ARTEMIS
On the road to ECSEL

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and Programme Manager, ARTEMIS-JU

Advanced Research & Technology for Embedded Intelligence and Systems

ARTEMIS Joint Undertaking
The public private partnership for R&D in embedded systems

First Important Things to Know

- **ARTEMIS (and ENIAC) JU** are **INNOVATION** oriented, public-funded RD&I programmes
  - Market-facing developments (higher TRL) …
  - … drawing on new basic technologies (lower TRL) that serve these needs
- So: "**INDUSTRY**" refers to the eco-systems of:
  - Large, Medium and Small Enterprises
  - Private / Public Research Organisations
  - Universities
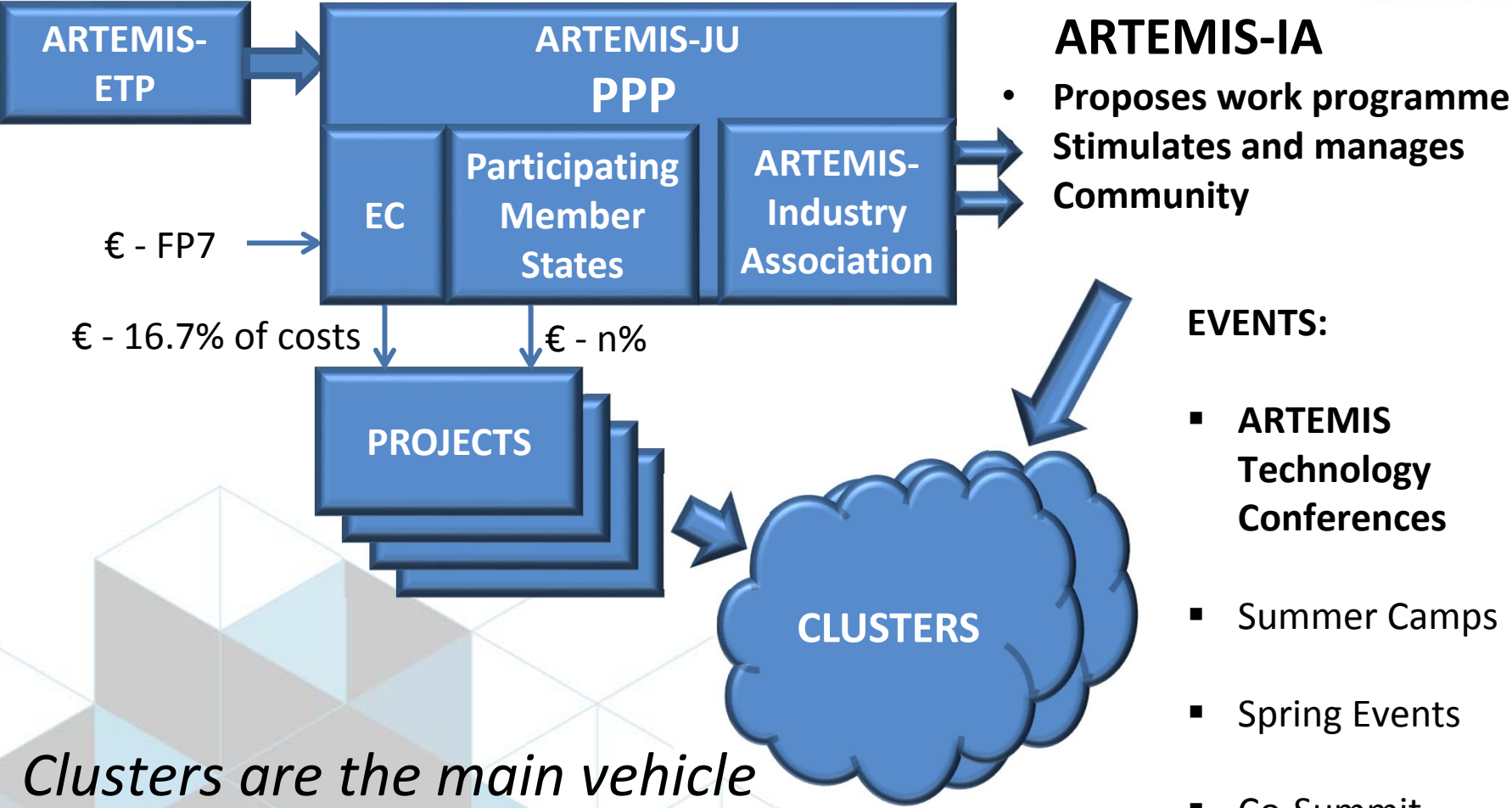- **Eco-Systems create the critical mass needed for sustainable businesses!**

