EMC²
CONSORTIUM CONFERENCE #2

October 1st, 2014, Oldenburg, Germany

The ARTEMIS-JU Project EMC²

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Advanced Research & Technology for Embedded Intelligence and Systems

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Project Overview

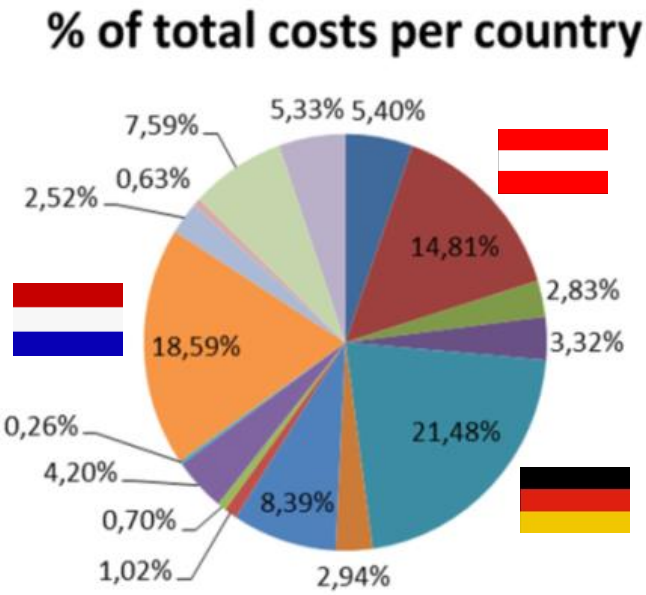
Embedded Multi-core Systems for Mixed-Criticality Applications in Dynamic and Changeable Real-Time Environments – EMC²

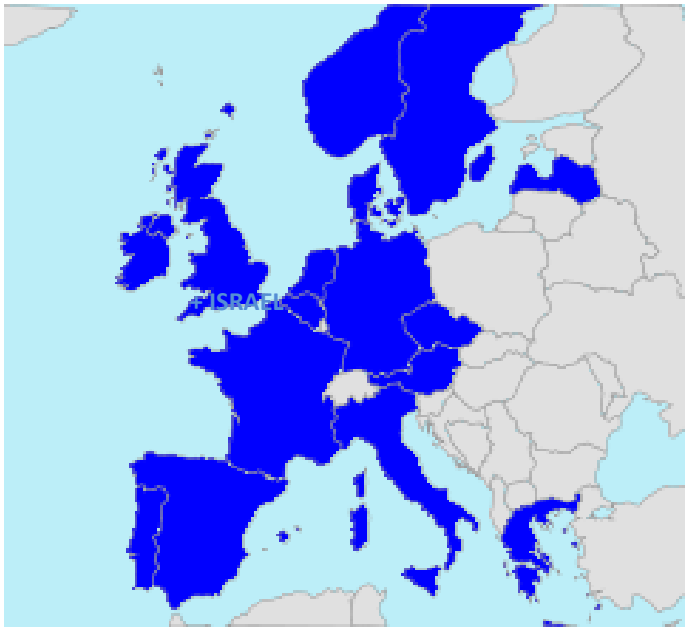
(Artemis Innovation Pilot Project (AIPP)

- AIPP 5: Computing Platforms for Embedded Systems
- Duration: 36 months, K/O April 1st, 2014
- Total Budget: 90 M€
- Total Resources: 800 person years
- Co-ordination: Infineon Technologies AG
- Consortium Size: 99 Partners, 16 EU Countries + Israel

Largest ARTEMIS-JU Project ever!

