

ARTIST 2

Network of Excellence

IST-004527 ARTIST2:
Embedded Systems Design

Spreading Excellence

Artist2 Technical Coordinator:

Bruno Bouyssounouse (Verimag)

with inputs from all NoE participants

The visibility of the ARTIST2 research effort in embedded systems design is worldwide. This is progressively creating a European embedded systems design community, and spreading the “artist culture” in all major research institutions.

To ensure that the next generation of researchers will continue in this direction we, as a consortium, devote a great deal of effort to Spreading Excellence, in both academic and industrial circles. Furthermore, through our links with both core and affiliated partners, we are actively setting up permanent links between industry and public research, leveraging on existing partner collaborations with major industrial players in the area.

This document shows that ARTIST2 has a strategic impact on the integration of multiple academic research communities, which are necessary to establish the new area of embedded systems design.

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1. Vision and Strategy for Spreading Excellence - Executive Summary

1.1 Overall Vision and Strategy

Our actions for Spreading Excellence are at 2 levels:

- *Targeted towards affiliated partners*

Affiliated partners are not core members in the consortium, but receive support for travelling to Artist2 meetings, and actively contribute to the implementation of the Joint Programme of Activities (JPA). These affiliated partners include industrial, SME, academic, and international affiliates.

- *Targeted towards the scientific and technical community in the large*

This is achieved mainly bottom-up through the organisation of scientific events, publications, distribution of tools and components, industrial partnerships (not funded by Artist2), education; and through the Artist2 web pages.

Regarding Scientific events, we distinguish between conferences and workshops, schools, and high-level events mainly for International Collaboration.

High Level Events for International Collaboration

High-level Events are intended to gather together the very best world-leading experts from academia and industry, to discuss progress on the state of the art, relevant work directions.

Three Artist2 members are on the steering board for the ARTEMIS European Technology Platform. In this capacity, they participate in working groups for defining the overall European long term strategy in the area.

Publications

The Artist2 community has been very active in publishing in scientific journals and conferences, as attested by the list of publications provided in this document. Clearly, this represents a huge amount of work. Publication of research is a bottom-up process, which may seem chaotic – but this is intrinsic to research.

Tools and Components

The Artist2 community plays a leading role in the distribution of software tools and components, on verification/validation tools. Some tools are distributed free of charge, such as UPAAL, IF. Others are commercialised, such as AbsInt, SymTA/S. For many other tools used in the platforms, and shared between the Artist partners, a common dissemination policy has not yet been defined.

Industrial Liaison

Artist2 has a wide array of affiliated industrial and SME partners (see the Periodic Activity Report). Most of these 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. Our active involvement in the European Technology Platform ARTEMIS also could have a significant and long-term impact.

In addition, each Artist2 partner has an outstanding track record for interaction with industry. Globally, the Artist2 consortium has a very 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.

We believe that the strong involvement of four main Artist2 partners in the SPEEDS Integrated Project has a very positive impact on progress in the state of the art, in component-based embedded systems engineering.

1.2 Affiliated partners

Affiliated partners are not core members in the consortium, but receive support for travelling to Artist2 meetings, and actively contribute to the implementation of the Joint Programme of Activities (JPA). These affiliated partners include industrial, SME, academic, and international affiliates.

At the end of Year 2, the NoE has 30 large industrial affiliated partners, 11 SMEs, 34 academic, and 16 international affiliated partners. All of these partners have participated in one or more of our technical events and work over the course of the Years 1&2. We have also had a very large number of participants from the wider research and industrial communities, who are not listed officially.

We also note a very large increase in the number of affiliated industrial partners, going from 14 at the end of Year1 to 30 presently.

As planned, the Artist2 consortium will continue to increase its affiliated partners. The procedure for joining Artist2 as affiliated partners has been clarified and is described here: <http://www.artist-embedded.org/artist/Becoming-an-Affiliated-Partner.html>

1.3 Scientific and Technical Community in the Large

This is achieved mainly bottom-up through the organisation of scientific events, publications, distribution of tools and components, industrial partnerships (not funded by Artist2), education; and through the Artist2 web pages.

Our sponsoring policy aims specifically at enforcing integration of existing scientific events in the area. This is sought in particular through the creation of Embedded Systems Week, in which we play a crucial role. Next year, the Embedded System Week will be organized in Salzburg, and will federate more than 6 conferences and workshops.

Another concrete example is our action within the DATE conference, in which we are working to shift the emphasis towards becoming the central European conference on embedded systems design, in collaboration with the ARTEMIS European Technology Platform.

Regarding Scientific events, we distinguish between conferences and workshops, schools, and high-level events mainly for International Collaboration.

The ARTIST2 community effectively plays an important role and leads the initiatives for organizing the most significant conferences in the area. In Europe, it has a very strong presence in the DATE conference, which is becoming the main conference on embedded systems within Europe. Over the past 4 years, the chairs of DATE have all been leading Artist members. Also for the past 4 years, we have organized 1-day Artist workshops within the DATE framework, on cutting-edge topics and including presentations from both Artist participants, and other world-class speakers.

Artist members have a leading role in the organisation of the Euromicro conferences. This year, we have again sponsored the 31st Euromicro Conference - Special session on Model Driven Engineering (MDE).

In international conferences, the ACM's flagship conference, EmSoft, has been initiated by leading members of Artist2. These researchers now chair the steering and executive committees. Artist partners are also in leading positions for conferences as RTSS (Real-Time Systems Symposium), CODES/ISS, Workshop on Languages, Compilers, and Tools for Embedded Systems (LCTES). Further details regarding sponsoring, as well as specific events and publications are given in this document.

Artist partners are also active members of the ACM's SIGBED, and the IEEE's upcoming Special Interest Group on Embedded Systems currently being set up. Artist members actively work for structuring international events on embedded systems.

This year the 2nd edition of the Embedded Systems Week, including EmSoft and CODES/ISS will take place in October 23-28th 2006, in Seoul (Korea).

1.3.1 International Collaboration

In Year 2, we have organised the first Artist-China school on embedded systems. The school gathered more than 50 participants, of which approximately 40 were students from the top universities in mainland China. Given the success of this first edition, it has been decided to organise a second ARTIST2 school in China, near Shanghai in 2007.

Furthermore, we are planning to organize an Artist2 – South American school in Buenos Aires, the last week of August, 2007.

We also had a joint meeting with the NSF in Helsinki, June 21-22 2006.

1.3.2 Publications

The Artist2 community has been very active in publishing in scientific journals and conferences, as attested by the list of publications provided in this document. Clearly, this represents a huge amount of work.

1.3.3 Tools and Components

The Artist2 community plays a leading role in the distribution of software tools and components, on verification/validation tools. Some tools are distributed free of charge, such as UPAAL, IF. Others are commercialised, such as AbsInt, SymTA/S. For many other tools used in the platforms, and shared between the Artist partners, a common dissemination policy has not yet been defined.

1.3.4 Industrial Liaison

Artist2 has a wide array of affiliated industrial and SME partners, as described in this document (section: "Affiliated Partners in the ARTIST2 Research Activities"). Most of these 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.

Our active involvement in the European Technology Platform ARTEMIS also could have a significant and long-term impact. Several Artist2 partners, including OFFIS, PARADES, VERIMAG; and TU Vienna, are actively involved in the ARTEMIS ETP, in particular leadership and active contribution to the Working Groups for the Strategic Research Agenda (SRA).

In addition, each Artist2 partner has an outstanding track record for interaction with industry. Globally, the Artist2 consortium has a very 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.

We believe that the strong involvement of four main Artist2 partners in 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.

In addition, Artist2 teams also play an important role in the following IPs:

- SOCRADES
(Service-oriented cross-layer infrastructure for distributed smart embedded devices)
- SHAPES Integrated Project ,
Scalable Software Hardware Architecture Platform for Embedded Systems
<http://shapes.atmelroma.it/wiki/bin/view/ShapesPublic/WebHome>

1.3.5 Course Materials

In Year 2, Artist2 has begun disseminating recent, high-quality Course Materials via its web portal: <http://www.artist-embedded.org/artist/-Course-Materials-.html>

This includes materials generated in Artist2 events, as well as pointers to high-quality materials from other sources.

This approach to disseminating course materials will further structured, refined and increased in Year 3.

1.3.6 Spreading Excellence and Impacts on other European groups

Here is a non-exhaustive list of highlights of Artist2 impacts on other groups. All Artist2 teams have strong contacts and impacts on outside teams.

Contacts with other NoE's in the area:

- Artist2 has initiated contacts with the HiPEAC and HyCon NoEs, in particular to discuss possible interaction and to provide some common input to the Artemis ETP definition.

In Year2, interaction with HiPEAC and HyCon also occurred at the cluster level.

- Interaction with HiPEAC took place through the Compilers and Timing Analysis cluster, around the respective compilation platforms (gcc for HiPEAC and ACE for Artist2.).
- Interaction with HyCon occurred mainly through the Control for Embedded Systems cluster. Furthermore, some collaboration started with the Adaptive Real Time cluster. Giorgio Buttazzo has been invited as a co-Program Chair to organize the International Conference on Hybrid Systems: Computation and Control (HSCC 2007).

