

# The CPS4EU project: Pre-Integrated Architectures for sustainable complex Cyber-Physical Systems

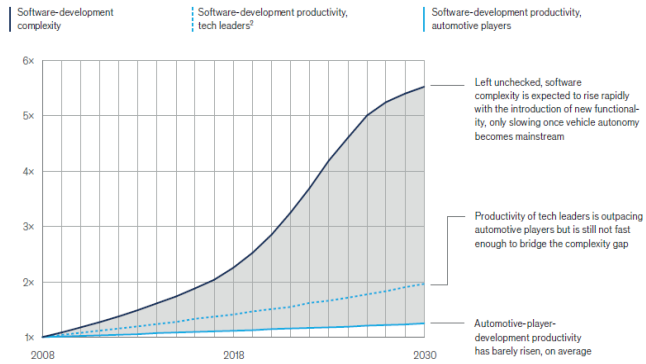
Philippe GOUGEON | VALEO

Etienne HAMELIN | CEA



The automotive industry is confronting a widening and unsustainable gap between software complexity and productivity levels.

Relative growth over time, for automotive features,<sup>1</sup> indexed, 1 = 2008



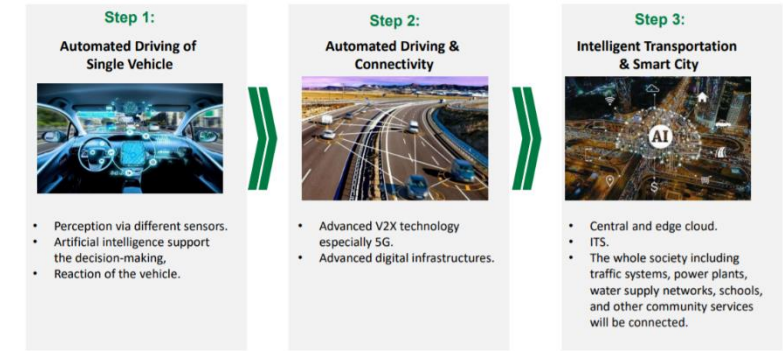
<sup>1</sup>Analysis of >200 software-development projects from OEMs and from tier-1 and tier-2 suppliers.  
<sup>2</sup>Top-performing quartile of technology companies.  
Source: Numerics by McKinsey



[Volkswagen Group – New Auto strategy, July 2021 ]

China Strategy  
China Approach

VDA Verband der Automobilindustrie



[VDA, China strategy, July 2020]

[McKinsey, The case for an end-to-end automotive software platform, January 2020]

- Increasing complexity of projects
- Software is the differentiator, scale is key
- New powerful aggressive industrial players
- Long term goals, long term business models