Country Distribution



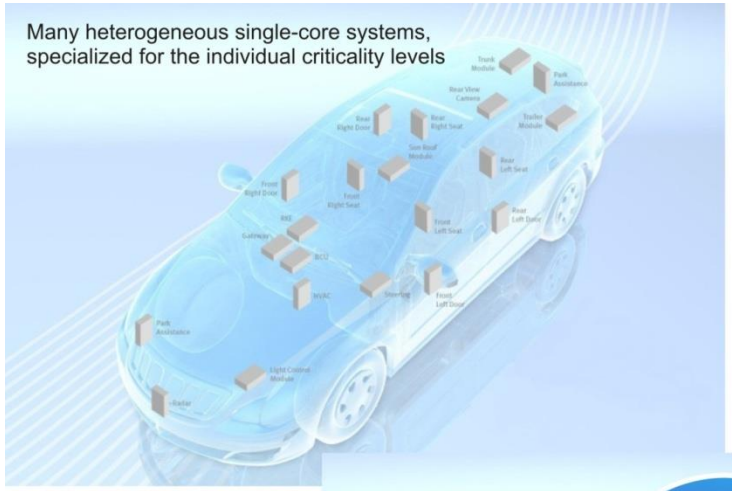


MultiCore Systems in Transportation Industry

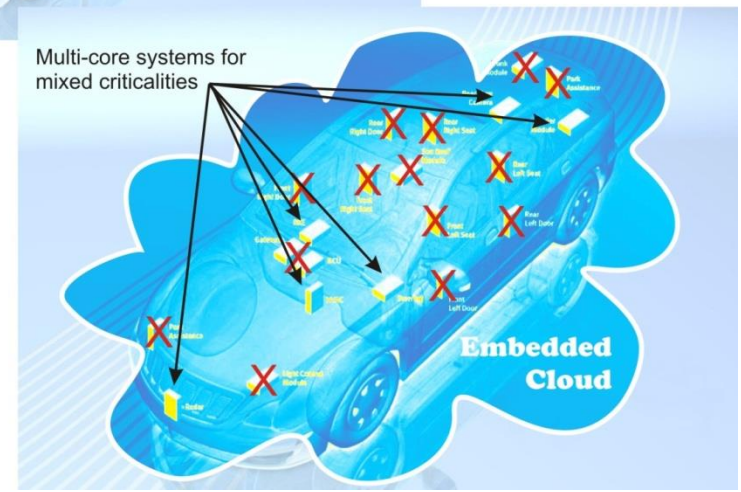
- Criticality-, Security-, Power-, Reliability- requirements increase ☛ **costs scale!**
- Number of ECUs in cars, trains, aircraft **cannot** grow anymore ☛ **need economically viable mixed-criticality systems!**
- System properties do not scale well ☛ **need of intelligent mixed-criticality scenarios!**

☛ **Significant reduction of control units needed!**

EMC² Vision



Vision



EMC² Solution Idea

- Aggregate resources (multi/many cores, ECU networks) in an "Embedded Encapsulated Cloud **E² Cloud**"

- Offer "expensive" system properties as services and **NOT** built-in for the whole application perimeter
  - Safety as a service
  - Security as a service
  - Real-time as a service
  - Power efficiency as a service
  - Reliability as a service
  - etc. (not as a service)

EMC² Objectives

EMC² objectives:

- Innovative & Sustainable Service-oriented Architecture
- Dynamic Adaptability in Open Systems
- Qualification & Certification of Multi-core Systems
- Scalability & Utmost Flexibility
- Integrated Tool Chains, Through the Entire Lifecycle

☛ cross-domain deployment in almost all ES-domains!

EMC² Expected Results

- Development of Service-oriented Architecture
  - Supporting Dynamic Adaptability
- Expensive system features only as Service-on-Demand:
  - Safety as a Service
  - Security as a Service
  - Real-time as a Service
  - Power/energy efficiency as a Service
  - Reliability as a Service
- All available computing resources of an embedded system will be aggregated and shared - Embedded Compute Cloud - usage.
- Enabling: Qualification and Certification of computing resources only as necessary – isolation of system resources

EMC² Basis

- EMC2 builds on the results of previous Artemis, European and National projects and provides the paradigm shift to a new and sustainable system architecture, which is suitable to handle open dynamic systems.

A system Approach -All System Levels Addressed

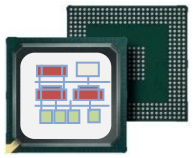
- Addressed system levels / architecture:
  - Heterogeneous Multi-core Hardware
  - System software – dynamic runtime environment/networking
  - Applications - cross domain
  - Design methodologies & tools
- Addressed aspects:
  - Fault tolerance
  - Energy management
  - Security and Safety under real-time conditions
  - Qualification , Reliability
  - ...