ARTEMIS JU Research:
The guiding principles

- **"Think BIG"**
  - **= projects with appropriate critical mass and significant societal impact**

- **"Act Socio-Economic"**
  - **= improved industrial efficiency "... to strengthen European competitiveness and allow the emergence of new markets and societal applications."**
    - **i.e. a focus on key technical issues, solving high-visibility issues with commercially valorisable results**

- **"Act Multi-national" (= "Act Pan-European")**
    - **= considers national/regional strategic priorities**

- **"Think Different"**
    - **= significant and complementary added-value to existing programmes**

Creating Impact – the "PPP model"

ARTEMIS-ETP → **ARTEMIS-JU PPP**

- EC
- Participating Member States
- ARTEMIS-Industry Association

€ - FP7 →

€ - 16.7% of costs

€ - n%

PROJECTS

CLUSTERS

Clusters are the main vehicle for creating CRITICAL MASS

ARTEMIS-IA

- **Proposes work programme Stimulates and manages Community**

EVENTS:

- **ARTEMIS Technology Conferences**

- Summer Camps

- Spring Events

- Co-Summit (with ITEA2)

ARTEMIS Tool Platforms

- "Embedded" = tools
- Tools = interoperability !
  - Libraries and design artefacts
- Complex methodologies require special tooling too!
  - Design, V&V, Safety, Certification, …

- ARTEMIS "Tool Platforms" offers a way to assure integration of heterogenous tooling into a stable, reliable workflow.

ARTEMIS "Tool Platform" concept
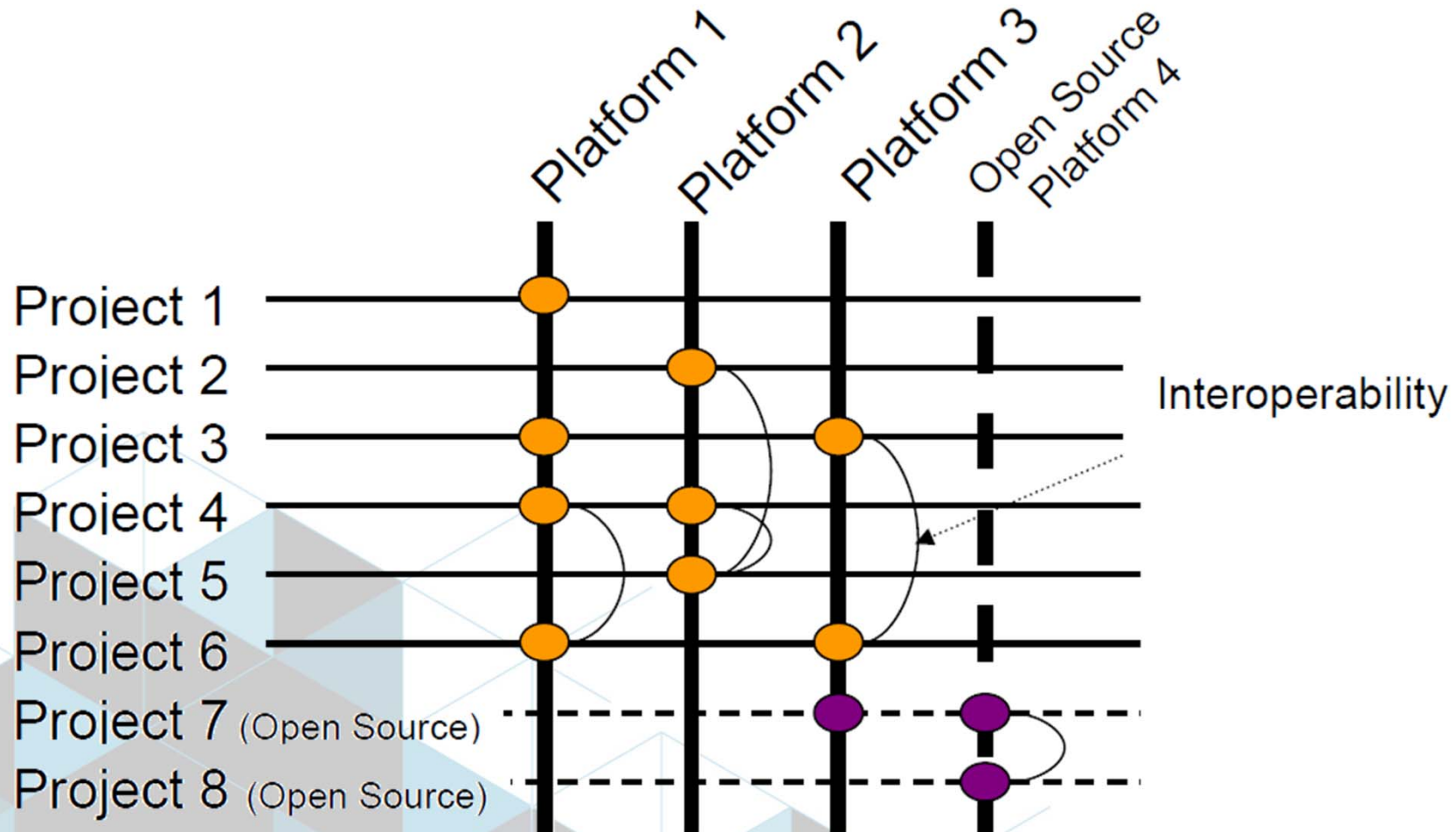
ARTEMIS projects on Hi-Rel and LPMC