ARTEMIS ETP

- Several Artist2 partners, including OFFIS, PARADES, VERIMAG; and TU Vienna, are actively involved in the ARTEMIS ETP, in particular leadership and active contribution to the Working Groups for the Strategic Research Agenda (SRA).

- Joseph Sifakis has been responsible of the ARTEMIS sub-group on Technology Frontiers, in which representatives from these other NoE's were represented.
- Artist2 teams (Saarland University and OFFIS) are strongly involved in the in the Transregional Collaborative Project AVACS, financed by the German Research Council (DFG).

Interaction with other groups:

- The Execution Platforms cluster gathers together most of the relevant European research teams on the topic, and has strong links to all the other relevant teams outside Artist2, such as: TIMA/Ahmed Jerraya; IMEC's MPSoC research team; University of Dresden, Hermann Härtig; Università degli Studi di Verona/Electronic Design Automation (EDA) group, Prof. Franco Fummi; University of Southampton,/Electronic Systems Design Group, Prof. Bashir Al Hashimi.

New project proposals:

- Artist2 teams are the driving for setting up a large Danish national research project aimed at coordinating the national activities within embedded system design in order to strengthen the industrial development and innovation, as well as research and PhD education.

Embedded Systems Institute in Eindhoven

- The Scientific Director of the Embedded Systems Institute (ESI) in Eindhoven, Ed Brinksmma, is prominent member of the Artist2 NoE and sits on the Strategic Management Board. His appointment at the ESI ensures that the vast number of large industrial research projects on embedded systems carried out on routine basis by this center will be connected to the Artist2 NoE.

2. International Collaboration

2.1 Overview and Highlights of International Impacts outside the EU

Collaboration between international organisations and institutions that are the main players in the area is a strategic action line for Artist2. Based on a long history of International Collaboration events starting in Artist1, (<http://www.artist-embedded.org/artist/-International-Collaboration-.html>), we exchange of information, and identify opportunities for common initiatives. These initiatives will concern joint R&D projects, working groups for standards, international roadmapping and strategic work directions in the area.

International Collaboration events have initially been developed with the USA, but now include China, Korea, and India. This is an ongoing process, with varying degrees of maturity depending on the International Collaboration partners involved.

International Collaboration at the Global NoE level:

- With the USA, we have a mature relationship that builds on extended ties and capital set up in Artist FP5 and Artist2. Here, the objective is to exchange information through high-level meetings on strategic research directions, education and training, and other selected topics.

A second direction for collaboration with the USA is through collaboration between Artist partners and NSF projects opened through specific international calls set up by the NSF (100k\$/project). There are existing collaboration projects between Verimag and Vanderbilt, TU Vienna and Berkeley, and others.

- This year, Artist2 has participated in a high-level International Collaboration event “Long Term Challenges in High Confidence Composable Embedded Systems” jointly organised by US partners (mainly Berkeley and the NSF), the European Commission, and Artist2. This event is described in detail below.
- We have increased our collaboration with China and continue to pursue it with India. With China, our contacts are mainly organized through the United Nations University in Macau. The tangible results from this is the organization in April 2006 of a joint Artist2/China Spring School, described in detail below.
- For Korea, Artist2 will organize a major workshop in Seoul in the framework of the Embedded Systems week, in October 2006.

International Collaboration at the cluster level:

- The Real Time Components cluster maintains close ties with the CHES project of NSF¹. CHES collects major US teams from key universities². Also, close ties exist with teams working on the area of *Discrete Event Systems* originating from control, as well as the teams working on *Hybrid Systems*³ and *Communication and Control*⁴. The work on standardization in OMG is done in strong collaboration with Carleton University Canada (Dorina Petriu and Murray Woodside).
- The Adaptive Real Time cluster had several interactions with the following research teams University of Illinois at Urbana Champagne, University of Virginia, University of California at Berkeley, Carnegie-Mellon University
- The Compilers and Timing Analysis cluster has strong ties to the Architecture and Compilers for Embedded Systems (ACES) group of Prof. Nikil Dutt at University of California, Irvine and the group of Prof. Rajeev Barua at University of Maryland at College Park focus on memory aware compilation and optimization issues.
- The Timing Analysis teams have links with Seoul National University (continuous exchange of PhD students and PostDocs), Florida State University, and Singapore National University.
- The Execution Platforms team has strong link with the main research groups in the area outside Europe, including: The University of North Carolina at Chapel Hill (Sanjoy Baruah and Jim Anderson); UC Berkeley (Jan Rabaey), MIT (Anantha Chandrakasan); University of Michigan (David Blaauw); Penn State University (Profs. Vijaykrishnan Narayanan, Mahmut Kandemir and Mary Jane Irwin); Carnegie Mellon University/System Level Design Group (Radu Marculescu),
- Teams from the Control for Embedded Systems cluster has strong ties and interaction with Carnegie Mellon Software Engineering Institute, US Army/AMCOM and Honeywell Labs.
- The Testing and Verification cluster has strong links to the work on software verification and testing taking place at Microsoft Research, Redmond, (Ball), NASA Ames and Kestrel Technologies (Holzman, Visser and Havelund) and Kansas (Hatcliff). Extraordinarily strong links exist to Parades (Sangiovanni Vincentelli), Rice University (Vardi, longstanding collaboration with Pierre Wolper on the highly appreciated and influential automata theoretic approach).

¹ <http://chess.eecs.berkeley.edu/> : Center for Hybrid and Embedded Software Systems

² http://chess.eecs.berkeley.edu/people/project_personnel/

³ <http://hsc06.csl.sri.com/> is the conference of this domain

⁴ See the control conference CDC'2005 <http://www.esi2.us.es/~cdcecc05/> where a –plenary has been devoted to this topic.

2.2 Year 2 Event: ARTIST2 / UNU-IIST Spring School in China 2006

<http://www.artist-embedded.org/artist/Spring-School-in-China-2007.html>

2.2.1 Overview

The first ARTIST / UNU-IIST Spring School on Models, Methods and Tools for Embedded Systems has been held in Xi'an, China, April 3rd – 15th 2006.

Given the success of this first edition, it has been decided to organise a second ARTIST2 school in China, near Shanghai in 2007.

- The school gathered more than 50 participants, of which approximately 40 were students from the top universities in mainland China: Peking University; Nangjing University; Institute of Software, Chinese Academy of Science; East China Normal University; Southwest University; Xidian University; Wuhan University; Northwest University; ZhengZhou University; Northwest Polytechnical University; National University of Defense Technology.
- The local organisation and logistics were of high quality, thanks to the excellent contribution from the Northwest Polytechnical University at Xi'an. The main lecturers for the school were four European researchers from ARTIST2 (Prof. Lothar Thiele, Peter Marwedel, Joseph Sifakis, Wang Yi).
- These main lectures were usefully complemented by seminars from distinguished Chinese researchers: Prof. Zhou Chaochen, He Jifeng and Zhiming Liu.

2.2.2 Lecturers and Seminar Speakers

Lecturers

[Prof. Dr. Peter Marwedel](#)

University of Dortmund, Germany

- ▶ Peter Marwedel received his Ph.D. in physics from the University of Kiel (Germany) in 1974. He worked at the Computer Science Department of that University from 1974 until 1989. In 1987, he received the Dr. habil. degree for his work on high-level synthesis and retargetable code generation based on the hardware description language MIMOLA.
- ▶ Since 1989 he is a professor at the Computer Science Department of the University of Dortmund. He served as the Dean of that Department between 1992 and 1995. His current research is focussed on software for embedded systems, with emphasis on code generation techniques for embedded systems, in particular energy-aware compilers.
- ▶ His publications include the books "Code Generation for Embedded Processors", "Retargetable Compiler Technology" and "Embedded System Design", all published by Kluwer Academic publishers.
- ▶ He is a member of the accreditation commission I (engineering and informatics) of ASIIN, a society in charge of the accreditation of engineering and science education in Germany. He received the teaching award of his University in 2003 and is a member of the ARTIST2 network of excellence on embedded and real-time systems in Europe.
- ▶ Dr. Marwedel heads the ICD, a private technology transfer center at Dortmund and is actively promoting the use of research results in industry.



[Dr. Joseph Sifakis](#)**VERIMAG Laboratory, Grenoble, France**

- ▶ Joseph Sifakis is CNRS researcher and the Director of Verimag Laboratory in Grenoble, France. He studied Electrical Engineering at the Technical University of Athens and Computer Science at the University of Grenoble.
- ▶ Joseph Sifakis worked on both theoretical and practical aspects of Concurrent Systems Specification and Verification. He contributed to the development of the state of the art in verification methods and tools by model-checking for both untimed and timed systems. His current research interests include modeling, design and analysis of real-time systems with a focus on composability and compositionality. (Further information: [here](#)).
- ▶ Joseph Sifakis is a member of the editorial board of several journals, co-founder of the CAV (Computer Aided Verification) conference and a member of the Steering Committee of the EMSOFT (Embedded Software) conference. He is the recipient of the CNRS Silver Medal in 2001.
- ▶ Joseph Sifakis is the scientific coordinator of the ARTIST2 European Network of Excellence on Embedded Systems Design.