EMC² - Application Domains Addressed

- Automotive
- Aerospace
- Railway
- Shipping
- Industrial manufacturing
- Logistics
- IT-infrastructure ('Internet of Things')
- Healthcare

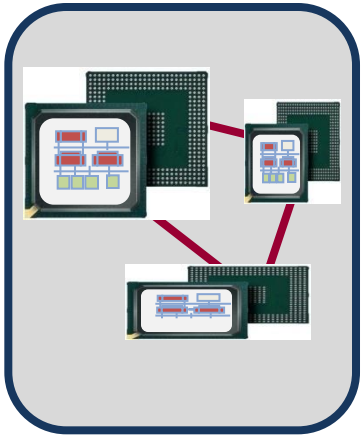
EMC² Embedded System in Terms of Complexity

C1: "Multi-Core SoC"



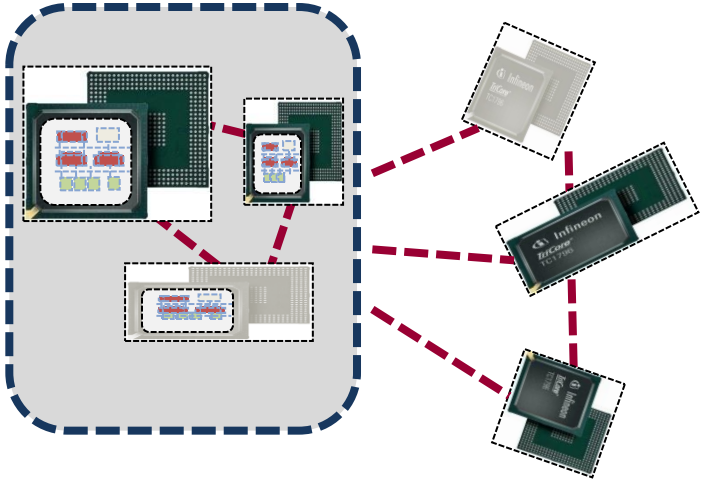
- mixed criticality on a SoC
- known and tested applications

C2: "*closed* system of networked Multi-Cores"



- known number of control units + applications
- test before runtime

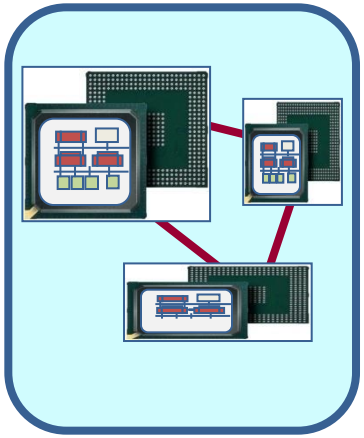
C3: "*open* system of networked Multi-Cores"



- variable number of control units + unknown applications possible

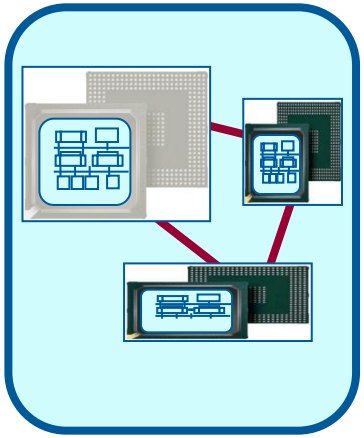
EMC² Embedded System in Terms of Dynamics

