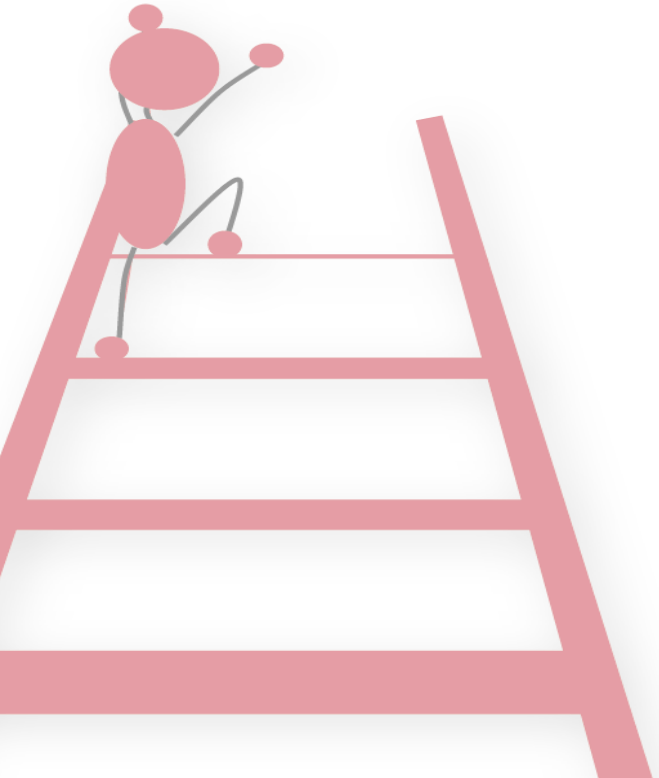
Distributed REal-time Architecture for Mixed criticality Systems (DREAMS)



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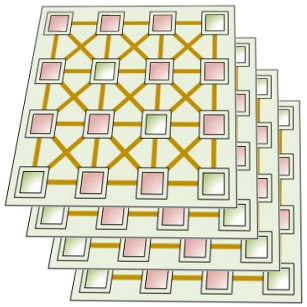
SEVENTH FRAMEWORK PROGRAMME

Mixed-Criticality Systems

- Pressing requirement to reduce the number of computers and cables
- Mixed-criticality systems integrate functions with different importance and safety levels
- Trend to multi-core platforms due to limited scalability of uniprocessors

Mixed-Criticality in Many Application Domains

Networked Multi-Core Chips



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Challenges in Mixed-Criticality Systems

DREAMS

- Modular certification of mixed-criticality systems
- Platforms for mixed-criticality systems and resource guarantees (multi-core processors, I/O, networks, memory)
- Development methodologies with support for design space exploration, scheduling and timing analysis
- Heterogeneous models of computation
- End-to-end systems engineering addressing significant extra functional properties (e.g., time, energy and power budgets, reliability, safety, security)

European Integrated Project DREAMS

- Project full title: Distributed REal-time Architecture for Mixed criticality Systems
- Project duration: October 1, 2013 – Sept. 30, 2017
- Type of project: Integrated Project (IP)
- Budget Total: 15.5 mill. EUR

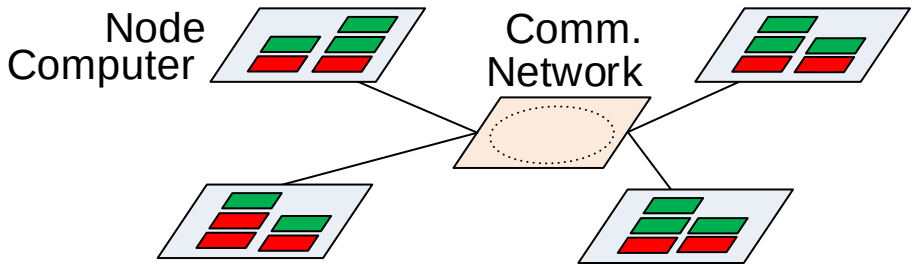
Industry	Thales SA	France
	Alstom Wind S.L.	Spain
	STMicroelectronics	France
	TÜV Rheinland	Germany
SME	TTTech	Austria
	RealTime-At-Work	France
	Virtual Open Systems	France
	FENTISS	Spain

Research Org.	ONERA	France
	Ikerlan	Spain
	SINTEF	Norway
	Fortiss	Germany
Univ.	Universität Siegen	Germany
	TU Kaiserslautern	Germany
	UPV	Spain
	TEI	Greece

