

Year 2 Review
Paris, November 8th and 9th, 2006

Achievements and Perspectives :

Real-Time Components

Cluster leader : Bengt Jonsson
Uppsala University
(Substituting for Albert Benveniste, INRIA)

Outline

- **Bengt Jonsson** Overview
- **Werner Damm**
The Workshop "Beyond Autosar"
 - From "Forums with specific industrial sectors"
- **Joseph Sifakis**
Foundations and applications of Component-Based Design
 - From "Seeding new research directions"
- **Francois Terrier**
Development of UML for RTES
- **Susanne Graf**
Platform for Component Modeling and Verification

Real Time Components: Topics

Component- and Model-based Development

- Interfaces and Composition
 - Functional: behavior
 - Extra-functional: QoS, Timing, resources, properties
- Composition of Heterogeneous systems
- Standardized modeling notations for Real-Time Embedded Systems
- Translations towards implementation
- Connecting supporting tool chains

Relevance for Industrial Sectors

Automotive Industry

- Sharing platforms between Distributed Software Components
- Standardized modeling formalisms
- Integration of 3rd party components
- Timing and Resource Analysis
- Movements: AUTOSAR, EAST-ADL

Avionics

- Integrated Modular Avionics: system integration at all levels

Industrial automation

- Model-Driven Development

.....

Partners

- Core Partners:
 - CEA (Francois Terrier)
 - EPFL Lausanne (Tom Henzinger)
 - France Telecom R&D (Pierre Combes)
 - INRIA (Albert Benveniste, Jean-Marc Jezequel)
 - OFFIS (W. Damm)
 - PARADES (Alberto Sangiovanni-Vincentelli)
 - Uppsala University (Bengt Jonsson)
 - VERIMAG (Paul Caspi, Joseph Sifakis)
 - TU Vienna (Hermann Kopetz)

Before RTC: ARTIST2 Year 1

Year 1:

Hard Real-Time

areas:

- Platform-based design
- Diagnosis
- Heterogeneous Systems

activities:

- On-Board Diagnosis
- Semantic Platform
- Merging Event/Time Triggered

Modeling and Components

areas:

- Composition of heterogeneous systems
- Components and Interfaces
- Modeling languages
- Transformation and Analysis

activities:

- Components Modeling and Composition
- Standardisation: UML for RTES
- Platform f. Components Modeling and Verification

Before RTC: ARTIST2 Year 1

Year 1:

Hard Real-Time

areas:

- Platform-based design
- Diagnosis
- heterogeneous systems

activities:

- On-Board Diagnosis
- Semantic Platform
- Merging ET + TT

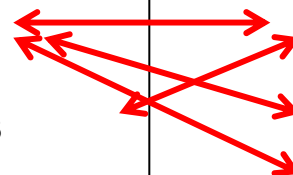
Modeling and Components

areas:

- Composition of heterogeneous systems
- QoS properties f. CBD
- Modeling languages
- Transformation and Analysis

activities:

- Composition and modeling
- Standardisation: UML for RTES
- Platform f. Components Modeling ...



Convergence of overlapping topics

Before RTC: ARTIST2 Year 1

Year 1:

Hard Real-Time

areas:

- Platform-based design
- Diagnosis
- heterogeneous systems

activities:

- On-Board Diagnosis
- Semantic Platform
- Merging ET + TT

Modeling and Components

areas:

- Composition of heterogeneous systems
- QoS properties f. CBD
- Modeling languages
- Transformation and Analysis

activities:

- Composition and modeling
- Standardisation: UML for RTES
- Platform f. Components Modeling and

Colocation of meetings

Before RTC: ARTIST2 Year 1

Year 1:

Hard Real-Time

areas:

- Platform-based design
- Diagnosis
- heterogeneous systems

activities:

- On-Board Diagnosis
- Semantic Platform
- Merging ET + TT

IP Speeds

Modeling and Components

areas:

- Composition of heterogeneous systems
- QoS properties f. CBD
- Modeling languages
- Transformation and Analysis

activities:

- Composition and modeling
- Standardisation: UML for RTES
- Platform f. Components Modeling and

Joint participation in Integrated Projects

RTC as a new cluster

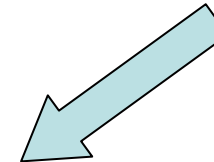
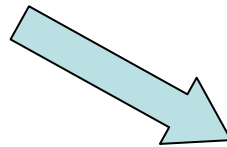
Year 1:

Hard Real-Time

- On-Board Diagnosis
- Semantic Platform
- Merging ET + TT

Modeling and Components

- Composition and modeling
- Standardisation: UML for RTES
- Platform for Components..