(\*) CPS: Cyber Physical Systems

**Qualcomm wants to buy Veoneer for \$4.6B, beating Magna's offer**

Aria Alamalhodaie @broadfrom / 6:34 PM GMT+2 • August 5, 2021

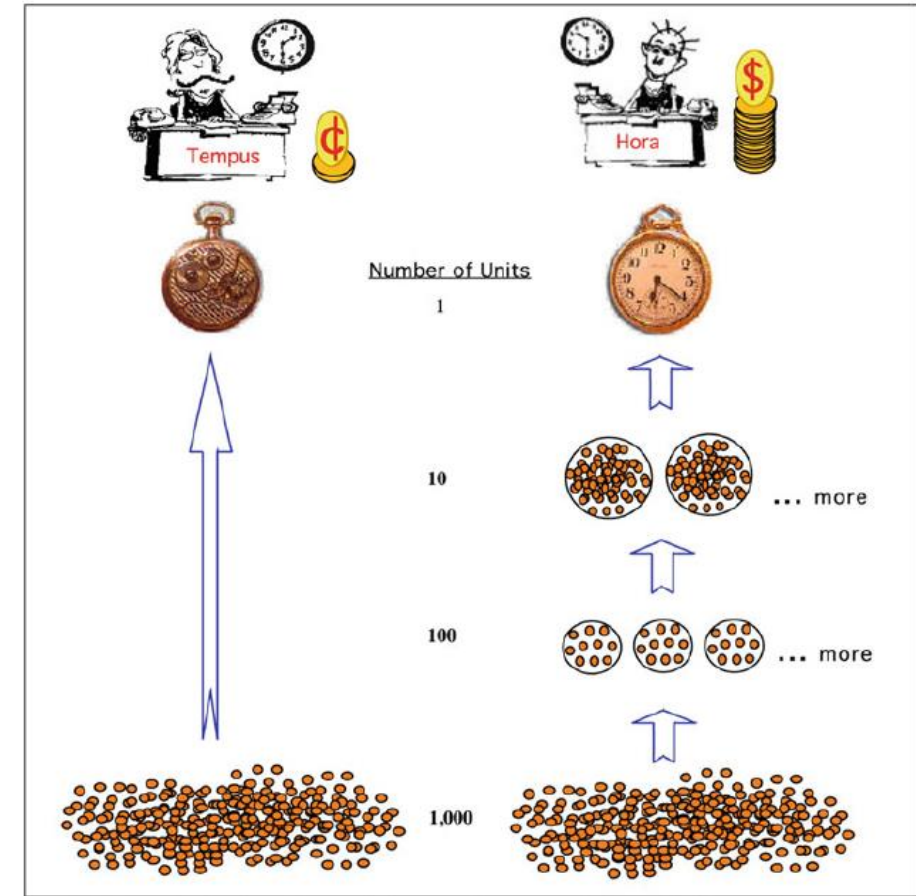
Comment



[Tech Crunch, August 2021]

## How to balance end user + societal expectations and sustainability ?

- **Functional safety**
- **Cybersecurity**
- **Privacy and Ethics**
- **IP rights**
- **Export rules**
- **Liability**
- **Traceability**
- **CO2 neutrality, Life cycle analysis**
- **Minimal usage of natural resources**



[J.Wu, Hierarchy theory: an overview, 2013. Illustration of the watchmaker parable, based on the description in H.Simon, 1962 ]

