Cyber Physical Systems for Europe

CPS4EU, Project Overview

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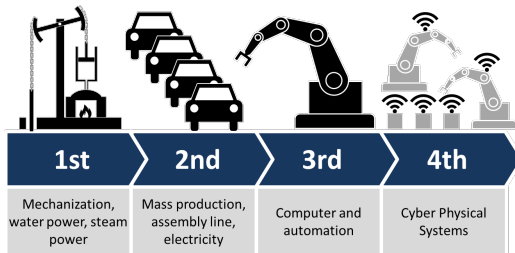
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# Cyber Physical Systems in brief

Cyber Physical Systems (CPSs) are systems that link the physical world (eg. through sensors or actuators) with the virtual world of information processing. They are composed from diverse constituent parts that collaborate together to create some global behaviour. These constituents will include software systems, communications technology, and sensors/actuators that interact with the real world, often including embedded technologies.

A CPS presents a collection of challenges not always found in a classical business information system or embedded system. To construct a CPS, a combination of different engineering competencies is required, spanning the technical domains as well as the corresponding application sectors, in the form of a new discipline of systems engineering.

CPS Concept

1st	2nd	3rd	4th
Mechanization, water power, steam power	Mass production, assembly line, electricity	Computer and automation	Cyber Physical Systems

Cyber Physical Systems (CPS) are key infrastructures for our modern society and represents one of the key factors of Industry 4.0. They can improve the quality of life of citizens and the competitiveness of European industry.
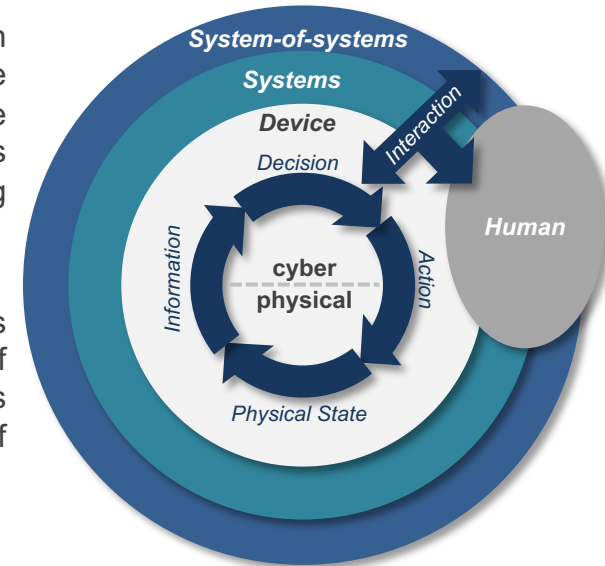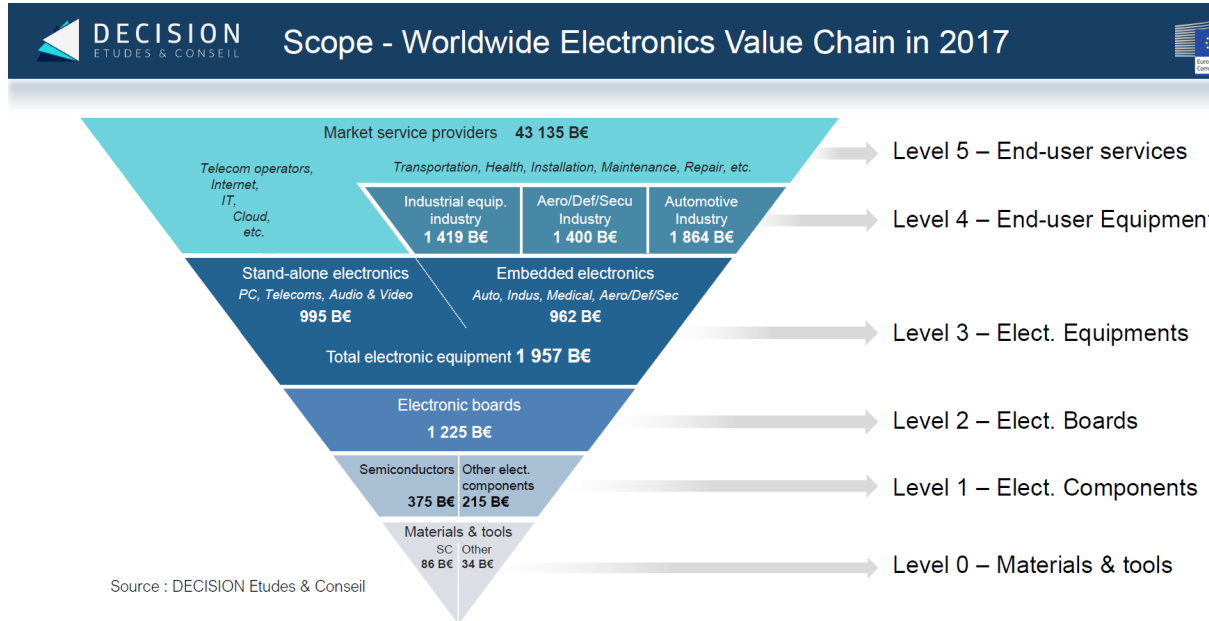
World wide components and systems production

