

H2020-Project: CREMA

Cloud-based Rapid Elastic MAnufacturing



Speaker



Technology Provider SME
Germany, 34 people

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Coord. CREMA
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CREMA project (www.crema-project.eu, project coordinator)
ADVENTURE (www.fp7-adventure.eu)
SIMPLI-CITY (simply-city.eu)
SAM (socialisingaroundmedia.com)
SOA4ALL (www.soa4all.eu)
Netchallenge (www.netchallenge.org)
... and some national projects in Germany

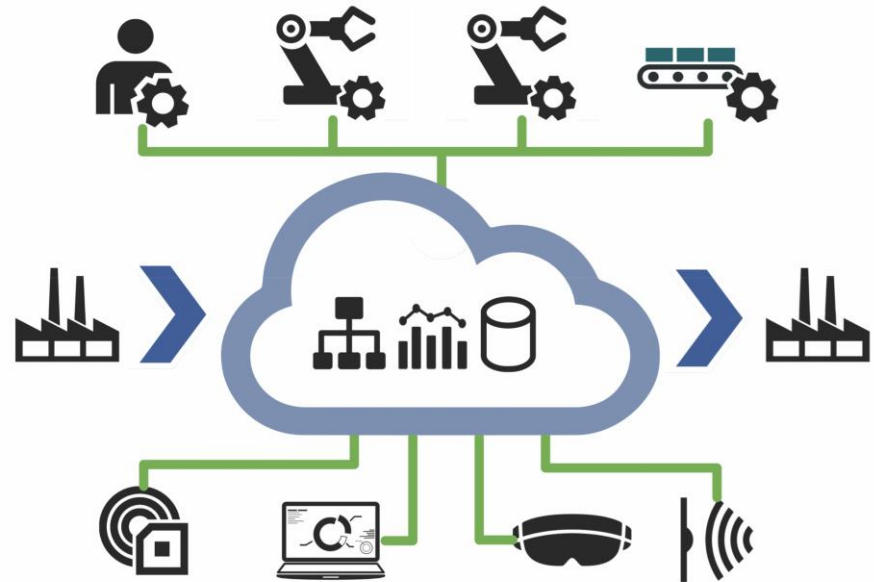
Does: write proposals, research documents, management and software development tasks, software development team leading; consumer desktop software, web-frontend and web-server programming, service oriented message-bus solutions and iOS mobile applications, including user-experience design, marketing campaigns and creative processes; proficient in Java (but hates this with a vengeance), C#/.NET and Objective-C / Swift as well as various popular programming frameworks.



Agenda



- Project
 - Vision
 - Technical Approach
 - The Real World
 - Use Cases I + II
 - The Business
-
- Highlights



Project Facts



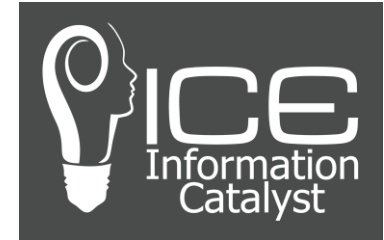
- Project Title: **Cloud-based Rapid Elastic MAnufacturing**
- *Collaborative Manufacturing 4.0 —
Tomorrows Manufacturing Vision Today*
- H2020 **Industry 4.0** Research Project
- **Started: January 2015**
- Duration: 36 Months (until December 2017)
- Budget: 5.324.720 €
- Coordinator: **Ascora GmbH**, Germany
- Technology Readiness Level: 1-6



Consortium



TECHNISCHE
UNIVERSITÄT
WIEN



FAGOR ARRASATE



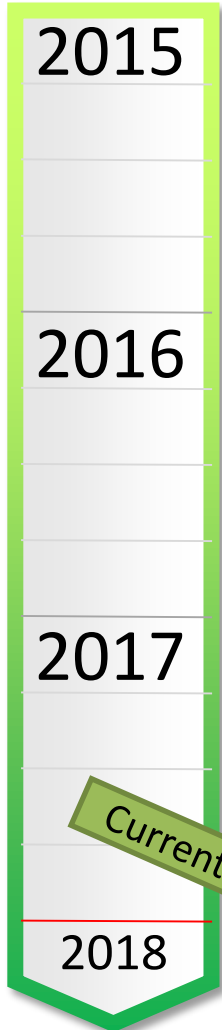
GOIZPER



The Project so far



- Tenneco
- Goizper
- Fagor
- Ford
- BMW



January 2015 – Plenary #1 (Kickoff, now, ASC, DE) — +Brussels
March 2015 – Plenary #1.1 (Optional Kickoff 2, IKER, ES)
June 2015 – Plenary #2 (FAGOR, ES)
Frankfurt (Aug, ASC) — Cowbridge (Sep, TANet) — Calpe (Okt, ICE)
December 2015 – Plenary #3 (UBI, DE)
January 2016 – Review #1 (Brussels, BE)
June 2016 – Plenary #4 (TUV, AT)
September 2016 – Working Meeting (DFKI)
Nov 2016 – Plenary #5 (IKER, ES) Workshop #1 (Hernani, ES)
February 2017 – Review #2 (Brussels, BE)
March 2017 – Plenary #6 (TCO, BE)
Oktober 2017 – Plenary #7 (DFKI, DE)
November 2017 – (Industrial) Workshop #2 at Waterton (TANet, GB)
February 2018 – Review #3 (Brussels, BE)

Vision

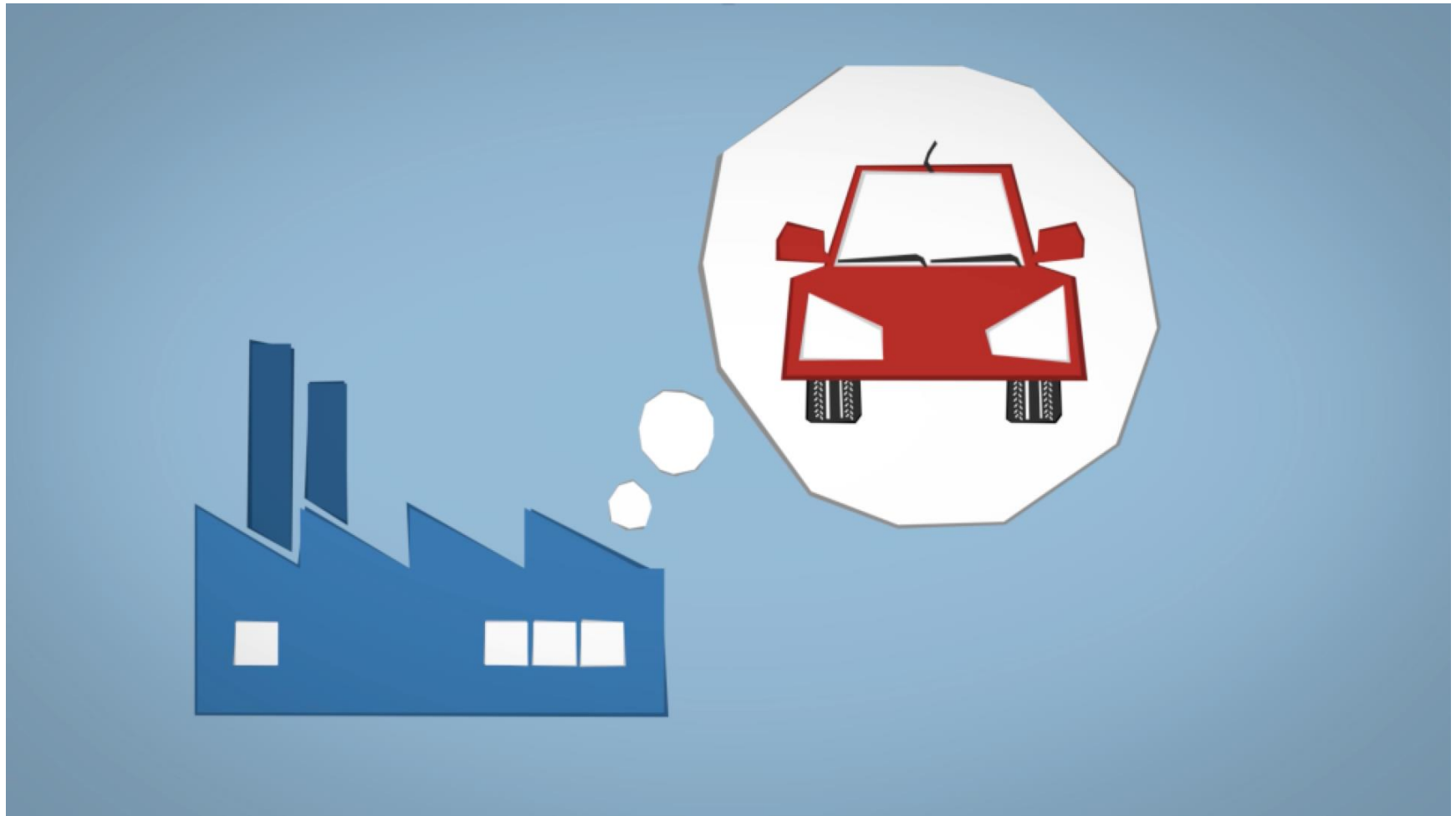


So, what is...