[Prof. Dr. Lothar Thiele](#)**Swiss Federal Institute of Technology Zurich, Switzerland**

- ▶ Lothar Thiele was born in Aachen, Germany on April 7, 1957. He received his Diplom-Ingenieur and Dr.-Ing. degrees in Electrical Engineering from the Technical University of Munich in 1981 and 1985 respectively. After completing his Habilitation thesis from the Institute of Network Theory and Circuit Design of the Technical University Munich, he joined the Information Systems Laboratory at Stanford University in 1987.
- ▶ In 1988, he took up the chair of microelectronics at the Faculty of Engineering, University of Saarland, Saarbrücken, Germany. He joined ETH Zurich, Switzerland, as a full Professor of Computer Engineering, in 1994. He is leading the Computer Engineering and Networks Laboratory of ETH Zurich.
- ▶ His research interests include models, methods and software tools for the design of embedded systems, embedded software and bioinspired optimization techniques.
- ▶ In 1986 he received the "Dissertation Award" of the Technical University of Munich, in 1987, the "Outstanding Young Author Award" of the IEEE Circuits and Systems Society, in 1988, the Browder J. Thompson Memorial Award of the IEEE, and in 2000-2001, the "IBM Faculty Partnership Award". In 2004, he joined the German Academy of Natural Scientists Leopoldina. In 2005, he was the recipient of the Honorary Blaise Pascal Chair of University Leiden, The Netherlands.

[Prof. Dr. Wang Yi](#)**Uppsala University, Sweden**

- ▶ Wang Yi received his Ph.D in Computer Science from Chalmers University of Technology in 1991. Since 2000, he is a professor (real time systems) at department of information technology, Uppsala University.
- ▶ His research interests are mainly in formalisms, methods and tools for the



design, verification and implementation of distributed, embedded and real time systems.

- ▶ He is leading the UPPAAL research group in Uppsala, developing the model checker UPPAAL in collaboration with Aalborg University, and TIMES, a tool for schedulability analysis and code synthesis.
- ▶ He is an associate editor for journal: IEEE Transactions on Computers since 2002.

Seminar Speakers

[Dr. Zhiming Liu](#)

United Nations University (UNU-IIST), Macao

- ▶ Zhiming Liu received his PhD from the University of Warwick (UK) in 1991. Zhiming Liu worked as a research fellow at the University of Warwick during 1988 -1994 , a lecturer in Computer Science at the University of Leicester (UK) during 1994-2005. He joined UNU-IIST as a research fellow in Junly 2002.
- ▶ Zhiming Liu's research includes formal methods and theories of computer systems development, in particular in the areas of Real-Time, Fault-Tolerant Systems, Object Systems and Component Systems. His research results have been published in main stream journals, including ACM TOPLAS, Theoretical Computer Science and Formal Aspects of Computing, and proceedings of conferences.
- ▶ Zhiming Liu is a member of the editorial board of International Journal on Innovations in Systems and Software Engineering. He is the founder of ICTAC (International Colloquium on Theoretical aspects of Computing) and FACS (Workshop on Formal aspects of Component Systems). He is a member of the Steering Committes of ICTAC and SEFM (IEEE Conference on Software Engineering and Formal Methods).



[Prof. Zhou Chaochen](#)

Institute of Software, Chinese Academy of Sciences (CAS)

- ▶ Personal Details: Born in 1937. Married with 2 children.
- ▶ Education: Undergraduate study at Peking University in 1954-1958; Postgraduate study at Institute for Computing Technology, CAS, in 1963-1967.
- ▶ Research interests: Formal techniques for programming, including formal semantics, specification, verification and design calculi for computing systems.
- ▶ Previous Positions since 1992: 1992- Professor, Institute of Software, CAS; 1992-1997, Principal Research Fellow, International Institute for Software Technology, United Nations University (UNU/IIST); 1997-2002 Director of UNU/IIST.
- ▶ Academic Membership: 1993- Member of CAS; 2000- Member of the Third World Academy of Sciences.



2.2.3 Organisation

The ARTIST2 / UNU-IIST / China Spring School was initialized and organized jointly by the [ARTIST2 Network of Excellence](#) (European Commission's IST programme), the International Institute for Software Technology of the United Nations University ([UNU-IIST](#), Macao), and North West Polytechnic University ([NWPU](#), China).

It was sponsored by the European Commission, NWPU, and UNU-IIST. In China, it was supported by the following major research institutions:

- Shanghai Embedded Systems Institute ([SESI](#)),
- Chinese Academy of Sciences' [ISCAS](#) laboratory,
- China Computer Foundation ([CCF](#)) Technical Committee on Theoretical Computer Science (chairman: Prof. Huowang Chen; secretary, Prof. Jianping Yin).



Coordination Committee

- Prof. LI Zhanhuai, deputy dean of Computer School, Northwest Polytechnic University (China)
- Dr. LIU Xiaojian, Northwest Polytechnic University (China)
- Dr. LIU Zhiming, UNU-IIST (Macao)
- [Prof. WANG Yi](#), Uppsala University (Sweden)
- [Bruno BOUYSSOUNOUSE](#), ARTIST2 Technical Coordinator, Verimag Laboratory (France)

Local Organisation

- Local organisation was handled by: Liu Xiaojian at Northwestern Polytechnical University (China).

2.3 Year 2 Event: Joint US-EU-TEKES workshop : Long Term Challenges in High Confidence Composable Embedded Systems

June 21-22, 2006 Helsinki, Finland

<http://www.artist-embedded.org/artist/Joint-US-EU-TEKES-workshop.html>

Artist2 participated in the organisation of this event.

2.3.1 General Chairs

Helen Gill, NSF; Alkis Konstantellos, EC; Kimmo Ahola, Tekes; Joseph Sifakis, VERIMAG, Grenoble; Manfred Morari ETH-Zurich; Olli Venta, VTT; US Shankar Sastry, U. of California Berkeley; Bruno Sinopoli, U. of California Berkeley; George Pappas, U. of Pennsylvania, Philadelphia

2.3.2 Agenda

-- June 21st 2006 --

Existing relevant NSF and EC Programs and Initiatives

Chair: Frankie King, National Coordination Office

[Update: NSF Programs and US HCSS Coordinating Group](#)

Dr. Helen Gill, National Science Foundation

[Aims of IST-NSF Cooperation in Embedded Systems](#)

Dr. Alkis Konstantellos, EC-IST

Dr. Thomas Skordas, EC-IST

Session 1: (Meta-)Modeling and Compositional Design

Co-Chair: Dr. Joseph Sifakis, VERIMAG

Co-Chair: Dr. Janos Sztipanovits, Vanderbilt University

[Component-based Design](#)

Dr. Joseph Sifakis, VERIMAG

[An SoC Architecture for the Composition of Components in an Embedded System](#)

Dr. Herman Kopetz, Vienna University of Technology

[Networked Embedded Systems Design Challenges](#)

Dr. Jan Bormans, IMEC

[Aspects of Composition in Metamodeling](#)

Dr. Janos Sztipanovits, Vanderbilt University

[Some Compositionality Problems in High-Confidence Embedded Systems](#)

Dr. Insup Lee, University of Pennsylvania

[On Composing High-Confidence Services ... on the Path to Tackling Complexity!](#)

Dr. Neeraj Suri, TU Darmstadt

[Towards Compositional Design for Distributed Embedded Systems](#)

Dr. Luca Carloni, Columbia University

-- June 22nd 2006 --

Plenary Session

Chair : Dr. Olli Venta, TEKES

[IT Security in Industrial Systems](#)

Dr. Jouni Keronen, Chief Information Officer, Fortum Corporation

Session 2: Control of Networked Embedded Systems

Co-Chair : Dr. Shankar Sastry, UC Berkeley

Co-Chair : Dr. Antonio Bicchi, University of Pisa

[Smart Embedded Components in Cross-Layer Collaborative Infrastructures](#)

Dr. Armando Colombo, Schneider Electric

Dr. Mihai Huzmezan, United Technologies Research Center

Dr. Suzanne Woll, United Technologies Research Center

[Challenges in Embedded Systems](#)

Dr. Keijo Manninen, Honeywell Finland

[Embedded software in cars – where software engineers and control engineers meet ... and still misunderstand](#)

Dr. Stefan Kowalewski, Aachen

[Networked Embedded Hybrid Control Systems](#)

Dr. John Koo, Vanderbilt University

[Symbolic Control of Dynamic Systems](#)

Dr. Antonio Bicchi, University of Pisa

[Sensor and Actuator Networks – Research Challenges](#)

Dr. Heikki Koivo, Helsinki University of Technology

[Embedded Control Systems: Challenges and Opportunities](#)

Dr. George Pappas, University of Pennsylvania

[Challenges in Distributed Control in Specknets*](#)

Dr. D.K. Arvind, University of Edinburgh

Discussion of open research issues**Cross-cutting links between Sessions 1, 2****Possible research areas for a joint US/EU collaboration**

Session 3: Cybersecurity for Embedded Control Systems

Co-Chair : Dr. Paulo Verissimo, University of Lisbon

Co-Chair : Dr. Robin Bloomfield, City College, London

[Cyber-Physical Systems: Beyond Sensor Webs](#)

Dr. Shankar Sastry, U.C. Berkeley

[Control and Security of Networked Embedded Systems: Component Based Synthesis](#)

