Year 3 Review Brussels, February 24th, 2011

Cluster

Achievements and Perspectives :

Modeling and Validation

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Cluster Leaders: Kim G. Larsen, Aalborg University Susanne Graf, Verimag



Core Teams (Modeling & Validation)

Kim Larsen (Aalborg – Denmark)

Timed automata based models.
 Performance analysis and synthesis.

Susanne Graf (VERIMAG – France)

- Component-based design. Extra-functional properties..
- Tom Henzinger (IST Austria)
 - Rich Interfaces. Quantitative properties and resources..
- Thierry Jéron (INRIA France)
 - Model-based testing, control synthesis
- Martin Törngren (KTH Sweden)
 - Integrated models and validation.
- Christoph Kirsch (Salzburg Austria)
 - Timing and reliability modeling.

- Wang Yi (Uppsala Sweden)
 - Resource modeling and timing analysis.
- Joseph Sifakis (VERIMAG France)
 - Component-based design. Structural verification
- Sébastien Gérard (CEA LIST France); – Model-based engineering, standard modeling.
- Jozef Hooman (ESI Netherlands);
 - Quantitative modeling and testing.
- Boudewijn Haverkort (ESI, Netherlands)
 - Quantitative Modeling
- Werner Damm (OFFIS Germany);
 - Component-based design and semantic foundation.
- Alberto Sangiovanni-Vincentelli (Trento - Italy)
 - Platform-based design.
- Bengt Jonsson (Uppsala Sweden)
 - Component-based mod. & ver.



Affiliated Teams

- Henrik Lönn, Volvo Technology
- Jacques Pulou, France Telecom
- Roderick Bloem, TU Graz

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- Koos Rooda, TU Eindhoven
- Paul van den Hof, TU Delft
- Tiziaqna Villa, Uni. Verona,
- Pierre Wolper, CFV, Belgium
- Yiannis Papadopolis, Uni. of Hull
- Ahmed Bouajjani, LIAFA

- Stavros Tripakis, University of California at Berkeley, USA
- Jean-Francois Raskin, CVF, Belgium
- Joost-Pieter Katoen, Aachen
- Holger Hermanns, U. of Saarland
- Christel Baier, Dresden
- Patricia Bouyer, Nicolas Markey, Philippe Schnoebelen, LSV Cachan
- Wil van der Aalst, TU Eindhoven
- Frits Vaandrager, Radboud U. Nijmegen
- Mehmet Aksit, Twente University

+ several industrial partners at national levels.



High-Level Objectives

- Establish a coherent mathematically sound family of design flows spanning the areas of computer science, control, and hardware based on model- and component-based theories, methods, and tools:
 - **model-based**, to achieve portability

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- **component-based**, to achieve scalability
- **analyzable** (deterministic, ..), to achieve predictability
- tool-chains cost-efficient development, early design-space exploration
- Requires a new scientific foundation
 - new **abstractions** for computing as a physical, imperfect act
 - from Boolean correctness to quantitative robustness measures: failure rate, life time, input tolerance, etc.
- Impact on safety critical industries (aerospace, automotive) as well as high volume systems (professional systems, consumer electronics).

Overview of Cluster Activities

MODELING

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VALIDATION

Susanne Graf (VERIMAG)

Kim G. Larsen (Aalborg)

Component Modeling Compositional Validation Resource Modeling Quantitative Validation Quantitative Modeling Cross-layer Validation



Overview of Cluster Activities

MODELING

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VALIDATION

Susanne Graf (VERIMAG)

Kim G. Larsen (Aalborg)





State of the Integration in Europe

Extensive collaboration between partners of the cluster

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- **Extensive collaboration** with leading research teams outside Europe.
- Extensive interaction with other communities
- National Centers and projects
 - CISS, ESI, ...
 - DaNES, DOTS, Testec, ICES, ...

FP7/ARTEMIS/ESF Projects

- Pro3D (STREP)
- SMECY (ARTEMIS)
- ACROSS (ARTEMIS)
- SYSMODEL (ARTEMIS)
- VERDE (ITEÅ)
- RECOMB (ARTEMIS)
- MBAT (ARTEMIS)

and existing ones: QUASIMODO (STREP), MULTIFORM (STREP), COMBEST (STREP), GASICS, CESAR, GENESYS, ADAMS, ATTEST2, SPEEDS (IP), CREDO,,



Building Excellence

• **146 publications** (Y1 156, Y2 150)

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- **40** joint publications (Y1 47, Y2 46)
- 3 Best Paper Awards
 ICTSS10, ROBLON10, IEEE TII
- High level of dissemination through PhD schools and industrial seminars (>40 keynote presentations).
- Strong impact on a number of important international conferences (CAV, TACAS, FORMATS, EMSOFT, CONCUR, ETAPS, HSCC,...)
- Transfer to industry long-term collaboration performed by individual partners. National centers and laboratories.