CREMA

IOT
Big Data
Process Designer
Machinery
Abstraction
Marketplace
Workshops
Leasing
Knowledge
Plenary
Automotive
Releasing
Harmonisation
Rules
Sensors
Exploitation
Optimisation
Dashboard
KPI
Industry
Manufacturing
Business Plan
Services
Virtualisation
Collaboration
Data Model
Storage
CPS

Vision Video

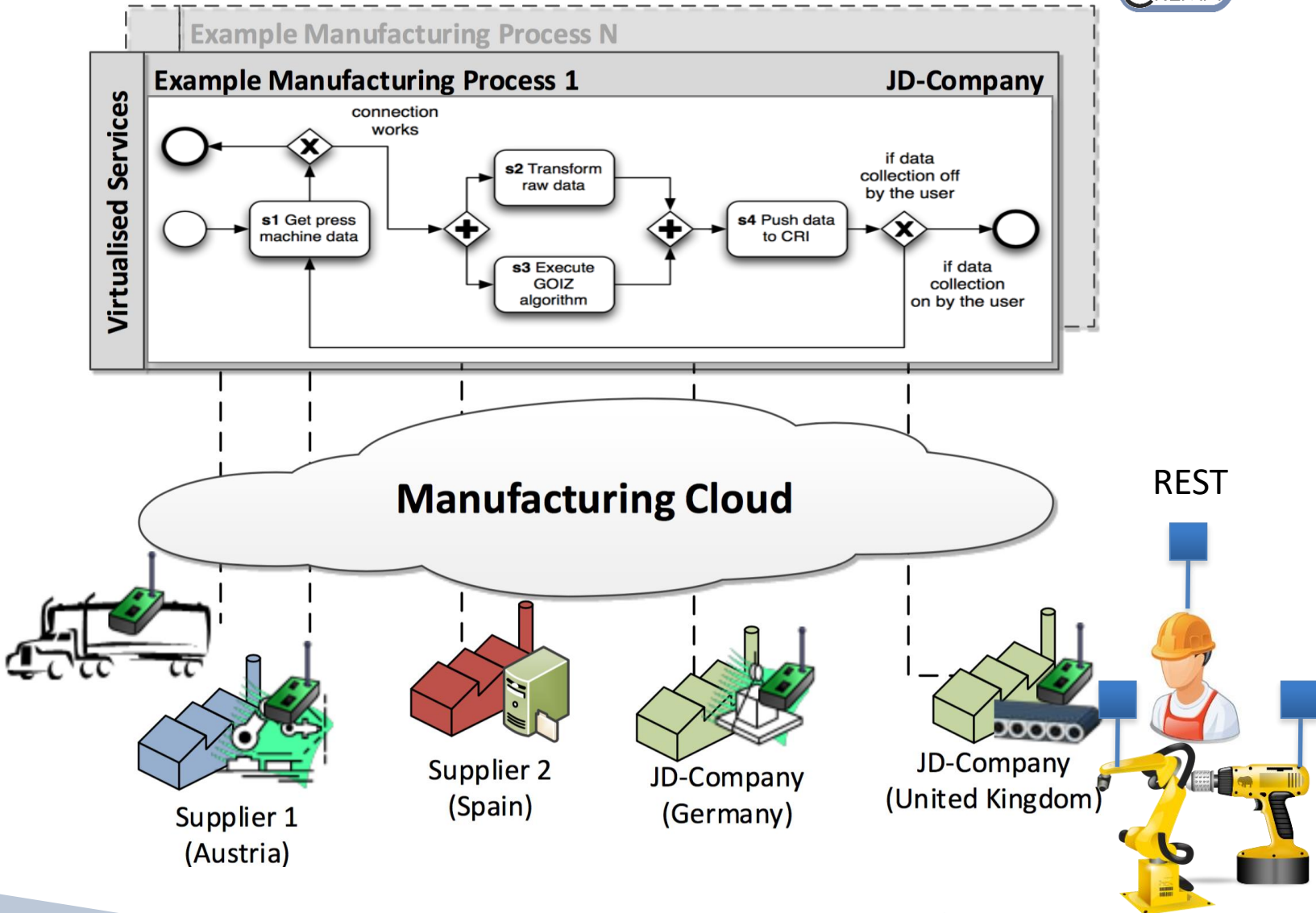


Vision



- Provide everything-as-a-service (**XaaS**)
- Connect **CPS**, **workers** (via head- or handsets), **robots**, **vehicles**, **software**, **sensors**, etc. with services, describe those semantically, and store them (→ marketplace)
- Enable **easy process creation** by integrating services from marketplace using a graphical BPMN editor
- Support the **complete manufacturing cycle**: modelling of processes, execution, adaptation and monitoring
- Execute **services on demand** and meter them using leasing and releasing of assets, enable pay-per-use – to bridge local-factory / company borders

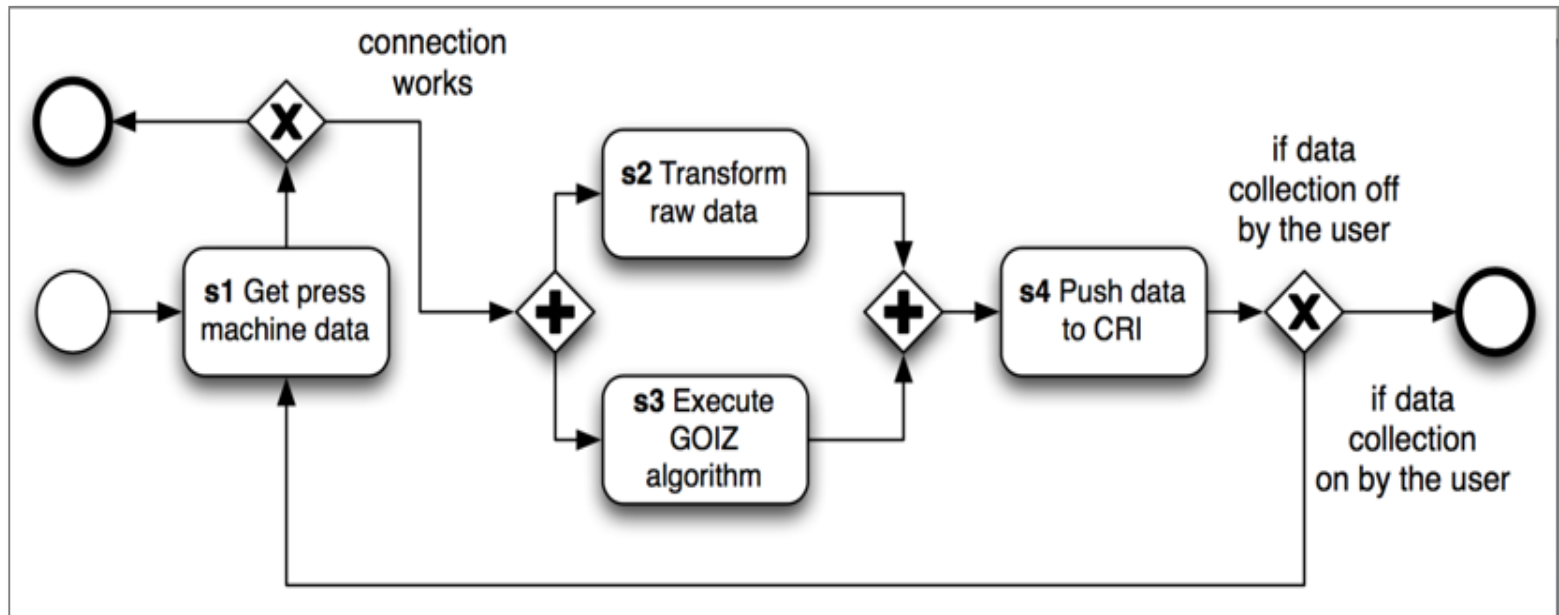
XaaS Controlled By BPMN Processes



Control by BPMN Process



- The **Programming Language** of CREMA
- Activities are connected to CPS-XaaS services
 - XaaS includes CPS, people, software, sensors, robots...
- Enable **actions and reactions** to events