Key Achievements of DREAMS

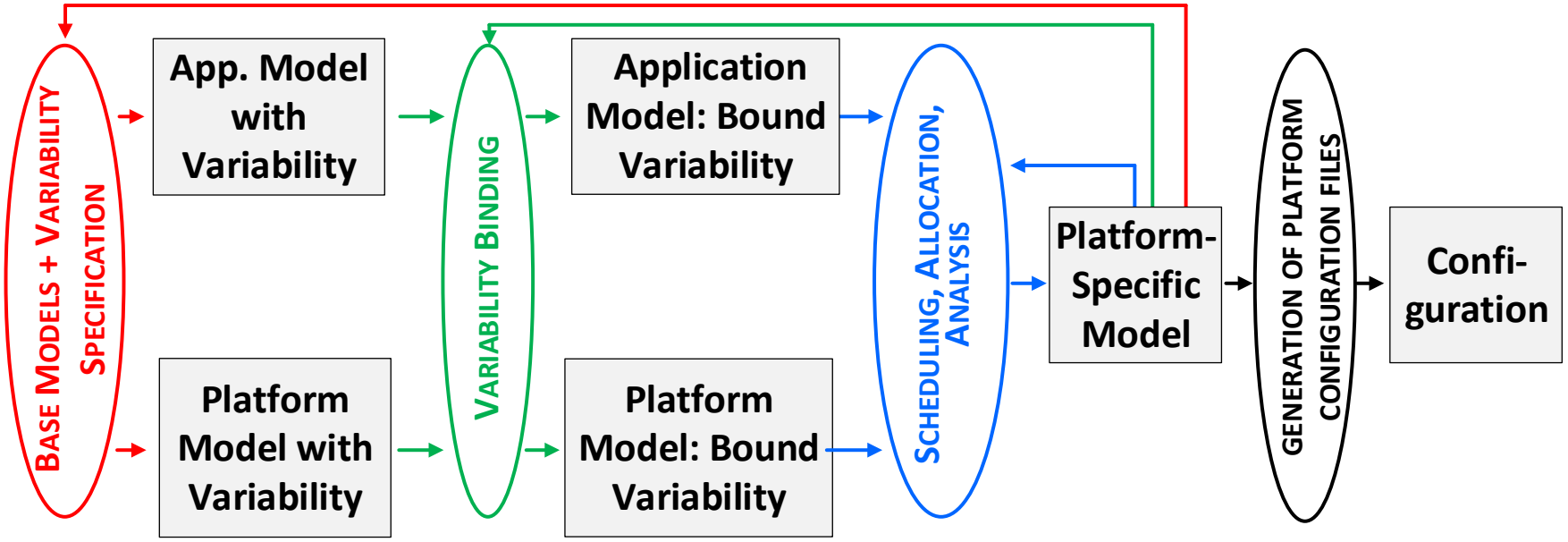
Mixed-criticality architecture for networked multi-core chips

1. Architectural style and modelling methods
2. Virtualization technologies for security, safety, real-time
3. Adaptation strategies for mixed-criticality systems
4. Model-driven development methodology and tools
5. Modular certification and mixed-criticality product lines
6. Feasibility of DREAMS architecture in real-world scenarios
7. Promoting widespread adoption and community building



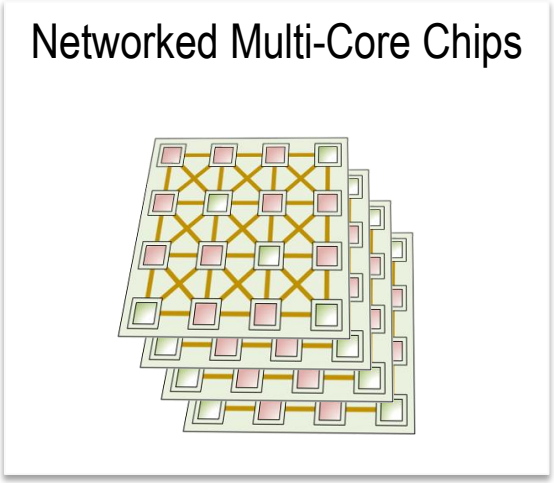
Architecture and Modelling Methods

- Architecture style for seamless virtualization of networked embedded platforms with support for security, safety and real-time performance
- *Models of hierarchical platforms* comprised of networked multi-core chips to enable MDE
- *Development process* ranging from modelling and design to validation of mixed-criticality systems