(\*) CPS: Cyber Physical Systems

## NIST Framework for CPS (2017)

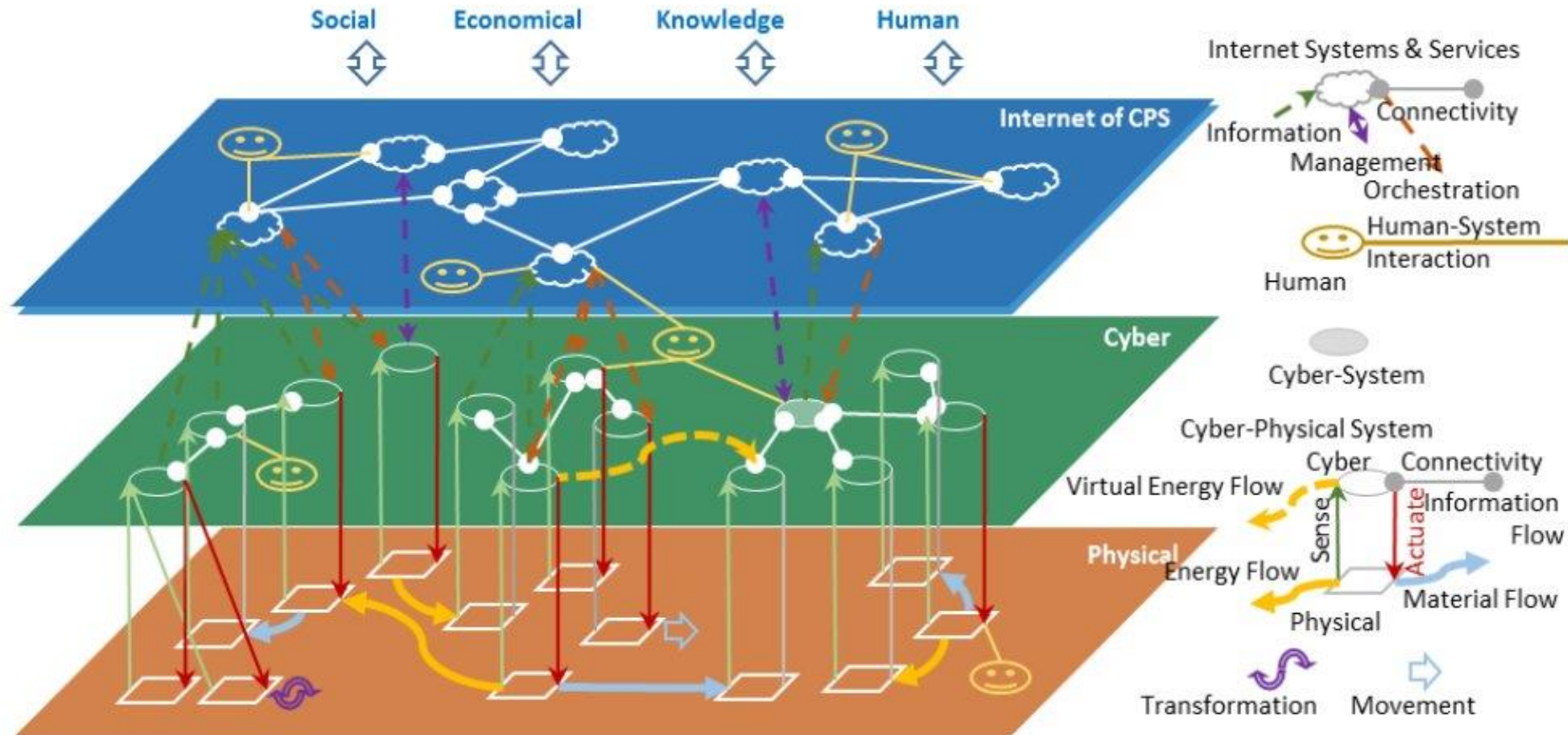


Figure 14: A CPS View: Systems of Systems



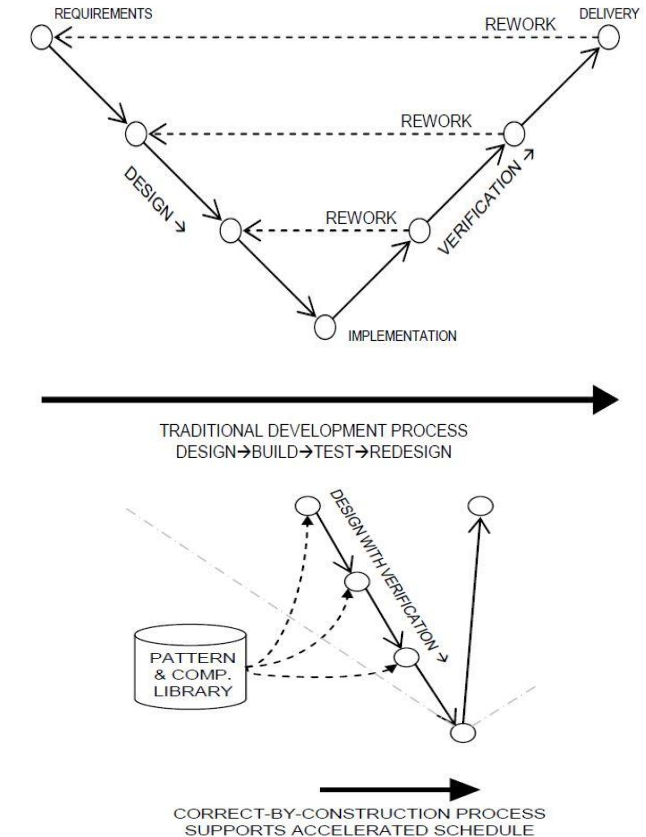
## The CPS4EU Project

- Managed by ECSEL JU
- 36 Partners from 5 European Countries
- 53 M. Euro budget
- 16 use cases in Automotive, Industry, Energy and for SMEs
- 7/2019 to 6/2022
- Web site:  
[www.cps4eu.eu](http://www.cps4eu.eu)
- LinkedIn group:  
[www.linkedin.com/groups/12372370/](https://www.linkedin.com/groups/12372370/)