D1: “quasi static“



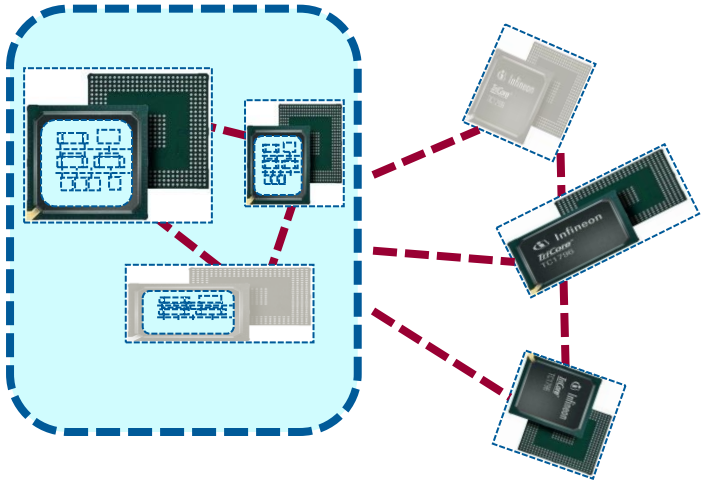
- static scheduling
- no dynamic changes at runtime
- uses already the new SoA

D2: “dynamic changes in a *closed* system”



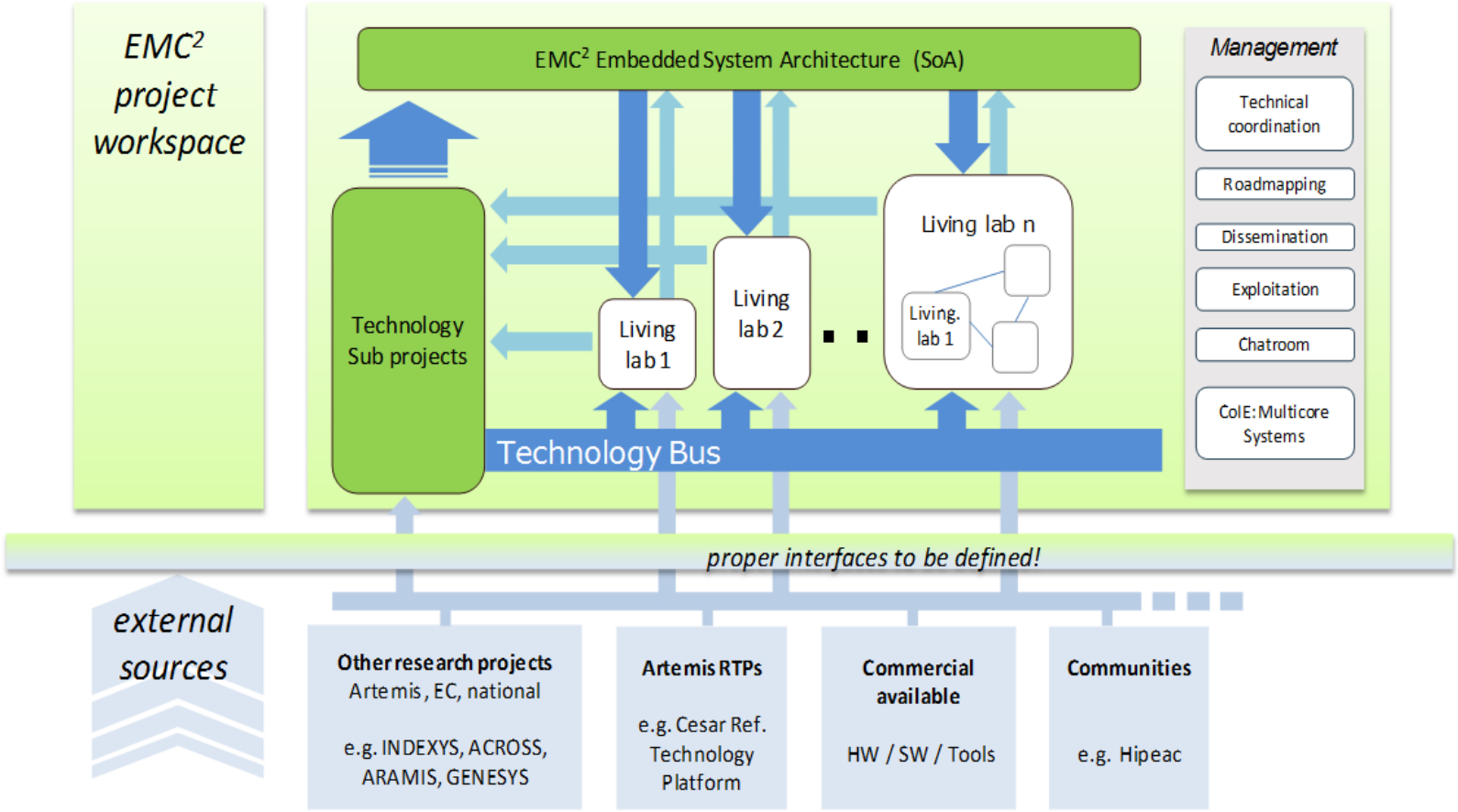
- known number of control units + applications
- dynamic changes possible:
  e.g. re-configuration, re-start, migration