KEY TREND: Digitalisation of products and services: +110 B€ by 2020 [2]

Source DEI, Digital Single Market- March 2018

Scope - Worldwide Electronics Value Chain in 2017

Market service providers	43 135 B€		Level 5 – End-user services
Telecom operators, Internet, IT, Cloud, etc.	Transportation, Health, Installation, Maintenance, Repair, etc.		
	Industrial equip. industry 1 419 B€	Aero/Def/Secu Industry 1 400 B€ — Automotive Industry 1 864 B€	Level 4 – End-user Equipments
Stand-alone electronics PC, Telecoms, Audio & Video 995 B€	Embedded electronics Auto, Indus, Medical, Aero/Def/Sec 962 B€		Level 3 – Elect. Equipments
Total electronic equipment 1 957 B€			
Electronic boards 1 225 B€			Level 2 – Elect. Boards
Semiconductors 375 B€	Other elect. components 215 B€		Level 1 – Elect. Components
Materials & tools SC 86 B€ Other 34 B€			Level 0 – Materials & tools

Source : DECISION Etudes & Conseil

[1] The semiconductor industry is very internationalized and the different production steps of a semiconductor systematically occurs in different countries. As a consequence, the production in Europe in this diagram corresponds to the share of the world production made by companies whose nationality of principal shareholder is European.
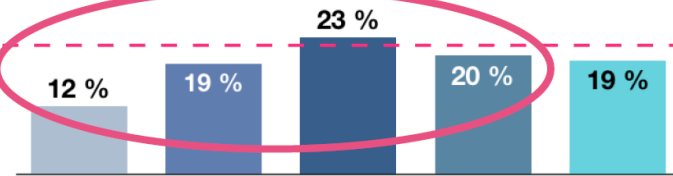
← **Europe**

← **20% of World Production**

← **15% of World Production**

← **5% of World Production But**
- **55% of Automotive**
- **>50% of energy and security**
- **> 40% of Automation/Industry**

ECSEL Joint Undertaking

Embedded Electronic European driver

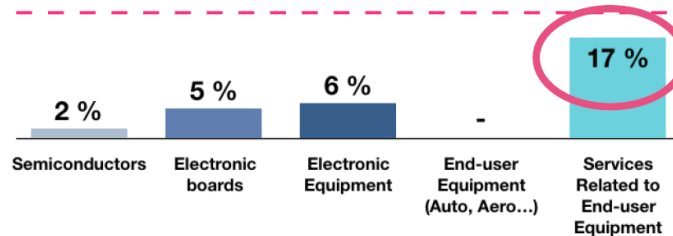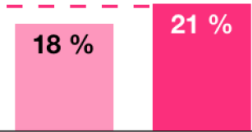Results – Electronic equipments (2/2)

The share of the European production in the global electronic value chain (EU%World)

Electronics value chain

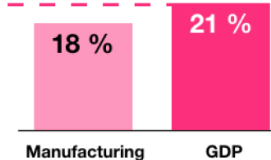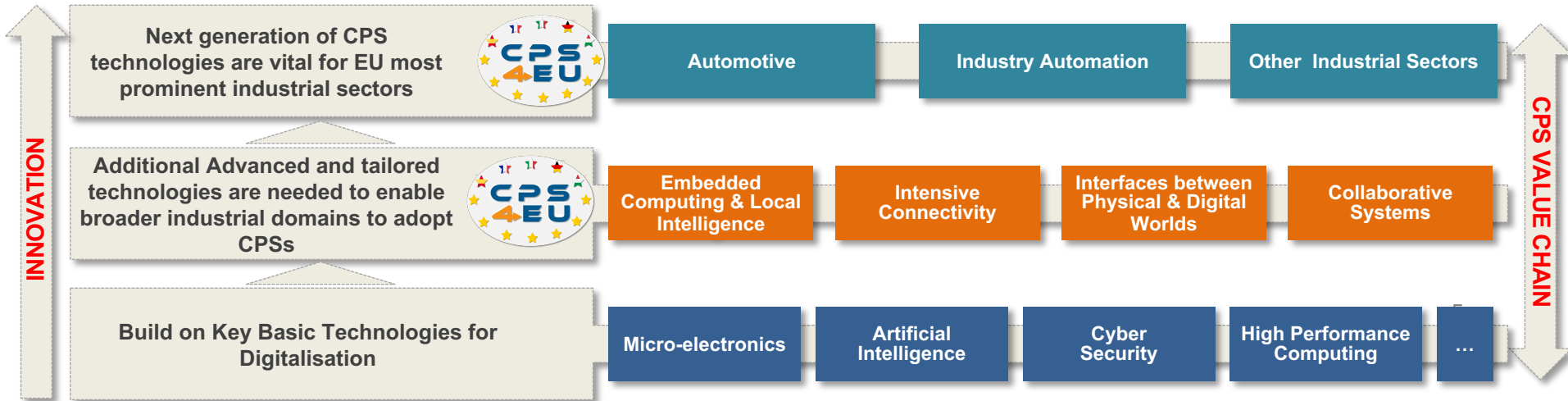Macro-economic data