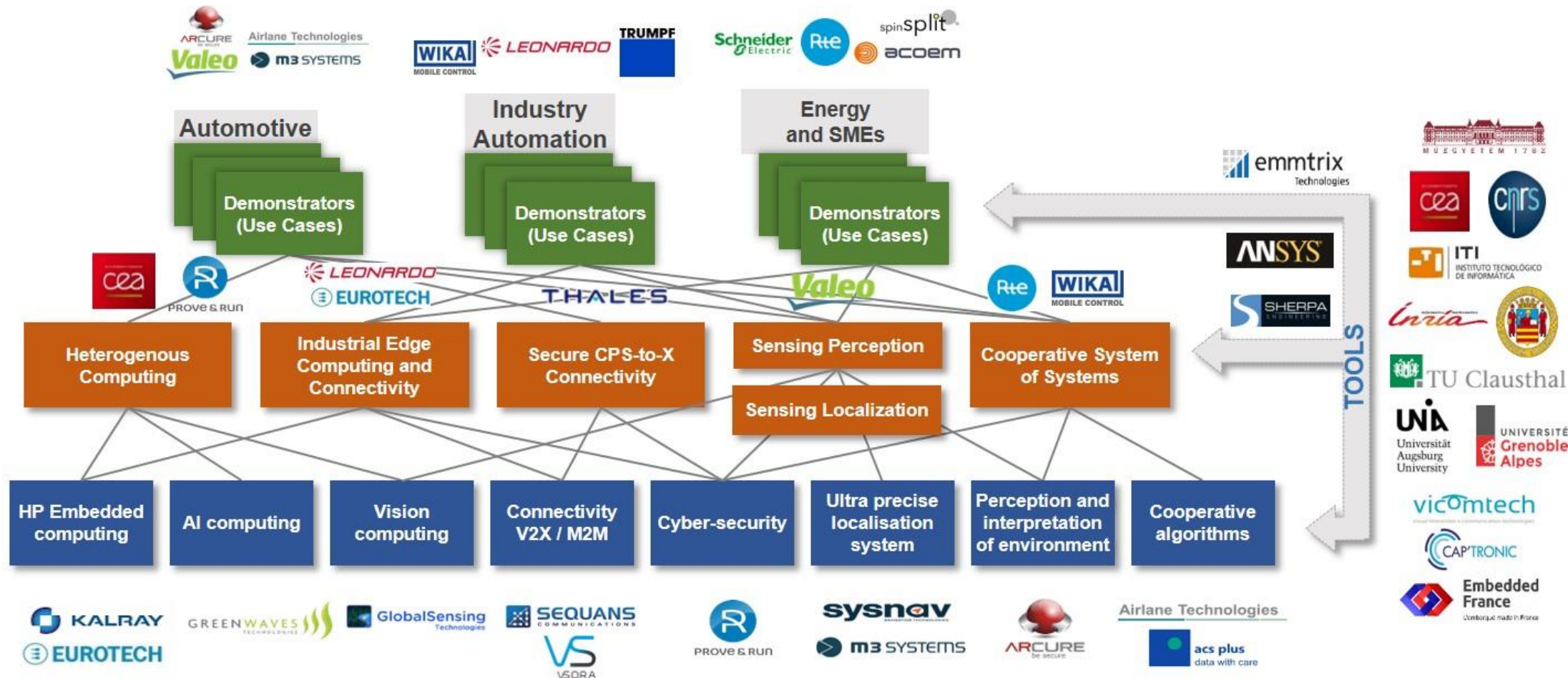
## The Design Pattern concept extended to complex Cyber-Physical Systems

- Reduction of the R&D effort
- Trustworthy-oriented Architectures
- For three CPS layers: Physical, Cyber and Internet of CPS
- Manageable size: not too large, not too small
- Scalability for networked eco-systems
- Compatibility with legacy components, processes and tools
- Inter-operability with other components or tools
- Pre-validated concepts to ensure homologation
- Flexibility to be configurable for the developer needs
- Possibility to be extended with new additional features