Technical Approach



Describe & Create XaaS Services

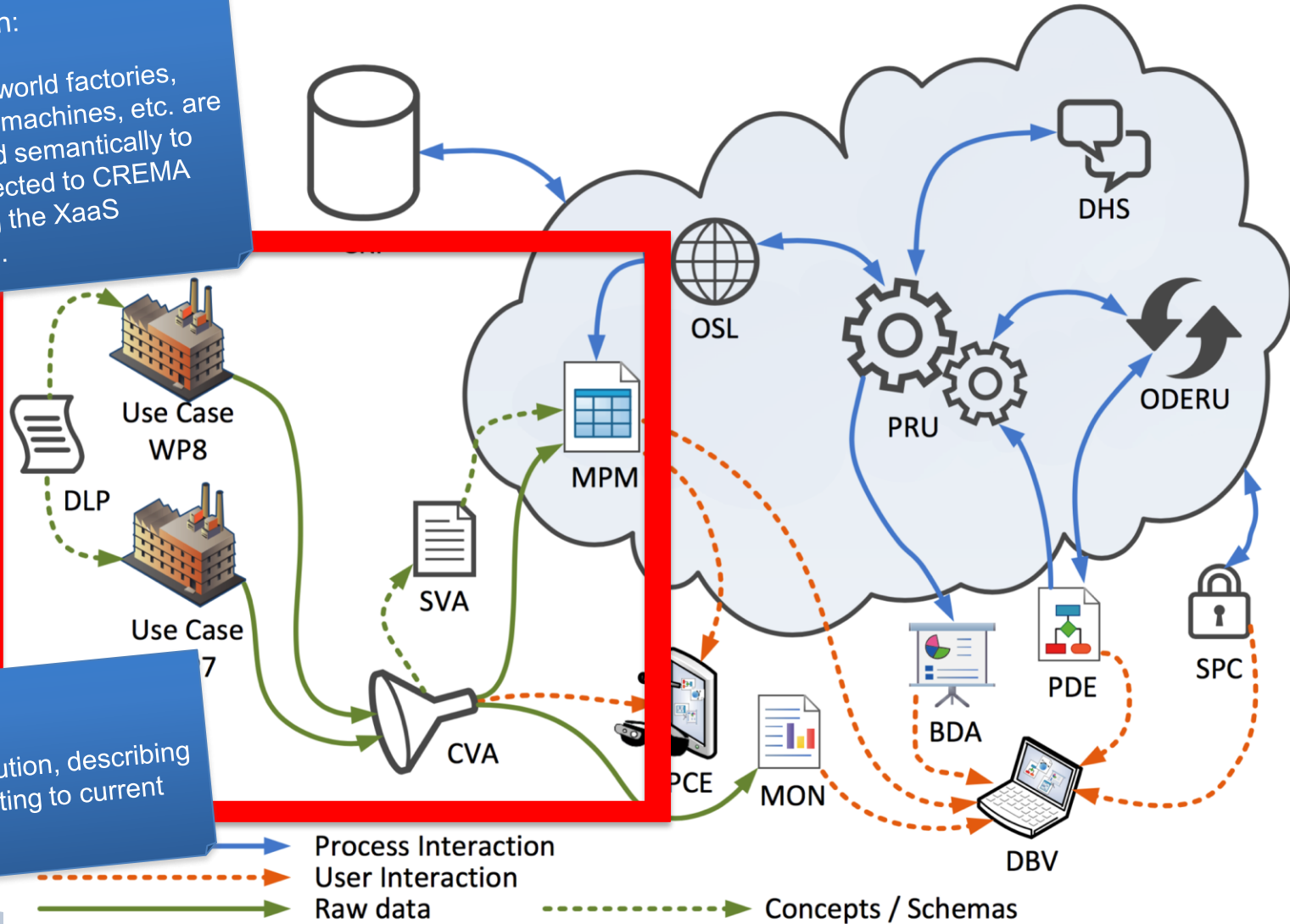


Innovation:

Two real-world factories, including machines, etc. are described semantically to be connected to CREMA following the XaaS principle.

Enables:

Additive solution, describing and connecting to current systems

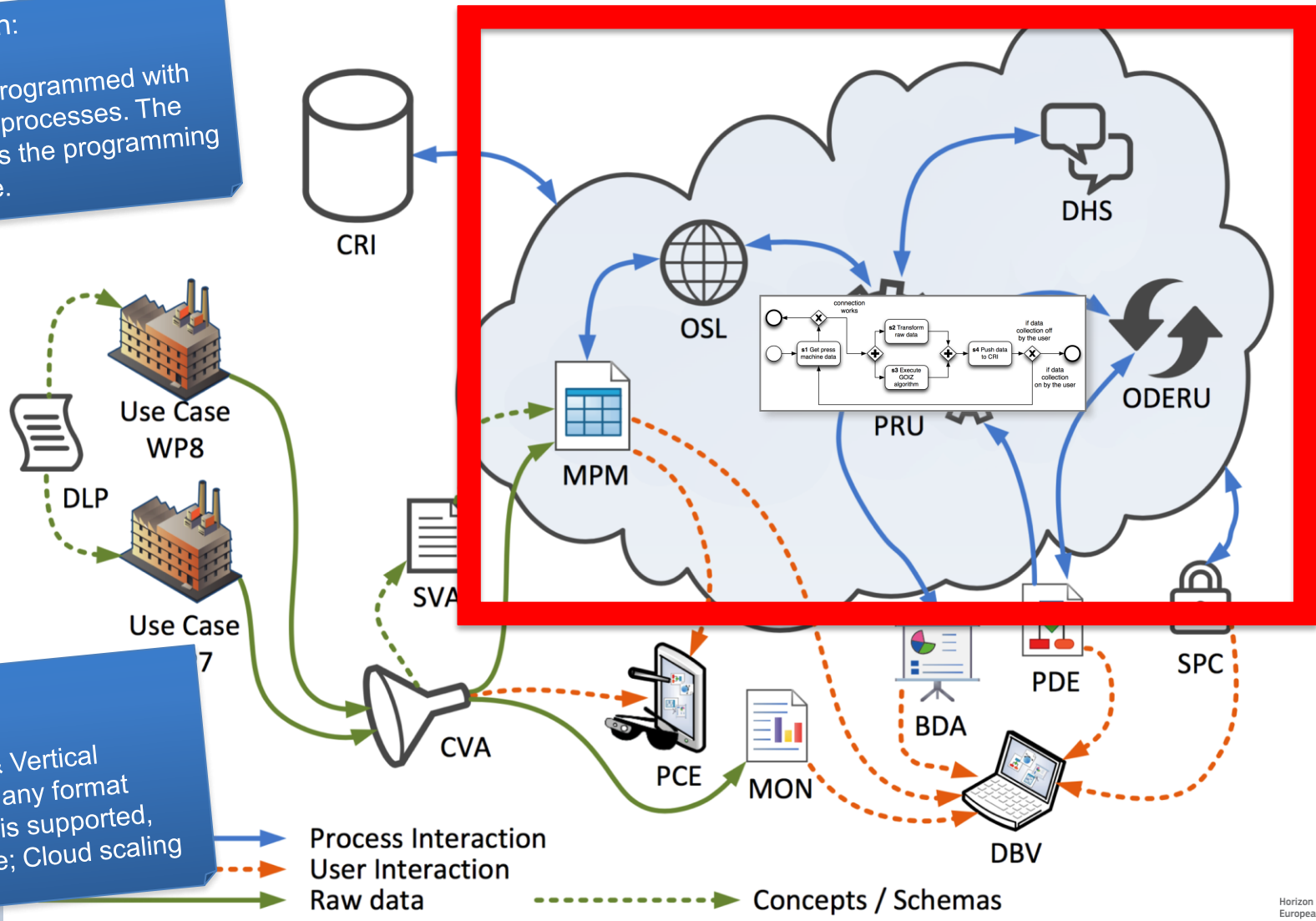


- Process Interaction
- User Interaction
- Raw data
- Concepts / Schemas

Process "Brain"

Innovation:
XaaS is programmed with business processes. The process is the programming language.

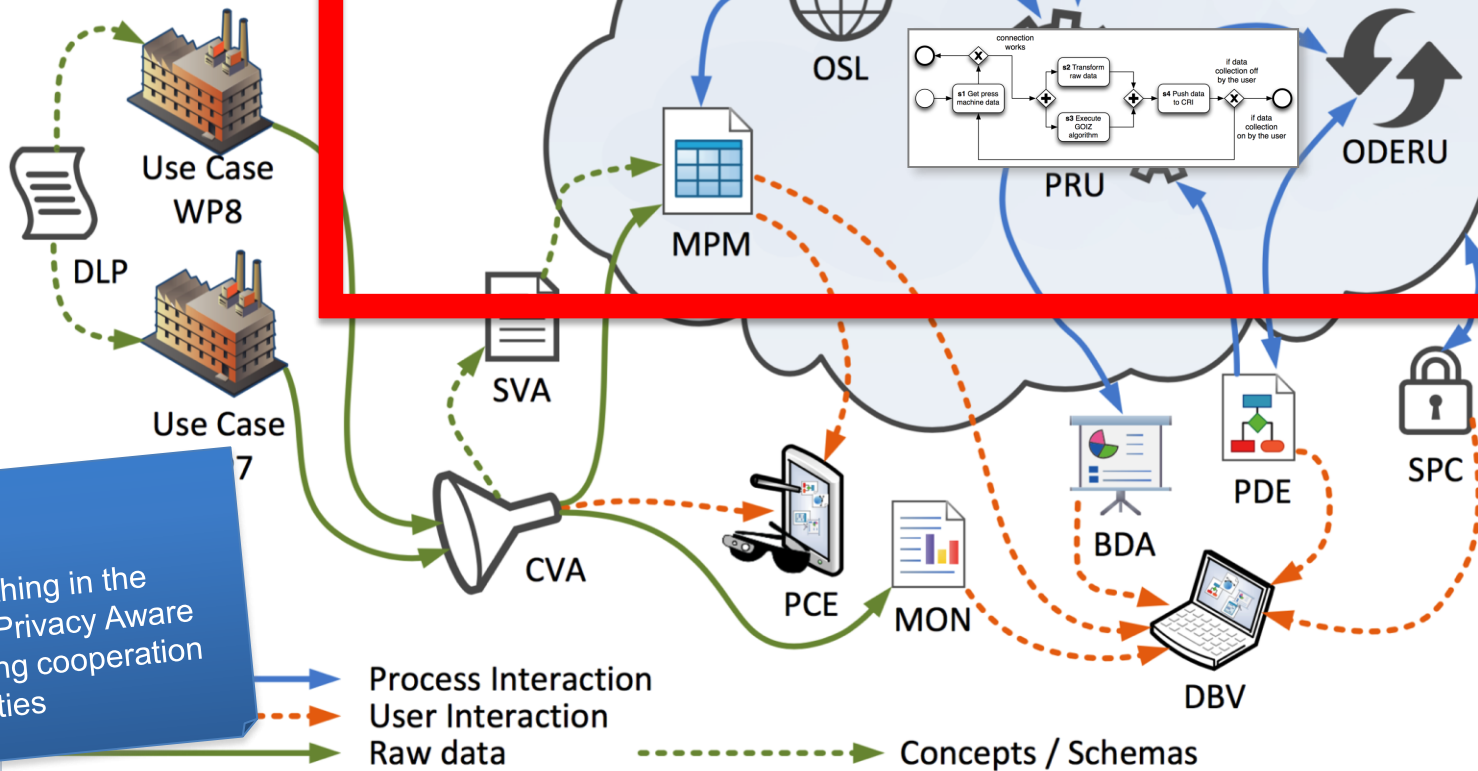
Enables:
Horizontal & Vertical Integration, any format conversion is supported, very flexible; Cloud scaling



Elastic Cloud Resources

Innovation:

Providing a holistic data-privacy-aware Cloud-based Manufacturing Framework supporting the whole manufacturing life-cycle.