D3: “dynamic changes in an *open* system”

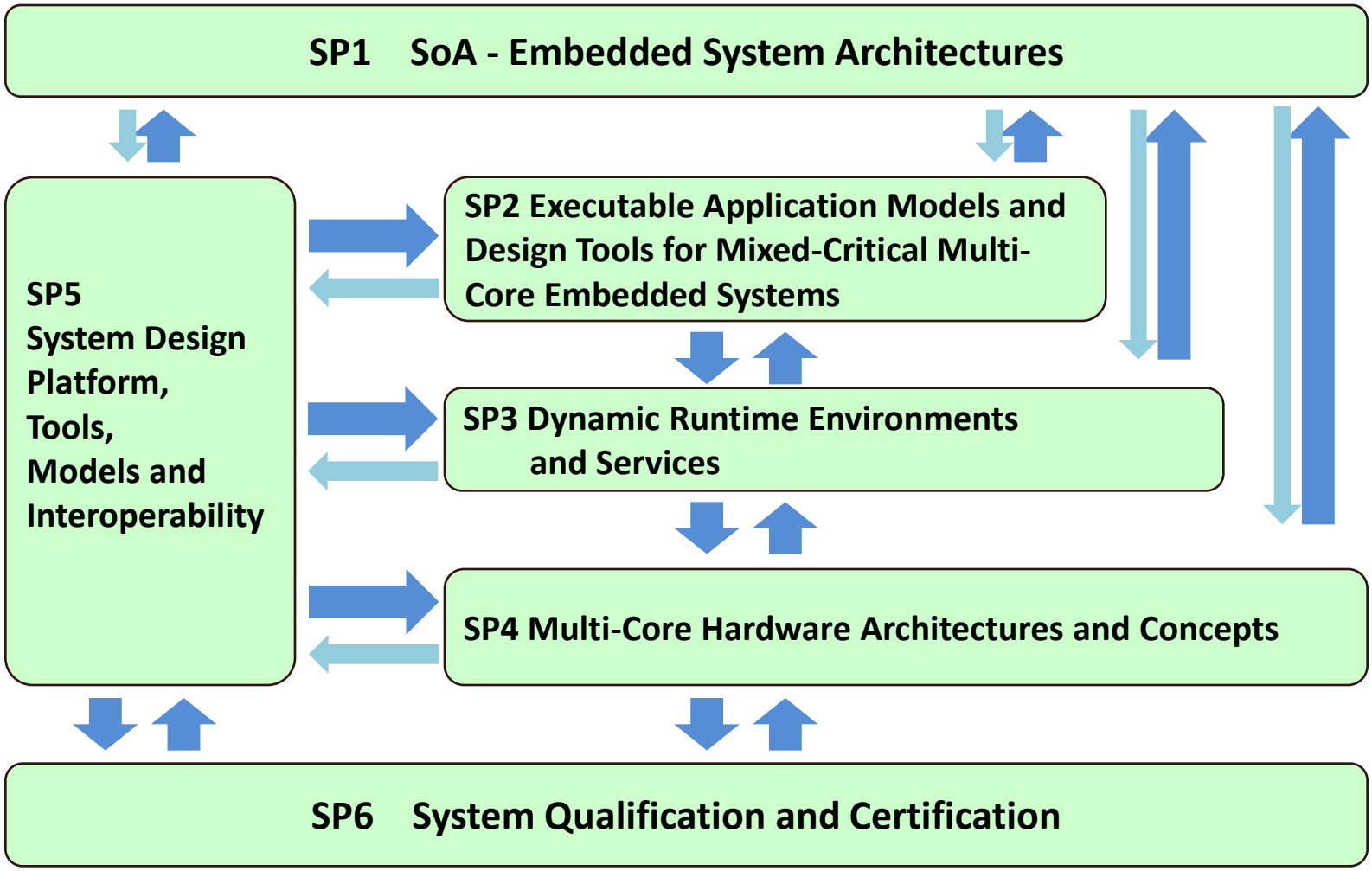


- variable number of control units + unknown applications possible
- full range of dynamic changes possible