Embedded electronics — 18 % | 21 %

- Semiconductors: 12 %
- Electronic boards: 19 %
- Electronic Equipment: 23 %
- End-user Equipment (Auto, Aero…): 20 %
- Services Related to End-user Equipment: 19 %

Stand-alone electronics — Manufacturing 18 % | GDP 21 %

- Semiconductors: 2 %
- Electronic boards: 5 %
- Electronic Equipment: 6 %
- End-user Equipment (Auto, Aero…): -
- Services Related to End-user Equipment: 17 %

Source : DECISION Etudes & Conseil

EFECS– November 2018

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CPS: the Answer to Digitalization Game Changer

Leveraging on the key basic technologies enabling digitalisation, a new generation of CPS enabling technologies are required for prominent industrial sectors

INNOVATION →

CPS VALUE CHAIN

| Next generation of CPS technologies are vital for EU most prominent industrial sectors | Automotive | Industry Automation | Other Industrial Sectors |

| Additional Advanced and tailored technologies are needed to enable broader industrial domains to adopt CPSs | Embedded Computing & Local Intelligence | Intensive Connectivity | Interfaces between Physical & Digital Worlds | Collaborative Systems |

| Build on Key Basic Technologies for Digitalisation | Micro-electronics | Artificial Intelligence | Cyber Security | High Performance Computing | … |

«CPS will be pivotal in the upcoming industrial revolution» (Y. Gigase, ADTC 2019)

Key innovations of CPS4EU

Major innovations to provide key CPS technologies:

- 3 computing modules devoted to master **real-time systems (WP1)**
- 2 connectivity modules to master **dynamic communication (WP2)**
- 2 **innovative interfaces with the physical world** through the integration of sensors and actuators towards the autonomous system paradigm **(WP3)**
- A **collaborative systems** to master multi-scale modeling and behavior prediction **(WP4)**
- 4 **pre integrated architectures** and **CPS tools** to handle the explosion of the complexity of CPS systems **(WP5-6).**

… that will be double validated, by:

- **technology providers** through their products catalogue evolution **(WP 1-4)**
- **large companies** through 15 demonstrators **(WP7-9)**.

… and widely disseminated.

# The strong impact of CPS4EU

- Strengthening the overall CPS value chain by:
  - Fostering world class European technology providers, in particular SMEs (14 SMEs participate to CPS4EU project)
  - Creating high potential of development and clear leadership possibilities for all CPS4EU countries.

- Maintaining the EU leadership of CPS technologies by:
  - Enabling the creation of innovative European CPS products, able to strengthen leadership and competitiveness of both LEs and SMEs
  - Facilitating the use of CPS technologies in diversified sectors through relevant demonstrators
  - Allowing diversified industrial sectors to benefit from the same CPS modules and architectures, a major step towards standardizations.

- Ensure CPS technology sovereign procurement for European large enterprises
  - Enabling strong cooperation between CPS technology providers and CPS users.

- Strong dissemination plan to reach at least 1,000 European SMEs enabling Better CPS awareness and usage for all industrial sectors

From Basic Modules to Vertical Applications…

- CPS modules are developed by SMEs to ensure **sovereign procurement**.
- Pre-integrated architecture allow basic CPS modules to be used in **different industrial sectors**.
- The pre-integration concept allows an efficient **reuse approach** with drastic **reduction of implementation effort** for both CPS module providers and users.
- 15 **demonstrators** cover Automotive, Industry Automation and other key industrial sectors (eg. Energy).