"Hi-Rel"		Low-Power Multi-Core	
Call	**Project**	**Call**	**Project**
2008	CESAR	2008	INDEXYS
2008	CHARTER	2008	SCALOPES
2008	CHESS	2009	ACROSS
2008	SYSMODEL	2009	ASAM
2009	iFEST	2009	SMECY
2009	RECOMP	2010	PRESTO
2010	MBAT	2011	CRAFTERS
2010	pSAFECER	2011	PaPP
2011	DESERVE	2012	CONCERTO
2011	nSafeCer	2012	COPCAMS
2011	VARIES	2013	Almarvi
2011	VeTeSS	2013	EMC2
2012	CRYSTAL	2013	R5-COP

ARTEMIS programme, as CLUSTERS

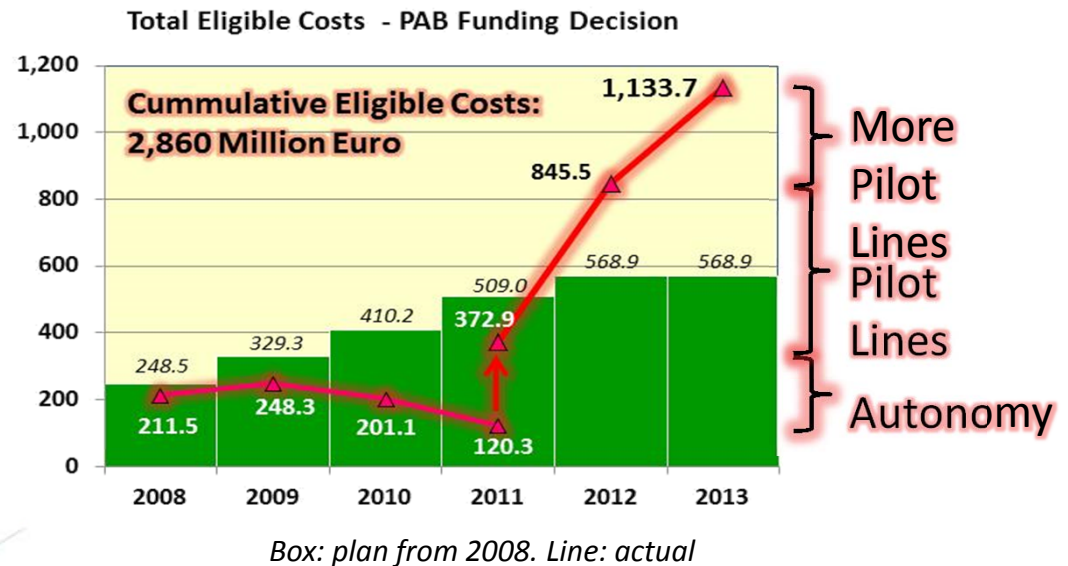

Clusters
Investment (Total Cost) ALL CALLS (2008-2013)
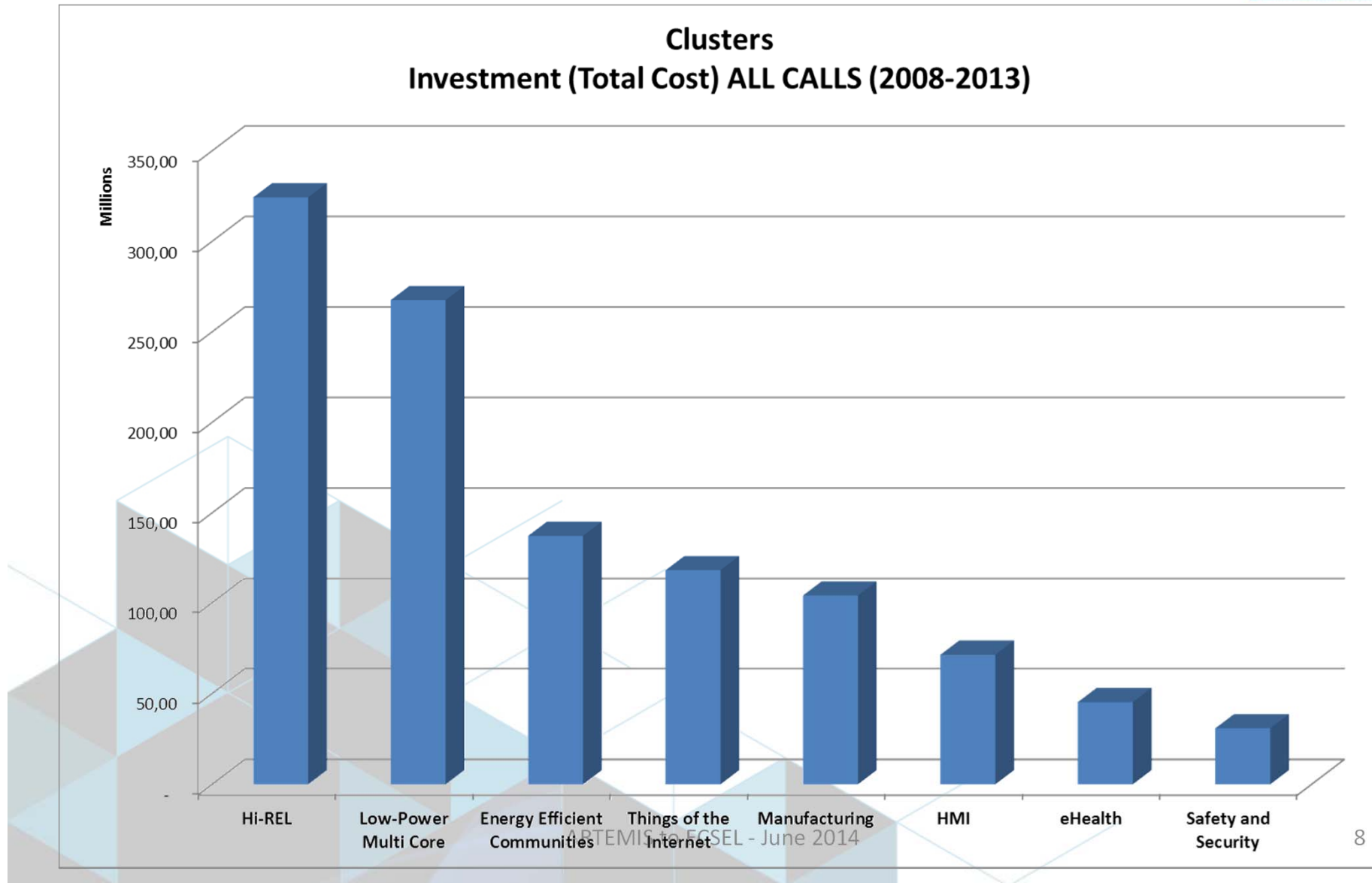
Game Changer ...

- ## 2011 - ENIAC JU introduces "Pilot Lines"
    - **Very large initiatives leveraging considerable National interest and funding**

    - ***Very successful!***

Total Eligible Costs - PAB Funding Decision

Cummulative Eligible Costs: 2,860 Million Euro

Box: plan from 2008. Line: actual

- ## 2012 - ARTEMIS introduces "AIPPs"
