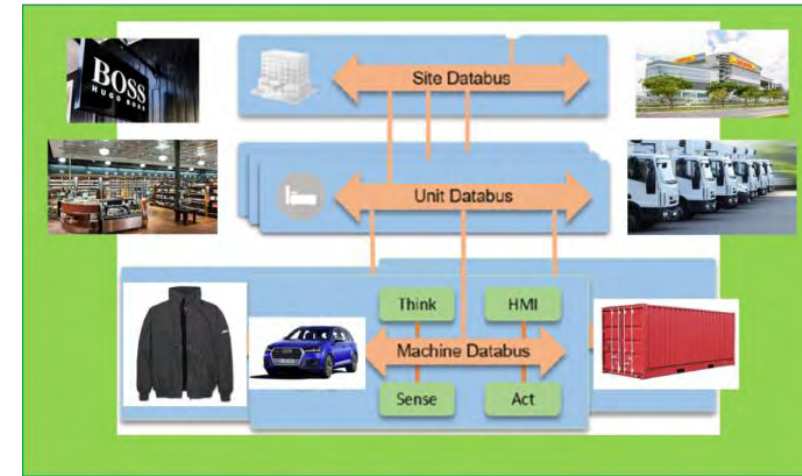
MIDIH: Data-Driven Smart Factory-Product



SMART FACTORY view

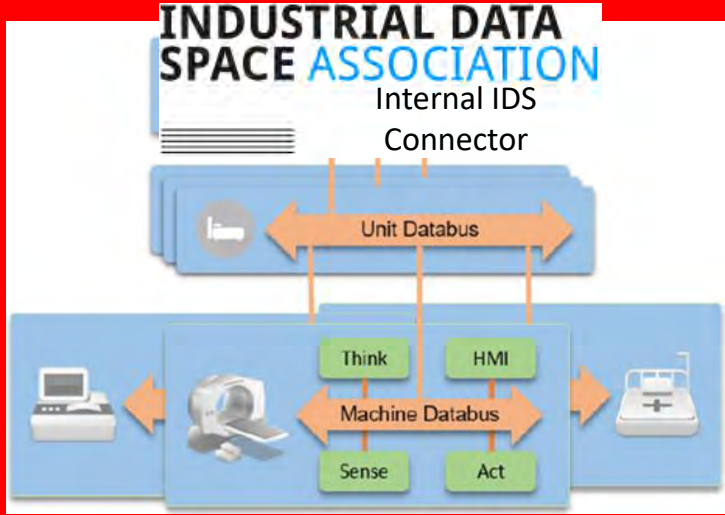
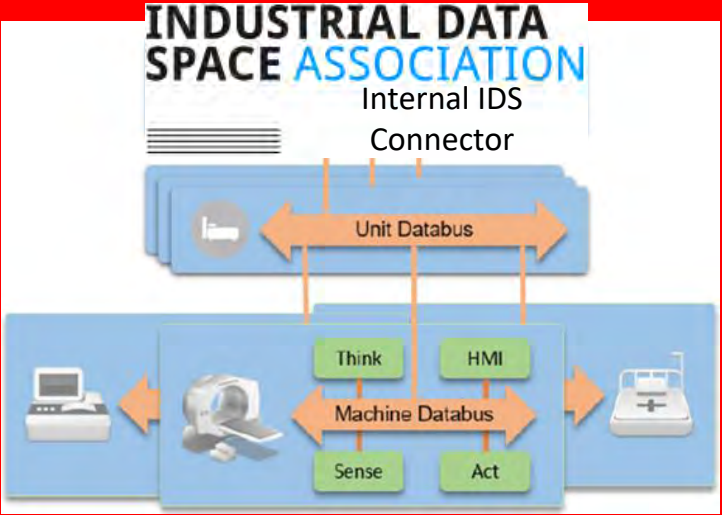
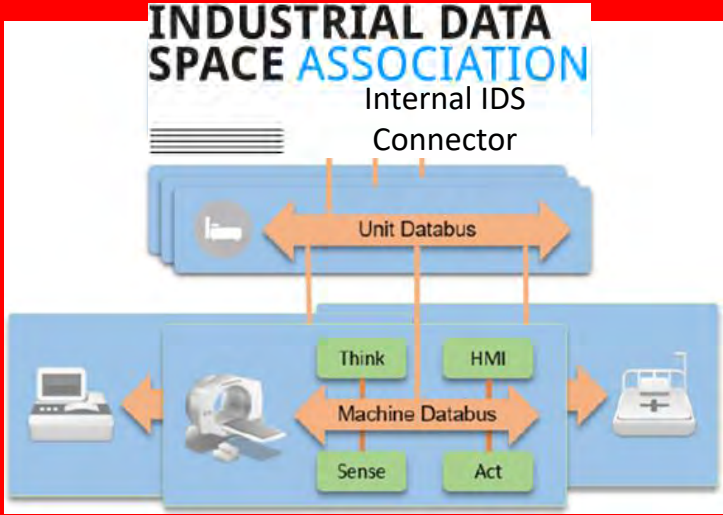


