Information Society
Technologies

ARTIST2 Workshop at DATE'06

W4: "Design Issues in Distributed, Communication-Centric Systems"

Organisers:

Bruno Bouyssounouse   *(VERIMAG Laboratory)*
Rolf Ernst   *(TU Braunschweig)*
Lothar Thiele   *(ETH Zurich)*

AGENDA - morning

8:30   **Welcome and Introduction**

8:45   **ARTIST2 NoE on Embedded Systems Software Design: Structuring the Research Area in Europe**
Bruno Bouyssounouse, VERIMAG Laboratory, FR

9:00   **Distributed Safety-Critical Applications in Automotive: New Developments in CAN**
Luis Almeida, University of Aveiro, PT

9:35   **Current Trends and Work Directions in Sensor Networks**
Tarek Abdelzaher, University of Illinois at Urbana Champaign, USA

10:10   BREAK

10:30   **Communication Issues on MPSoC Platforms: Performance, Power and Predictability**
Luca Benini, DEIS – Bologna U, IT

11:05   **Model-based Design and Network Centric Systems**
Marcello Coppola, ST Microelectronics, FR

11:40   **Model-based Design and Network Centric Systems**
Janos Sztipanovits, Vanderbilt University, USA

12:15   LUNCH

AGENDA - afternoon

13:30 **Modelling Networked Embedded Systems: From MPSoC to Sensor Networks**
Jan Madsen, TU Denmark, DK

14:05 **Optimisation of Robust Communication-Centric Systems**
Rolf Ernst, TU Braunschweig, DE

14:40 BREAK

14:55 **Cooperating Objects in Wireless Sensor Networks**
Paul Havinga, University of Twente, NL

15:30 **Interface-based Design and Performance Analysis of Distributed Embedded Systems**
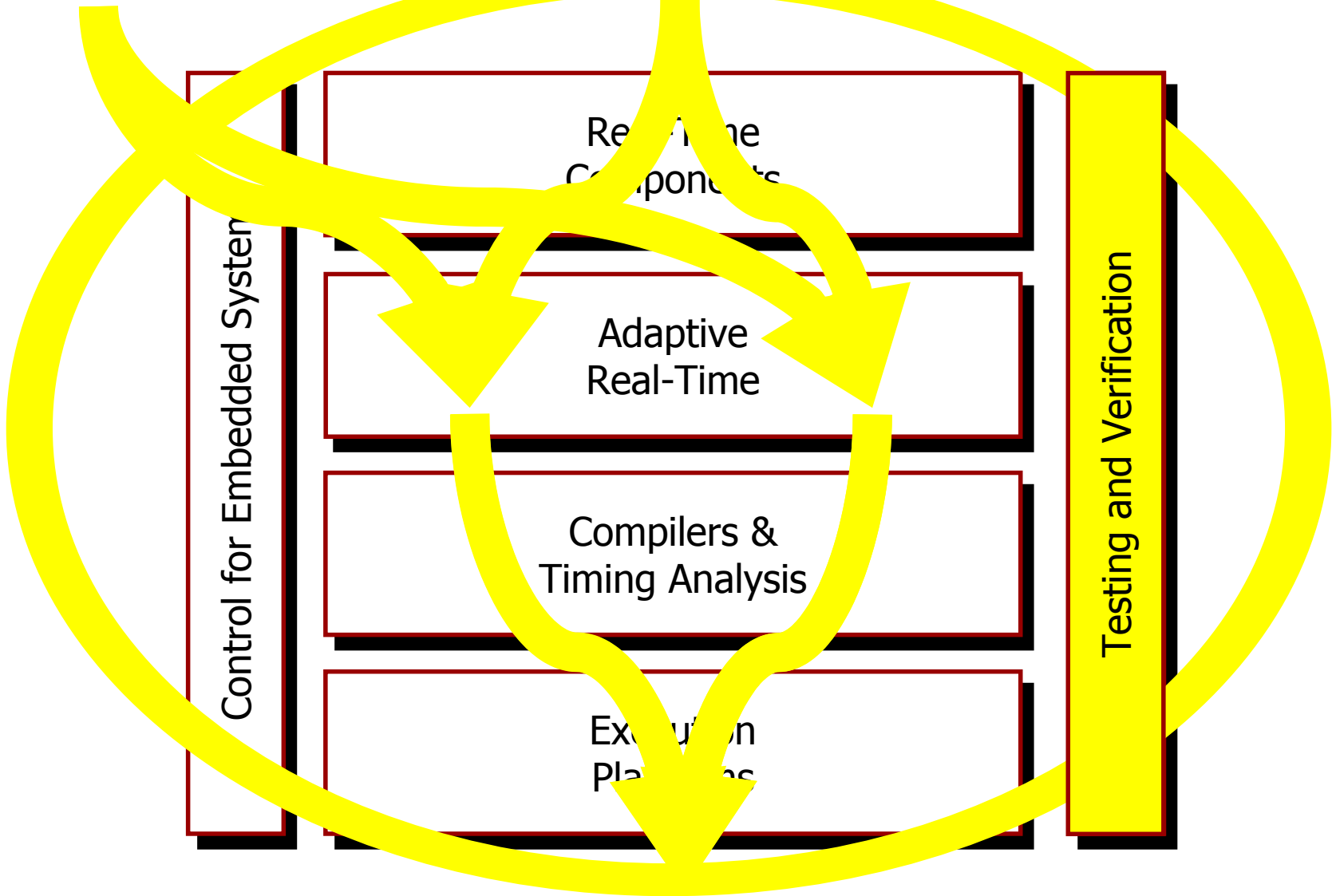Ernesto Wandeler, ETH Zurich, CH