    - **Also very large iniaitves, designed to focus the Innovation Potential of its CLUSTERS**

ARTEMIS AIPPs

- **CRYSTAL**
  - Methods and Tools for ultra-high-dependability systems
  - Transport, Medical, …
- **Arrowhead**
  - Efficient manufacturing and energy
  - Integrated energy distribution for industry and domestic
- **EMC²**
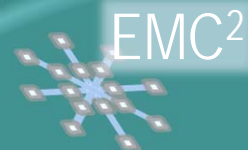 - Pushing the boundaries for multi-core programming and use in demanding, mixed-criticality apps.
- *Dependable, safe wireless communication -> ASP*
- *eHealth*

ARTEMIS AIPP "EMC²" – the power of clustering

Multi-core Technology

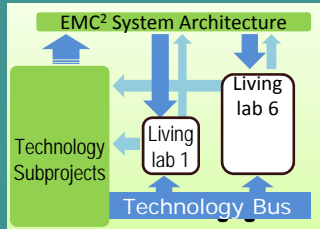*A CLUSTER of ARTEMIS projects*

INDEXYS 6
SCALOPES 4
iLAND 1
ACROSS 8
ASAM 2
SMECY 6
PRESTO 2
CRAFTERS 3
PaPP 2
COPCAMS 4
R3COP 7

EMC²

'Embedded Multi-Core Systems for Mixed Criticality Applications in Dynamic and Changeable Real-time Environments'
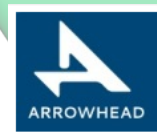
98 Partner , 16 EU Countries, 100 Mio € Budget