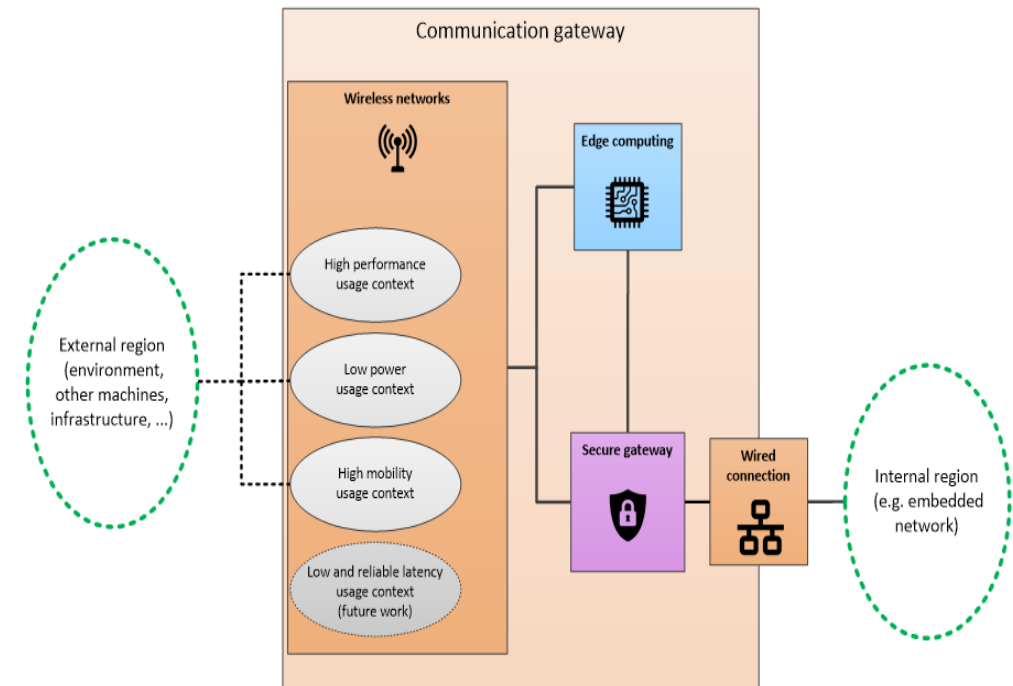
[D.Coffer et al., Rockwell-Collins, Complexity-reducing design patterns for cyber-physical systems, 2011]

## The CPS4EU Eco-system



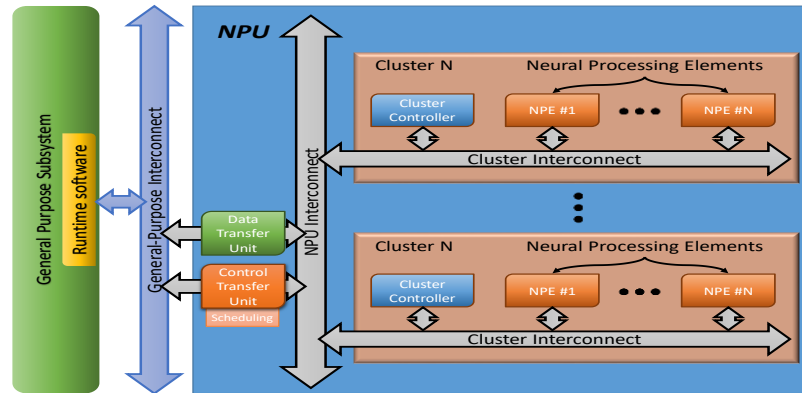
## 6 PIARCHs from CPS4EU

- Secure CPS-to-X connectivity
- Heterogenous computing for AI
- Cooperative system of systems
- Industrial edge computing gateway
- Sensing perception
- Sensing localization

