ARTEMIS
On the road to ECSEL

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Advanced Research & Technology for Embedded Intelligence and Systems

Why JTIs?

- The EU 7th FP identifies Joint Technology Initiatives (JTIs) as:
  - Means to support trans-national cooperation in key areas where research and technological development can contribute to European competitiveness and quality of life.

- With the purpose to
  - Boost European research investments by providing a clear framework, which encourages both industry and Member States to increase their involvement

What are JTIs?

- Legal framework:

  Joint Undertakings are set up under Article 187 TFEU (ex Article 171 TEC) as a new way of realizing public-private partnerships at European level in the field of industrial research.

- JTIs were set up in fields of high industrial and policy significance:
  - Fuel Cells and Hydrogen (FCH)
  - Aeronautics and Air Transport (Clean Sky)
  - Innovative Medicines (IMI)
  - Nanoelectronics Technology (ENIAC)
  - Embedded Computing Systems (ARTEMIS)

To be merged (ECSEL)

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**

ARTEMIS – the clustering process

ARTEMIS' industry-driven projects have a large footprint with rich content, addressing societal and business needs

Project clusters are developing:

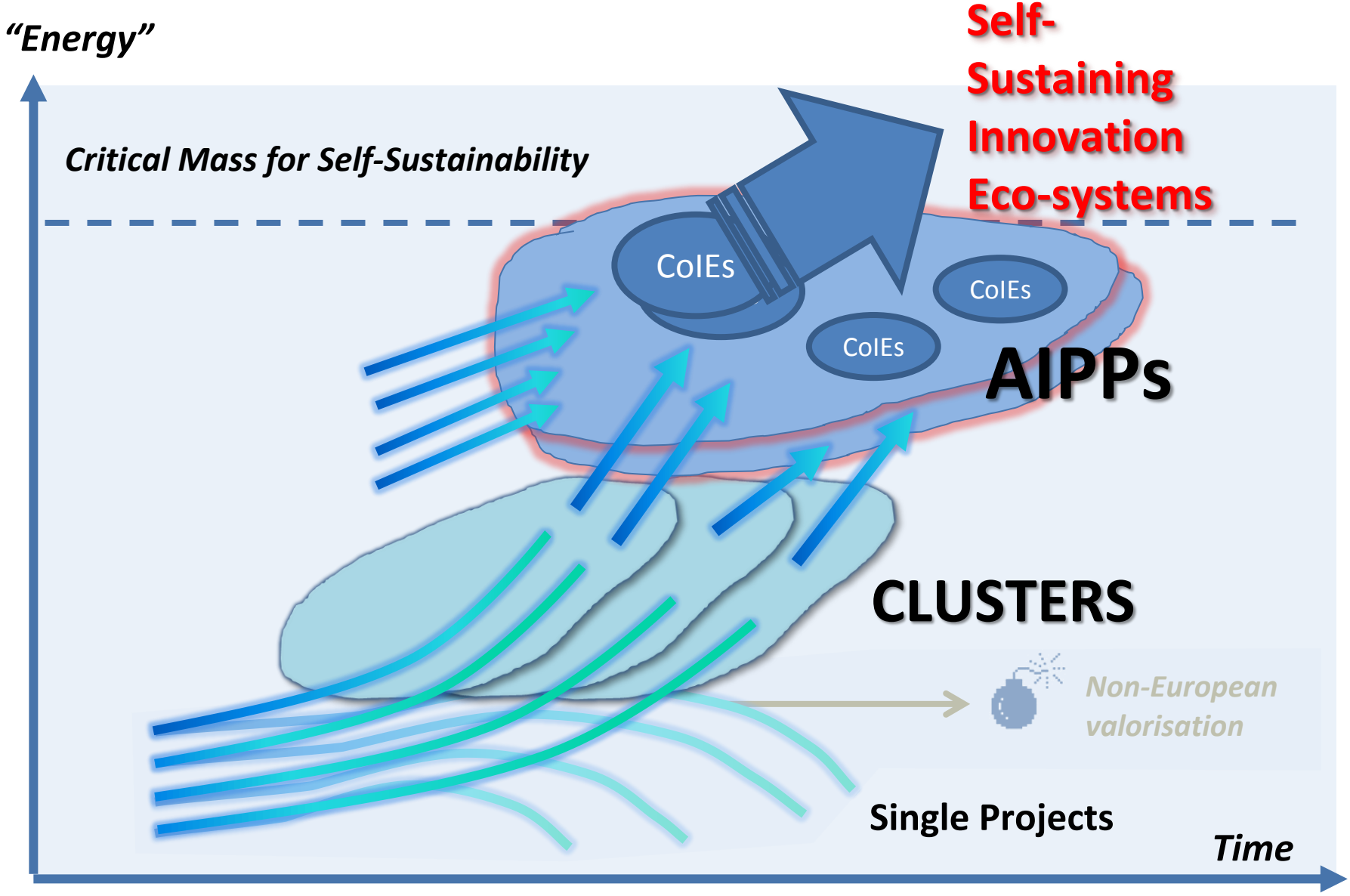
- **Safety and reliability** (CESAR, RECOMP, MBAT, pSafeCer, nSafeCer, iFEST, …)
- **Electric Vehicle** (IoE, POLLUX with ENIAC-E^{3}CAR and FP7-CASTOR/Smarttop)
- **Energy efficient communities** (eDIANA , ENCOURAGE, IoE, eGOTHAM, …)
- **Low-power Multi-Core for embedded** (ACROSS, SCALOPES, SMECY,…)
- **E-health** (CHIRON, HIGH PROFILE)
- **"Things of the internet"** (SOFIA, SIMPLE, SMARCOS, iLAND)
- **Sustainable Manufacturing** (eSONIA, R3-COP)