Project Structure



Technology Sub-Projects – Cross Domain Deployment



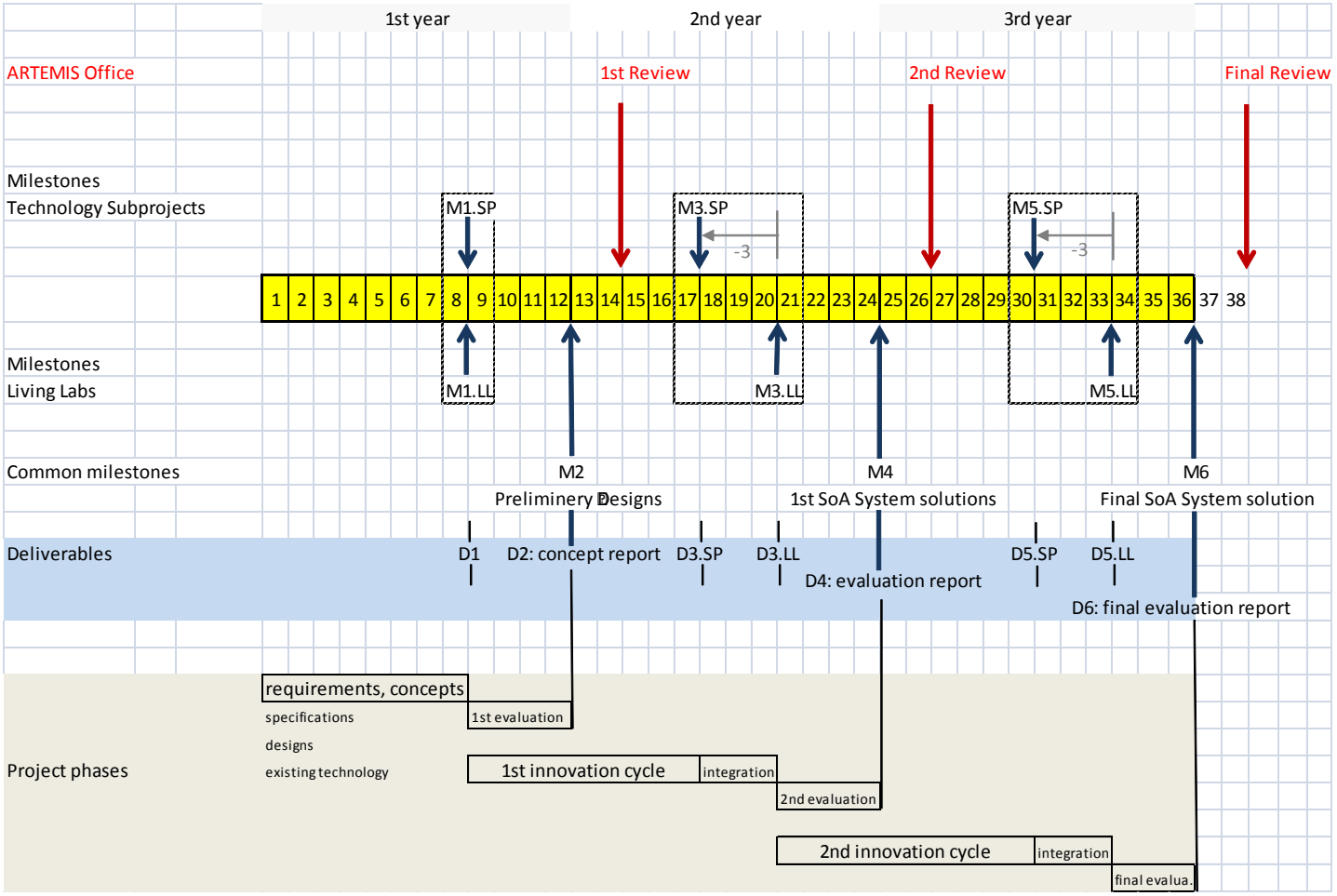
Living Labs – Domain / Application Specific Technology

