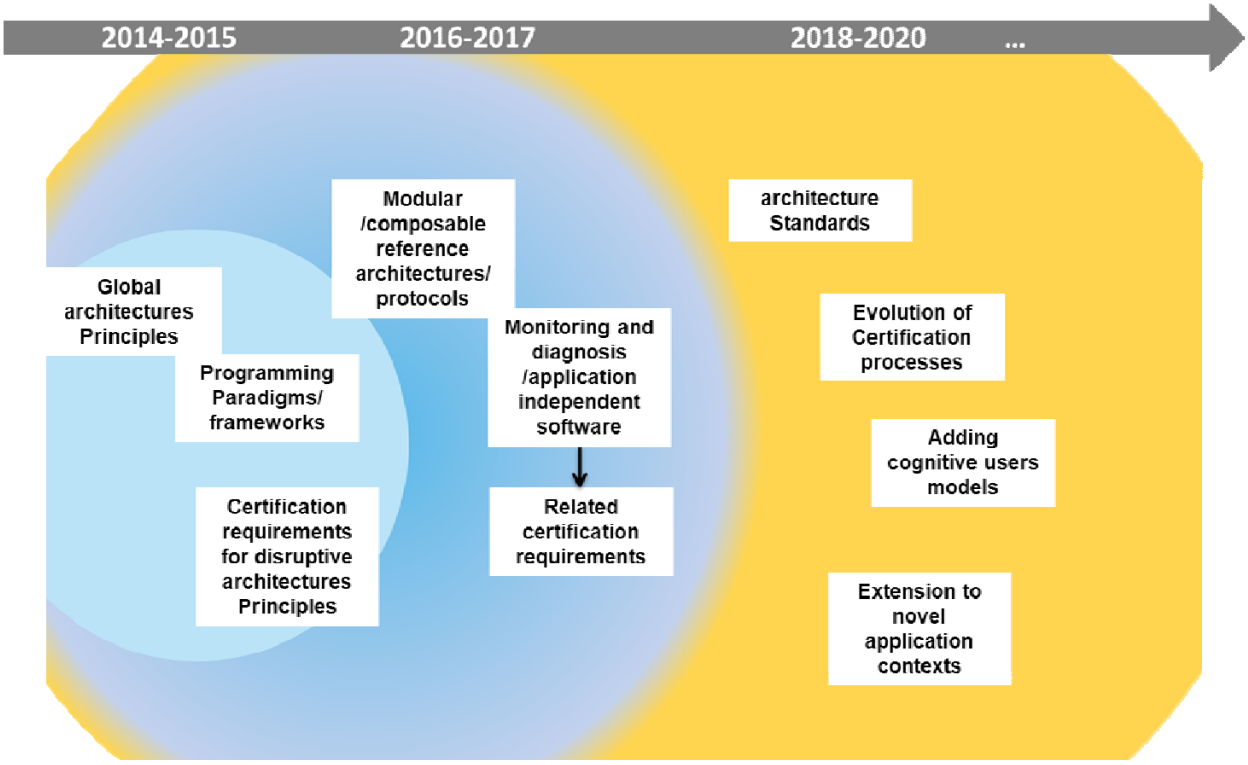
A- Architectures Principles and models for Autonomous Safe and secure Cyber-Physical Systems

- **Short term**: for defining global architectures principles, programming paradigms and frameworks for CPS taking into account safe and secure operation in non-deterministic environment. Certification requirements for disruptive architectures principles are considered at this stage.

- **Medium term**: for translating these principles into modular and composable reference architectures and protocols including monitoring and diagnosis as well as application independent software; for producing certification guidelines when appropriate.

- **Longer term**: for producing architecture standards and evolution of certification processes when relevant; for adding cognitive users' model to the global CPS architectural models, targeting extensions to novel application contexts.



The ambition of this cluster A is to define principles and models encompassing a wide range of applications. Adoption of computing technologies from cluster D, and feedback from autonomous adaptive and cooperative CPS (cluster C) should be considered along the phases of the roadmap.

Research Challenge	Expected Impact (Sub-Challenges)	Ph1 2014 - 2015	Ph2 2016 - 2017	Ph3 2018 - 2020	Cross reference to Annex1
A – Architectures Principles and models for Autonomous Safe and secure CPS					
A.1 Providing safety and enabling certification (e.g., ISO 26262) in highly complex and non-deterministic environments	Enable validation and certification with affordable costs				2.1
A.2 Enable the secure and safe convergence of safety-critical systems and consumer IT	Principles and architectural framework for combined safety-related and security-related domains				3.3
A.3 Reference Architectures for single safe and secure CPSs	architecture principles and programming paradigms; reference architectures; design patterns, HW/SW co-design; Special focus on: reference architectures for seamless interaction and autonomous control Interfacing CPSs to advanced materials, photonic and biotechnological components Handling cloud-machine-interaction service platform architectures for cooperative cyber-physical services **Applications (e.g.:** automotive, aerospace, smart buildings, smart health, smart production, energy efficiency, food chain,)				1.2 ; 3.1
A.4 Monitoring and diagnostics in CPS	On-board diagnostics for detecting malfunction of systems during operation; Software methods for real-time data plausibility checks of generic inputs; Modular data acquisition for generic inputs				2.3; 2.6; 2.7
A.5 Reference Architectures for secure and safe cooperative CP-SoS	Safe and secure middleware and OSes, Digital identities for things Architectural principles for secure, robust, reconfigurable, dynamic System of Systems and CPS; special focus on: reference architectures for seamless connectivity and interaction reference architectures for adaptive, predictive and autonomous control reference architectures for inter-CPS semantic interoperability and trust **Applications (e.g.** smart cities, smart districts, smart co-mobility, smart buildings, smart health, smart production, energy efficiency, food chain,)				1.2; 3.1; 3.2; 2.5
A.6 Reference Architectures for new industrial use-cases - users driven design process	Novel models and reference architectures based on the requirements of novel industrial applications				3.4