Enables:

Store everything in the Cloud, in a Privacy Aware way, enabling cooperation with 3rd parties

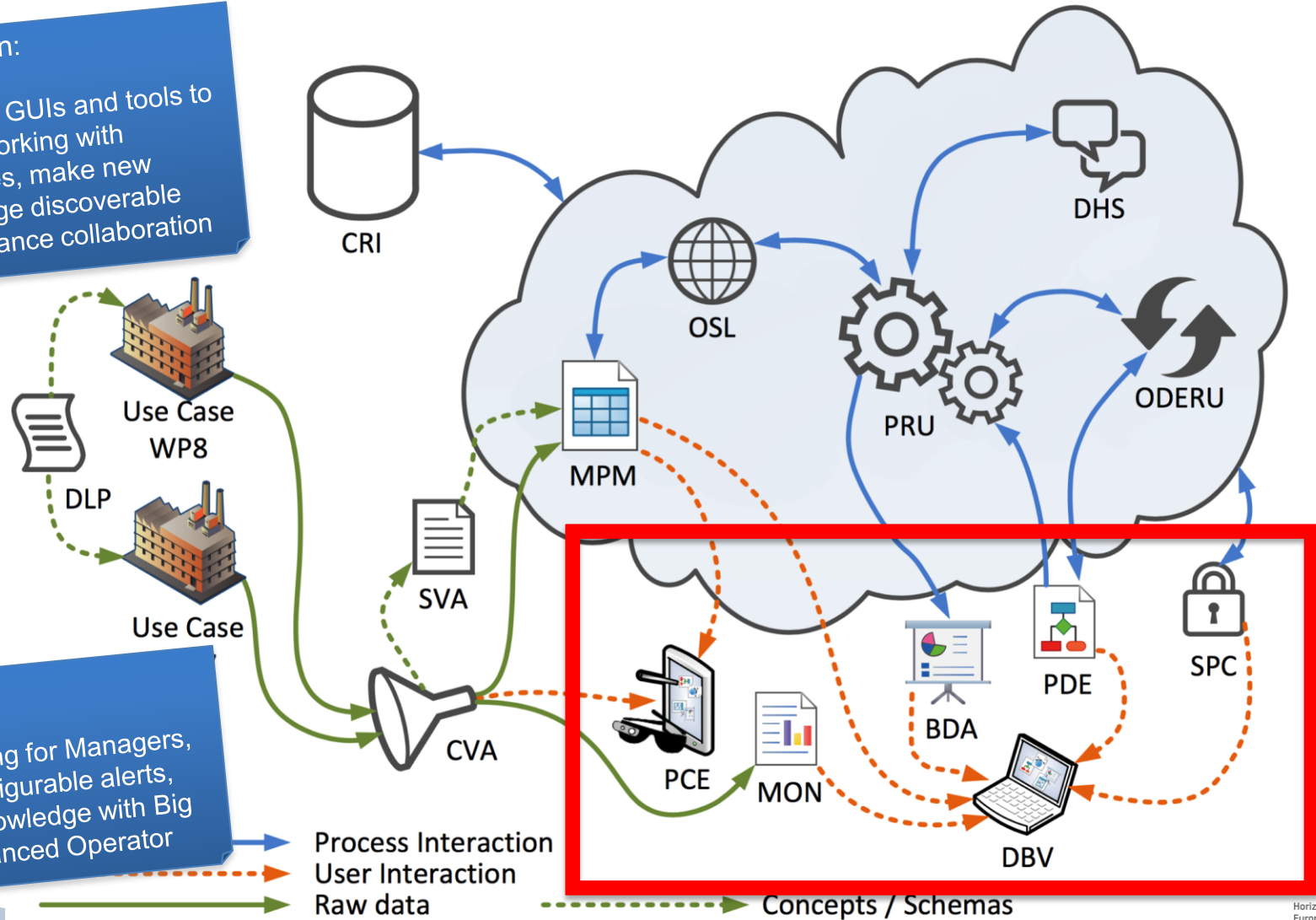
- Process Interaction
- User Interaction
- Raw data
- Concepts / Schemas

Analytics & User Interaction



Innovation:

Providing GUIs and tools to enable working with processes, make new knowledge discoverable and enhance collaboration



Enables:

Programming for Managers, instant configurable alerts, analyse knowledge with Big Data; Enhanced Operator

Process Interaction
User Interaction
Raw data

Concepts / Schemas

Horizon 2020
European Union funding
for Research & Innovation

CREMA has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 637066

The Real World

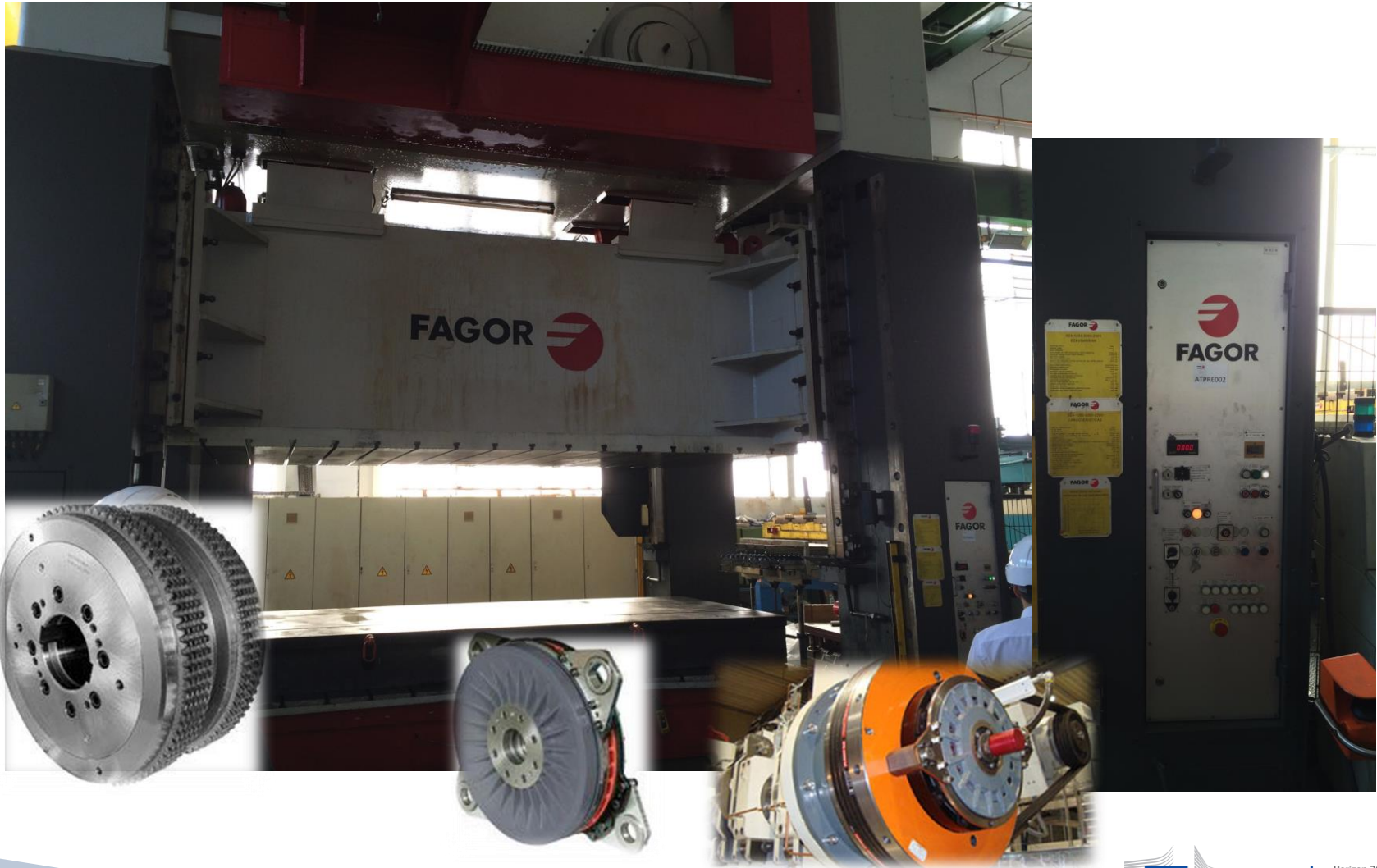


- Research pilots are designed to create business value
- Two Use Cases
 - Component Prototypes to improve current status
 - Use Case I — Predictive Maintenance
 - FAGOR, GOIZPER
 - Use Case II — Automotive
 - TENNECO
- Evolve from a research project to a start-up in early 2018 based on a business plan created during the project