Dr. John Baras, University of Maryland

[Security challenges in systems-of-embedded-systems](#)

Dr. Paulo Verissimo, University of Lisbon

[Model-based Security Engineering](#)

Dr. Jan Jurjens, TU Munich (Germany) and Open University (UK)

[Predictable and Robust Data Distribution in Systems of Embedded Systems](#)

Dr. Roberto Baldoni, University of Rome, La Sapienza

Session 4: Certification and Metrics for High Confidence Systems

Chair: Dr. Helen Gill, National Science Foundation

[Certification and metrics challenges](#)

Dr. Robin Bloomfield, City College, London

[Aviation Software Systems for the Second Century of Flight: Design for Certification](#)

Dr. Claire Tomlin, U.C. Berkeley/Stanford

[Something about certification \(for stuff that can kill people or cost \\$ gazillions\)](#)

Dr. Eric Feron, Georgia Institute of Technology

-- June 23 --

Wrap Up Discussions**Open research issues****Cross-cutting research themes between all workshop sessions****Possible research areas for a joint US/EU collaboration****EU-US-TEKES Government to Government Discussions****2.4 Events Planned for Year 3****2.4.1 Artist2 - Foundations and Applications of Component-based Design***October 26th, 2006 Seoul, South Korea*<http://www.artist-embedded.org/artist/Artist2-Foundations-and.html>Artist2 organises this event, within [EMSOFT'06](#), at the [Embedded Systems Week](#).

The workshop aims to gather together researchers from computer science and electrical engineering and will seek a synthesis between the underlying paradigms and techniques.

Programme Chairs

- Joseph Sifakis (co-chair)
Verimag Laboratory
- Lothar Thiele (co-chair)
ETH Zurich

Objectives and Scope

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.

2.4.2 WESE'06 - Embedded Systems Education

October 26th, 2006 Seoul, Korea

<http://www.artist-embedded.org/artist/WESE-06-Embedded-Systems-Education.html>

Artist2 participates in the organisation of this event, within [EMSOFT'06](#), at the [Embedded Systems Week](#).

Additional funding is provided by the ACM.

Overview

This second workshop on the subject aims to bring researchers, educators, and industrial representatives together to assess needs and share design, research, and experiences in embedded systems education.

It is widely recognized that the embedded system domain is a multidisciplinary one, requiring a large variety of skills from control and signal processing theory, electronics, computer engineering and science, telecommunication, etc., as well as application domain knowledge. This has motivated a recent but ever growing interest in the question of educating specialists in this domain and this has also been recognized as a particularly difficult problem. After a successful first event in Jersey City, USA (2005), this second workshop on the subject aims to bring researchers, educators, and industrial representatives together to assess needs and share design, research, and experiences in embedded systems education.

Topics and Focus

Particular topics of interest include but are not limited to:

- Industrial needs regarding embedded systems education
- Embedded systems curricular design and implementation
- Control and signal processing issues
- Computer science issues
- Real-time computing issues
- Distributed systems issues
- Architecture and design issues
- Hardware/software co-design
- Hands-on experiences and labs
- Teaching embedded systems

2.4.3 Artist2 / UNU-IIST School in China – 2007

August 1-10 2007 Suzhou (near Shanghai),

ARTIST2 will organize, in collaboration with UNU-IIST, the 2nd edition of a school on embedded systems design.

<http://www.artist-embedded.org/artist/Artist2-UNU-IIST-School-in-China.html>

Artist2 leading members: Karl-Erik Arzen (Lund), Luca Benini (Bologna), Paul Caspi (Verimag), Kim Larsen (Aalborg) will lecture at the school.

The organisation will be similar to the first edition of the school, described in detail above.

2.4.4 First ARTIST European-SouthAmerican School for Embedded Systems

August 27-31 2007 UADE, Buenos Aires – Argentina

The purpose of the school is to foster the well established and dynamic research cooperations in the field of embedded systems between groups in Europe and South America, by allowing south-american students (specially graduate), to meet european researchers.

We strongly believe this will offer an excellent opportunity to strengthen the relationships with mutual benefit.

The school will be a repeated event on a yearly basis. Besides the lectures given by European researchers, there will be invited talks by southamerican researchers and space (poster session) for graduate students to present and discuss their work.

Scientific Committee:

- [Victor Braberman](#), Universidad de Buenos Aires, Buenos Aires, Argentina.
- [Pedro D'Argenio](#), Universidad Nacional de Cordoba, Cordoba, Argentina.
- [Markus Endler](#), PUC-Rio, Rio de Janeiro, Brazil.
- [Jean-Marie Farines](#), Universidade Federal de Santa Catarina, Florianopolis, Brazil.
- [Joni da Silva Fraga](#), Universidade Federal de Santa Catarina, Florianopolis, Brazil.
- [Gerhard Fohler](#), University of Kaiserslautern, Kaiserslautern, Germany.
- [Julius Leite](#), Universidade Federal Fluminense, Rio de Janeiro, Brazil.
- [George Lima](#), Universidade Federal da Bahia, Bahia, Brazil.
- [Alfredo Olivero](#), Universidad Argentina de la Empresa, Buenos Aires, Argentina.
- [Rodrigo Santos](#), Universidad Nacional del Sur, Bahia Blanca, Argentina.
- [Joseph Sifakis](#), CNRS-VERIMAG, Grenoble, France.
- [Sergio Yovine](#), CNRS-VERIMAG, Grenoble, France.

3. Organisation of Summer Schools

3.1 Directly Organized and Funded by Artist2 in Year2

In Year 2, Artist2 has directly organized and funded the following workshops.

First European Laboratory on Real-Time and Control for Embedded Systems

July 10-14, 2006 Pisa, Italy

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.

<http://www.artist-embedded.org/artist/-First-European-Laboratory-on-Real-.html>

ARTIST2 / UNU-IIST Spring School in China 2006

April 3-15, 2006 Xi'an, China

The first ARTIST / UNU-IIST Spring School gathered more than 50 participants, of which approximately 40 were students from the top universities in mainland China.

<http://www.artist-embedded.org/artist/-ARTIST2-UNU-IIST-China-School-.html>

ARTIST2 Graduate Course on Embedded Control Systems

April 3-7, 2006 Prague, Czech Republic

The objective of the Course is to provide an overview of the main principles and technologies for supporting the development of embedded control systems.

<http://www.artist-embedded.org/artist/-ARTIST2-Graduate-Course-on-.html>

ARTIST2 Summer School 2005

September 29th - October 2nd 2005 Näslingen, Sweden

ARTIST2 Summer School on Component & Modelling, Testing & Verification, and Statical Analysis of Embedded Systems

<http://www.artist-embedded.org/artist/-ARTIST2-Summer-School-2005-.html>

3.2 Plans for Year3: Schools Directly Organized and Funded by Artist2

The following Artist2 schools are planned for Year 3.

Artist2 / UNU-IIST School in China - 2007

August 1-10, 2007 Suzhou (near Shanghai), China

ARTIST2 will organize, in collaboration with UNU-IIST, the 2nd edition of a school on embedded systems design in Suzhou (near Shanghai).

<http://www.artist-embedded.org/artist/-Artist2-UNU-IIST-School-in-China-.html>

ARTIST2 - MOTIVES 2007

February 19-23, 2007 Trento, Italy

ARTIST2 Winter School 2007 offers foundational tutorials and lectures on exciting emerging technologies and industrial applications - given by leading scientific and industrial experts.

<http://www.artist-embedded.org/artist/-MOTIVES-2007-.html>

First ARTIST European-SouthAmerican School for Embedded Systems

August 27-31 2007 UADE, Buenos Aires – Argentina

The purpose of the school is to foster the well established and dynamic research cooperations in the field of embedded systems between groups in Europe and South America, by allowing south-american students (specially graduate), to meet european researchers.

See the detailed description of this school in the section on International Collaboration, above.

3.3 Plans for Year3: Schools Partially Organized and/or Funded by Artist2

In addition, Artist2 plans to help fund and/or participates in the organisation of the following schools in the area.

ADSD 2006: Advanced Digital Systems Design

September 25-29, 2006 Lausanne, Switzerland

Design course for multimillion-transistor Systems-on-Chip and other state-of-the-art embedded products. The course spans from purely digital-design topics to some compiler-related issues.

<http://www.artist-embedded.org/artist/-Advanced-Digital-Systems-Design-.html>

FOSAD 2006: 6th International School on Foundations of Security Analysis and Design

September 10-16, 2006 Bertinoro, Italy

The International School on Foundations of Security Analysis and Design (FOSAD) has been one of the foremost events established with the goal of disseminating knowledge in this critical area. The main aim of the FOSAD school is to offer a good spectrum of current research in foundations of security - ranging from programming languages to analysis of protocols, from cryptographic algorithms to access control policies and trust management - that can be of help for graduate students and young researchers from academia or industry that intend to approach the field.

<http://www.artist-embedded.org/artist/-FOSAD-2006-6th-International-.html>

MDD4DRES

September 4-8, 2006

A goal of this summer school is to provide participants with the information needed to understand and apply MDE approaches to the development of embedded systems. The summer school will also include lectures from experts in academia and industry on topics related to MDE practices and methods, and to emerging MDA technologies.