SMART PRODUCT view



MIDIH: Data-driven Smart Supply Chain

SMART SUPPLY CHAIN view



MIDIH Experimentation in FIAT (Sfactory)

FCA Application in IVECO. Overview



- The use case is in IVECO, the 4th truck maker in Europe.
- The Suzzara plant manufactures the Daily:
 - a middle size commercial truck,
 - 1000+ variants
 - 300 jpd
 - A local and global network of suppliers

- The plant requires to
 - Monitor quality of final product
 - Maintain equipment to best working conditions
- On an innovative welding cell integrated with
 - Sensoring system
 - IT infrastructure integrated with the SCADA systems

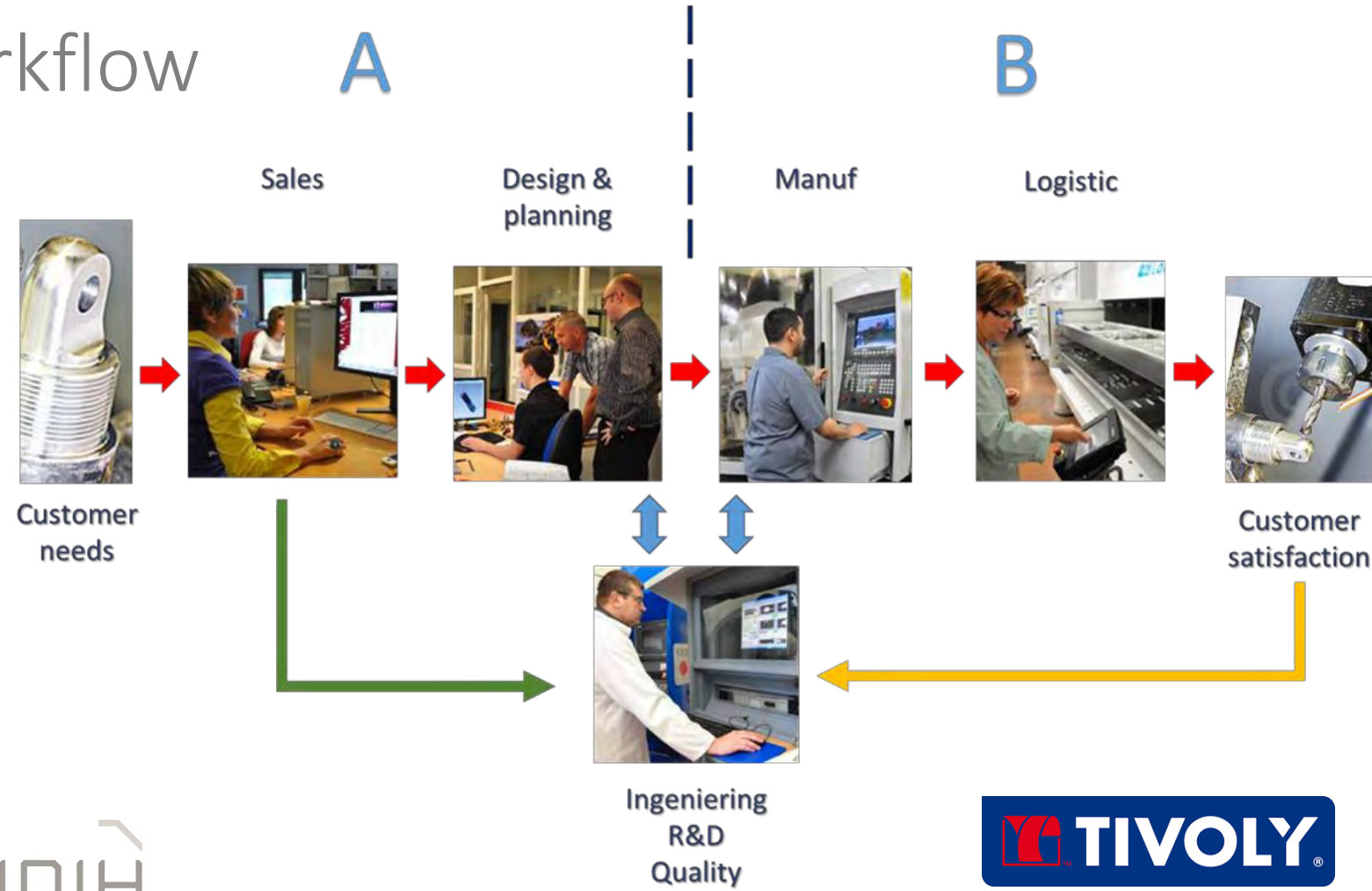


- With the expected following functionalities
 - Monitor and identify incoming events
 - Visualise and enable decision making

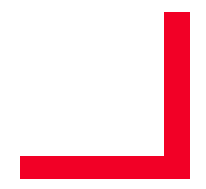


MIDIH Experimentation in NECO (Sproduct)

Workflow



Achieve the agility of production and distribution necessary to respond to the expectations of our current and future customers' leading our journey towards operational excellence



MIDIH Experimentation in ThyssenKrupp (IDS)



Selling Tracking and Tracking Services to Customer using IDS Interfaces (e.g. Thyssen)



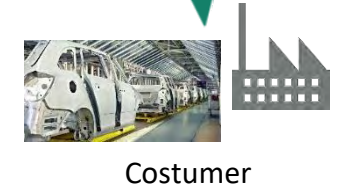
INDUSTRIAL DATA SPACE ASSOCIATION

vallourec Supply Chain Management



