



Roadmap Pitch: CyPhERS – Cyber Physical European Roadmap and Strategy







Platforms4CPS Roadmap Workshop



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CyPhERS project

- **CyPhERS:** Cyber-Physical European Roadmap and Strategy
- Support Action, co-financed by the EC FP7 – ICT-2013.3.4
- 6 partners from 5 European countries
- Project duration: July 2013 - February 2015, 20 months
- GA No.: 611430
- Web: www.cyphers.eu
- Reference Commission:
 - Ulf Andersson, MAQUET
 - Manfred Broy, TU Munich
 - Karl Henrik Johansson, KTH
 - Marco Di Natale, University of Pisa
 - Joseph Sifakis, EPFL / Verimag
 - Roberto Zafalon, ST

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CyPhERS: Recommendations for Action

Strengthen Key Research

- Intensify Enabling Sciences (M); Address Human-Machine Interaction (M); Foster Cross-Disciplinary Research (M)

Accelerate Maturation of Technologies

- Support Maturation Initiatives (S); Promote Available Infrastructure (M); Coordinate Installation of Key Systems (L)

Facilitate Interoperability of Technology

- Provide Reference Platforms (M); Homogenize Interoperability Standards (M); Define System-Level Design Methodologies (L)

Support Open Innovation

- Provide Open Standards (S); Promote Open Source and Open License (M); Increase Open Data (S)

Anticipate New Business Models

- Activate Networks for Open Innovation (L); Facilitate Business Service Infrastructure (M); Provide Clear Liability Frameworks (L)

Foster Enabling Education and Training

- Stimulate Collaboration in Education (M); Promote Life-Long Learning (M); Support T-Shaped Education (L); Provide Educational Platforms (M)

Raise Societal Awareness

- Enable Decision Makers (S); Stimulate Public Discussion (M); Achieve Societal Consensus (L)

Ensure Trustworthiness

- Harden Infrastructure (M); Protect Data Ownership (M); Adapt Dependability Regulations (L)

Recommendations for CPS Research Priorities

- **Enabling Sciences:** “Research and Innovation Activities in core fields – from physical via ICT and data to system level – must be intensified.”
- **Cross-Disciplinary Research:** “Research programs must address integration of participating disciplines, homogenization and integration of ontologies, domain models and languages.”
- **Human-Machine Interaction:** “Integration of behavioural science and technical disciplines – from multi-modal ergonomics to modelling human behaviour – must be key research.”
- **Interoperability Standards:** “Interoperability standards for components from different domains and organizations must be established and homogenized.”
- **System-Level Design:** “Methodologies must be defined that support modular development of system-level services chains of physical, technical, and organizational processes.”
- **Reference Platforms:** “Research activities should provide medium-TRL reference platforms along stack of disciplines with a potential to be applied in several domains.”
- **Open Source & License:** “Funding programs for research activities should promote the provision of open-source or open/free license results .”

Main barriers identified

Technological barriers: Complexity

- Involved technologies has not yet reached the maturity needed to ensure the required trustworthiness of CPS
- Insufficient dependability technology to avoid propagation of faults or attacks, and to support the mixing of different levels of assurance as well as methodical integration of safety and security aspects.

Scientific barriers: Multi-Paradigm

- Lack of established body of knowledge on how to adequately model all the relevant aspects of CPS
- Foundational theories of CPS-related disciplines not combined in a common integrating systems theory.

Education barriers: Competence

- Current education and training systems are often not focused on and prepared for the transfer of evolving knowledge.
- The availability of personnel with necessary skills and expertise is considered as being too low, with only limited possibility of additional mobilization within or outside Europe

Economic barriers: Disruption

- Current business processes – including the organizational set-up of value-networks – are often more focussed on the traditional, product-oriented market models.
- Disruptive business model facilitates the invasion of value-networks by new participants from the field of ‘cyber’-infrastructure, who then are dominating the business models of CPS

Innovation barriers: Legislation

- Insufficient applicability of current techniques and tools for certification to characteristics of CPS
- Inhomogeneous fragmentation of regulations leads to uncertain – economic and legal – risks, posing a substantial innovation barrier.

Recommendations for CPS Implementation

- **Available Infrastructure:** “Public-private partnerships are needed to ensure the availability and affordability of dependable and trustworthy ICT infrastructure.”
- **Open Standards:** “Funding programs must promote definition, provision, and evolution of open – both pre-normative and normative – standards.”
- **Open Innovation:** “Platforms should be provided facilitating initialization of contacts between innovators trying to enter service ecosystems and existing providers of services.”
- **Service Infrastructure:** “Set-up of necessary technological and regulatory service infrastructure for providing highly dependable services must be supported.”
- **Education Platforms:** “Private-public cooperations for the operation of educational platforms must be supported, facilitating experimentation with new technologies and interdisciplinary learning .”

Strategic recommendations

Coordinate Installation of Key Systems:

- Trans-European large-scale public-private partnerships should be formed to implement infrastructure for CPS in key fields of societal importance (e.g., energy, transport), to address societal challenges and also position Europe as a key player in cyber-physical systems

Increase Open Data:

- To accelerate the implantation of innovative governing schemes the availability of open data should be increased by supporting activities facilitating the access to open and live data

Provide Clear Liability Frameworks:

- Suitable liability regulation frameworks and corresponding supporting technologies must be put into place that help to identify acceptance and delegation of responsibilities for services provided.

Foster Education and Training:

- Stimulate collaboration in education, especially to cross-fertilize foundational science and pragmatic engineering. Promote industrial-academic alliances to engage established engineers in life-long learning. Support “T-shaped” education combining the depth in a specific discipline with the necessary breadth in cross-cutting knowledge.

Raise Societal Awareness:

- Enable decision makers to be able to understand the impact of CPS on society and markets. Establish dedicated dissemination activities addressing the wide public outside the scientific community to ensure an understanding and acceptance of the socio-technical nature of CPS.

PLATFORMS
4CPS



Creating the CPS Vision, Strategy, Technology Building Blocks and Supporting Ecosystem for Future CPS Platforms

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