16:10 CLOSE

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W4: "Design Issues in Distributed,
       Communication-Centric Systems"

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ARTIST2 NoE
on Embedded Systems Software Design:

Structuring the Research Area in Europe

Bruno Bouyssounouse: Artist2 Technical Coordinator
VERIMAG Laboratory

Selected Topics : ARTIST2 Clusters

Control for Embedded Systems

Real-Time Components

Adaptive Real-Time

Compilers & Timing Analysis

Execution Platforms

Testing and Verification

Core Participants (1/2)

	Short Name	Full Name and Country	Key researchers
1	CDC	Caisse des Dépots et Consignations (France)	**None**
2	UJF/ Verimag	University Joseph Fourrier / Verimag (France)	Paul Caspi, Susanne Graf, Nicolas Halbwachs, Yassine Lakhnech, Oded Maler, Joseph Sifakis
3	Aachen	RWTH Aachen (Germany)	Rainer Leupers
4	Aalborg	BRICS – Aalborg University (Denmark)	Kim Larsen, Anders Ravn
5	AbsInt	AbsInt Angewandte Informatik GmbH (Germany)	Christian Ferdinand
6	Aveiro	University of Aveiro (Portugal)	Luis Almeida
7	Cantabria	Universidad de Cantabria (Spain)	Michael Gonzalez Harbour
8	CEA	Commissariat à l'Énergie Atomique – Laboratoire LIST (France)	François Terrier
9	CFV	Centre Fédéré en Vérification, Université de Liège (Belgium)	Pierre Wolper
10	Czech TU	Czech Technical University (Czech Republic)	Vladimir Kucera
11	Dortmund	Dortmund University (Germany)	Peter Marwedel
12	DTU	Technical University of Denmark (Denmark)	Jan Madsen
13	ETHZ	Swiss Federal Institute of Technology – Zurich (Switzerland)	Lothar Thiele, Manfred Morari
14	FTR&D	France Telecom R&D	Pierre Combes, Kathleen Milsted
15	INRIA	Institut National de Recherche en Informatique et Automatique (France)	Albert Benveniste, Benoit Caillaud, Alain Girault, Thierry Jéron, Jean-Marc Jézéquel, Paul Le Guernic, Eric Rutten, Yves Sorel, Robert de Simone
16	KTH	Royal Institute of Technology (Sweden)	Martin Törngren
17	Linköping	Linköping University (Sweden)	Petru Eles
18	LSV / CNRS	Centre National de la Recherche Scientifique / Laboratoire LSV (France)	Michel Bidoit, Hubert Comon, Philippe Schnoebelen