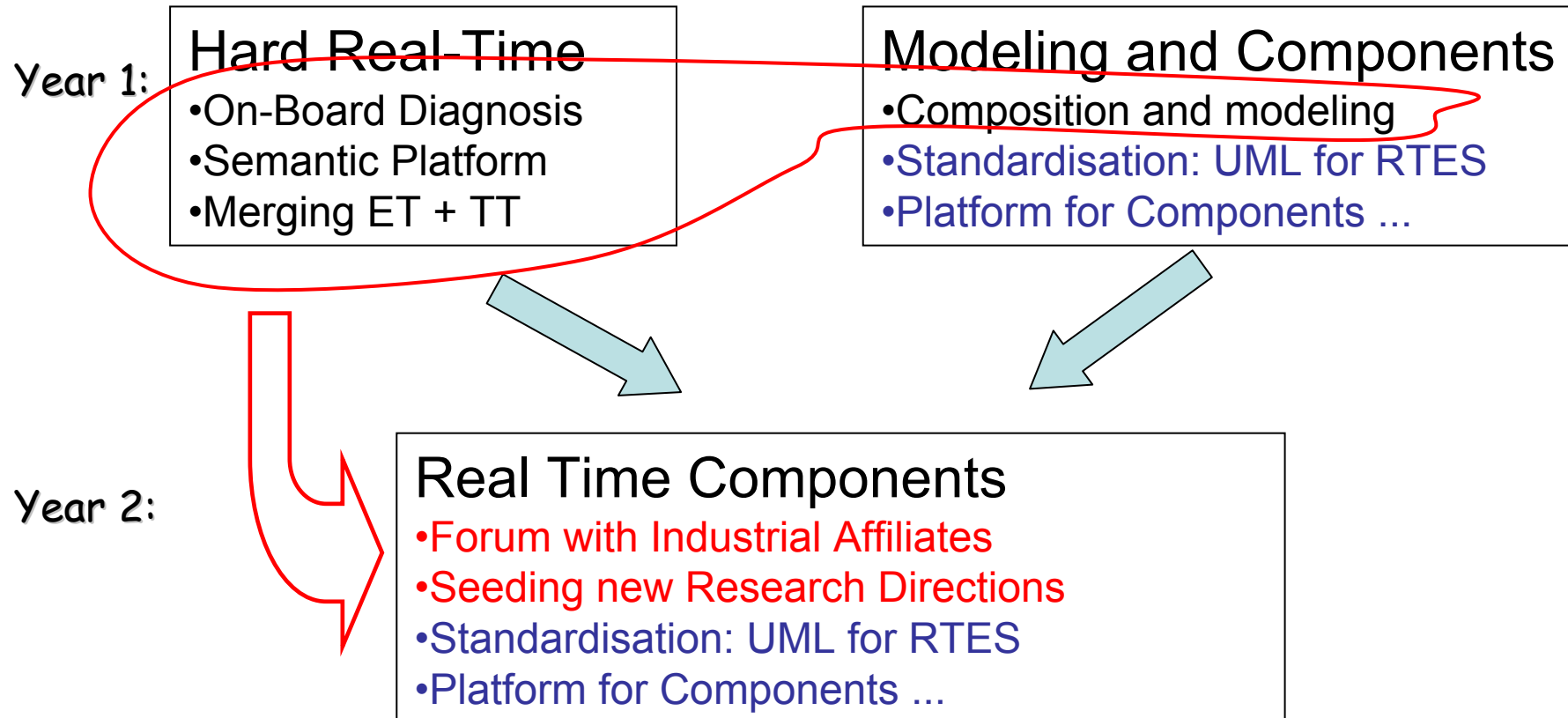


Year 2:

Real Time Components

- Forum with Industrial Affiliates
- Seeding new Research Directions
- Standardisation: UML for RTES
- Platform for Components...

