ARTEMIS 2013 AIPP5

EMC²

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Executable Application Models and Design Tools for Mixed-Critical, Multi-Core Embedded Systems

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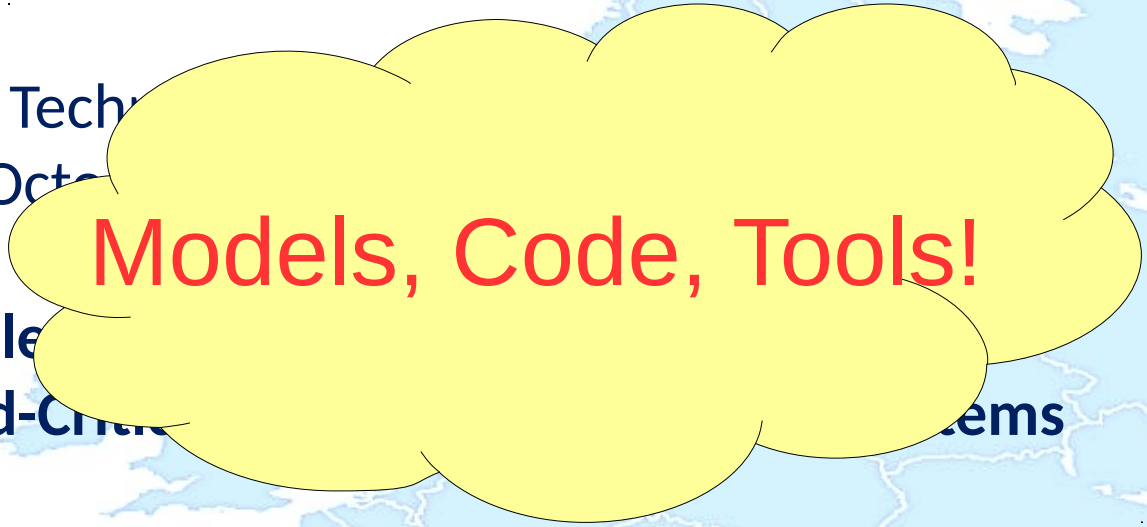
Executable

for Mixed-Cri **tems**



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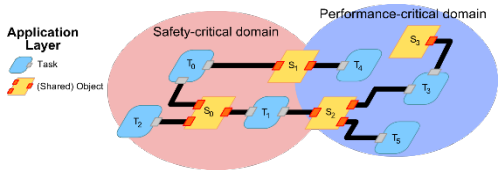
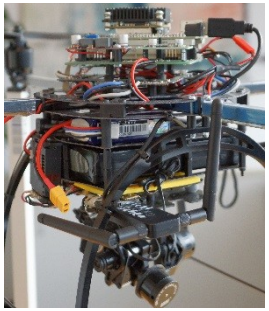
Highlights

- Modeling, tool highlights
  - Seamless development process for EMC2 applications
    - **Application level modelling** kit for mixed-critical applications
    - Specification of **functional and extra-functional** properties
    - **Simulation** of fully deployed system models on **virtual multi-core platforms**



  - **Analysis and optimization** of MCMC systems
    - Integration of tools into framework
    - Estimation and evaluation of design decisions
    - Determination of optimal mapping and scheduling

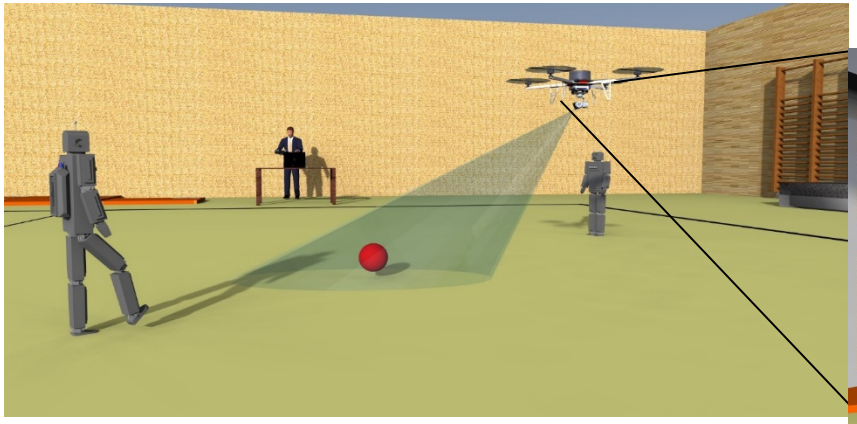


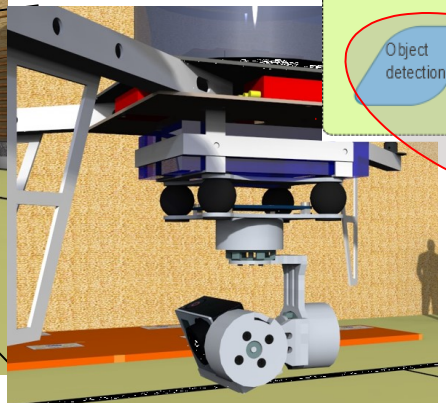
- Development, use cases
  - Tools and methodologies **applied to internal use-case**
  - Ongoing **evaluation** and **knowledge transfer** of the proposed methods and tools with Living Lab and 3rd party use cases