Core Participants (2/2)

Core Partner	Short Name	Full Name and Country	Key scientists
19	Lund	Lund University (Sweden)	Karl-Erik Årzén
20	Mälardalen	University of Mälardalen (Sweden)	Björn Lisper
21	OFFIS	Kuratorium OFFIS e. V. (Germany)	Werner Damm, Bernhard Josko
22	PARADES	PARADES EEIG (Italy)	Alberto Sangiovanni Vincentelli
24	UP Madrid	Universidad Politecnica de Madrid (Spain)	Juan de la Puente
25	Saarland	Saarland University	Reinhard Wilhelm
26	STM	ST Microelectronics – Central R&D (France)	Christian Bertin
27	Eindhoven	Technical University of Eindhoven (Netherlands)	Martin Rem
28	TU Vienna	Technical University of Vienna (Austria)	Hermann Kopetz, Peter Puschner, Philipp Petti
29	TUBS	Technical University Braunschweig (Germany)	Rolf Ernst
30	Twente	University of Twente (Netherlands)	Ed Brinksma
31	UoB	University of Bologna (Italy)	Luca Benini
32	Uppsala	Uppsala University (Sweden)	Bengt Jonsson
33	UPVLC	Universidad Polytecnica de Valencia (Spain)	Alfons Crespi
34	York	University of York (UK)	Guillem Bernat, Alan Burns, Iain Bate, Andy Wellings
35	Porto	Polytechnic of Porto	Eduardo Tovar
36	EPFL	Ecole Polytechnique Fédérale de Lausanne	Tom Henzinger
37	Pisa	Scuola Superiore Sant'Anna (Pisa)	Giorgio Buttazzo
38	Ace	Ace	Joseph Van Vlijmen
39	Kaiserslautern	University of Kaiserslautern	Gerhard Fohler

ARTIST2 NoE : Team Leaders

Real Time Components

Hard Real Time
Albert Benveniste – INRIA
Alberto Sangiovanni – PARADES
Paul Caspi – Verimag
Hermann Kopetz – TU Vienna
Werner Damm – OFFIS

Modeling and Components
Bengt Jonsson – Uupsala
François Terrier – CEA/LIST
Jean-Marc Jezequel – INRIA
Susanne Graf – Verimag
Tom Henzinger - EPFL

Adaptive Real-time
Giorgio Buttazzo – Pisa
Alan Burns – University of York
Michael Gonzalez - Cantabria
Luis Almeida – Aveiro
Gerhard Fohler – Kaiserslautern
Juan de la Puente – Polytechnic de Madrid

Testing & Verification
Kim Larsen - Aalborg/ CISS
Ed Brinksma – Twente/Eindhoven
Pierre Wolper – Centre Fédéré de Verification
Michel Bidoit - LSV
Thierry Jeron - INRIA

Control for Embedded
Karl-Erik Arzen – Lund
Martin Torngren – KTH
Alfons Crespo – UP Valencia
Vladimir Kucera - Czech TU

Compilers and Timing Analysis
Reinhard Wilhelm - Saarland
Rainer Leupers - Aachen
Christian Bertin – ST Microelectronics
Christian Ferdinand – AbsInt
Peter Marwedel - Dortmund
Puschner, Krall – TU Vienna
Bjorn Lisper –Maalardalen
Guillem Bernat – University of York
Joseph van Vlijmen – Ace
Niklaus Holsti - Tidorum

Execution Platforms
Lothar Thiele – ETH Zurich
Jan Madsen –DTU (TU Denmark)
Luca Benini – UoB
Petru Eles – ESLAB/Liu
Rolf Ernst – UBR
Josef Hooman - Eindhoven