RTC as a new cluster



Scientific and Industrial Fora

- Carefully prepared with well stated objectives
- Inviting high-quality speakers, offering complementary views on the focal topic
- Presentations can be long and tutorial
- Detailed minutes, seen as a scientific tool, not just as proof of existence of the meeting
- Having real impact on ongoing research

Component Interfaces and Composition for non-functional aspects

- Research trends
 - Real-Time Scheduling community
 - Formal verification community (e.g., timed automata)
 - OO Software technology community (Contracts)
 - Different modeling formalisms (MetaH, extensions of UML)
- ARTIST2 Work and Integration
 - Develop a coherent view on handling nonfunctional properties*
 - “Rich Component Model” combining different viewpoints (INRIA, OFFIS, PARADES, VERIMAG)
 - New techniques for specifying timing properties of interfaces (EPFL, ETHZ, Timisoara, Uppsala)
 - Contracts for Real-Time Embedded systems (Cantabria, Thales)
 - Timed “coordination languages” (EPFL, PARADES)

Composition of Heterogeneous systems

- Research trends
 - Design tools (Ptolemy, Metropolis) (PARADES)
 - BIP (VERIMAG)
 - Theories for heterogeneous composition (Tag systems, ...)
- ARTIST2 Work and Integration
 - Develop a foundation for building heterogeneous systems*
 - Further development and application of Tag systems (INRIA, PARADES)
 - BIP: Implementation and applications (VERIMAG, FTRD)
 - Metropolis -> Metropolis II (PARADES)
 - Architecture for Systems on Chip (Vienna)

Standardized modeling notations f. RTES

- Existing work
 - UML profiles (SPT),
 - Automotive (EAST-ADL)
 - SysML
- ARTIST2 Work and Integration

Incorporate coherent handling of RTES aspects into standards

- UML for MARTES (approaching completion): subsuming UML/SPT, and aiming to be consistent w. other standards (CEA, Cantabria, INRIA)
- Executable UML foundation (CEA, INRIA, Thales)
- UML/SysML compliant component framework

Integration of tool chains

- Existing work
 - Many verification and analysis tools (Kronos, UPPAAL,MAST, ..)
 - Modeling tools
 - Transformation technology
- ARTIST2 Work and Integration

Integrate efforts on modeling, development, and analysis tools

 - Initial versions of tool chains in “Platform for component modeling and verification”.
 - Using BIP as an intermediate semantic platform
 - Kermeta – IF – Giotto (EPFL,INRIA)

Techniques for Software Implementation

- ARTIST2 Work and Integration
 - Asynchronous implementation of synchronous designs (INRIA, PARADES, VERIMAG)

Concrete Milestones

- Forums with specific industrial sectors: meeting on embedded electronics in the automotive industry..
- Seeding new research directions: meeting on “Models of Computation and Communication (MoCC)
- Platform for Component Modelling and Verification: initial versions of tool integrations
- UML for Real-Time Embedded Systems: initial submission to the OMG standard for the UML profile for Modeling and Analysis of Real-Time and Embedded Systems (MARTE).

Concrete Milestones

- Forums with specific industrial sectors: meeting on embedded electronics in the automotive industry.. *achieved*
- Seeding new research directions: meeting on “Models of Computation and Communication (MoCC) *planned for Nov. 16-17, Zurich.*
- Platform for Component Modelling and Verification: initial versions of tool integrations *achieved*
- UML for Real-Time Embedded Systems: initial submission to the OMG standard for the UML profile for Modeling and Analysis of Real-Time and Embedded Systems (MARTE). *achieved*

Events

Schools:

- ARTIST2 Summer School, (Sweden, Sept 05)
- Model Driven Development f. RTES (Brest, Sept 06)

Workshops

- Distributed Embedded Systems (Leiden, Nov 05)
 - By execution platforms cluster: comparing techniques for timing and performance analysis
- Beyond Autosar (Innsbruck, March 06)
- Foundations and applications of Component-Based Design: (EMSOFT workshop, Seoul, Oct. 06)

Conferences Workshops, ...