EMC² System Architecture

Technology Subprojects

Living lab 1

Living lab 6

Technology Bus

Scientific Communities

HiPEAC
COMPILATION ARCHITECTURE

10 CESAR
2 CHARTER
4 CHESS
1 SYSMODEL
6 iFEST
6 RECOMP
11 MBAT
4 pSafeCer
5 nSafeCer
5 DESERVE
1 VARIES
7 VeTeSS
4 CONCERTO

Safety-critical Systems

Another CLUSTER of ARTEMIS projects

Innovation Pilots

ARROWHEAD

CRYSTAL

And 2 AIPPs!

Number 1: ARTEMIS has been the largest programme ever, focused on Safety Critical Systems

Number 2: ARTEMIS has been the largest programme ever, focused on Multi-core Technology

.. starting from single projects towards the EMC² platform approach..

What does this mean for ECSEL?

- **ECSEL** = "Electronic Components and Systems"
  - Nanoscale semiconductor technology
    - (ENIAC-JU) – high-performance computing devices an more
  - Smart interfaces and integration
    - (EPoSS ETP) – interface to the physcial world
  - System Engineering, software architecture and model-based design
    - (ARTEMIS-JU) – adding application value, especially for complex, high-dependability systems
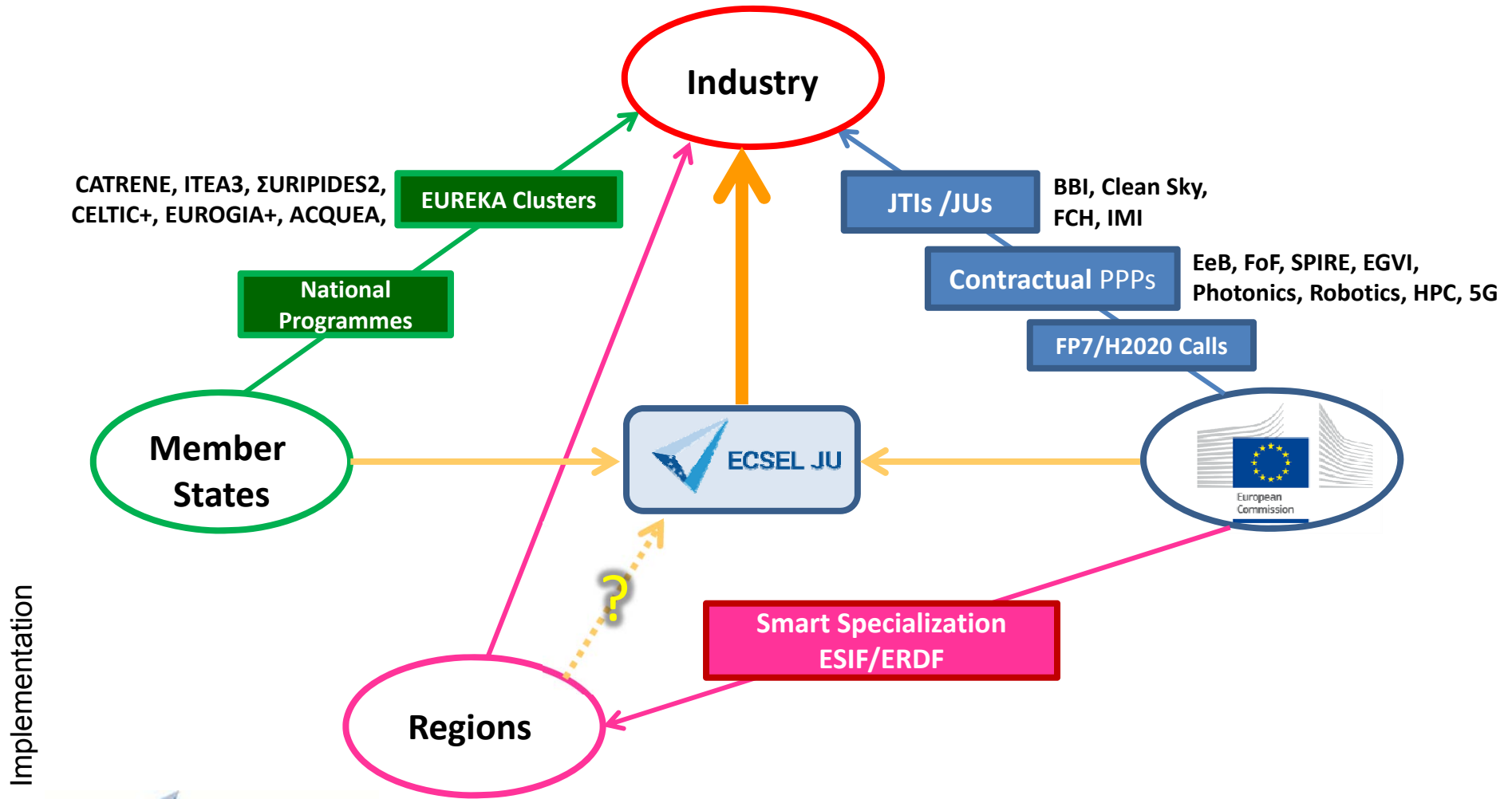
What does this mean for ECSEL?