Artist2 Structure
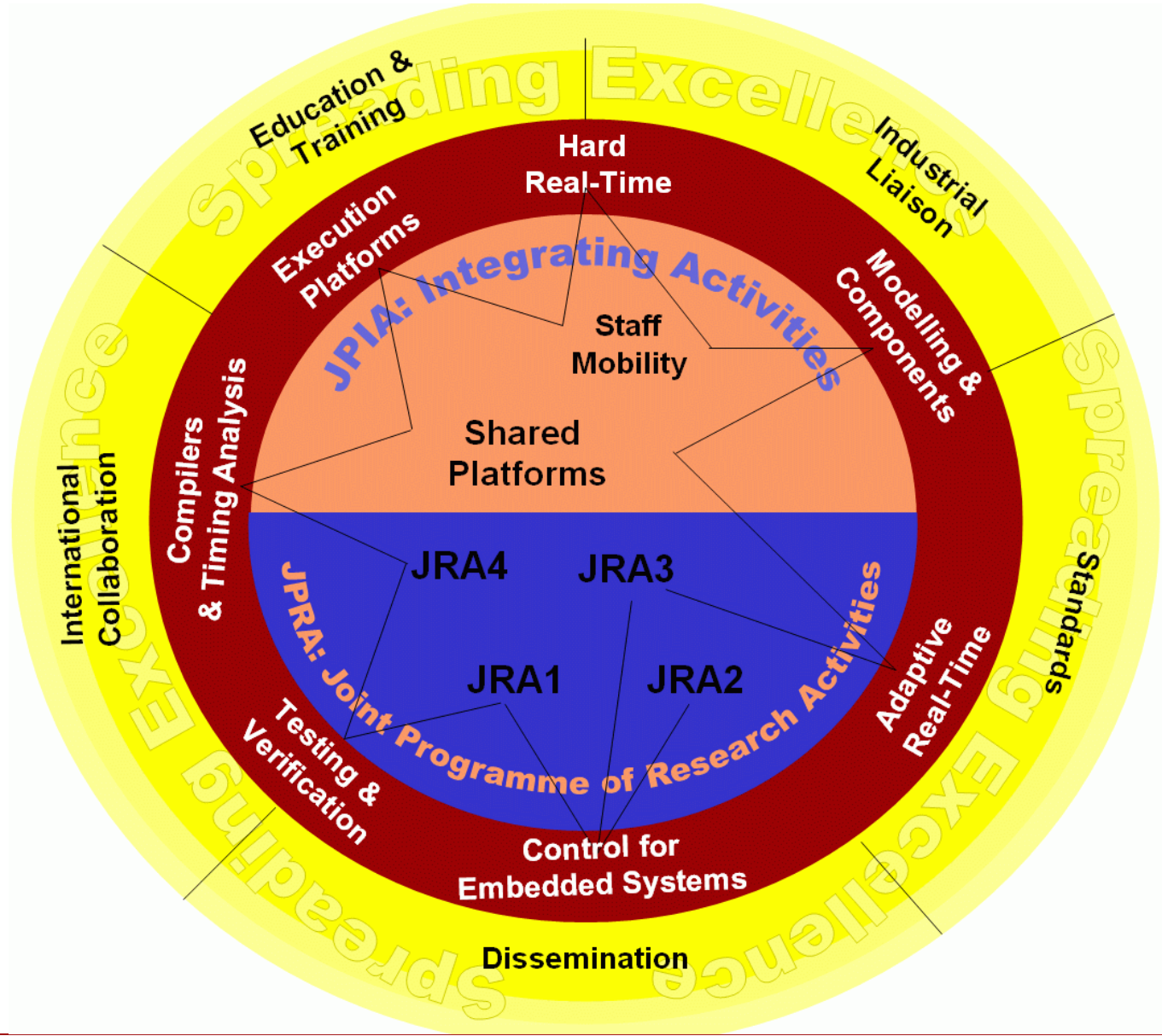
Affiliated Partners

Affiliated Industrial Partners

ABB, Airbus, Bosch, DaimlerChrysler, EADS, EDF, Ericsson Mobile Platforms, Hispano-Suiza, Honeywell Prague, Infineon, Israeli Aircraft Industries, Nokia Mobile Phones, Philips Research, Siemens Mobile Phones, STMicroelectronics, SymTA Vision, Telelogic, Thalès Research and Technology, Volkswagen, Volvo, Volvo Car Corporation

Affiliated SME Partners

ACE, ARTiSAN Software, dSPACE, Enea Embedded Technology, Esterel Technologies, Evidence, IAR Systems, Tidorum, TNI-ValioSys, TTTech

Affiliated Academic Partners

Miroslaw Malek (Humboldt-University of Berlin), Francky Catthoor (IMEC), Isabelle Puaut (IRISA), Geert Deconinck (K.U. Leuven), Stefan van Baelen (K.U. Leuven), Ahmed Bouajjani (LIAFA-Paris), Ivica Crnkovic (Mälardalen **), Jan Tretmans (Nijmegen), Laurent Pautet (Paris Telecom), Luciano Lavagno (Politecnico di Torino), Giuseppe Lipari (Scuola Superiore S. Anna), Marius Minea(Timisoara), Andreas Krall (TU Vienna **), Carlos Delgado Kloos (U. Carlos III of Madrid), Marisol García-Valls (U. Carlos III of Madrid), Willem-Paul de Roever (U. Kiel), Julio Medina (Univ. of Cantabria **), Lucia Lo Bello (Univ. of Catania), Pau Marti (Universitat Politècnica de Catalunya), Lubos Brim (University Brno), Bernhard Steffen (University Dortmund **), Andrea Bondavalli (University of Florence)

** different team from the Artist2 partner

Industrial Liaison