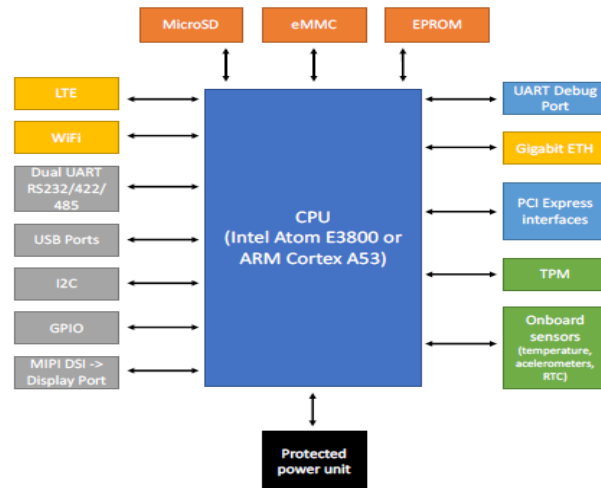


**Secure CPS-to-X connectivity PIARCH**

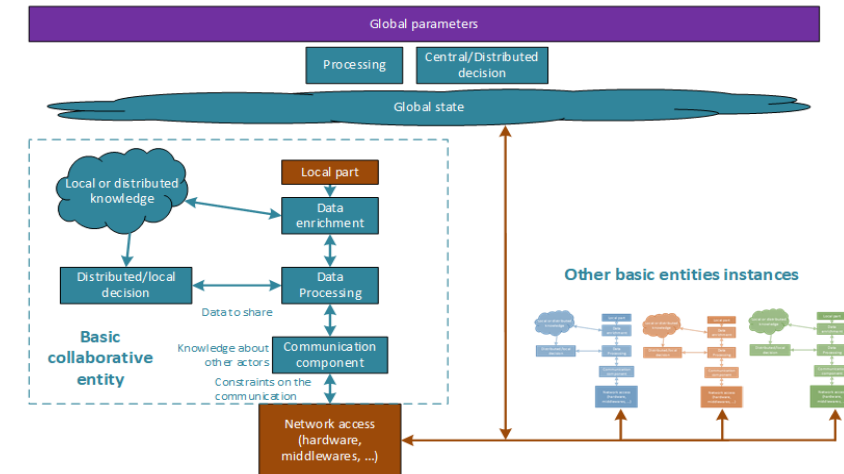




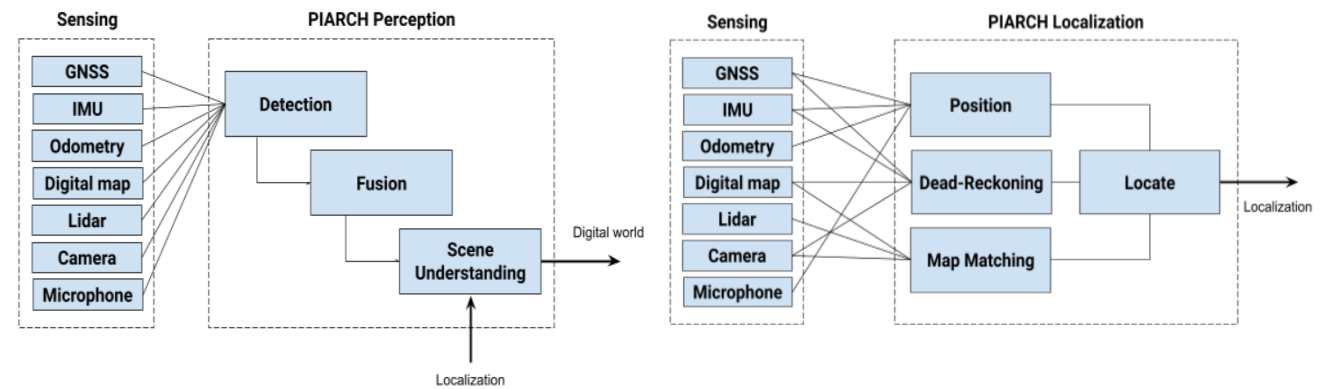
## Heterogenous AI computing PIARCH



## Industrial Edge computing gateway PIARCH



## Cooperative system of systems PIARCH



## Sensing perception and localization PIARCHs

Valeo Mobility Kits  
Sensors, software and tools for new  
mobility players (NMP) and other  
technological markets



Web site:

[www.valeo.com](http://www.valeo.com)

Contact:

Pedro Moreno-Lahore

Business development manager

Email:

[cda.valeo-  
mobilitykits.mailbox@valeo.com](mailto:cda.valeo-mobilitykits.mailbox@valeo.com)



## Sensors



Ultrasonic HP  
Kit (Basic)



Surround View  
Cameras 1 Mpix  
(Gen 2)