Order to Cash Process
Fraunhofer

3. Supply chain tracking for costumers

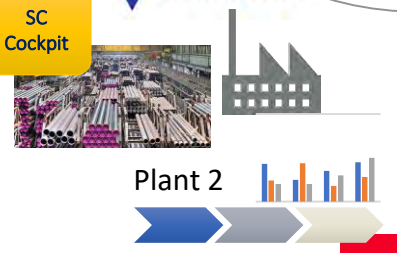
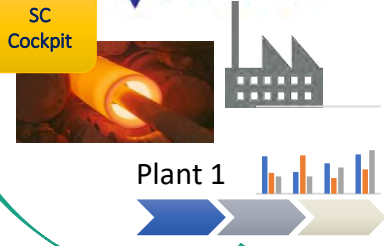


2. Standardized information flow and transparency

SC-Cockpit -> Transformation from central tool to standardized decentral solution used by every plant.

1. SC-Cockpit as App with IDS interface

Using the SC-Cockpit as a standard tool in the supply chain. Every Partner has it's own limited view with standard interface to interchange data



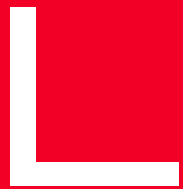
INDUSTRIAL DATA SPACE ASSOCIATION

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Plant 2

THE MIDIH 1st Open Call TOPICS



The MIDIH Open Call 1st

[PROJECT](#)[OPEN CALL](#)[DIH NETWORK](#)[NEWS](#)[PARTNERS](#)

Call for Proposals for Data driven applications and experiments in CPS/IOT

Project MIDIH Manufacturing Industry Digital Innovation Hubs, co-funded from the European Union's Horizon 2020 research and innovation programme under grant agreement No 767498, foresees as an eligible activity the provision of financial support to third parties, as a means to achieve its own objectives.

MIDIH Call-1 targets the development of data driven applications, by IT SMEs as technology providers, and experiments in CPS/IoT by Manufacturing SMEs.