ECSEL = Scale and Impact

- Both ENIAC-JU and ARTEMIS have proven that large, "Pilot Line"- like initiatives are:
  - Feasible
    - we have good project managers !
  - Effective
    - high-visibility results of direct industrial/societal relevance
  - Economic
    - A High ROI for the public and private investments

  - **"Pilot Lines" are <u>AN ESSENTIAL COMPLEMENT to European collaborative R&D projects</u>**

The Tripartite Joint Undertaking: one Mechanism among Many

Industry

CATRENE, ITEA3, ΣURIPIDES2, CELTIC+, EUROGIA+, ACQUEA,

EUREKA Clusters

National Programmes

JTIs /JUs

BBI, Clean Sky, FCH, IMI

Contractual PPPs

EeB, FoF, SPIRE, EGVI, Photonics, Robotics, HPC, 5G

FP7/H2020 Calls

Member States

ECSEL JU

European Commission

?

Smart Specialization ESIF/ERDF

Regions

Implementation

ECSEL JU

Draft Multi-Annual Strategic Plan for ECSEL

ECSEL JU

Programme Areas

- ECSEL is called upon to address:

  a) *design technologies, process and integration, equipment, materials and manufacturing for micro- and nanoelectronics while targeting miniaturisation, diversification and differentiation, heterogeneous integration;*

  b) *processes, methods, tools and platforms, reference designs and architectures, for software and/or control-intensive embedded/cyber-physical systems, addressing seamless connectivity and interoperability, functional safety, high availability, and security for professional and consumer type applications, and connected services; and*

  c) *multi-disciplinary approaches for smart systems, supported by developments in holistic design and advanced manufacturing to realise self-reliant and adaptable smart systems having sophisticated interfaces and offering complex functionalities based on, for example, the seamless integration of sensing, actuating, processing, energy provision and networking.*

The ECSEL JU Programme

- Based on the "Multi-Annual Strateigc Research and Innovation Agenda" (**MASRIA**) published by the participating Industry Associations
  - Available on their respective web-sites
  - (Search for: ARTEMIS-IA, AENEAS, EPoSS)

- Covers the complete electronics components and systems value chain through key applications and enabling technologies (including the necessary design technologies)
  - Semiconductor technologies and devices
  - Smart sensors / actuators
  - Embedded intelligence and software / **Cyber Physical Systems (CPS)**
  - Design technologies