GOIZPER



Use Case I – Predictive Maintenance



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Sensor-ized press machine

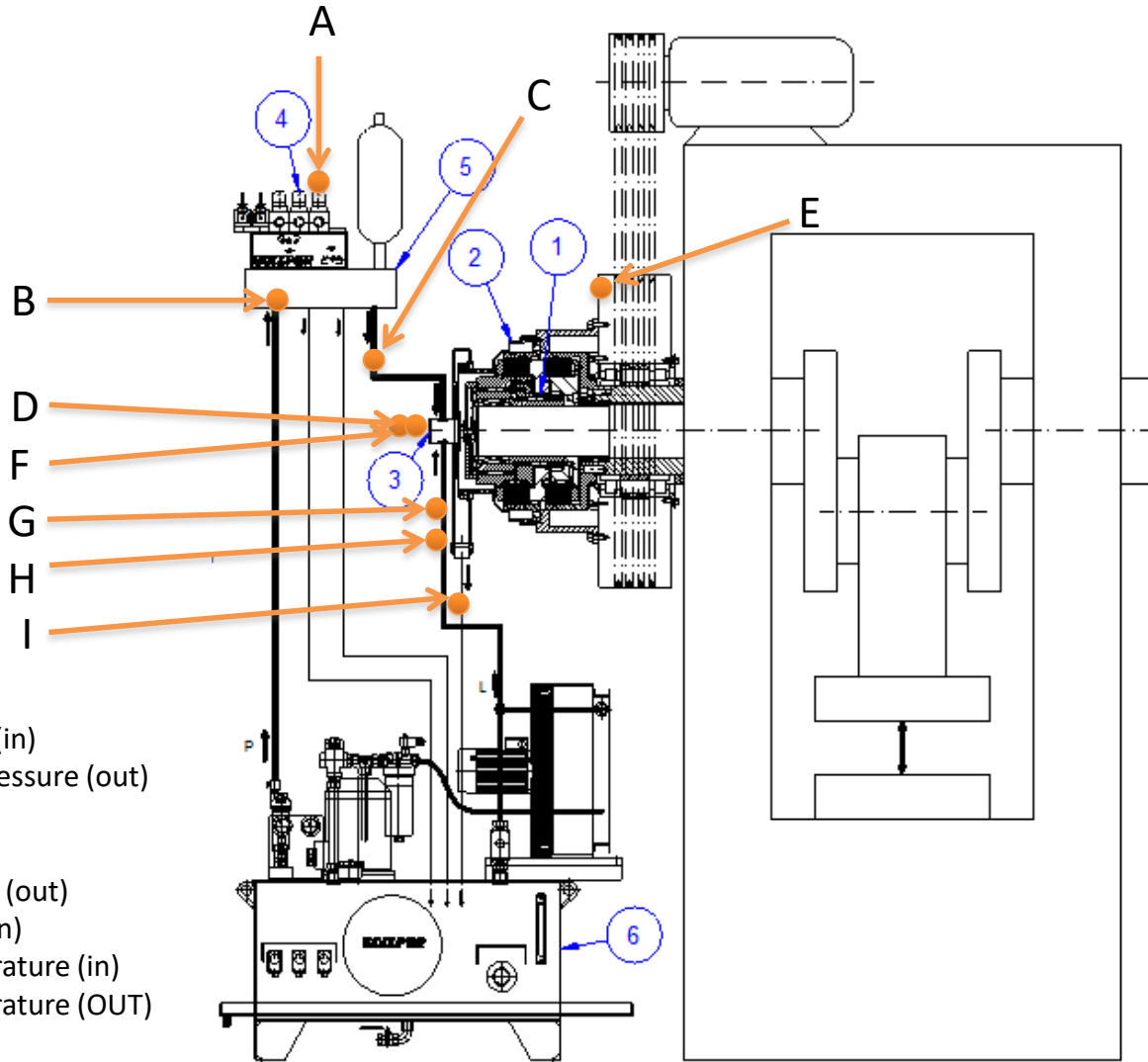


○ Components

1. Clutch-Brake
2. Oil collector
3. Rotary union
4. Control valve
5. Control unit
6. Power pack

● Required sensors

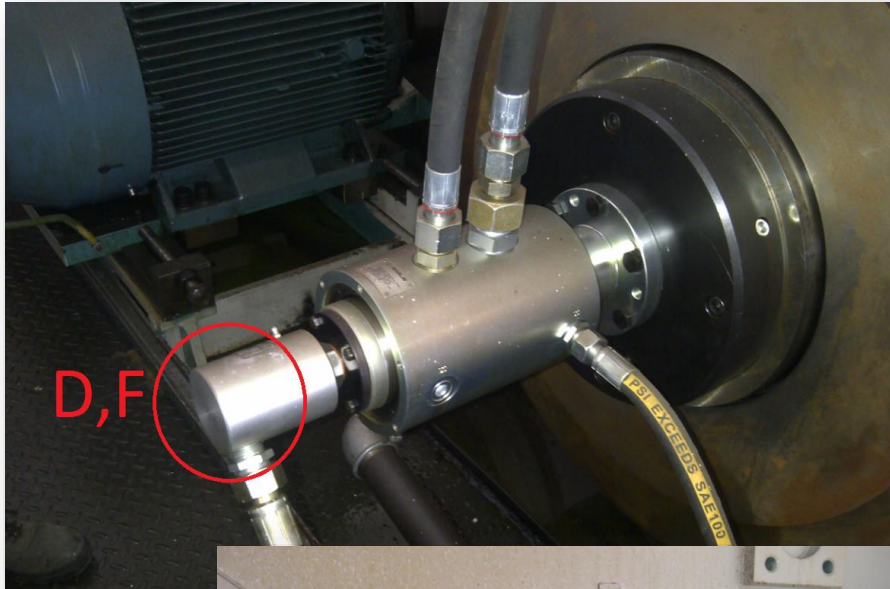
- A. Opto-coupler: Trigger signal
- B. Pressure transducer, *PN 3592*: Line pressure (in)
- C. Pressure transducer, *PN 3592*: Application pressure (out)
- D. Encoder, *E6B2-CWZ1X*: Shaft position
- E. Inductive sensor: Flywheel axis speed (in)
- F. Tachometer, *RDC 205*: Application axis speed (out)
- G. Flow meter, *SU 7000*: Refrigeration oil flow (in)
- H. Temperature sensor *PT100, TM4101*: Temperature (in)
- I. Temperature sensor *PT100, TM4101*: Temperature (OUT)



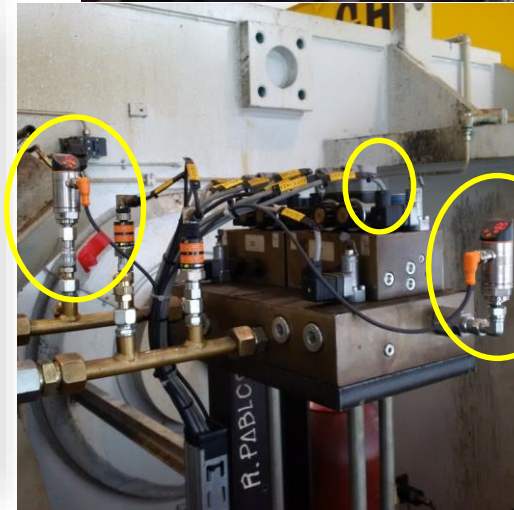
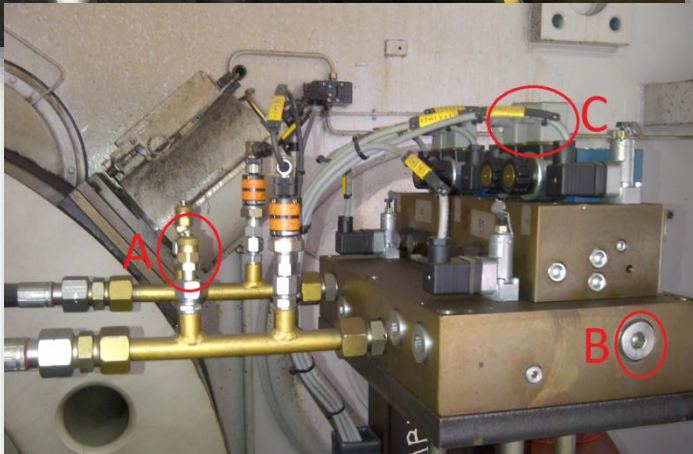
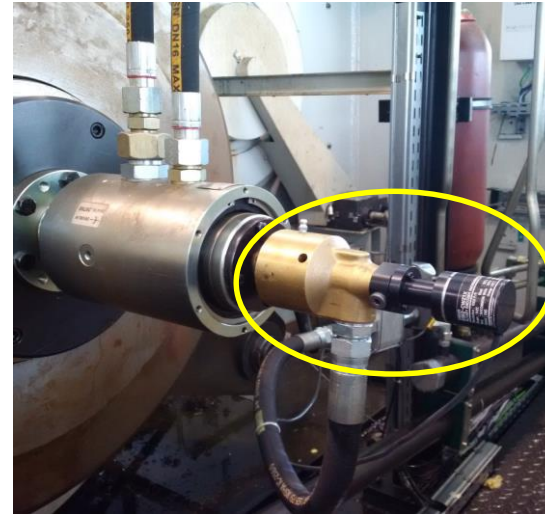
Details next presentations & demonstration in Coffee Break