Most of these Affiliated Industrial Partners have participated in some way in the Artist2 technical meetings and the overall effort. There is strong, high-level industry participation through the various Spreading Excellence events organised by Artist2.

- Strong involvement in the European Technology Platform ARTEMIS, which could have a significant and long-term impact.

- Strong impact on European R&D in embedded systems, through participation in the three main Integrated Projects: DECOS, ASSERT, and RUNES. This impact is visible via the achievements in these Integrated Projects, related to time-triggered architectures and modelling and validation at the architectural level.

- The recently accepted SPEEDS Integrated Project will also have a very positive impact on progress in the state of the art, in component-based embedded systems engineering.

International Collaboration

- July 7 **Component-based Engineering for Embedded Systems**
  July 8 **Transatlantic Research Agenda:**
         Future Challenges in Embedded Systems Design
  Participants: Airbus, Boeing, UC Berkeley, Carnegie Mellon, Polytechnic of Catalonia, CEA-DRT, CEA-List, CNRS, EADS, Ericsson, Embedded Systems Institute, European Commission, European Space Agency, Ford Research, Honeywell Labs, INRIA, ISI/Vanderbilt, I-Source Gestion, Israel Aircraft Industries, Naval Research Lab, NSF, OFFIS, Philips Research, Porto Advanced Engineering Institute, Princeton, Rolls Royce UTC, Raytheon, Rutgers, Saarland University, Stanford University, Thalès, Verimag, TU Vienna, Volvo Technology

- **Common project proposals**
  eg: discussions with:

  - ➢ Tata Research Development & Design Centre (TRDDC)