Open Call Application

Apply before 29th of June 2018

Documentation

[Template Proposal](#)

[Guide for Applicants](#)

[Reference Architecture](#)

(Latest update: 22/05/18)

Overall Budget 960k EUR; each project funded up to 60k EUR; expected 16 winners (8+8)



WEBINAR: JUNE 14th 15:00-17:00 CEST



The Technological Topic T1: SP Simulation Models

T1. Modeling and Simulation innovative HPC/Cloud applications for highly personalized Smart Products

The Smart Products MIDIH reference architecture defines reference functions and reference implementations for innovative applications acquiring and processing data from the **Product Lifecycle**, from its design to its operations to its end of life. Modelling and Simulating complex one-of-a-kind products in the different configurations (e.g. as-designed, as-manufactured, as-maintained, as-recycled or re-manufactured) requires the availability of huge and sophisticated computational IT resources, that just modern Cloud-HPC datacenters could offer.

The **T1** topic looks for product-oriented industrial modelling & simulation IT experiments, which are using the MIDIH "**Data in Motion**" and "**Data at Rest**" architectures and reference implementations and the MIDIH Data Infrastructures. *Candidates are required to provide advanced algorithms / applications based on the MIDIH architecture and to provide the correspondent datasets to be experimented in MIDIH HPC/Clouds*



The Technological Topic T2: SF Digital Twin

T2. Smart Factory Digital Twin models alignment and validation via edge clouds distributed architectures

Edge / Fog computing reference architectures and distributed local clouds frameworks aim at inserting a new computational layer between the Real World and the Cloud. Smart factory **Digital Twins** are digital representations of a real-world artefact in a production site (a machine, a robot, or even the whole production line). Traditionally such models run on the cloud but when real-time (or near real time) performance is required, they can be moved and deployed on a reduced scale closer to the real world.

The **T2** topic looks for factory-oriented Digital Twin IT experiments, which are using the MIDIH "edge / fog" computing architecture and reference implementations and the MIDIH Didactic Factories in Milano and Bilbao. *Candidates are required to provide advanced Factory digital models and to deploy them onto the MIDIH edge/fog framework available in our **two didactic factories**.*



The Technological Topic T3: SP/SF AR/VR applications

T3. Advanced applications of AR / VR Technologies for Remote Training / Maintenance Operations (Smart Product and Smart Factory)

Virtual and Augmented reality applications are suitable to enhance both Smart Factory and Smart Product scenarios. In **Smart Factory** scenarios, production systems, machineries, robots, warehouses, AGVs need to be properly virtualised, while in **Smart Product** scenarios, virtual models are needed for complex products such as airplanes, vessels, trucks. Typical applications are concerned with remote training, virtual design and commissioning, maintenance operations involving both engineers, workers and even citizens. The **T3** topic looks for **product-oriented or factory-oriented virtual / augmented reality** IT experiments, which are using the MIDIH "Data in Motion" and "Data at Rest" architectures and reference implementations and the MIDIH Training Facilities. *Candidates are required to provide advanced VR/AR applications based on the MIDIH architecture and to experiment such systems in one of our two Training Factories in Milano and Bilbao*



The Technological Topic T4: AI / ML in SC Optimisation

T4. Machine Learning and Artificial Intelligence advanced applications in Smart Supply Chains management and optimisation

According to EC Digitising EU Industry communication and subsequent working groups (especially the WG 2 about Digital Platforms for Manufacturing), Industrial IoT, Industrial Analytics and Artificial Intelligence are the three major pillars for Industry 4.0 Digital Transformation. MIDIH is focussing on providing Open Source "Data in Motion" and "Data at Rest" reference implementations as development (API and SDK) platforms for innovative applications. The **MIDIH Smart Supply Chain** scenario is particularly suitable for advanced ML /AI distributed applications due to its inherent heterogeneity of models, ontologies, systems which makes it very difficult for a mere statistical Data Analytics solution to meet its requirement.

The **T4** topic looks for ML/AI applications on multi-stakeholders' owned heterogeneous datasets justifying **Data Sovereignty and Smart Contracts** requirements.