BEFORE



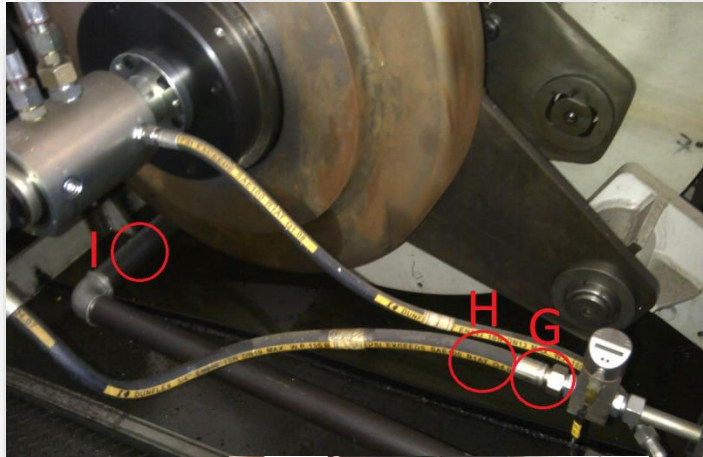
NOW



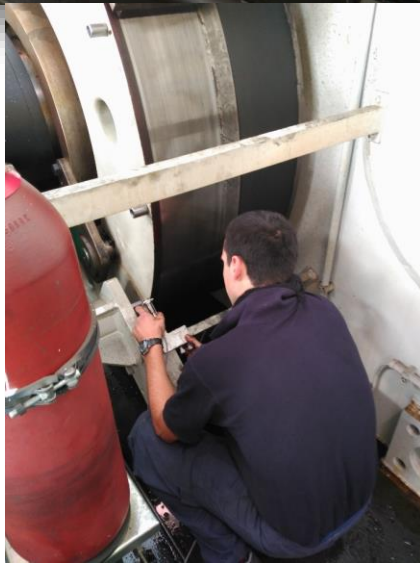
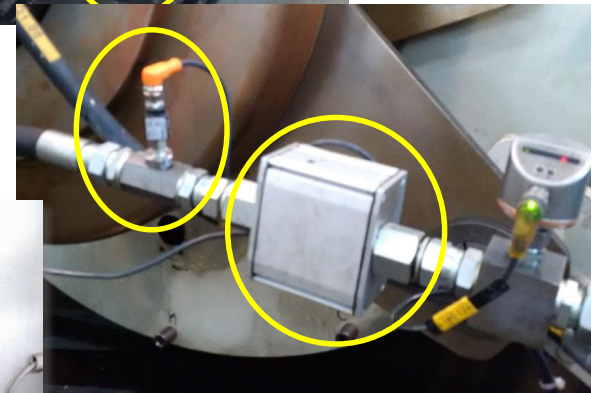
Details next presentation & demonstration in Coffee Break