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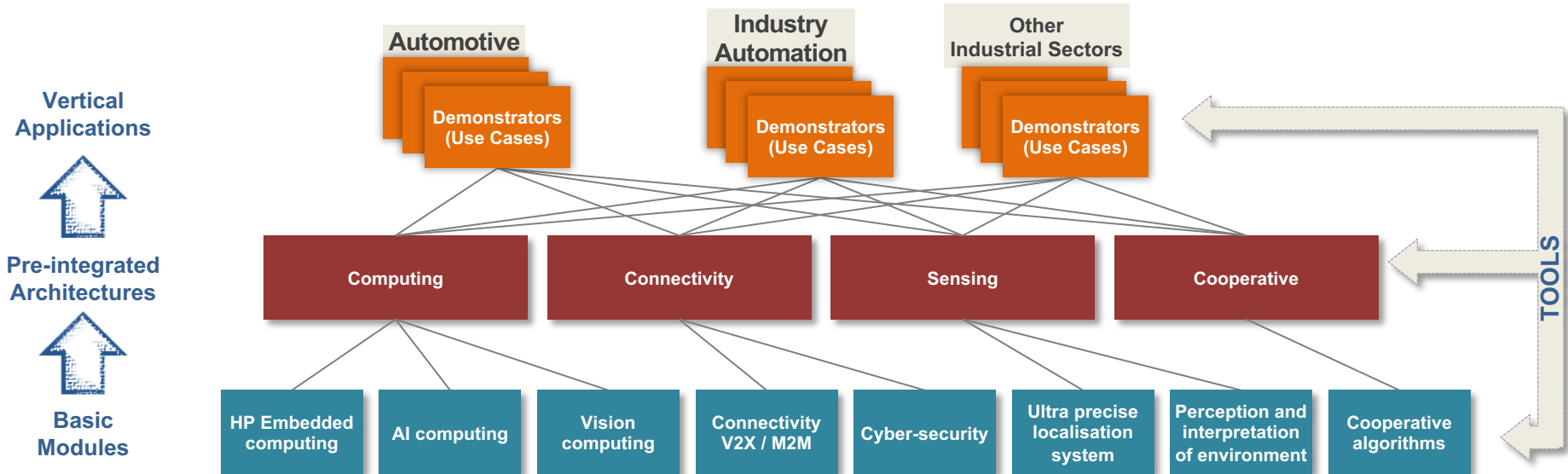
Maintain Strong Consortium

The Consortium is represented by 36 partners from 5 European countries involving 14 SMEs/Midcap:

France

- **VALEO VISION SAS (Coordinator)**
- ACOEM (01dB-Metravib)
- AIRLANE TECHNOLOGIES
- ANSYS FRANCE
- ARCURE
- CAPTRONIC (JESSICA FRANCE)
- CEA
- CNRS
- EMBEDDED FRANCE
- GLOBALSENSING TECHNOLOGIES
- GREENWAVES TECHNOLOGIES
- INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET AUTOMATIQUE
- KALRAY
- M3 SYSTEMS
- PROVE&RUN
- RTE
- SCHNEIDER ELECTRIC FRANCE
- SEQUANS COMMUNICATIONS
- SHERPA ENGINEERING
- SYSNAV
- THALES RESEARCH & TECHNOLOGY
- UNIVERSITE GRENOBLE ALPES
- VSORA

Germany

- ACS plus
- emmtrix
- Technische Universität Clausthal
- TRUMPF Ditzingen
- University Augsburg
- WIKA Mobile Control GmbH

Hungary

- Budapest University of Technology and Economics
- Spinsplit Technical Research and Development Ltd Liability Company

Italy

- Leonardo S.p.A.
- EUROTECH S.p.A.
- Università degli Studi di Salerno

Spain

- Instituto Tecnológico de Informática
- Tecnologías, Servicios Telemáticos y Sistemas, S.A.

Legend:
- *SMEs/Midcap*
- *LE*
- *Non Profit, Academics/RTO*
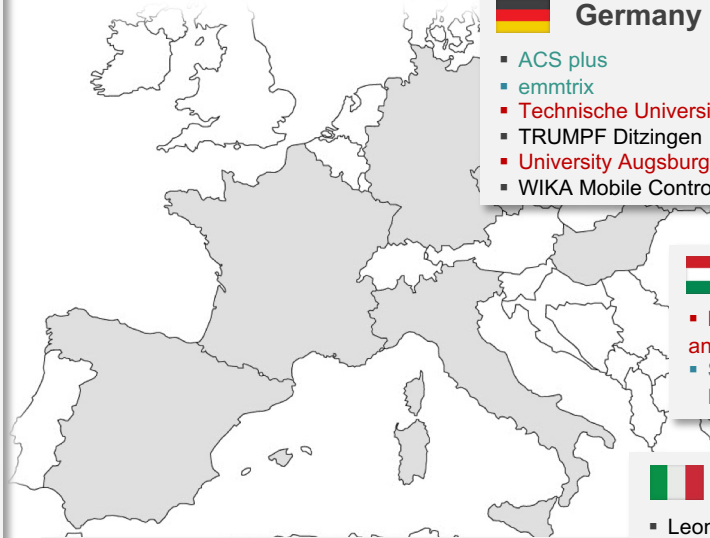
Acknowledgments

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