Lidar  
(Scala gen1)

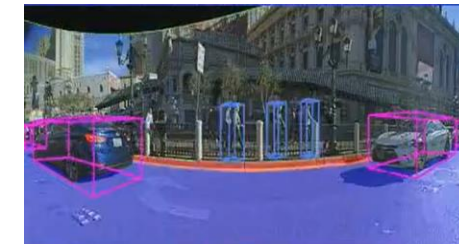


Lidar  
(Scala gen2)

## Software

### DEEP MANTA AI

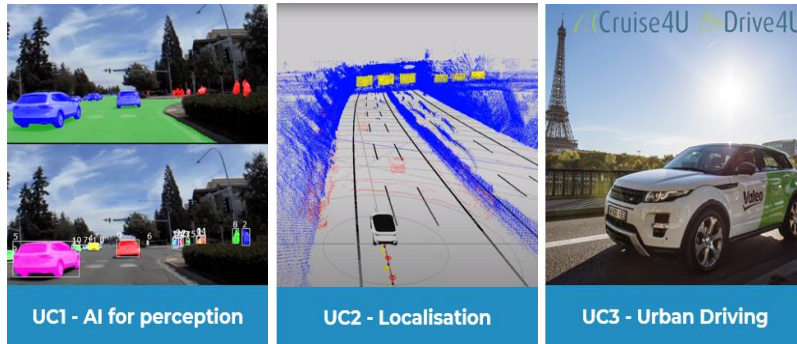
3D/2D Objects  
perception & semantic  
segmentation



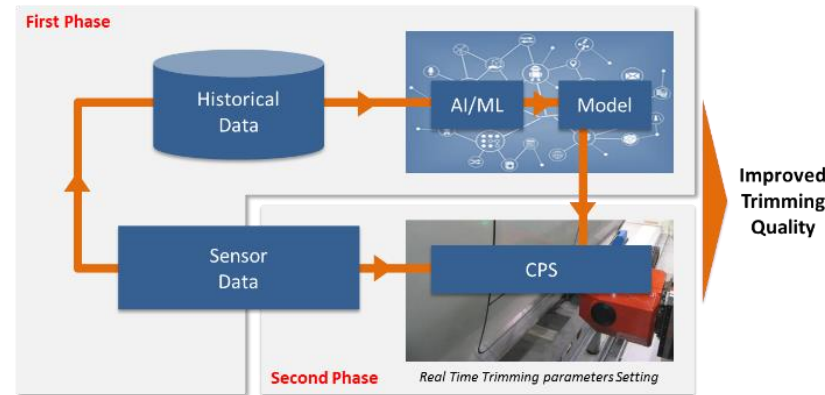
Also available on [Autonomous  
Stuff.com](http://AutonomousStuff.com)

*More coming soon...*

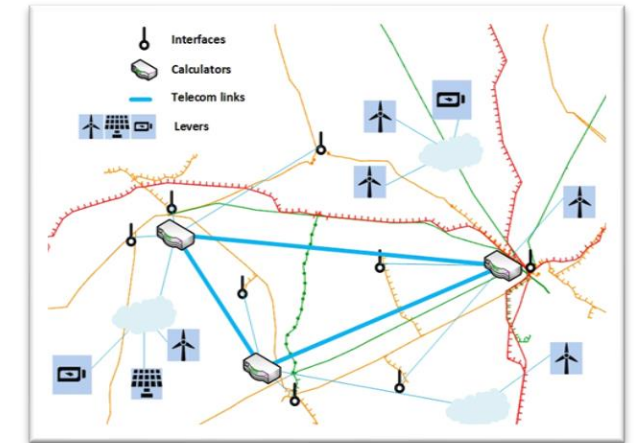
## 16 Use cases using at least 1 PIARCH (TRL 6-7) – Large Enterprises