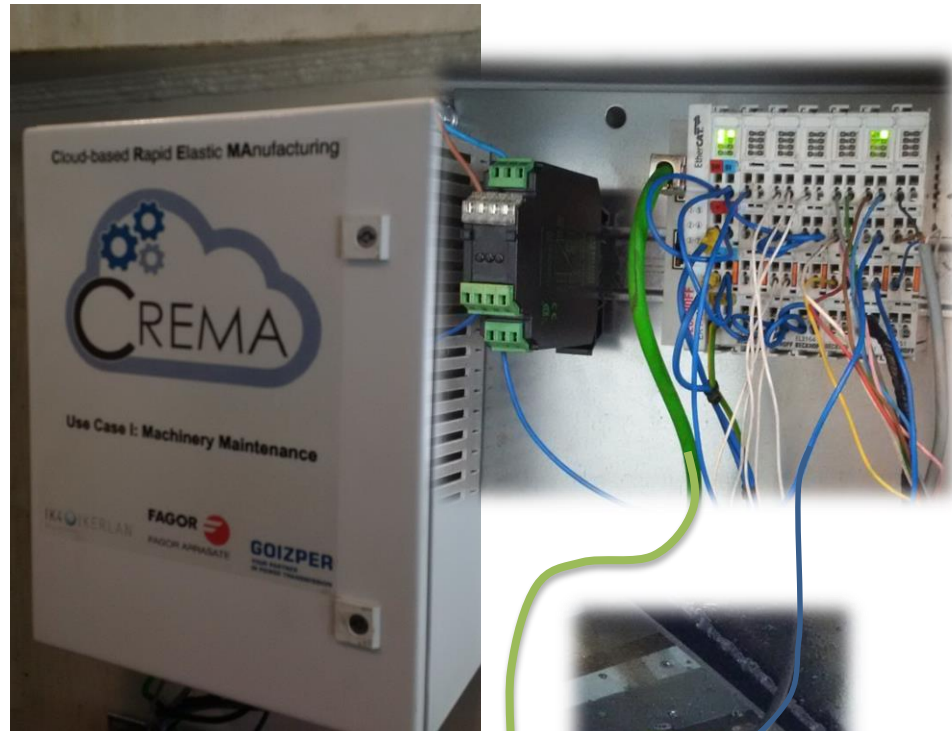
BEFORE



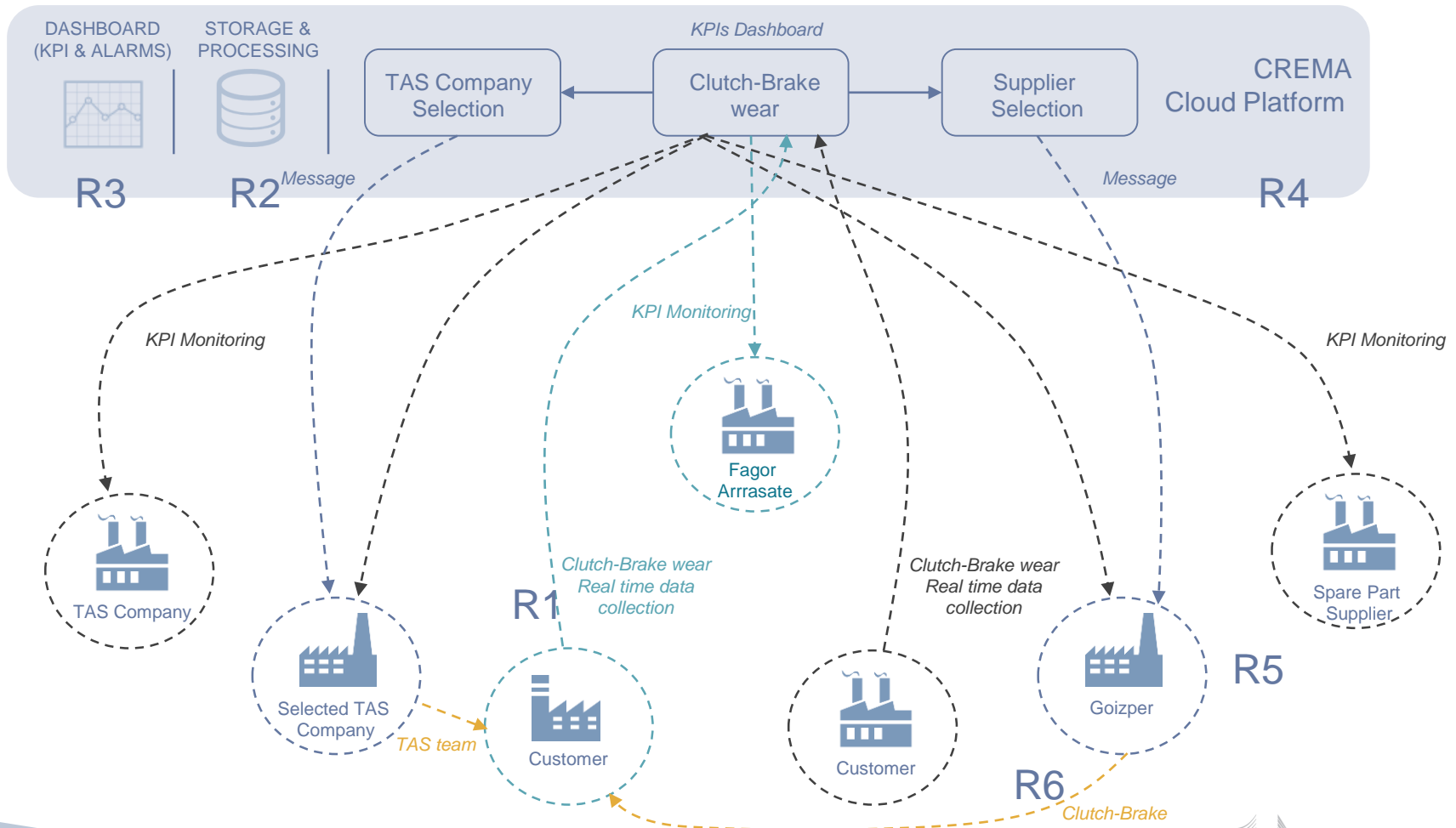
NOW



Details next presentation & demonstration in Coffee Break



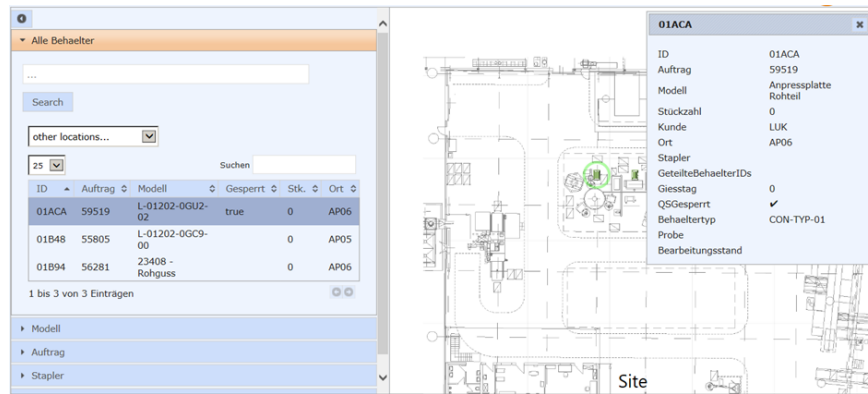
Use Case I — Predictive Maintenance



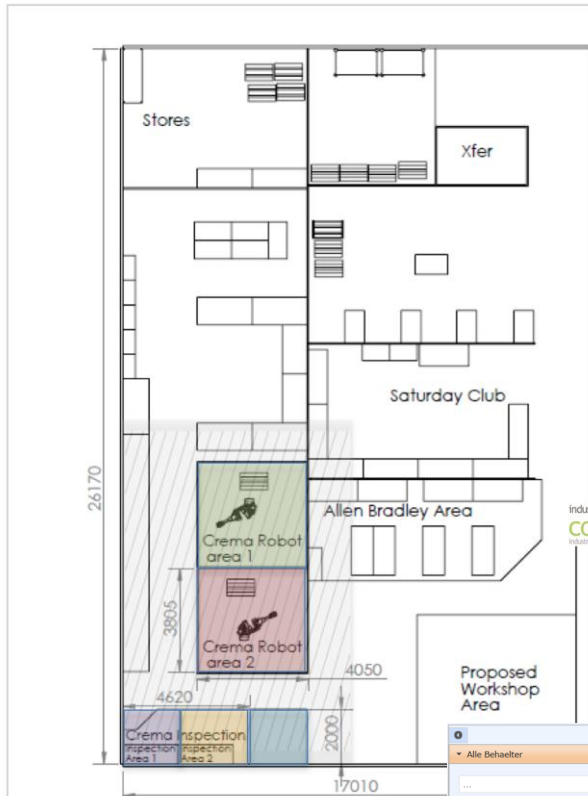
Use Case II - Automotive



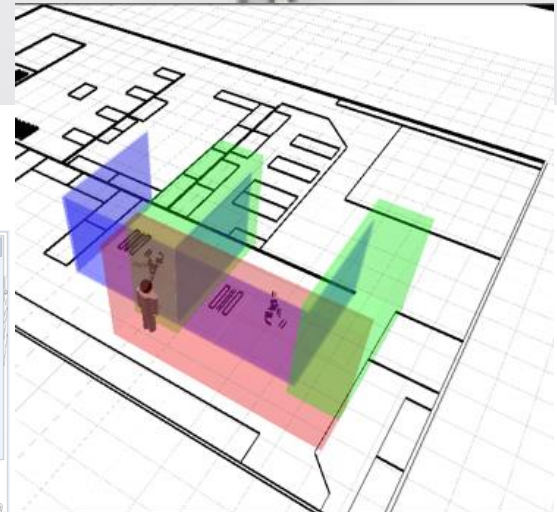
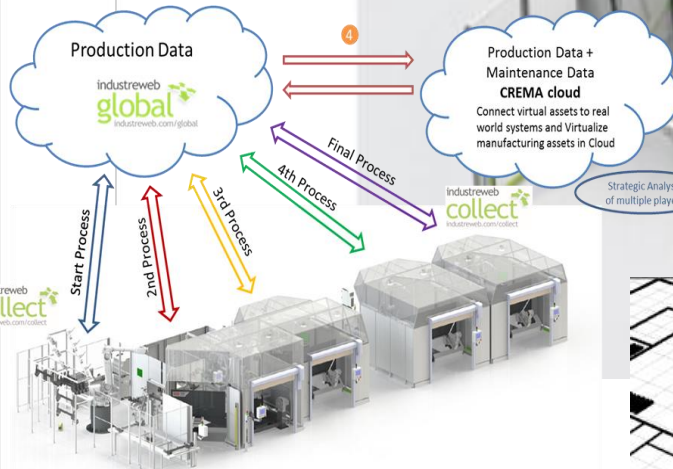
- At **TENNECO Europe**
- More traditional **lines-based manufacturing**
- Welding robots making car exhausts / suspension gear
- **Augmented Operator** has more information
- **Location technology** by UBISENSE to know the location of people, tools, products, etc. used for error proofing



Details next presentations & demonstration in Coffee Break



- Zone 1
- Zone 2
- Zone 3
- Zone 4



Alle Behälter

Search

other locations...

ID	Auftrag	Modell	Gesperrt	Stk.	Ort
01ACA	59519	L-01202-0GU2-02	true	0	AP06
01B48	55805	L-01202-0GC3-00		0	AP05
01B94	56281	23408 - Rohguss		0	AP06

1 bis 3 von 3 Einträgen

- Modell
- Auftrag
- Stapler

01ACA

ID	01ACA
Auftrag	59519
Modell	Anpressplatte
Stückzahl	Rührteil
Kunde	LUK
Ort	AP06
Stapler	
GeteilteBehälterIDs	
Gespartag	0
QSGesperrt	✓
Behältertyp	CON-TYP-01
Probe	
Bearbeitungsstand	

Site



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Business Plan



- CREMA as a Company
- **CREMA**nufacture (*working title*)
 - During research, combine dissemination activities to create a **business plan**
- Take what was realized in the research project
- Extend it and polish it for the market
- Focus on use case partners first
- Provide value, create profit and develop CREMA further
- Targeting SMEs
- Includes Ubisense and IndustrieWeb products
- Available 2018 / Q3

Business Plan



Products

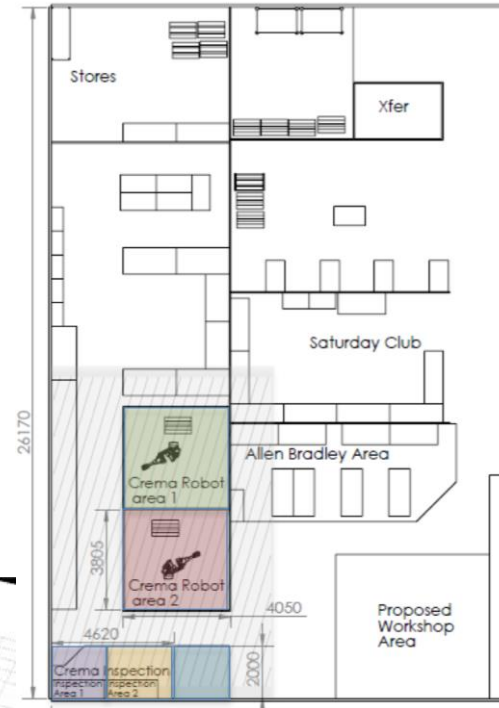
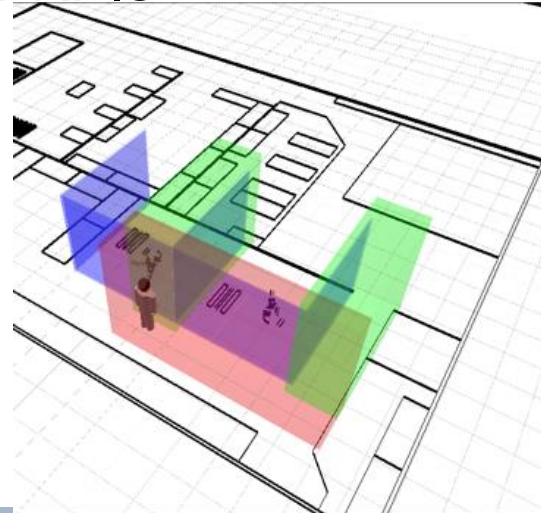


- All usable with the actions / reactions
- Track & Trace
- Collaborative Monitoring
- Data Analytics
- Optimization
- (later) Marketplace

Products (1) Track and Trace



- **Track & Trace**
 - Indoor Location, find assets quickly
 - Quality Assurance
 - Reduction of Human Errors
 - Add sensors where needed
 - Monitor KPIs
 - Calculate OEE & other KPIs
 - Notify about errors



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Commission

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Products (2) Collaborative Monitoring



- **Collaborative Monitoring**
 - Empowering workers and operators
 - More information about machines, tools and schedules
 - Better (intra-company) support & communication features
 - Smart Asset Knowledge Database

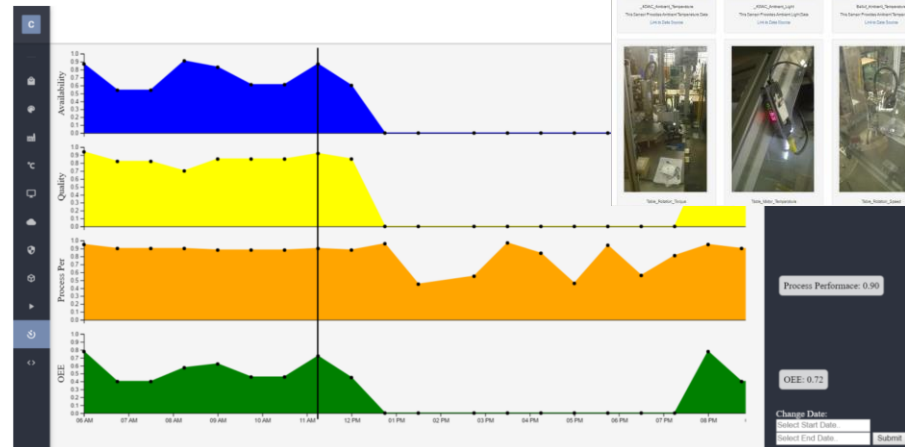
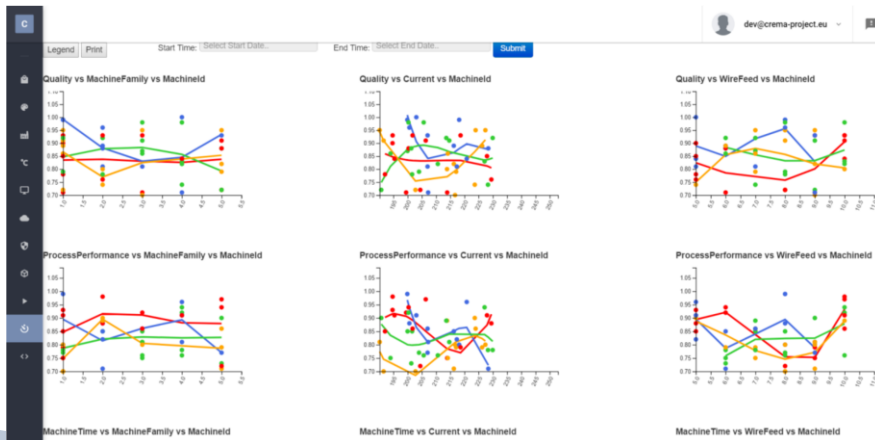
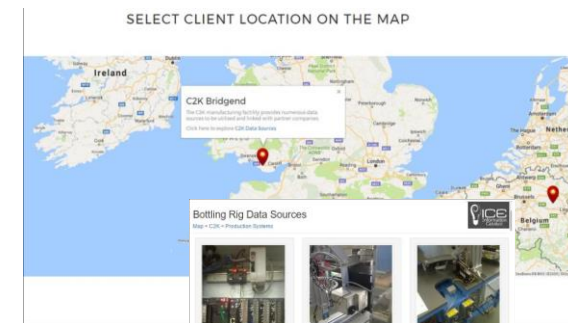
NAME	OPERATOR
A	WELDING
C	WELDING
D	WELDING
G	WELDING
L	WELDING