ECSEL JU Draft Programme Architecture
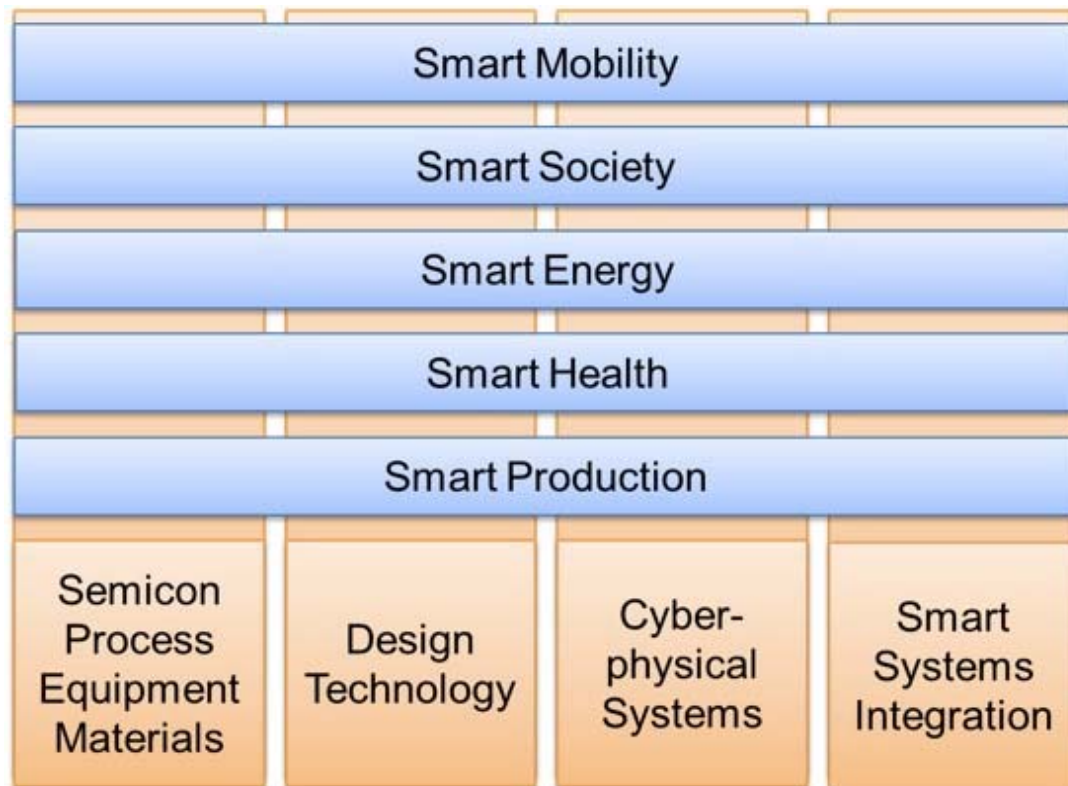
Smart Mobility				
Smart Society				*Applications driven by the opportunities created for Industry to help address Societal Challenges*
Smart Energy				Key Applications
Smart Health				**PART A**
Smart Production				
Semicon Process Equipment Materials	Design Technology	Cyber-physical Systems	Smart Systems Integration	**PART B** Essential Capabilities
				Technologies needed by Industry to make it happen...

ECSEL JU

Part A – Key Applications

1. Smart mobility

   – improve air quality, reduce congestion, sustain mobility for the elder generation and excel towards accident free mobility

2. Smart society

   – Intelligent, secure and easy-to-use solutions for digital inclusion, guaranteeing citizen privacy and reaching broad acceptance in the public.

Part A – Key Applications

3. Smart energy

   – Sustainable energy generation and conversion, Reducing energy consumption, Efficient community energy management

4. Smart health

   – Support for affordable care and well-being at home, abroad and in hospitals; heuristic care; food processing; and food safety

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Part A – Key Applications

5. Smart production

   I. manufacturing and process automation and new manufacturing and process technologies enabled by advanced electronics systems.

   II. manufacturing of semiconductors as a special topic

Part B – Essential Capabilities

1. Semiconductor Process, Equipment, and Materials

    – leadership in processing know-how for:
      - advanced and beyond CMOS (More Moore, MM),
      - heterogeneous (More than Moore, MtM)
      - and System in Package (SiP) technology

2. Design technologies

    – *"transform ideas and requirements efficiently into innovative, manufacturable, and testable products, at whatever level in the value chain"*

Part B – Essential Capabilities

3. ## Cyber-physical systems

   – *"next generation embedded intelligent ICT systems that are interconnected, interdependent, collaborative, autonomous and provide computing and communication, monitoring/control of physical components/processes"*

4. ## Smart systems integration

   – *"SSI addresses the (electronic) system itself, enabled by heterogeneous 3D integration of new building blocks for sensing, data processing, actuating, networking, energy scavenging and managing, that combine nano-, micro-, and power-electronics with micro-electro-mechanical and other physical, electromagnetic, chemical, and biological principles"*

ARTEMIS to ECSEL - June 2014

Project Topics

- *"Projects of the ECSEL programme do not necessarily have to limit themselves to covering only one of these key applications or essential technology capabilities; on the contrary, multi/cross-capability projects will be encouraged wherever relevant. This cross-capability work is vital in creating initiatives of adequate critical mass and vital in fostering innovation ..."*

The ECSEL JU Programme

- Based on Calls for Proposals
  - At least one per year

- Includes:
  - Pilot Lines and Innovation Pilots
    - large-scale integrating projects
    - specifically include higher TRLs
  - R&D projects
    - that should not work in isolation !
    - typically addressing lower TRLs

Project Types

- Innovation Actions
    - Pilot Lines and test beds
    - Demonstrators, innovation pilot projects and zones of full-scale testing
    - Higher TRLs – 4 to 8