The Next Wave: ARTEMIS-JU – Call 2012 & Call 2013

- **Build on the emerging clusters to seed**
  - **“Centres of Innovation Excellence” (CoIEs)**
    - **ARTEMIS-IA Labelling Criteria**
  - **“Self-Sustaining Innovation Ecosystems”**

- **How ?**
  - **Introduce INNOVATION PILOT PROJECTS**
    - **Large initiatives Integrating output from ARTEMIS projects and clusters**
    - **Addressing technological, societal and business need**

AIPPs – Step up to Innovation Excellence



Game Changer ...

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

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

A CLUSTER of ARTEMIS projects

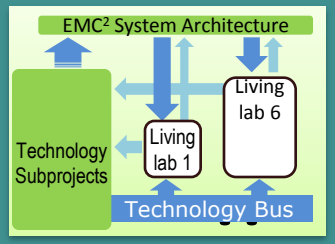
Multi-core Technology

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



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!

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

What does this mean for ECSEL?

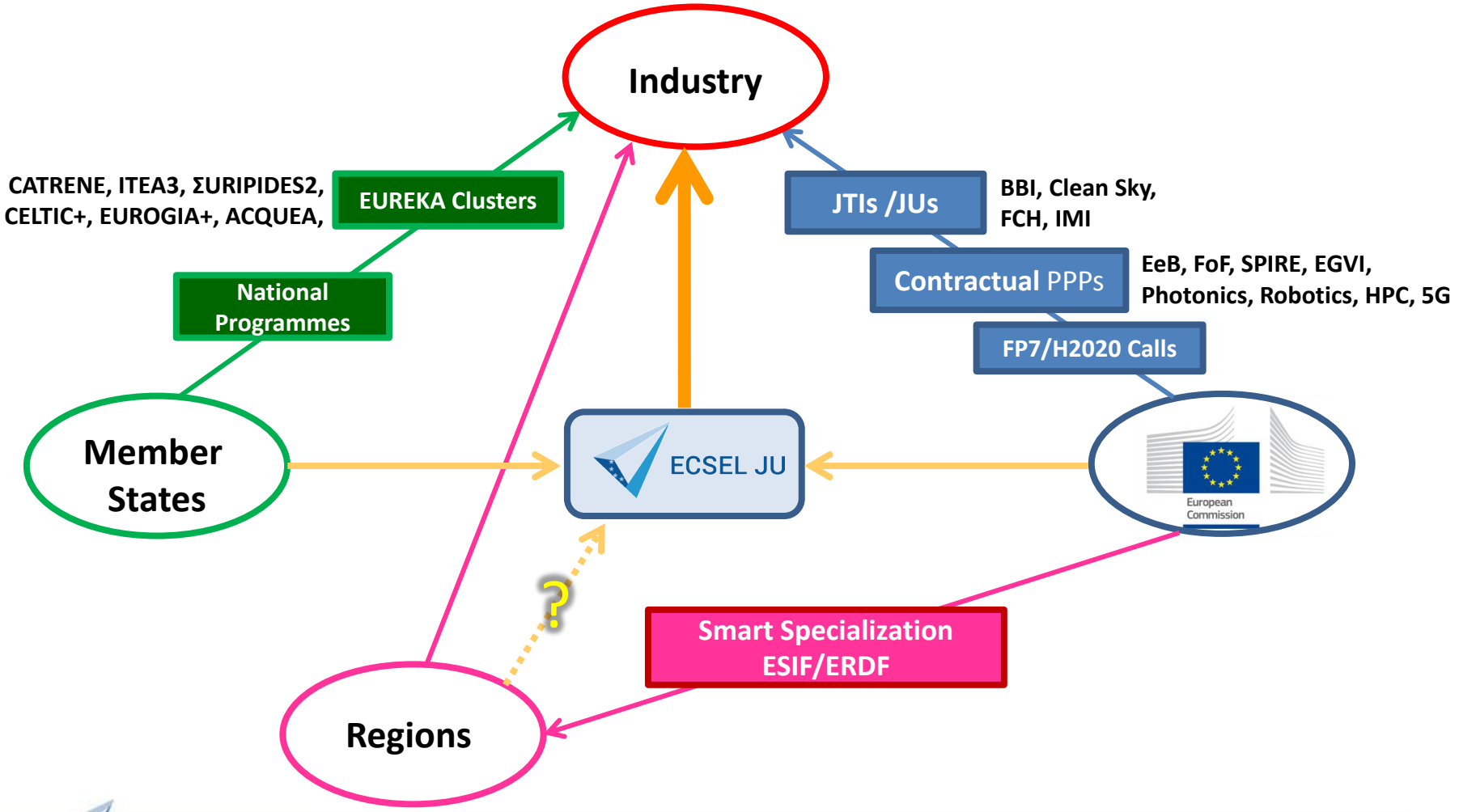
- **ECSEL** = “Electronic Components and Systems”
  - Nanoscale semiconductor technology
    - (ENIAC-JU) – high-performance computing devices an more
  - Smart interfaces and integration
    - (EPoSS ETP) – interface to the physcial world
  - System Engineering, software architecture and model-based 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