Virtualization Technologies

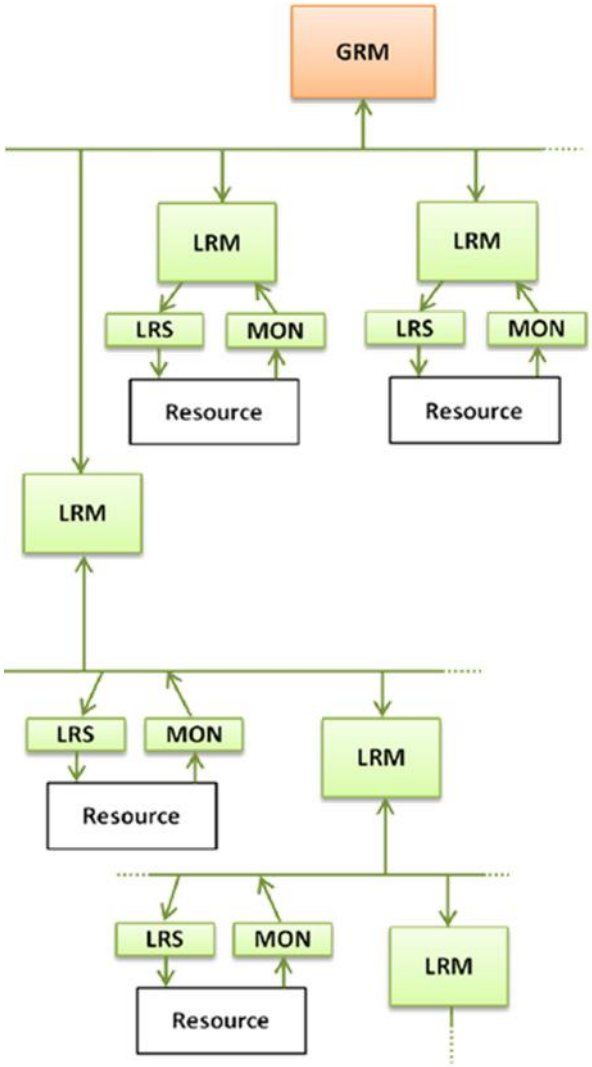
- Certifiable platform services for virtualization and *segregation of resources at cluster and chip-level*
  - I/O virtualization
  - Processor virtualization using hypervisors
  - Message-based networks and memory architectures
  - Dynamic resource management



- *Gateways* for end-to-end segregation as means for integration of mixed criticalities at chip-, network- and cluster-level
- Support for *monitoring and dynamic configuration*

Adaptation Strategies

- Support for *system wide, high level constraints*, such as end-to-end deadlines and reliability
- Combination of global strategies with local monitoring and management
  - *Monitor (MON)* for monitoring different resource types (e.g., availability, timing)
  - *Global Resource Manager (GRM)* for global decisions with information from monitors
  - *Local Resource Manager (LRM)* for local decisions and resource abstractions
  - *Local Resource Schedulers (LRS)* performs runtime scheduling of resource requests (e.g., execution on processor, memory)

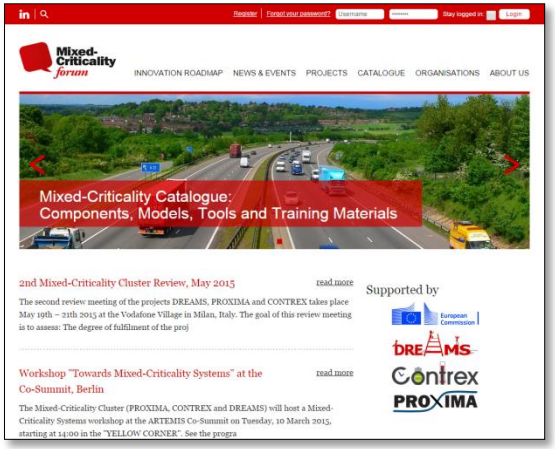


Demonstrators

- Avionic demonstrator: avionics display with different levels of criticality
- Wind power demonstrator: Wind turbine control system combining safety-critical application for the pitch control with non safety-criticals services
- Healthcare demonstrator: body gateway for a remote patient monitoring application

Community Building and External Collaboration

1. *Website* for mixed-criticality community with results provided by several projects (DREAMS, PROXIMA, CONTREX, CRYSTAL, EMC2, RECOMP)
2. Organization of *community building events* (e.g., community building activity at HIPEAC 2015 attracted more than 50 participants to discuss future directions of MCS)
3. Joint *standardization* activities
4. Facilitate *information flow* and interfaces between projects
5. *Training* of community
6. *Innovation roadmap* for MCS



MixedCriticalityForum.org

HIPEAC Workshop, Jan 2015

Conclusion and Key Achievements of DREAMS

- Leverage multi-core platforms for a system perspective of mixed-criticality systems combining the chip-level and cluster-level
- Reduced development cost and time-to-market for MCS
- Exploitation of economies of scale
- Consolidation and integration of virtualization solutions and development methods from previous projects
- Flexibility, adaptability and energy efficiency through integrated resource management
- Higher reliability, security and safety