<http://www.artist-embedded.org/artist/-MDD4DRES-.html>

4. Organisation of Workshops

These are all world-class events, featuring top speakers. See the links provided for details. As a rule, we always the slides and other pertinent materials available to the general public, via the Artist web portal.

The plans for Year3 are not exhaustive, since planning and organising workshops for Spreading Excellence is a continuous activity.

4.1 Directly Organized and Funded by Artist2 in Year2

In Year 2, Artist2 has directly organized and funded the following workshops.

CORDIE'06: Concurrency, Real-Time and Distribution in Eiffel-like Languages

July 4-5, 2006 York, UK

There is increasing interest in the use of formal techniques in object-oriented programming languages, e.g., contracts in Eiffel, JML/Java, Spec#/C#, and Spark/Ada. The intent behind the use of these techniques is, amongst other things, to support automated analysis (e.g., theorem proving, model checking, simulation), and improve documentation and reusability.

<http://www.artist-embedded.org/artist/-CORDIE-06-Concurrency-Real-Time-.html>

ARTIST2 Workshop on Requirements for Flexible Scheduling in Complex Embedded Systems

June 16th, 2006 Paris (Massy), France

As the complexity of embedded applications evolves, the gap between their timing requirements and the scheduling services provided by real-time operating systems increases. Today's systems require a mixture of quality of service, hard and soft real-time, and multiple resource management, which bring the need for raising the level of abstraction of the scheduling services.

<http://www.artist-embedded.org/artist/-Requirements-for-Flexible-.html>

ARTIST2 Workshop on Execution Platforms / Cluster Meeting

May 22-23, 2006 Bologna, Italy

<http://www.artist-embedded.org/artist/-ARTIST2-Workshop-on-Execution-.html>

ARTIST2 Workshop on Specification and Verification of Secure Embedded Systems

May 18th, 2006 Pisa, Italy

<http://www.artist-embedded.org/artist/-ARTIST2-Workshop-on-Specification-.html>

ARTIST2 Workshop Beyond AutoSar

March 23-24, 2006

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.

<http://www.artist-embedded.org/artist/-ARTIST2-Workshop-Beyond-AutoSar-.html>

ARTIST Workshop at DATE'06*March 10th, 2006 Munich, Germany*

The workshop presented relevant, innovative, and holistic topics in communication-centric systems, sensor networks, dynamic real-time architecture, distributed computing, minimal operating systems, and self-organisation. More generally, these workshops aim to extend existing links between related multi-disciplinary communities, through world-class presentations and discussion on cutting-edge topics.

<http://www.artist-embedded.org/artist/-ARTIST-Workshop-at-DATE-06-.html>

Workshop: Distributed Embedded Systems*November 21-24, 2005 Leiden, The Netherlands*

<http://www.artist-embedded.org/artist/-Workshop-Distributed-Embedded-.html>

WESE'05 - ARTIST2 Workshop on Embedded Systems Education*September 22nd, 2005 Jersey City, New Jersey – USA*

<http://www.artist-embedded.org/artist/-ARTIST2-Workshop-Workshop-on-.html>

31st EUROMICRO Conference - Special session: Model Driven Engineering (MDE)*August 30th - September 3rd 2005 Porto, Portugal*

<http://www.artist-embedded.org/artist/-31st-EUROMICRO-Conference-Special-.html>

4.2 Plans for Year3: Workshops Directly Organized and Funded by Artist2

The following Artist2 workshops are planned for Year 3.

MARTES 2006*October 2nd, 2006 Genova, Italy*

This workshop gathers researchers and industrial practitioners to survey modeling and model-based analysis of distributed, real-time and embedded systems.

<http://www.artist-embedded.org/artist/-MARTES-2006-.html>

Foundations and Applications of Component-based Design*October 26th, 2006 Seoul, South Korea*

The workshop aims to gather together researchers from computer science and electrical engineering and will seek a synthesis between the underlying paradigms and techniques.

<http://www.artist-embedded.org/artist/-Foundations-and-Applications-of-.html>

WESE'06 - Embedded Systems Education*October 26th, 2006 Seoul, Korea*

This second workshop on the subject aims to bring researchers, educators, and industrial representatives together to assess needs and share design, research, and experiences in embedded systems education.

<http://www.artist-embedded.org/artist/-EmSoft-06-Workshop-on-Embedded-.html>

MoCC - Models of Computation and Communication*November 16-17, 2006 Zurich, Switzerland*

Communication and cooperation between several disciplines: software and hardware but also computer science and engineering, real-time and distributed systems, telecommunication, control and signal processing.

<http://www.artist-embedded.org/artist/-Models-of-Computation-and-.html>

ARTIST2 Workshop on Timing Analysis in the Industrial Development Process*November 17th, 2006 Paphos, Cyprus*

1-day workshop. This Special Track will be concerned with questions around the integration of timing analysis in the industrial development process.

<http://www.artist-embedded.org/artist/-Timing-Analysis-in-the-Industrial-.html>

ARTIST2 Workshop on Basic Concepts in Mobile Embedded Systems*December 3-4, 2006 Vienna – Austria*

It is the objective of this workshop to elaborate the basic concepts on mobile embedded systems based on existing approaches in distributed, real-time, and dependable systems.

<http://www.artist-embedded.org/artist/-ARTIST2-Workshop-on-Basic-Concepts-.html>

4.3 Plans for Year3: Workshops Partially Organized and Funded by Artist2

In addition, Artist2 plans to help fund and participate in the organisation of the following workshops in the area.

JTRES 2006*October 11-13, 2006 Paris, France*

Real-time and Embedded Java

This workshop seeks to identify remaining challenging problems remaining to be solved, and to report results and experience gained by researchers.

<http://www.artist-embedded.org/artist/-JTRES-2006-Java-Technologies-for-.html>

ARCS 2007*March 12-15, 2007 Zurich, Switzerland*

ARCS 2007 will cover a broad range of research topics related to basic technology, architecture, and application of computing systems. Organic Computing (Autonomic or Proactive Computing) may help to manage the increasing complexity of computing systems.

ARCS 2007 is intended for researchers, R&D engineers, and practitioners.

<http://www.artist-embedded.org/artist/-ARCS-2007-.html>

SCOPES 2007*April 20th, 2007 Acropolis, Nice, France*

SCOPES focuses on the software generation process for modern embedded systems. Topics of interest include all aspects of the compilation process, starting with suitable modeling and specification techniques and programming languages for embedded systems. The emphasis of the workshop lies on code generation techniques for embedded processors.

<http://www.artist-embedded.org/artist/-ARCS-2007-.html>

5. Keynotes, Workshops, Tutorials provided to the Embedded Systems Community

Artist2 partners have a very deep impact on the global embedded systems community, as is attested in the following direct contributions.

Keynote: "A Framework for Component-based Construction"

3rd IEEE International Conference on Software Engineering and Formal Methods (SEFM05)
Koblenz (D)– September 7-9, 2005

Joseph Sifakis (Verimag) presents the component framework BIP and plans for implementing it; which meanwhile has been achieved and will be used for connecting modelling and validation tools

Keynote: "Modelling Heterogeneous Real-time Components in BIP"

IEEE International Conference on Software Engineering and Formal Methods (SEFM06)
Pune, India – September 11-16, 2006

Josef Sifakis (VERIMAG) presented the BIP framework and its implementation focussing on case studies

<http://www-verimag.imag.fr/~async/index.php?view=components>

Keynote: "Modelling and verification of RTES: a framework & experimental results"

Workshop QAPL on quantitative aspects in programming languages at ETAPS 2006
Vienna (A)– April 2, 2006

Keynote talk by Susanne Graf (VERIMAG) on the modelling and validation problems encountered in the context of RTES, the modelling and IF-based validation framework implemented in OMEGA on hand of an industrial case study

<http://www-verimag.imag.fr/~async/>

Keynote: "UML and Components for System Modelling"

Conference name Euromicro – SEAA (Software Engineering and Advanced Applications) -
Porto, Portugal – August 30 – September 3, 2006

François Terrier (CEA) presented an overview of the component concepts proposed by the standard UML2, its relations with middleware related component concepts and their benefits in a Model Driven Engineering process.

<http://euromicro2005.fe.up.pt/keynotes.html#Francois>

Workshop: MARTES 2005, Modelling and Analysis of Real Time and Embedded Systems
MoDELS/UML 2005, Int. Conf. on Model Driven Engineering Languages and Systems
Montego Bay, Jamaica, Oct. 4, 2005

VERIMAG and CEA have been the initiators of this workshop on model-driven development and real-time and embedded systems as a follow-up event on the successful workshop series on Real time embedded systems SIVOES and SVERTS. MARTES has been hold in October 2005 as a satellite event of the MoDELS conference. The workshop attracted a number of interesting submissions and participants. The results of the workshop, as well as 2 best papers have been published in an LNCS volume. <http://www.martes.org/>

Presently, the second edition, to be held on October 3, 2006 in Genoa, Italy in conjunction with MoDELS/UML 2006 is being prepared.. Almost 40 participants are expected.