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;*

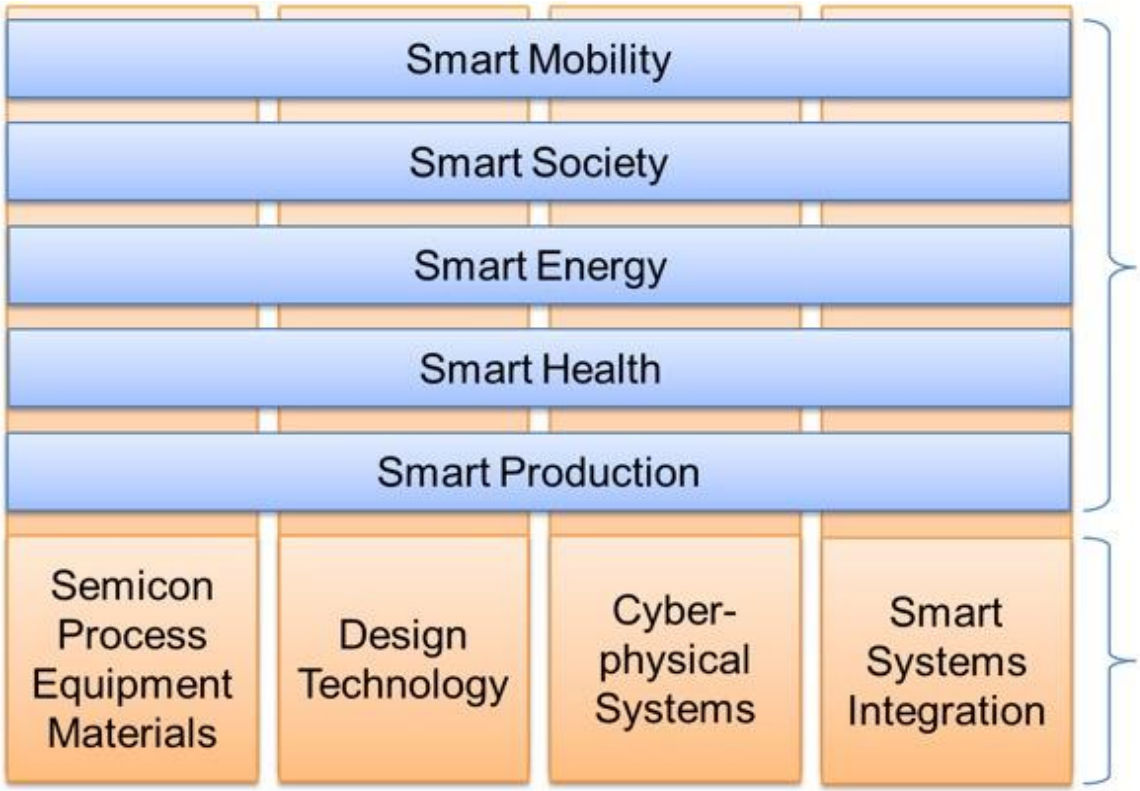
  b) *processes, methods, tools and platforms, reference designs and architectures, for software and/or control-intensive embedded/cyber-physical systems, addressing seamless connectivity and interoperability, functional safety, high availability, and security for professional and consumer type applications,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