LL 1	Automotive Applications
LL 2	Avionics Applications
LL 3	Space Applications
LL 4	Industrial Manufacturing and Logistics
LL 5	Internet of Things
LL 6	Cross Domain Applications

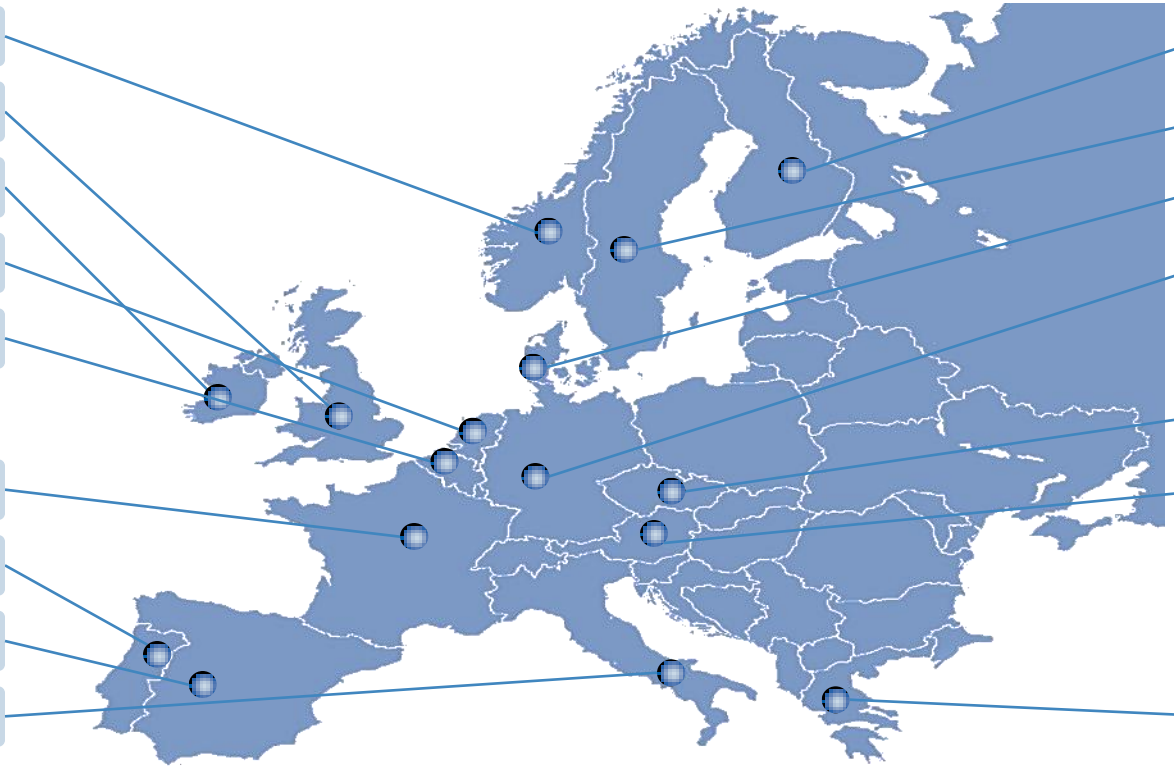
EMC² Schedule (1/2)

- The basic idea: launch 2 innovation cycles (iterations)
- Only 6 Pairs of Milestones:
  apply for all 12 subprojects of EMC²
- The technology subprojects handover results to Living Labs 3 month in advance: results from the technology SPs will be implemented in time

EMC² Schedule (2/2)



… a Real European Consortium …



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Thank you for your attention!

www.artemis-emc2.eu