- MARTES workshop (at MoDELS/UML, Jamaica, Oct. 05)
- MoDeVa workshop (Model Design and Validation) (at MoDELS/UML, Jamaica, Oct. 05)
- Safe-UML: Modellierung und Safty-Normen (workshop at Safetronic, Munich, 2006)
- Synchronous Languages Workshop (2006)
- Workshop on "topics in computation and control" (at HCCS, Santa Barbara, 2006)
- Formal Methods for Components and Objects (FMCO, Nov. 2005, Leiden)

Mobility and Interaction

Cluster partners are involved in numerous

- Conferences workshops
- Meetings of joint projects

Collaborative work in joint projects (IP-SPEEDS, SAVE, OpenEmBeDD, Persiforme, ...)

Some mutual visits

- J. Medina/ Cantabria -> CEA,
- H. Raffelt /Dortmund -> Uppsala

Assessment at Y0+2

- Merging of HRT and Components clusters was right
 - Exploiting common interests between merging clusters.
 - Significant overlap and contacts, e.g., in Joint Projects
 - Seminar activities open to all => leading to new contacts with other clusters, (e.g., execution platforms)
- Less room for “cluster meetings”
 - E.g., “UML f. RTES” activity was not heavily exposed to cluster => reporting/feedback meeting in 2007
- Seminar series problematic as “activities”
 - Not a natural unit for deliverable
 - **Proposal:** merge seminar series + work on associated topics into single activity

RTC in next 18 months

- **Component-based Design of Heterogeneous Systems**
 - Interfaces and composition
 - Heterogeneity
 - Interaction with industrial sectors
- **Platform for Component Modelling and Verification:**
- **UML for Real-Time Embedded Systems:**

Milestones for next 18 months

- **Component-based Design of Heterogeneous Systems**
 - Meeting on integrated Modular Avionics
 - Meeting on mobile distributed embedded systems
- **Platform for Component Modelling and Verification:**
 - Extend the existing tool chains to connect analysis and validation tools by means of mappings to a few semantic frameworks,
- **UML for Real-Time Embedded Systems:**
 - Finalize MARTE submission to the OMG, organize dissemination and feedback workshop

Future Events

Schools:

- MOTIVES ARTIST2 Winter School, (Trento, Feb. 19-23)

Workshops

- "Models of Computation and Communication (MoCC), Nov. 16-17, Zurich.
- Basic Concepts in Mobile Embedded Systems, Dec. 4-5, Vienna
- Inter-Platform Meetings (mid-April and July)
- Dissemination of UML for MARTE (April/May 2007)
- Integrated Modular Avionics (summer 2007)
- Predictability of Hardware in Automotive/Avionics and Semiconductor Industry
- Building Automation and Building Security Using embedded Systems Technology (Oct. 07)
- Foundations and Applications of Component-based Design (Oct. 07)



ARTIST2 Workshop on Basic Concepts in Mobile Embedded Systems

- Extending DSoS Conceptual Model (Gaudel et al. 2002) towards mobile systems
 - Wireless ad-hoc Sensor networks
 - Mobile Computer Networks
- Key Issues:
 - Naming, Addressing, Routing
 - Security/Trust
 - Real-Time Aspects
 - Location Awareness
 - Sensor Networks
 - Configuration



Rest of Cluster Presentation

- **Bengt Jonsson** Overview
- **Werner Damm**
The Workshop "Beyond Autosar"
 - From "Forums with specific industrial sectors"
- **Joseph Sifakis**
Foundations and applications of Component-Based Design
 - From "Seeding new research directions"
- **Francois Terrier**
Development of UML for RTES
- **Susanne Graf**
Platform for Component Modeling and Verification