- Research and Innovation Actions
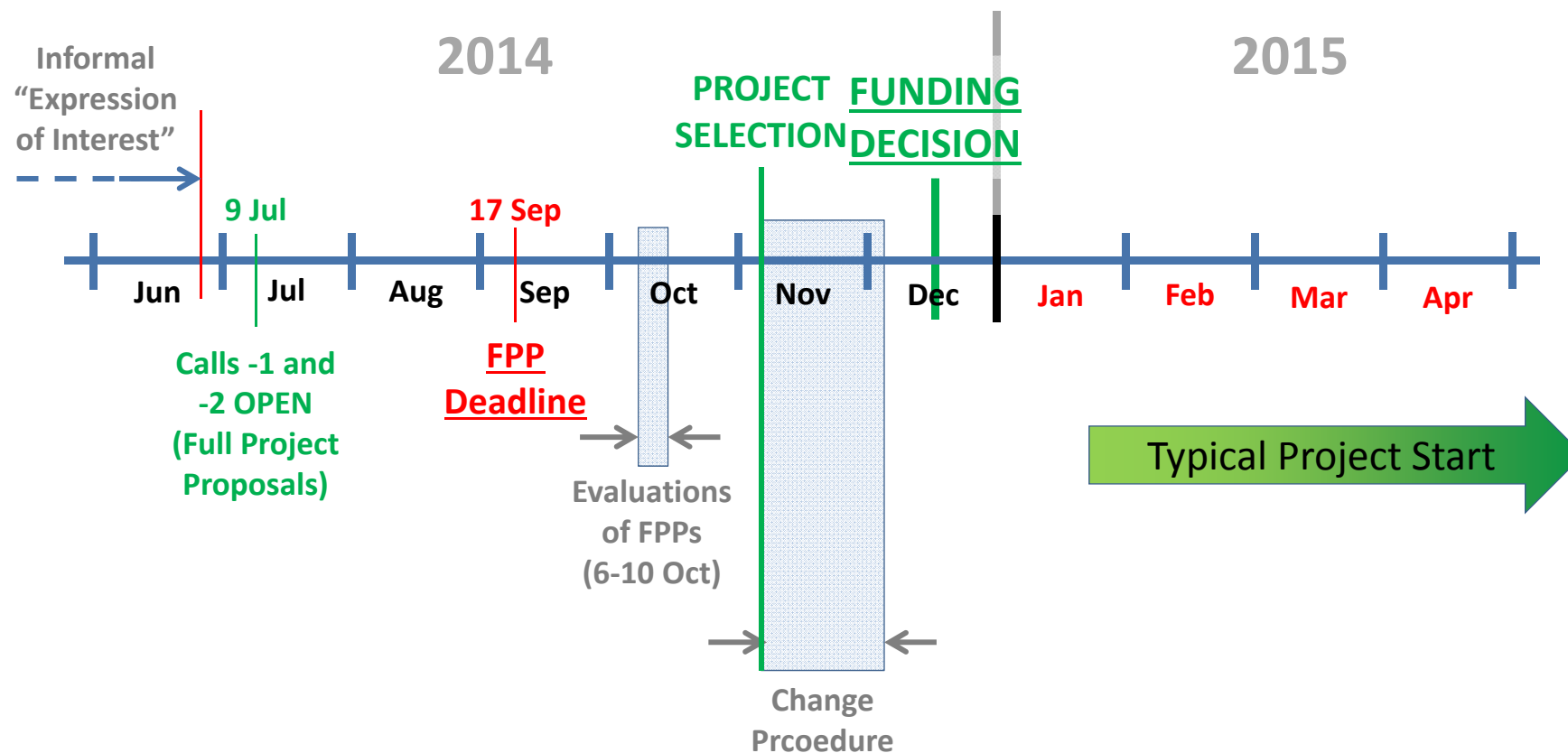   - Research and development ("Standard") projects
    - TRL 2 to 5

Calls in 2014

- 2 Calls
  - Research Innovation Action (RIA)
  - Innovation Action (IA)

Call	Type	Type equivalence	TRL focus
ECSEL 2014-1	Research and Innovation Action (RIA)	Industrial/Applied Research projects	2-5
ECSEL 2014-2	Innovation Action (IA)	Experimental development projects	4-8

Calls 2014 - Timeline

Conclusions

- ARTEMIS and ENIAC have set the scene
  - PPP model with tri-partite funding
  - Market-facing programmes supporting major initiatives
- ECSEL JU is ready to take over
  - Call mechanisms in place
  - A rich strategic plan that will encourage **impactful projects and pilots** in a programme embracing the whole ECS value-chain.

ECSEL JU

THANK YOU