  - ➢ Indian Institute of Science, Bangalore, India

  - ➢ National University of Singapore

  - ➢ and others

International Collaboration

- **International Collaboration Affiliated Partners**

  ➢ UC Berkeley – Ed Lee, Shankar Sastry

  ➢ University of Michigan - Kang G Shin

  ➢ University of Notre Dame – Sharon Hu

  ➢ University of Illinois at Urbana–Champaign – Lui Sha

  ➢ Stanford University – Giovanni De Micheli

  ➢ Tata Research and Development – Mathai Joseph

  ➢ University of Singapore - P.S. Thiagarajan

  ➢ University of Virginia – John Stankovic, Tarek Abdelzaher

  ➢ Columbia University – Stephen Edwards

Spreading Excellence Activities

Our actions for Spreading Excellence are at 2 levels:

- Targeted towards affiliated partners
  The NoE has 14 large industrial affiliated partners, 12 SMEs, 23 academic, and 14 international affiliated partners. Almost all of these partners have participated in one or more of our technical events over the course of the Year 1. We have also had a very large number of participants from the wider research and industrial communities, who are not listed officially

- Targeted towards the scientific and technical community at large:

  ➢ Organized & Sponsored Events   ➢ Education

  ➢ Standards   ➢ Dissemination

  ➢ International Collaboration   ➢ Industrial Liaison

Events Organized
Year1

Workshops and Seminars

- **Workshops at DATE05**   *also DATE04, Date06*
  "Embedded Systems Design: An Emerging Unified Discipline"
  Organizers: Albert Benveniste, INRIA, Bruno Bouyssounouse, VERIMAG, Giorgio Buttazzo, Pavia, Peter Marwedel, Dortmund, Reinhard Wilhelm, Saarland U, DE

- **ARTIST Seminar on Adaptive Real-Time Systems**
  with emphasis on Real-Time Control Systems
  Organized by TU Catalonia, with Pau Marti (Catalonia), Gerhard Fohler (Malardalen), , Technical University of Catalonia (UPC), Barcelona, Spain, June 20-23, 2005

- **First S.Ha.R.K. Workshop**   on the Shark RT-Kernel
  Organised by Scuola Superiore Sant'Anna (Pisa)
  February 28 — March 04, 2005

- **WESE 04** - Workshop on Embedded Systems Education at EmSoft 05
  Organized by Paul Caspi (Verimag), Jeff Jackson

Events Organized
Year1

Summer Schools and Courses

- **ARTIST2 Summer School on Component & Modelling, Testing & Verification, and Statistical Analysis of Embedded Systems**
  Sept 29 - Oct 2, 2005
  Bengt Jonsson (Uppsala), Ileana Ober (Verimag), Sebastien Gérard (CEA), Alberto Ferrari (PARADES), PA Muller, Joseph Sifakis (Verimag), Susanne Graf (Verimag), Jean-Francois Raskin, Thierry Jéron (INRIA), Reinhard Wilhelm, Brian Nielsen (Aalborg), Stavros Tripakis (Verimag), Joost-Pieter Katoen (Twente)

- **Artist2 Graduate Course on Embedded Control Systems**
  Pedro Albertos (Valencia)
  with Lund University (Control Department), Universidad Politécnica de Valencia(Computer Engineering and Systems Engineering Departments), Royal Institute of Technology (KTH) Stockholm (Control Dept, Mechatronics Dept, Optimization & Systems Dept), Czech Technical University Prague (Control Dept), Universidad Politécnica de Madrid (Real-Time Systems Group)

Upcoming Events

BEYOND AUTOSAR

Innsbruck, March 23-24th 2006
http://www.artist-embedded.org/FP6/ARTIST2Events/Events/Innsbruck06/

System modelling and design activities are currently providing key technologies for advancement to the European automotive industry. Today, software functions are generally implemented on separate ECUs, with little reuseability or hardware independence. Existing reusable subsystems are integrated late in the design process. The industry is now moving towards new approaches that would allow the integration of middleware and software services acting across several ECUs, allowing deployment of applications independently from the actual computing architecture.

The AUTOSAR consortium has made progress towards improving component and subsystem integration. Remaining open issues include capturing and modelling end-to-end characteristics, both functional and extra-functional (e.g., related to timing) and defining a rich component model supporting such end-to-end analyses.