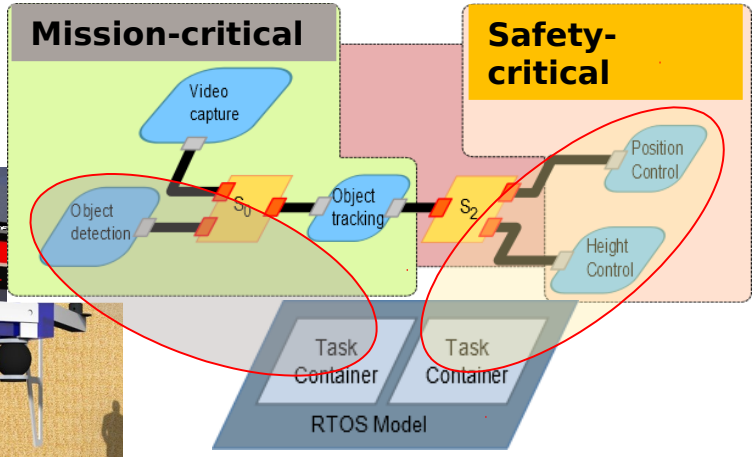
Internal evaluation example

Example: Safe optimization of QoS in Mixed-Critical Applications

- Safety critical System
  - 3 parallel Flight Control Tasks (2 ms)
  - 6 Sensor Channels (2-30ms)
  - 3 Sensor Compute Tasks (2 ms)
  - Small violations accumulate to crash
- High Throughput Video application
  - Mission critical object detection
  - Minimal 6 frames/second
  - Demand for high data throughput

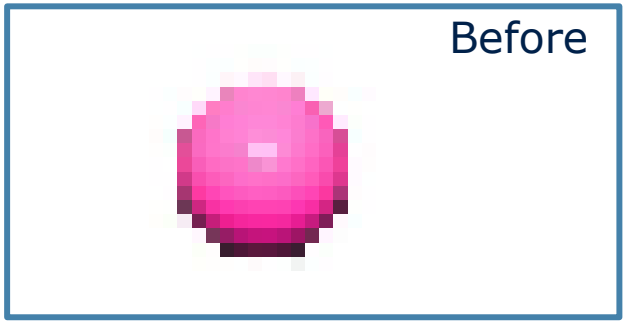




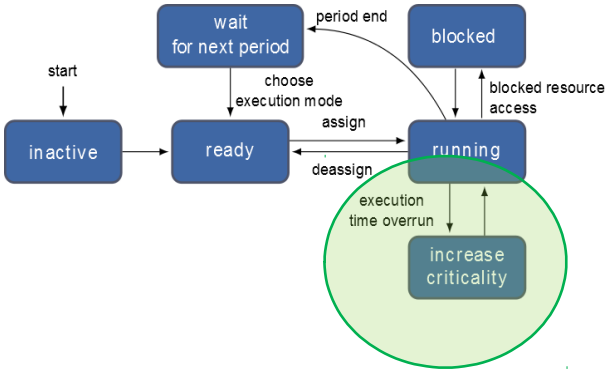


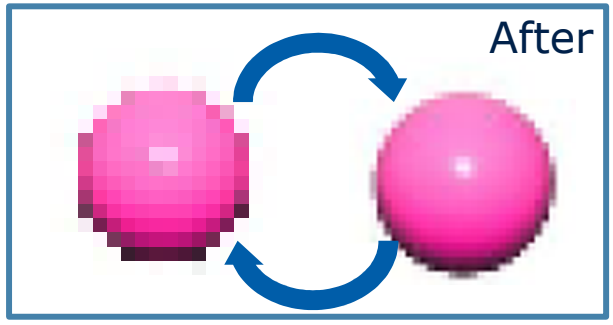
Internal evaluation example

Static schedule (WCET based)

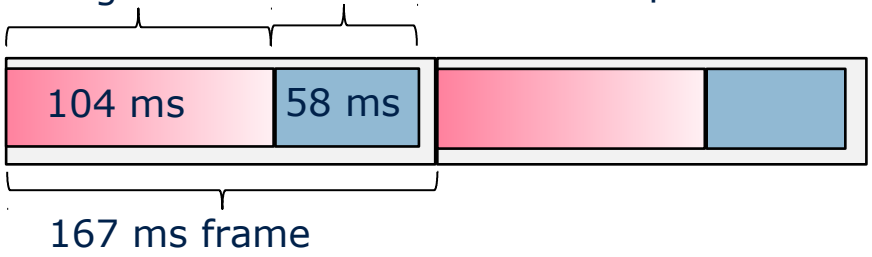


Dynamic Criticality Modes

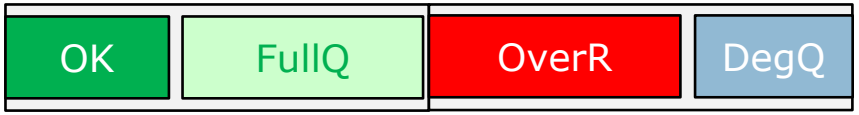




Flight CS Video Proc: 300x200 px.