Products (3) Data Analytics



- **Data Analytics**

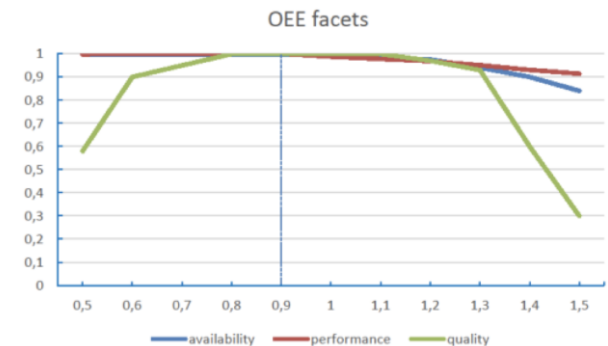
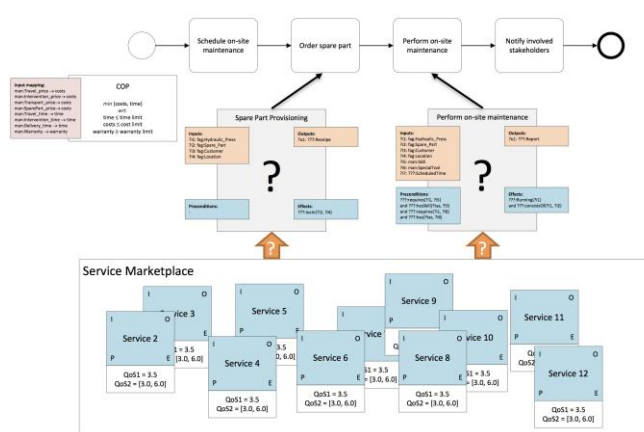
- Store, analyse and share data on the Cloud
- Find out new knowledge and trends
- Visualize data correlations



Products (4) Optimization



- **Optimization**
 - Optimizing parameters
 - Errors in the process can be automatically analysed and a solution by service replacement can be proposed
 - KPI-driven parameter optimisation
 - Functional and nonfunctional optimization can be modelled in process



Products (Future) Marketplace



- **Marketplace**
 - Amazon for Services, Products and Resources
 - Detailed Semantic Description possible
 - Horizontal Integration

 - More data privacy controllable (like Facebook)
 - Privacy settings for people, teams, plant, company, partners & public
 - E. g. more visibility for plants in own company
 - E. g. no exact numbers visible externally
 - Intra-site resources factored into optimization

Products (Special) Features



- Not only observations →
 - programmable reaction →
 - less time wasted!
- Worker empowerment
 - More information →
 - Better reaction time
- Extremely adaptable, runs on major Cloud providers
- Integration with existing systems on site
- If you have an issue, we can likely fix it

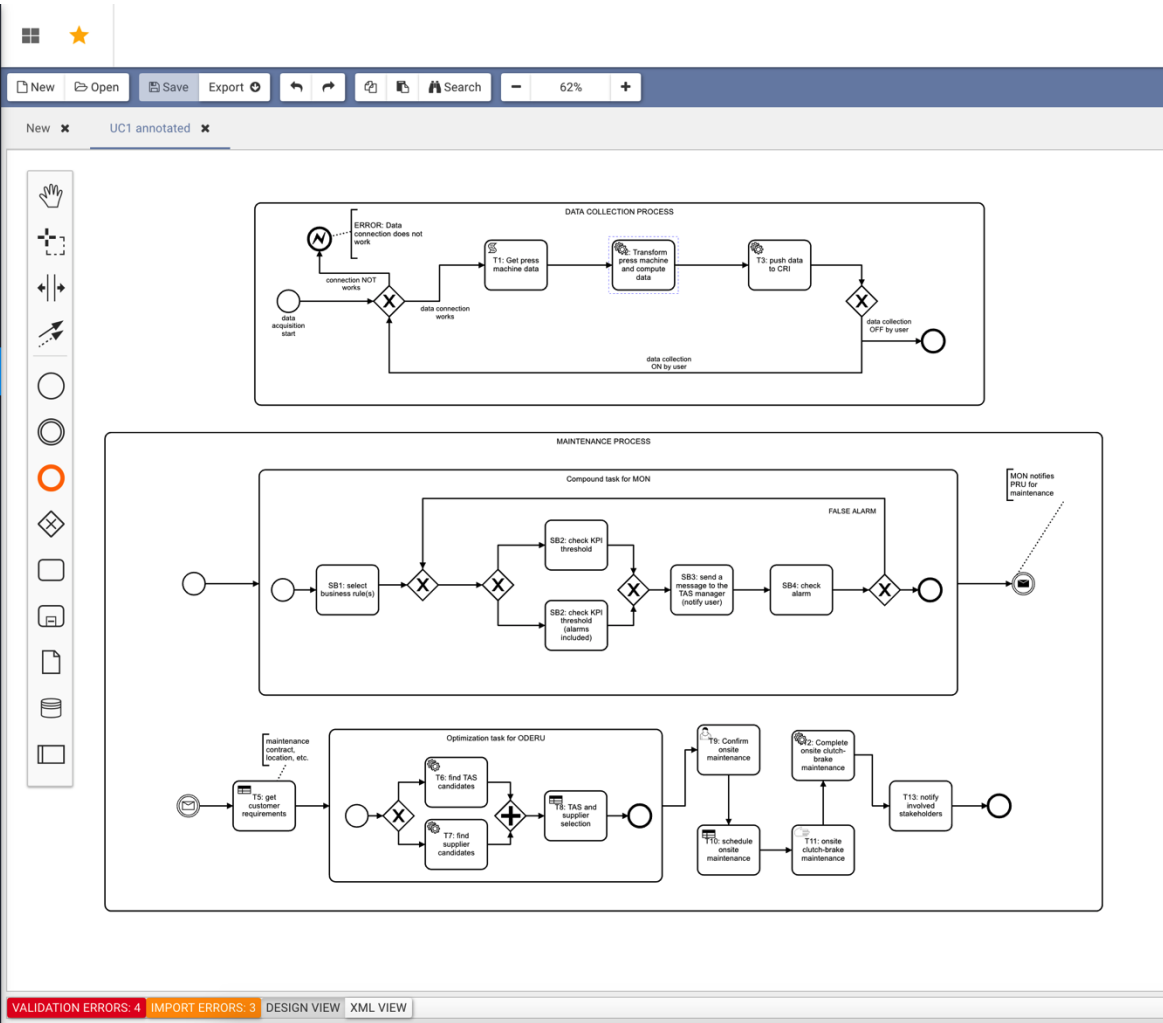
Highlights: User Experience



CREMA

CREMA MODULES

- Sample!
- PCE UI Streaming
- Hardware Platform
- CRI Demo App
- CVA
- PDE**



Properties Optimization Marketplace Process Store

ServiceTask_0q8m1n1

ID: ServiceTask_0q8m1n1

Name: T2: Transform press machine and compute data

x: 624 y: -4

width: 100 height: 80

Annotations

Inputs: 2 | Outputs: 1 | Preconditions: 1 | Effects

+ADD INPUT [X] CLEAR

- 1 http://127.0.0.1:8080/CREMA/Ontologies/merged_v1.owl#Raw_E
- 2 http://127.0.0.1:8080/CREMA/Ontologies/merged_v1.owl#Algori



Highlights: Issues in Proposals



- Importance of Exploitation and Impact rise
- Products may not be funded directly
 - Alternative Exploitation Strategies should be suggested
 - Continuation of development and support after funding
- Security is required, but not in focus
- Industry 4.0 issue #1: Trust → Legal framework?
- Not only Security → Data Privacy
- User Interfaces → User Experience
- Changes in Description of Action were necessary

Highlights: Changes



- At proposal time, a perfect plan is impossible
- Changes are good for projects
 - **Business Plan**
 - Dissemination → Video, Slogans, Pitches, ...
 - Focus on Service and Docker registry, also serve project dockers to make components more portable
 - Add **Security & Privacy component** (Privacy in the Cloud)
 - Ubisense brings **Location Technology** → added to Use Case 2 and a T4.4 (Cyberphysical Systems)
 - Seeing Factories and real-world problems added changes in Agile Personal Collaboration Environment

CREMA Summary



- Project changed from research-driven → Real World
- Manages Privacy in the Cloud
- Business Plan, create company to continue work
- Tenneco interested in kick-starting CREMAmanufacture
- **Products** available Q3 / 2018 with affordable pricing for SMEs:
 - Track & Trace
 - Collaborative Monitoring
 - Data Analytics
 - Optimisation
- If you want to use or be part of CREMAmanufacture, contact us: <http://cremanufacture.com>

Thanks for your attention!



FAGOR ARRASATE

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