Workshop MoDeVa 2005: Model Design and Validation

MoDELS/UML 2005, Int. Conf. on Model Driven Engineering Languages and Systems
Montego Bay, Jamaica, Oct. 4, 2005

The second edition of this workshop has been organized conjointly by the IRISA Lab of the University of Rennes and the CEA (who is the initiator of this workshop). It was held in October 2005 as a one day satellite event of the MoDELS conference. Half of the duration of the workshop was dedicated to pre-selected papers presentations and the other part of the workshop was dedicated to active discussions on different topics. A summary of those discussions together with the two best papers of the workshop have been published in [1]. The third edition of MoDeVa will be a satellite event of MoDELS 2006.

Workshop: Requirements for Flexible Scheduling in Complex Embedded Systems

Massy (France) the 16th of June, 2006

This workshop was organized by Michael González, from the University of Cantabria and Thales. It represents a collaboration with the Adaptive Real Time Cluster. It was held in Massy (France) the 16th of June, 2006. J. Medina presented in this workshop "Notes on the RT components-based framework for FRESCOR: modelling, verification, and run-time support". This presentation dealt with a number of issues about the requirements for scheduling services in the component-based framework envisioned for the FRESCOR project.

Workshop: Safe-UML: Modellierung und Safty-Normen, workshop at the Safetronic 2006, Munich, Germany, November 2006.

This workshop is organized by OFFIS together with OPRAIL partners. The topics of this workshop are related to the use of UML within the development of safety critical systems, where the development process has to be compliant to safety standards. Within this workshop the OPRAIL partners will report on there experience with Safe-UML.

<http://www.safetronic-veranstaltung.de/>

Summer school: MDD for Distributed Real Time Embedded Systems

Brest, France – September 4-8, 2006

This summer school was co-organized by CEA. It is the third edition of a series of summer school which focuses on model-driven related issues in the context of real-time and embedded systems development. The main goal of this summer school series is to provide participants with the most up-to-date information needed to understand and apply MDE approaches to the development of distributed, real-time and embedded systems. For that purpose, we have gathered experts from a variety of research labs and industries to give seminars that provide insights into the ongoing research works and practical applications related to MDE for DRES

<http://www.mdd4dres.info>

Summer school: ARTIST Summer school on Component & Modelling, Testing & Verification, and Static Analysis of Embedded Systems

Nässlingen, Sweden, September 29 to October 2, 2005

This summer school included contributions from several ARTIST clusters, and in particular several tutorials by the platform partners on relevant topics, such as modelling languages (MARTE), tools (IF, Metropolis), modelling techniques (BIP, Metropolis) and model transformation techniques (Kermeta)

<http://www.artist-embedded.org/FP6/ARTIST2Events/SummerSchools/Artist05.html>

Tutorial: The IF toolset
SDLforum 2005
Grimstad, Norway, June 20, 2005

Iulian Ober presented the IF tool, by focussing on case studies successfully carried out within the Omega project with the IF tool chain for validating UML specs; IF will be connected to the platform. <http://www-verimag.imag.fr/~graf/SLIDES/2005-sdlforum-IF-tutorial.pdf>

Workshop: MARTES 2005

Modelling and Analysis of Real Time and Embedded Systems
MoDELS/UML 2005, Int. Conf. on Model Driven Engineering Languages and Systems
Montego Bay, Jamaica, Oct. 4, 2005

Verimag and CEA have been the initiators of this workshop on model-driven development and real-time and embedded systems as a follow-up event on the successful workshop series on Real time embedded systems SIVOES and SVERTS. MARTES has been hold in October 2005 as a satellite event of the MODELS conference. The workshop attracted a number of interesting submissions and participants. The results of the workshop, as well as 2 best papers have been published in an LNCS volume. <http://www.martes.org/>

Presently, we are actively preparing the second edition, to be held on October 2 or 3, 2006 in Genova, Italy in conjunction with the 9th International Conference on Model Driven Engineering Languages and Systems, MoDELS/UML 2006.

Summer school: MDD for Distributed Real Time Embedded Systems

Brest, France – September 4-8, 2006

This summer school was co-organized by CEA. It is the third edition of a series of summer school which focuses on model-driven related issues in the context of real-time and embedded systems development. The main goal of this summer school series is to provide participants with the most up-to-date information needed to understand and apply MDE approaches to the development of distributed, real-time and embedded systems. For that purpose, we have gathered experts from a variety of research labs and industries to give seminars that provide insights into the ongoing research works and practical applications related to MDE for DRES <http://www.mdd4dres.info>

Tutorial: Status and perspectives of the UML profile for Marte
MDD for Distributed Real Time Embedded Systems Summer School

Brest, France – September 4-8, 2006

Sébastien Gérard gave this tutorial on Marte. The current architecture of th new OMG standard for real-time and embedded systems has been presented and some specific technical focuses has been done: the non-functional property framework, the sub-profile for modelling software execution resources and the subprofile for model-based schedulability analysis.

<http://www.mdd4dres.info>

Tutorial: UML for Real Time Systems

Artist Summerschool on Component & Modelling, Testing & Verification, and Statical Analysis of Embedded Systems

Nässlingen, Sweden, September 29 to October 2, 2005

Sébastien Gérard gave this tutorial on UML for real-time systems. The talk has been focused on native concepts of UYML2 for real-time and on its extensions (profiles) specically dedicated to real-time modelling and analysis.

<http://www.artist-embedded.org/FP6/ARTIST2Events/SummerSchools/Artist05.html>

ARTIST2 Workshop: Design Issues in Distributed, Communication-Centric Systems

DATE Conference, Munich, Germany, 10.3.2006

Organiser: Bruno Bouyssounouse, Rolf Ernst, Lothar Thiele

Objective: The workshop presented relevant, innovative, and holistic topics in communication-centric systems, sensor networks, dynamic real-time architecture, distributed computing, minimal operating systems, and self-organisation.

URL: <http://date.eda-online.co.uk/2006/prog/index.php?id=42>**ARTIST2 Workshop: Distributed Embedded Systems**

Leiden, Netherlands, 21.11. - 24.11.2005

Organiser: Lothar Thiele

Objective: Benchmarking and comparison of different formal analysis approaches

URL: <http://www.tik.ee.ethz.ch/~leiden05/>**Keynote address by Tom Henzinger and Joseph Sifakis: The embedded systems design challenge**

14th International Symposium on Formal Methods (FM) - August 2006

We summarize some current trends in embedded systems design and point out some of their characteristics, such as the chasm between analytical and computational models, and the gap between safety-critical and best-effort engineering practices. We call for a coherent scientific foundation for embedded systems design, and we discuss a few key demands on such a foundation: the need for encompassing several manifestations of heterogeneity, and the need for constructivity in design. We believe that the development of a satisfactory Embedded Systems Design Science provides a timely challenge and opportunity for reinvigorating computer science.

Tutorial: Supporting predictable design using formal analysis techniques

ARTES Summer School, Stockholm Schweden, August 21-25 2006.

Speaker: Arne Hamann and Razvan Racu, Technical University of Braunschweig.

URL: <http://www.artes.uu.se/events/summer06/>**Talk: Scheduling Analysis in Practice - Early Lessons Learned***ARTIST2 Workshop: Distributed Embedded Systems*, Leiden, Netherlands - November 21-24th, 2005.

Speaker: Kai Richter

URL: <http://www.tik.ee.ethz.ch/~leiden05/>**Talk (in german): Zuverlässige und effiziente Integration eingebetteter Systeme - ein Widerspruch?**

Annual Meeting IEEE Computer Society, Wolfsburg Germany, July 2006.

Speaker: Rolf Ernst, Technical University of Braunschweig.

Invited Lecture by Martin Törngren: "Automotive Embedded Systems – research challenges", Aug. 24, 2006, ARTES summer school (www.artes.uu.se)**Invited Lecture by Martin Törngren** at Mecel (a Swedish subsidiary of Delphi): **"Cost-efficient and systematic verification of embedded control systems"**, June 14, 2006

Performed at the occasion of starting a new national project between Mecel and KTH.

Invited Lecture by Martin Törngren at ENEA: "Automotive Embedded Systems; characteristics, trends and challenges", May 17, 2006**Invited Lecture by Martin Törngren at PLM Forum 2006: "Challenges for PLM of Mechatronic Systems"**, Stockholm, May 10, 2006 A forum arranged by Technia AB.**Martin Törngren invited panelist for the ARTIST2 workshop: Beyond Autosar**, Innsbruck, March 24, 2006.

General Keynote : "Quo Vadis, EDA? Reasoning about the Trends and Challenges of Engineering Design Automation" Alberto Sangiovanni-Vincentelli**Keynote : "Automotive Electronics: Steady Growth for Years to Come" Alberto Sangiovanni-Vincentelli**

ASP-DAC Conference, Yokohama, Japan, Jan. 24-27, 2006

Conference Chair: F, Hirose

Presentation of the Conference (part of): On behalf of the [Organizing Committee](#), I would like to welcome you to the Asia and South Pacific Design Automation Conference 2006 (ASP-DAC 2006). ASP-DAC is a sister conference of DAC, DATE and ICCAD, and it is the 11th event of this conference series. ASP DAC 2006 will be held at Pacifico Yokohama, Japan, from January 24 through 27, 2006, jointly with the Electronic Design and Solution Fair 2006.