Applications driven by the opportunities created for Industry to help address Societal Challenges

Key Applications

PART A

PART B

Essential Capabilities

Technologies needed by Industry to make it happen...

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

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

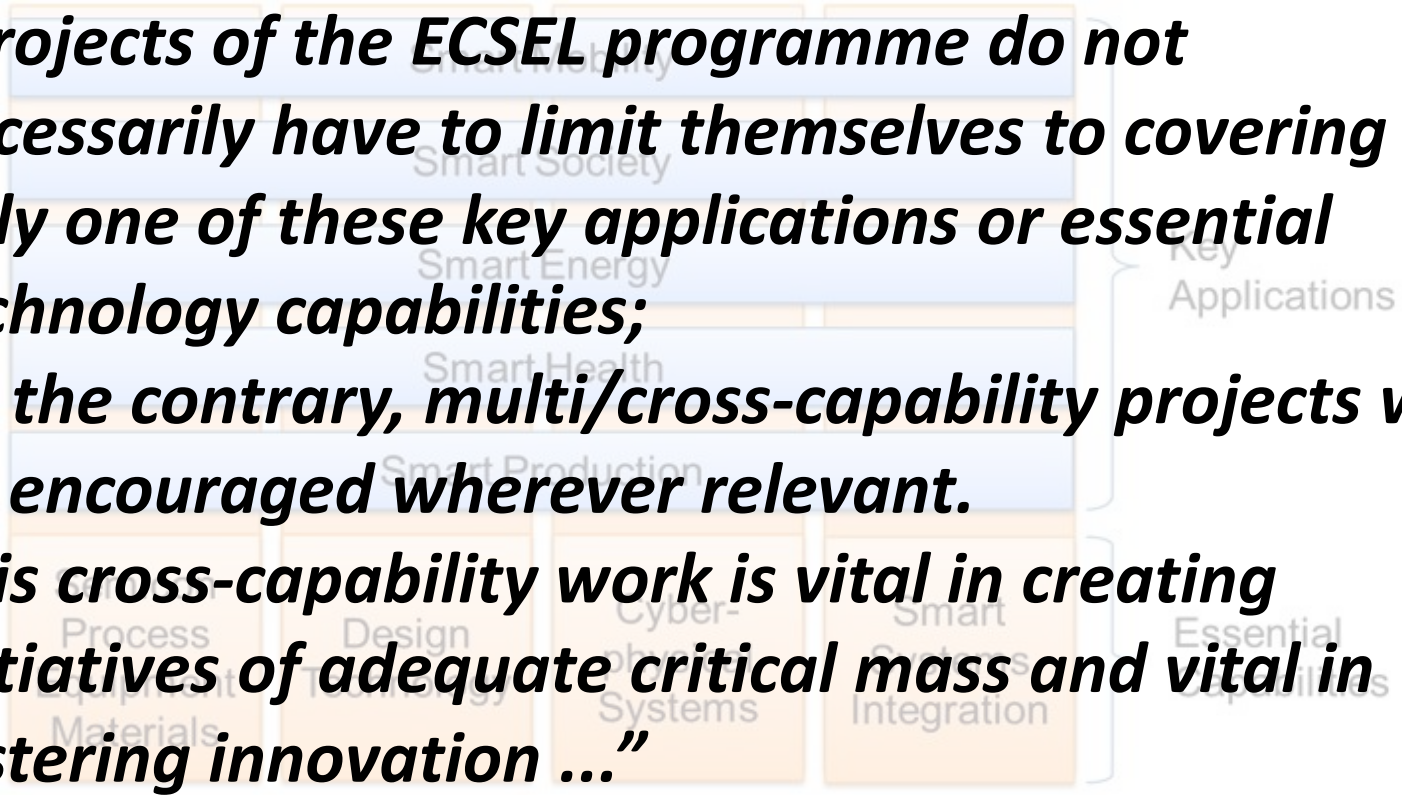
1. Semiconductor Process, Equipment, and Materials
   - leadership in processing know-how for:
     - advanced and beyond CMOS (More Moore, MM),
     - heterogeneous (More than Moore, MtM)
     - and System in Package (SiP) technology
2. Design technologies
   - *"transform ideas and requirements efficiently 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"*

