

Report on the ARTIST2 Workshop on
**Foundations and Applications of
Component-based Design**

Embedded Systems Week 2006

Seoul Oct. 26, 2006

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ARTIST2, Y2 Review,

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Aims

- The workshop aims to gather together researchers from **computer science** and **electrical engineering** and will seek a synthesis between the the underlying paradigms and techniques. The focus is not only on fundamental results but also on their implementation in methods and tools and their concrete application in areas such as automotive, avionics, consumer electronics and automation.
- Discuss recent results on component-based design with emphasis on design frameworks for **real-time** systems encompassing **heterogeneous** composition and models of computation. Especially frameworks for handling **non-functional and resource constraints**, design under conflicting dependability criteria, trade-offs between average performance and predictability.

Aims

The workshop will address specific challenges such as:

- Foundations and Expressiveness of System Description Formalisms
 - What are the basic concepts for describing components?
 - What types of component interaction that are directly supported?
 - What kind of resources can be modeled and are they first class citizens of the formalism (energy, memory, time, ...)?
 - How do you think the following models, styles and design principles are interrelated and can be combined:
 - synchrony vs. asynchrony
 - event-triggered/data-triggered/time triggered
 - separation of concerns
- Component-based Design, Methods and Tools
 - What kind of analysis methods are or should be supported?
 - Compositional verification techniques
 - resource usage (such as energy, time, memory)
 - What kind of design methods are or should be supported?
 - property preserving structuring principles
 - refinement/implementation relations
 - What kind of tradeoffs between predictability and efficiency can be exploited?
 - What kind of implementation methodologies do the proposed formalisms support and what kind of tools are or could be made available?
 - Application Scenarios and Relevant Case Studies
 - What kind of applications have been or should be looked at that illustrate the above issues

Thursday, October 26th 2006,
within EMSOFT'06, at the Embedded Systems Week
in Seoul, Korea.

9:00	Opening
	Edward A. Lee, UC Berkeley (invited talk) Causality Interfaces for Actor Networks
9:50	Sankalita Saha, Dong-Ik. Ko, and Shuvra S. Bhattacharyya, University of Maryland A Meta-modeling Framework for Dynamic Reconfiguration of Dataflow Graphs
10:10	coffee break
10:40	Janos Sztiapanovits, Institute for Software Integrated Systems (ISIS) Towards the Compositional Specification of Semantics for Heterogeneous Domain-Specific Modeling Languages
11:00	Ingo Stierand and Werner Damm, University of Oldenburg Cyclic Timed Interfaces
11:20	Thomas A. Henzinger, EPFL and UC Berkeley, and Slobodan Matic, UC Berkeley An Interface Algebra for Real-Time Process Graphs
11:40	Hans-Gerhard Gross and Arjan van Gemund, Delft University of Technology Bridging the Gap between Non-formal and Formal Software Component Requirements Specifications for Embedded System Engineering
12:00	lunch
13:30	Joern Janneck, XILINX (invited talk) Building a System from Actors
14:20	Kai Richter and Marek Jersak, Symtavision GmbH, and Arne Hamann and Rolf Ernst, Technical University of Braunschweig Scheduling Analysis in the Automotive Design Flow
14:40	Hugo Andrade, John Breyer, Gerardo Garcia, and Jacob Kornerup, National Instruments Corporation A Unified Graphical Representation and Tool for Design and Integration of Components in Heterogeneous Distributed Real-Time Systems
15:00	coffee break
15:30	Ananda Basu, Marius Bozga and Joseph Sifakis, VERIMAG, and Gregor Gößler, INRIA Rhône-Alpes Component-based Construction of Real-time Systems in BIP
15:50	Abhik Roychoudhury and P.S. Thiagarajan, National University of Singapore A Verification Framework for Interacting Process Classes
16:10	Lothar Thiele, Ernesto Wandeler, and Nikolay Stoimenov, ETH Zurich Real-Time Interfaces
16:30	Cheng-Yao Chen, Jason Schlessman, and Wayne Wolf, Princeton University Towards Accessible Real-Time Distributed Embedded Vision Middleware
16:50	Discussion Session
18:00	closing

Foundations and Expressiveness of System Description Formalisms - Heterogeneity

Basic concepts for describing components - Gap between

- Software Engineering “object-oriented” view : component is a means for structuring data and functions
- Systems Engineering “actor-oriented” view: components have behavior, rich interfaces and interaction models e.g. Ptolemy

What types of component interaction that are directly supported?

- Blocking (RdV) or non blocking (broadcast)
- Atomic (synchronous languages), non atomic (Java)

Synchronous execution (Matlab/Simulink) vs Asynchronous execution (UML)

What kind of resources can be modeled?

- CPU time, memory, power

Composing Components and their properties

Instances of compositionality principles?

- Building correct systems from correct components
- Non interference of component features in the a system
- Abstraction vs. precision
- Scalability

Component interfaces with several domains: how to combine/make them consistent

Is there a close relation between application domain and component interaction?

Methodology

Separation of concerns

- Are concerns orthogonal in embedded systems?
- What are instances of this principle

What is a design space? Instances of design spaces

Semantic frameworks

- Denotational semantics
- Operational semantics

Expressiveness notion for the comparison of existing component frameworks – we need a notion taking into account structure