The Experimentation Topic E1: Additive manufacturing

E1. Integrating CPS / IOT subtractive production technologies in Additive Manufacturing experimental facilities

Additive Manufacturing includes different technologies for products manufacturing through the addition of layers of materials (polymer, metals, composites or ceramics) to obtain complex shapes, functional or semi functional prototypes from data models (typically CAD).

The E1 topic looks for CPS/IOT data-driven experiments to explore the design challenges and opportunities of additive manufacturing combined with traditional subtractive technologies, aspects of products customization, rapid manufacturing, design concepts, assembly strategies, combinations of components, cybersecurity etc. Experiments must use the MIDIH reference architectures and reference implementations and the MIDIH Data Infrastructures.

In alignment with **AMABLE**, the I4MS project which facilitates digital design and solution for secure data chain in additive manufacturing, experiments results will be shared publicly in dissemination events and through the I4MS tools.



The Experimentation Topic E2: Robotics

E2. Integrating CPS / IOT factory automation technologies in Robotics experimental facilities

Robots are used in manufacturing to execute mainly these types of operations: material handling (pick up and place, movements), processing operations (tool manipulation, welding), assembly and inspection. Current challenges for robotics in manufacturing are related to efficiency, human-robot collaboration, and cognitive operations.

The **E2** topic looks for CPS/IOT data-driven experiments for sensor data collection, data analytics, and machine learning for the implementation of factory automation technologies supported by robotics which must use MIDIH reference architectures and reference implementations and the MIDIH Data Infrastructures. Candidates are required to provide experiments based on the MIDIH architecture and to provide the correspondent datasets to be experimented in MIDIH HPC/Clouds. In alignment with **Horse**, the I4MS project which proposes a flexible model of smart factory involving collaboration of humans, robots, AGV's (Autonomous Guided Vehicles) and machinery in the manufacturing environment, experiments results will be shared publicly in dissemination events and through the I4MS tools.



The Experimentation Topic E3: Process Industry

E3. Integrating CPS / IOT discrete manufacturing technologies in Process Industry experimental facilities

The manufacturing industry can essentially be classified into two main categories: process industry and discrete product manufacturing. The process industry transforms material resources into a new material with different physical and chemical properties. This material is then usually shaped by discrete manufacturing into an end user product or intermediate component.

The **E3** topic looks for CPS/IOT data-driven experiments involving all actors along the full value chain – from different types of raw material suppliers, through industrial transformation into intermediate products and applications, with the goal of reducing the environmental footprint and increase industrial efficiency. The experiments must use MIDIH reference architecture and reference implementations and the MIDIH Data Infrastructures.

Candidates are required to provide experiments based on the MIDIH architecture and to provide the correspondent datasets to be experimented in MIDIH HPC/Clouds.

In alignment with **SPIRE**, the EU **Public-Private Partnership** dedicated to innovation in resource and energy efficiency enabled by the process industries, experiments results will be shared publicly in dissemination events and through the SPIRE tools.



The Experimentation Topic E4: Whouse Logistics

E4. Integrating CPS / IOT factory logistics technologies in Warehouse management experimental facilities

CPS/IoT play a fundamental role in the factory internal logistics: innovative IT applications need to be developed specifically for planning, scheduling and **monitoring raw materials** and finite products inside the production system.

The **E4** topic looks for CPS/IOT data-driven experiments involving the integration of the different actors and stakeholders of the supply chain that will guarantee a total coordination and alignment between all the value chain phases. The experiments must use MIDIH reference architecture and reference implementations and the MIDIH Data Infrastructures.



Submission Tool



Online Submission tool

- **Electronic submission only**

<https://midih.ems-innovalia.org>

- Filetype: pdf Max: 5M Max. 10 pages
- Contact details: midih_opencall@innovalia.org
- There is an helpdesk inside the application
- Register before the deadline to receive information by email (e.g. updated documentation)



Online Submission tool



[Support](#) [Calls](#)

[Login](#) | [Register](#)

I would like to submit proposals

Thank you for your interest in MIDIH Open Calls. Please click on the box below in order to register as a proposer and be able to submit your proposal.

[Register as a proposer](#)

I would like to evaluate proposals

Thank you for your interest in evaluating proposals under MIDIH Open Calls. Please click on the box below in order to register as an independent expert.