Building Excellence

Conferences and workshops organized

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- FORMATS 2010, Conference on Formal Modeling and Analysis of Timed Systems, IST Austria, 2010
- Workshop: Formalisms for Description and Visualization of Embedded Systems Architectures, April 2010 as part of the CPS week at KTH in Stockholm
- Workshop: Green and Smart Embedded System Technology: Infrastructures, Methods and Tool, April 2010 as part of the CPS week at KTH in Stockholm
- Workshop: Software Synthesis, October 2010, as part of ESWEEK, at Phoenix, US, co-organized by A. Sangiovanni Vincentelli and P. Marvedel
- Workshop: IWBDA: International Workshop on Bio-Design Automation Associated with DAC 2010, co-organizer and panel moderator, Alberto Sangiovanni Vincentelli
- Dagstuhl Seminar on Quantitative Models: Expressiveness and Analysis, Dagstuhl, January 18-22, 2010. Organizers Kim G. Larsen, Christel Baier, Manfred Droste, Paul Gastin



Building Excellence

Conferences and workshops organized

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- PhD School QMC: Quantitative Model Checking PhD School, Copenhagen, February 2-5, 2010. Organizers Kim G. Larsen, Joost-Pieter Katoen
- Gasics Workshop 2nd Workshop on Games for Design, Verification and Synthesis, September, Paris, 2010, Co-located with CONCUR 2010.
- ISOLA'10 Track: Quantitative Verification in Practice. 18 October 2010, Heraclion, Krete.
- EMSOFT Tutorial: Quantitative System Validation in Model-Driven Design, Scottsdale, Arizona, U.S.A.
- Workshop: Second IEEE International workshop UML and Formal Methods
- (UML&FM'2010) held in conjunction with the 12th International Conference on Formal Engineering Methods, ICFEM 2010,November 16th, 2010 Shanghai, China.
- Workshop: 1st international workshop on Model Based Engineering for Robotics (RoSym'10), co-located with MODELS'2010 and supported by Robotics Task Force at OMG.
- Workshop: MoBE-RTES 2010, May 4th, 2010, organized in conjunction with ISORC 2010)



Achievements Y3

Modeling

Validation

- - Component Modeling & Compositional Validation Component-based design frameworks (functional, timing and stochastic aspects)
 - Robustness
 - Coordination Languages
 - Tool Integration (meta-models and model-transform.)
- Resource Modeling

 Multi-core scheduling •

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- Modeling paradigms for quantitative resources
- Platform models
- Quantitative Modeling •
 - Weighted automataPriced TA

 - Quantitative communication models
 - Energy Games

- Quantitative Validation
 - Schedulability analysis for multiprocessor, multi-core
 Scheduler overhead

 - Poweraware
 - Safety Cricitical Java
 Combinations of AI and MC
- Cross-layer Validation
 <u>Model-based testing</u>

 - Controller synthesis for timed games, modal specifications and scenariobased specs. SEVENTH FRAME

Tools & Platforms

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Tools & Platforms (Recommendation 5)

- Tool integration should go beyond individual projects; the team should at least formulate conditions for integrability
- One should think about the solution for "saving the tools" produced by the community as outcome of research.



• Prerequisites

- Individual tools need well-defined API's (syntax & semantics)
- Three approaches
 - Common Formats (standardization)
 - Gateways between tools
 - Derive global results from partial results produced by different tools
- Challenges for tools to survive
 - Industrial take-up
 - Technical support for maturing/ sustaining academic tools
 - Open source?
- Survival of the fittest!



SH1: Model-Based Testing

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SH1: Model-Based Testing

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SEVENTH FRAMEWORK

SH1: Model-Based Testing

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SH2: Contracts & Interfaces



Borrowed from Sophie Quinton

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SH2: Contracts & Interfaces

- **Probabilistic Contracts** [INRIA]
- Constraint Markov Chains [INRIA, CISS, ITU, Aachen]



Refinement

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- Parallel composition
- Conjunction of contracts.
- Deterministic Hull.
- Quotient ?



Scientific Highlight: Tool integration

Integration of Academic tools in Combest (last year)

Framework for facilitating tool integration in an industrial Context: the CESAR approach

Based on important experience gained in earlier projects

- Speeds, (Omega,...) --- common meta models & focus on integration of validation tools
- ATESST --- high level architecture language EAST-ADL (complementing AUTOSAR)



COMBES





مرتزية Highlight "Tool Integration: CESAR Approach"



Layered Approach: Core Meta Model and Tailoring to Industrial Needs (Application Domain or Company)



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SEVENTH FRAMEWOR

Plans for Y4

- Develop and extend the results from Y1&Y2 along the six research directions.
- Increase industrial impact & visibility of cluster results (competences and tools).
 - Adaptation and evaluation of validation methods and tools within ARTEMIS projects (CESAR, RECOMP, MBAT)
 - Design flows and tool chains. (well on its way)
- Increased focus on

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- Learning & Statistical Model Checking
- Multi-processor and Multi-core
- Sensor networks
- Cluster Meeting on Robustness at SIES, Symposium on Industrial Embedded Systems, Vesterås, 15-17 June, 2011

Plans for Y4

- FORMATS 2011, Conference on Formal Modeling and Analysis of Timed Systems, 21-23 September, Aalborg, Denmark.
- GASICS Workshop on Games for Design, Verification & Synthesis, September 10, 2011 – co-located with CONCUR 2011 (Nicolas Markey, Jean-Francois Raskin, Wolfgang Thomas, Kim G. Larsen)
- EUROSYS, 2011 (Christoph Kirsch, Salzburg)

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- Embedded World, March 1-3, 2011, Nürnberg, Germany
- Microsoft Research Software Summit, Paris, April 13-15, 2011 (Verification in the Embedded Application Industry)
- 5th Summerschool on Modelbased Development of RT Embedded Systems, 2011.
- Cluster PhD School on Quantitative Model Checking (Autumn, 2011; Copenhagen, Denmark).





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