**Automotive use case  
(Valeo) – Urban  
automated driving**

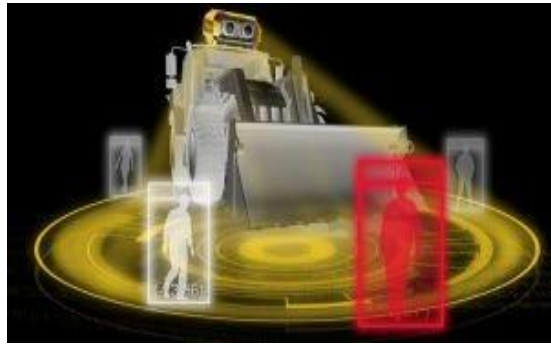


**Industry automation  
use case (Leonardo) –  
Improved trimming  
quality**

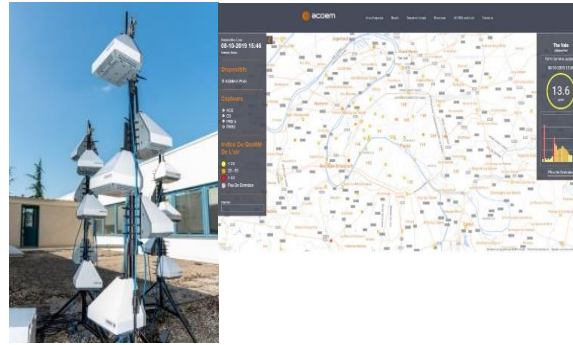


**Energy use case (RTE)  
– Distributed controls  
for energy  
transmission network**

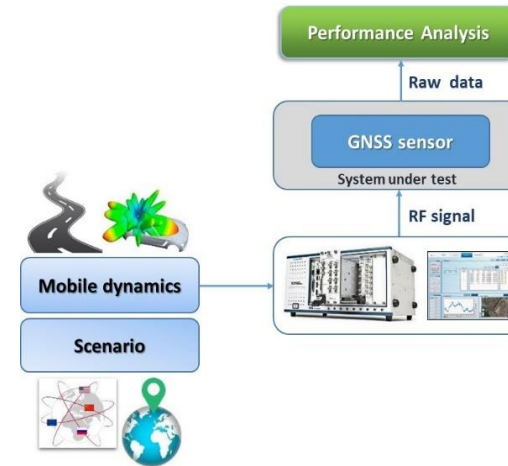
## 16 Use cases using at least 1 PIARCH (TRL 6-7) – Small & Medium Enterprises



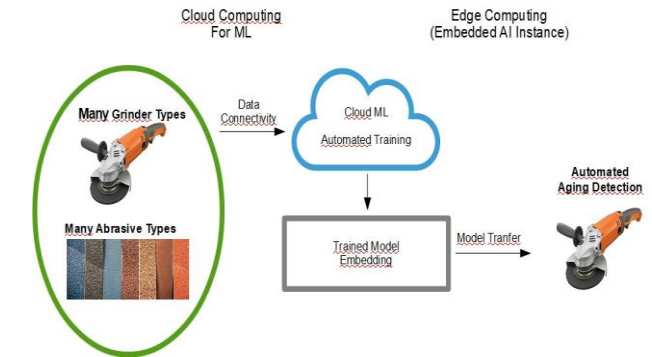
**SME use case (Arcure)**  
Pedestrian detection on  
off-road construction  
trucks



**SME use case (ACOEM)**  
Monitoring network for  
environment quality and  
threat detection



**SME use case (M3S)**  
Open loop test bench for  
GNSS positioning



**SME use case (Airplane)**  
SaaS for intelligent motor  
control application on  
handheld tools



## Pre-Integrated Architectures for sustainable complex Cyber-Physical Systems

- Solutions to reduce R&D Efforts for complex CPS developments
- Practical approach for current and upcoming challenges
- Fit well to networked eco-systems
- Meet expectations of large companies, SMEs and tool providers

- Contact our project partners for more information:

<https://cps4eu.eu/wp-content/uploads/2020/11/CPS4EU-presentation-Summary.pdf>

- Or contact by email [philippe.gougeon@valeo.com](mailto:philippe.gougeon@valeo.com) et [etienne.hamelin@cea.fr](mailto:etienne.hamelin@cea.fr)

- Thank you for your interest about CPS4EU
- Merci **Captronic** and **Embedded-France** for your contributions to the CPS4EU project
- Add a blocker in your agenda on **9-10/11/2022** for our final event !