<http://www.aspdac.com/aspdac2006>

Keynote : "Innovazione a 360 gradi: l' Elettronica del Futuro" Alberto Sangiovanni-Vincentelli

Il Giornata della Innovazione, Confindustria, Roma March 3, 2006, Pasquale Pistorio Organizer

The goal of the meeting was to discuss the role of innovation in industry with particular emphasis on embedded and networked systems. The audience was about 4,000 industrialists in all sectors in Italy. Outcome was a series of new interactions with white goods industry such as Indesit, the largest company in the domain in Europe.

Invited Talk and Organization of a Special Session on Networks: Is "Network" the Next "Big Idea" in Design? Network Paradigms in Systems, Sensors, & Silicon. Alberto Sangiovanni-Vincentelli

Date 2006, Munich, Germany, March 6-10, 2006

In the last decade, we started to design blocks with millions of atomic elements transistors, gates, lines of code. As complexity continues to grow, we are moving away from creating each element from scratch, toward methodologies that emphasize connecting the right elements, in the right communication patterns, to achieve the right functionality. This view of design is being called the network paradigm. Complex component interactions can create a range of amazing behaviors, some useful, some unwanted, some even dangerous. To manage these, a "science" for network design is evolving, applicable in some surprising areas. In this session, we survey three application domains, and discuss the modeling, analysis, and design challenges involved. From large-scale hardware/software systems, to dynamically adaptive sensor networks, to network-on-chip architectures, these ideas are finding wide application. Is the "network" the next "big idea" for our community?

<http://www.date-conference.com/>

Key Note: Challenges and Opportunities for System Theory in Embedded Controller Design, Alberto Sangiovanni-Vincentelli

2nd IFAC Conference on Analysis and Design of Hybrid Systems, Alghero, Sardinia, Italy – June 7-9, 2006

Abstract: Embedded controllers are essential in today electronic systems to assure that the behaviour of complex systems as cars, airplanes, trains, building security management systems, is compliant to strict safety constraints. I will review the evolution of embedded systems and the challenges that must be faced in their design. I will also present methodologies aimed at simplifying and speeding the design process. The role of hybrid systems in the development of embedded controllers will be outlined. Future applications such as wireless sensor networks in an industrial plant will also be presented.

<http://www.diee.unica.it/adhs06/program.html>

TUTORIAL AND PANEL – Communication Methods and Networking in Automotive Systems, Alberto Sangiovanni Vincentelli

Date 2006, Munich, Germany, March 6-10, 2006

The purpose of this special session is to evaluate bottlenecks and drawbacks of today's automotive electronic and car network systems, as well as to discuss and envisage new concepts for future system design in automotive electronics and their networks. Both aspects, hardware design and tool-integration into existing development tools will be discussed. The main emphasis is on architectures, design-flow, tool-development, applications and system design.

<http://www.date-conference.com/>

Tutorial: Tools for Hybrid Embedded Systems: Modeling, Verification, and Design Alberto Sangiovanni-Vincentelli

Design Automation Conference, July 24-28, San Francisco, USA

This tutorial gives a detailed overview of the current landscape of tools for the specification, design, and validation of hybrid embedded systems.

The basic principles of hybrid systems (systems that feature both continuous and discrete time components) modeling will be presented as the common theoretical underpinning for all the tools. The core of the tutorial will be live demonstrations of about a dozen tools that have been developed in the industry and academia.

For each tool, a brief presentation of its syntactic and semantic characteristics will be followed by a practical exposition of how to use it to model and design some simple, but challenging "running examples", thereby showing its advantages and limitations. This will provide a sound mechanism to compare the tools by illustrating their differences in terms of expressiveness, usability, power, and performance. Some industrial examples will be modeled, presented, and discussed.

<http://www.dac.com/43rd/pindex.html>

Keynote: Real-Time Issues in Mobile Wireless Networks

Speaker: Giorgio Buttazzo

Conference: 9th Int. Conference on Principles of Distributed Systems (OPODIS 2005)

Pisa, Italy - December 12-14, 2005

Keynote: Towards Component-Based Operating Systems

Speaker: Giorgio Buttazzo

Conference: Workshop on Operating Systems Platforms for Embedded Real-Time applications (OSPERT 2006)

Dresden, Germany - July 4, 2006

Keynote: Predictable Response Times in Event-Driven Real-Time Systems

Speaker: Michael González Harbour

Conference: Automotive – Safety & Security 2006

Stuttgart, Germany – October 2006

<http://www.automotive2006.de/>

Keynote : The challenges of operational flexibility in real-time communication

Speaker: Luis Almeida

Conference: Real-Time Systems Workshop at CEDI 2005, the 1st Spanish Congress on Informatics

Granada, Spain – September 15th, 2005

<http://cedi2005.ugr.es/2005/invitados.shtml>

Workshop : Requirements for Flexible Scheduling in Complex Embedded Systems
Massy(Paris), France – June 2006

As the complexity of embedded applications evolves, the gap between their timing requirements and the scheduling services provided by real-time operating systems increases. Today's systems require a mixture of quality of service, hard and soft real-time, and multiple resource management, which bring the need for raising the level of abstraction of the scheduling services. The objective of this workshop was to develop a set of requirements for building a flexible scheduling framework for applications demanding various types of tasks, constraints, and scheduling paradigms within the same system. The framework is oriented towards the contract-based scheduling of multiple resources such as the processors, the networks, dynamically reconfigurable modules, interrupts with time protection, shared resources with time protection, memory protection, and energy/power-aware scheduling. The framework should ensure that the techniques developed can be used in different application domains. The targeted application domains are at least industrial control systems, media processing applications, automotive embedded systems, telecommunications, and artificial intelligence. The set of requirements developed in the workshop should allow ongoing and future research and development projects to focus on the real needs of embedded systems, collected through the consensus of a large group of interests and experts, brought together through the ARTIST2 Network.

<http://www.artist-embedded.org/artist/-Requirements-for-Flexible-.html>

Keynote: The challenges of operational flexibility in real-time communication

Luis Almeida, University of Aveiro

CEDI 2005, Congreso Español de Informática

Granada, Espanha – 13-16th of September, 2005

This was the first congress of this kind in Spain, joining together a rather large set of different topics related to Informatics. The congress was organized like a federated set of mini-symposia or workshops running together, each dedicated to a specific topic, and with just a few global activities.

The talk was within the "Simposio de Sistemas de Tiempo-Real" and it addressed the issues related with improving operational flexibility in communication systems as required for distributed adaptation, from operational architectures to run-time mechanisms, timeliness guarantees, fault-tolerance, safety, dynamic QoS management and reconfiguration.

http://cedi2005.ugr.es/2005/programa_s20_str.shtml

Workshop: Requirements for Flexible Scheduling for Media Processing

Massy, France, June 16, 2006-09-08

A workshop on requirements for adaptive resource management was held together with the FRESCOR project. Part of the workshop focused on requirements for media processing.

http://soller.eit.uni-kl.de/mediawiki/index.php/Main_Page

First European Laboratory on Real-Time and Control for Embedded Systems

RETIS Lab, Scuola Superiore Sant'Anna, Pisa, Italy, July 10-14, 2006.

A graduate course on real-time and control for embedded systems was held in Pisa (Italy), at the RETIS Lab of the Scuola Superiore Sant'Anna, on July 10-14, 2006. It was organized in collaboration with the Control cluster lead by Karl-Erik Arzen.

The purpose of the course was twofold. The first objective was to 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. The second and more challenging goal was to show how to apply theory into practice, teaching students how to develop simple real-time distributed control applications using the state-of-the-art technologies available into the Shark kernel.

URL: <http://www.artist-embedded.org/FP6/ARTIST2Events/Events/RT-Control/>

Course: Improving your research skills: a mini workshop for graduate students*RETIS Lab, Scuola Superiore Sant'Anna, Pisa, Italy – March 14-17, 2006**Speaker: Lui Sha (University of Illinois at Urbana Champagne, USA)*

This course was aimed at teaching students how to do research. In particular, it addressed the problems of how to learn, formulate and solve research problems, and how to communicate.

Research means re-search: searching again and again in the product space of problem formulations and solutions until potentially high impact technologies is found. The efficiency of any search depends greatly on the methods we use, no matter the search is for oil under the ground or for new knowledge. In this mini-workshop, Professor Lui Sha shared his experience on research and education with the students, who have been guided to discover their skills and better organize their research plans. Students have learnt how to organize teams to create and improve research plans. <http://feanor.sssup.it/~giorgio/sha06>

Keynote: Real-Time Issues in Mobile Wireless Networks**Conference: 9th Int. Conference on Principles of Distributed Systems (OPODIS 2005)**

Speaker: Giorgio Buttazzo

Pisa, Italy – December 12-14, 2005

This talk presented some of the most challenging problems to be solved in order to support the development of mobile wireless networks of cooperating robots. Some of these problems include the real-time execution of acquisition and control processes, the efficient management of computational resources, the software control of energy consumption, the real-time communication protocols on wireless networks, and the development of distributed agreement algorithms for reaching a consensus in collective decisions.