This workshop will gather key industry players from AUTOSAR and key scientists to discuss fundamental issues for embedded automotive systems design. It will consist of industrial presentations and in-depth technical panel discussions.

Upcoming Events

At EmSoft'06:

Foundations and Applications of Component-based Design

Seoul, October 22-25 2006

http://www.artist-embedded.org/FP6/ARTIST2Events/Events/Components_EmSoft/

The objective is to 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.

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.

Upcoming Events

Graduate Course on Embedded Control Systems

Prague, April 3rd-7th 2006
http://www.artist-embedded.org/FP6/ARTIST2Events/Events/EmbeddedControl/

Currently, most automated control applications are implemented as embedded components. This strong interaction between Control and Embedded systems forces the need of a new generation of researchers that can combine both fields. The course will provide a basic understanding of :

- Basic concepts on Embedded Control systems from the Control point of view

- Real-Time concepts

- Interaction between the control design and control implementation

- Real-Time implementation of control algorithms in a multitasking environment

- Analysis of the effects of the execution platform on control performance

- Control-based approaches for modeling, analysis, and design of embedded control and communications systems

- Overview of different off-line scheduling problems found in embedded systems

- Embedded systems development

Upcoming Events

Spring School in China
on Models, Methods and Tools for Embedded Systems

Xi'an, China, April 3rd-15th, 2006
  http://www.artist-embedded.org/FP6/ARTIST2Events/Events/ChinaSchool/

We aim to provide a forum for young professors, lecturers, researchers, postgraduates (advanced master and PhD students) working in the fields of modelling, design, implementation, validation and performance analysis of embedded systems as well as engineers from industry with practical background with the development of embedded systems.

The school is mainly intended for top students, researchers, and engineers in China.

Upcoming Events

Summer Course & Lab on
Real-Time and Control for Embedded Systems

Pisa, July 10-14th 2006

http://www.artist-embedded.org/FP6/ARTIST2Events/Events/Innsbruck06/

Real-Time distributed embedded systems play a crucial role in our society including several application domains such as automotive, telecommunications, robotics, and multimedia systems. These systems generally work under precise timing constraints, to achieve the required level of performance and predictability. Consequently, embedded systems design requires expertise in several disciplines, including control theory, networking, real-time computing, and operating systems. Unfortunately, such expertise is rarely found in European curricula.

Thus, the proposed course has two main goals:

• Provide the most important concepts and methodologies used in developing real-time embedded systems, including fundamentals of real-time scheduling, operating systems, distributed systems, and control theory. In particular, the course will teach how these disciplines can be integrated to achieve predictable system behavior.

• The second and more challenging goal of this course is to show how to apply theory into practice, teaching students how to develop simple real-time distributed control applications using a real-time operating system (Shark) specifically developed for education..

Further Conferences/Workshops Planned

- EmSoft within Embedded Systems Week

- ARTIST2 Workshop: System Modelling for the Automotive Industry on AUTOSAR (Innsbruck, Austria - March 24th, 2006).

- MARTES in October 2006 on Modelling and Analysis of Real Time Embedded Systems

- Fundamental Challenges raised by Integrated Modular Avionics, in fall 2006 or winter 2007.

- Fundamental Challenges related to Real-Time Components raised by Consumer Electronics and Telecommunications, in fall 2006 or winter 2007.

- Conceptual Model for Distributed Embedded systems, and a taxonomy of MoCCs (Models of computation and Communication), in spring or fall 2006.

- Workshop on system modelling for communication centric systems, in the summer of 2006.

- Workshop on distributed embedded systems in Leiden (21.11.2005 – 24.11.2005).

- Workshop on Dynamics and Models of Computer Software Systems (June-August 2006)

- Control over Networks (June 2006)

- Adaptive RT, HRT and Control Workshop 1 (late Spring 2006).

- Adaptive RT, HRT and Control Workshop 2 (late Fall 2006).

- Workshop on the link between formal and computational models (July 9-16, 2006, Venice, Italy)