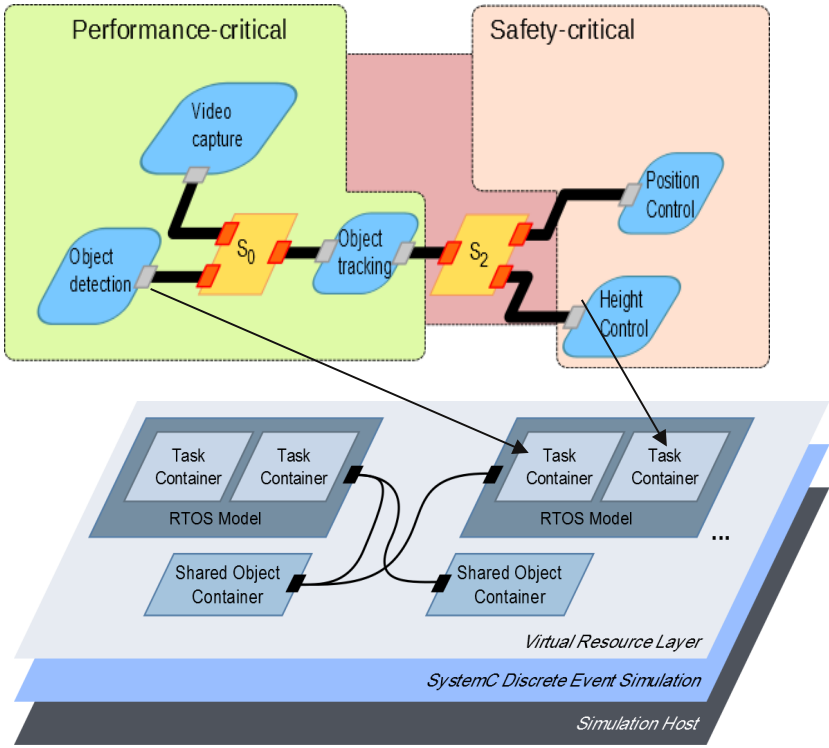
95% (typical case) Flight CS: 64 ms
Leaves: 103 ms or 460x320 px.



Criticality Policy	# Degraded	# Full Quality	Av. Throughput
Static	30	0	1055 Kb/sec
Dynamic	13 (±3)	17(±3)	1923 Kb/sec (182%)

Internal evaluation example

- Modelling approach **presented and discussed within the project**
- Integrate Multi-core RTOS/platform models with **hardware platform**
- **Joint effort** for integrating the model-based quadrocopter description into platform implementation
- Future:
  triple-modular redundancy proof-of-concept platform for **fail-operational mixed-criticality** systems



Technology transfer

Tech. No.	Technology title	C_ADAS and C2X	C_Highly automated riving	C_Multi Domain Avionic rchitecture	C_Hybrid Avionics ntegrated Architecture	C_MPSoC Software and ools for Space	C_Platform Applications	C_Drives and electric otors in industrial pplications	C_Manufacturing quality ontrol by 3D inspection	C_Seismic surveying by hip	C_Medical imaging
		T7.1	T7.2	T8.1	T8.2	T9.2	T9.4	T10.1	T10.4	T12.1	T12.3
2.1	DSE: DSE-Ychart: DSE using the Y-chart apporach and DSE for mixed-critical parallel embedded platforms (TNO,	3					3				
2.2	HW/SW support to mixed-critical parallel embedded platforms (UNIVAQ)						2				
2.3	"art2kitekt" - A toolset to model and analyze mixed criticality, multi core real-time systems (ITI)					2			4		
2.4	Optimal internal resource assignment algorithm for scheduling a task set (TUE)	4									
2.5	Formal verification in model driven development of multi-core systems (TUE)	4									
2.6	Pareon Verify - dynamic program verification of multicore software + Code quality analysis tools (Vector, CINI)			2							3
2.7	Application Modelling and Implementation Methods (OFFIS, UoMAN)		2		3			2		1	

Technology transfer phases	
Definition	
Evaluation	
Development	
In Transfer	
Transfer complete	

Scope 1:	Complete implementation into use cases in the project
Scope 2:	Partial implementation into use case
Scope 3:	Will be transferred to LL (WP7-12) but not implemented into use case
Scope 4:	Topic for future applications; technology transfer subsequent to EMC2