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

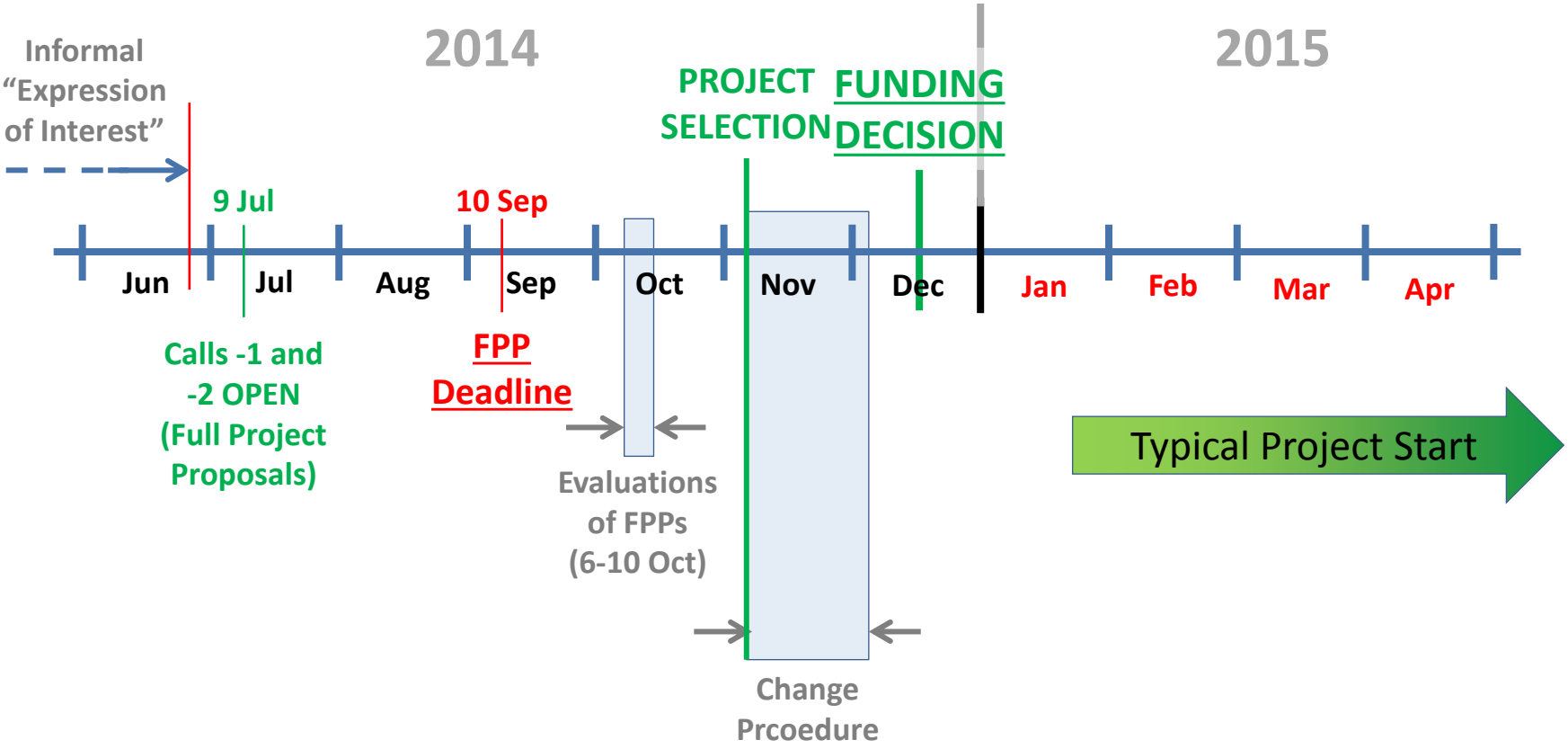
- Innovation Actions
  - Pilot Lines and test beds
  - Demonstrators, innovation pilot projects and zones of full-scale testing
  - Higher TRLs – 4 to 8
- Research and Innovation Actions
  - Research and development (“Standard”) projects
  - TRL 2 to 5

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.

THANK YOU