[Register as an expert](#)



Online Submission tool

MIDIH Support Calls Login Register

Proposer registration

Title (*):

First Name(s) (*):

Family Name(s) (*):

Gender (*): Female Male

Phone (*):


Email (*): [Verify email](#)

Confirm email (*):

Password (*):

Confirm password (*):

Country (*):


Please enter the characters shown in the image to verify your registration (*): 

By registering as a proposer for MIDIH calls:

- You certify that the information provided in your application is true
- You accept the [Privacy policy, terms and conditions](#)
- I have read and agree with the aforementioned conditions



Online Submission tool

 [Support](#) [Calls](#) [Login](#) [Register](#)

Your account has been confirmed. Please complete the registration process with details of your working status.

Working Status (*): Organisation

VAT / Registration number (*):



Online Submission tool

The screenshot displays the user interface of the MIDIH online submission tool. At the top, there is a navigation bar with the MIDIH logo, menu items for 'Support', 'Calls', and 'My area', and a user profile section for 'Carmen Polcaro' with a 'Logout' button. A dropdown menu under 'My area' includes 'My profile', 'My calls', and 'My notifications'. The main content area features a call card for 'Call identifier: midih-OpenCall1' with a status of 'Receiving proposals'. The card lists key dates: 'Publication date: 2018-03-28', 'Opening date: 2018-03-29 10:00:00 (Brussels time)', and 'Closing date: 2018-06-29 17:00:00 (Brussels time)'. It also specifies a 'Budget: 960,000.00 €', 'Ending date of proposals evaluation: 2018-07-31', 'Starting date of negotiations: 2018-09-02', and 'Ending date of negotiations: 2018-09-30'. The 'Call responsible' is listed as 'Carmen Polcaro'. Below the call card, there are three tabs: 'Call general details' (selected), 'Thematic areas', and 'Supporting documentation'. The 'Call general details' tab contains a 'Call Summary' section with two paragraphs of text and a 'Call Keywords' section with a bulleted list: IoT, BigData, CPS, and I4MS. A 'Back to Calls' button is located at the bottom right of the page.

MIDIH Support Calls My area Carmen Polcaro Logout

My profile My calls My notifications

MIDIH Call Data driven applications and experiments in CPS/IoT

Call identifier: midih-OpenCall1 Status: Receiving proposals

Publication date: 2018-03-28 Ending date of proposals evaluation: 2018-07-31

Opening date: 2018-03-29 10:00:00 (Brussels time) Starting date of negotiations: 2018-09-02

Closing date: 2018-06-29 17:00:00 (Brussels time) Ending date of negotiations: 2018-09-30

Budget: 960,000.00 € Call responsible: Carmen Polcaro

Call general details Thematic areas Supporting documentation

Call Summary

MIDIH Call-1 targets the development of data driven applications, by IT SMEs as technology providers, and experiments in CPS/IoT by Manufacturing SMEs.

The open call aims at complementing functionalities around MIDIH reference architecture and performing experiments in CPS/IOT based on the components provided by the architecture.

The experiments must cover one of the three main scenarios: Smart Factory or Smart Product or Smart Supply chain.

Call Keywords

- IoT
- BigData
- CPS
- I4MS

Back to Calls



Online Submission tool

MIDIH Support Calls My area Carmen Polcaro | Logout

Calls > MIDIH First Open Call Data driven applications and experiments in CPS/IoT > Proposal structure

Call general details

Thematic Areas

Proposal structure

Evaluation

Supporting documentation

Call Overview

Sections of the technical proposal

Title (*):

Size (*):

Description:

Section name	Size	Description	Actions
Abstract	2000	Please provide the summary of the project (max 2000 characters), Please note that this information may be used for dissemination purposes.	

Budget breakdown

Description:

Define the annexes of the proposal (Accessible after registration to the call. e.g. Technical proposal template in Word)

Annex name	Max. Size (MB)	Type of document	Mandatory	Template
Technical Proposal	5	PDF	Yes	-



THANK YOU and
GOOD LUCK!

MIDIH

MANUFACTURING · INDUSTRY
DIGITAL · INNOVATION · HUBS