<http://www.di.unipv.it/OPODIS2005/>**Keynote: Towards Component-Based Operating Systems****Conference: Workshop on Operating Systems Platforms for Embedded Real-Time applications (OSPERT 2006)**

Speaker: Giorgio Buttazzo

Dresden, Germany – July 4, 2006

This talk presented the characteristics and the advantages of having a component based operating system, also discussing the difficulties to be solved and possible solutions that can be adopted at the kernel level.

<http://www.cs.ucsc.edu/~sbrandt/OSPERT.html>**Keynote: Real-Time, Distributed Control Systems: Performance, Resource Planning, Applications**

Speaker: Josep Fustes

RETIS Lab, Scuola Superiore Sant'Anna, Pisa, Italy – May 3, 2006

In real-time control systems, the interplay of real-time constraints and control specifications can be somewhat subtle. In order to successfully analyze the behavior of a distributed control system, the type and location of jitter and delay must be characterized, and their effect on the performance of the control system understood. This talk presented how timing affects control and real-time performance and how the group at the University of Catalonia is facing the analysis and design methods for distributed control systems that cannot guarantee equidistant sampling and actuation.

The talk gave an introduction of control theory centred in the time related properties, explaining the relation between continuous and discrete sampled control systems and clarifying the interaction between performance specifications of control and real-time systems.

Keynotes

Andy Wellings from the University of York gave the invited keynote presentation at CORDIE (see below). The title of this talk was: "RECOOP: Real-Time SCOOP for Eiffel".

Workshop : Ada 2005

York, 22/23rd March, 2006

A two day workshop/meeting for this activity was held in York with 12 participants from York, Cantabria, Madrid, Porto and Vienna. The agenda for the meeting was as follows:

Workshop : CORDIE

York, 4/5 July, 2006

ARTIST2 personnel and financial support were provided for the first CORDIE workshop. Participants were able to bring to the discussions the needs of the flexible real-time community. Publications are likely to result in the coming year.

The First Symposium on Concurrency, Real-Time, and Distribution in Eiffel-like Languages (CORDIE) took place on 4/5 July 2006 in York. The focus of the conference was on adding concurrency and real-time features to object-oriented languages that support contract-based methods (e.g., Eiffel/Spec# pre- and postconditions of methods), and on the tradeoffs that must be considered when attempting to make such additions.

<http://www.artist-embedded.org/artist/-CORDIE-06-Concurrency-Real-Time-.html>

Hans van Someren delivered a lecture for students at Aachen on compiler technology – 21st June 2006.

A CoSy workshop was held in Amsterdam 3rd-5th May 2006 for academic partners including Dresden, Berlin, Bologna, University of Amsterdam, Delft and Leiden.

Rainer Leupers has given tutorials related to ARTIST2 activities at SBAC (Rio, Sep 2005), AICCSA (Dubai, Mar 2006), HiPEAC summer school (L'Aquila, Jul 2006), and MPSoC (Colorado, Aug 2006).

Peter Marwedel has organized a compiler workshop at Nokia (Düsseldorf, Jun 2006) with invited speakers including Heiko Falk, Andreas Krall, and Rainer Leupers from ARTIST2.

Tutorial: The ROSE Source-To-Source Translator**14th International Conference on Parallel Architectures and Compilation Techniques, (PACT'05), 2005**

Saint Louis, MI, U.S.A – September 2005

Organization: Markus Schordan (TU-Vienna), together with Daniel J. Quinlan, Bronis R. de Supinski, Qing Yi, Richard Vuduc (Lawrence Livermore National Laboratory)

The tutorial was organized as a hands-on tutorial, separated in five sessions. Each session was organized such that participants got an overview of one component in ROSE, followed by a demo, and some hands-on exercises. Participants brought their own laptops and connected to our server for implementing the exercises. The tutorial covered the ROSE C++ intermediate representation, grammar based program analysis and data-flow analysis (PAG), pre-defined loop optimizations, visualization of the intermediate representation and attached analysis results.

ARTIST2 Summer School: Component & Modelling, Testing & Verification, and Static Analysis of Embedded Systems

Nässlingen, Sweden – Sept, 29th – Oct, 2nd, 2005

The ARTIST2 Summer School was a 4 day summer school for young researchers working or wanting to work in the fields of modelling, validation and performance analysis of embedded systems as well as engineers from industry with practical background in design and testing of embedded systems. The school was completely booked out, mainly with young people from all over Europe.

<http://www.artist-embedded.org/FP6/ARTIST2Events/SummerSchools/Artist05.html>

Workshop: 6th Intl WORKSHOP ON WORST-CASE EXECUTION TIME ANALYSIS 18th Euromicro Intl Conference on Real-Time Systems

Dresden, Germany – July 4, 2006

The goal of the workshop was to bring together people from academia, tool vendors, and users in industry, which are interested in all aspects of timing analysis for real-time systems. The workshop has provided a relaxed forum to present and discuss new ideas, new research directions, and to review current trends in this area. The workshop was based on short presentations that have encouraged discussion by the attendees.

Platform Meeting: Timing Analysis Platform meeting

Amsterdam, Netherlands – November 8, 2005

- Status of Activities
- Work plan for next 18 months
- Spreading Excellence
- Presentations

Platform Meeting: Timing Analysis Platform meeting

Munich, Germany – March 7, 2006

- Report of the follow-up review, 27.1.06 Brussels, and the Strategic Management Board meeting, 28.2.06 Paris
- AIR (ARTIST2 Intermediate Representation)
- Flow representation
- WCET benchmark collection of Mälardalen
- ESA project of Tidorum and Rapita
- Coupling between Dortmund compiler backend and aiT

Platform Meeting: Timing Analysis Platform meeting

Dresden, Germany – July 5, 2006

- Instruction semantics (computation semantics) and their representation in AIR (Stephan Thesing)
- Presentation of AIR (AbsInt)
- Reporting for the ARTIST2 Review
- Adapting SWEET to CRL2 (Mälardalen)
- The ISoLA special track
- Discussion of the WCET Tool Competition

**Special Track on Timing Analysis in the Industrial Development Process
2nd International Symposium on Leveraging Applications of Formal Methods,
Verification and Validation (ISoLA) sponsored by ARTIST2.**

Paphos, Cyprus – November 15 – 19, 2006

Many safety-critical embedded systems have to satisfy hard real-time constraints. These systems need sound methods and tools to derive reliable run-time guarantees. The guaranteed run times should not only be reliable, but also precise. The achievable precision is highly dependent on characteristics of the target architecture and on the software design and implementation method.

Experience has shown that a tight integration of Timing Analysis into the development process and the development tool chain improves the achievable precision. This Special Track will be concerned with questions around the integration of timing analysis in the industrial development process.

<http://sttt.cs.uni-dortmund.de/isola2006/index.php?id=tracksandsession#a2>

Keynote : Lecture on Compiler Technology

Aachen, Germany – June 2006

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Keynotes: Peter Marwedel: Towards laying common grounds for embedded system design education, Opening, Embedded Systems Week (at Manukau Institute of Technology)

Auckland, New Zealand, Nov. 16th, 2005

The talk proposed an approach for introducing embedded systems at the college level.

Mini-Keynote: Jan Madsen: Evolving MPSoC Solutions

MPSoC Symposium, Colorado

A key challenge of implementing an embedded systems application on a heterogeneous multiprocessor SoC platform is to find the right partitioning of the application onto the platform architecture. The right partitioning is dependent on the characteristics of the processors and the network connecting them, as well as the application. The mini-keynote addressed this challenge. <http://tima.imag.fr/MPSoC/>.

Workshop: SCOPES: 9th International Workshop on Software and Compilers for Embedded Systems*Dallas, US – Sept. 29th – Oct. 1st, 2005*

Software for embedded systems with emphasis on code generation for embedded processors.

<http://www.scopesconf.org>, <http://www.edaa.com/activities.html>**Tutorial: Peter Marwedel: Code optimizations for efficient embedded systems (at SCOPES 2005)***Dallas, US, Sept 29th, 2005*

The tutorial presented various code transformations aiming at improving the efficiency of embedded software, taking the limited resources of embedded systems into account

<http://www.scopesconf.org/Pgm.pdf>**Tutorial: Luca Benini: System Level Power Optimization (at course on Advanced Digital Design, organized by EPFL)***Lausanne, Switzerland, Oct. 8th, 2005*

The tutorial presented the main issues in power optimization (under various types of resource constraints) at the system level. The tutorial aimed at industrial as well as academic attendees.

<http://www.mead.ch/CoursLAP/ADSD-Program.html> (for the 2006 edition)**Tutorial: Rainer Leupers: Retargetable Compilation (at course on Advanced Digital Design, organized by EPFL)***Lausanne, Switzerland, Oct. 6th, 2005 (morning)*

The tutorial presented techniques for generating compilers from descriptions of the instruction set architecture (ISA). The tutorial aimed at industrial as well as academic attendees.

<http://www.mead.ch/CoursLAP/ADSD-Program.html> (for the 2006 edition)**Tutorial: Peter Marwedel: Memory-architecture aware compilation (at course on Advanced Digital Design, organized by EPFL)***Lausanne, Switzerland, Oct. 6th, 2005 (afternoon)*

The tutorial presented the benefits resulting from making compilers aware of the memory architecture. Significant reductions in terms of consumed resources (energy, time) can be achieved. The tutorial aimed at industrial as well as academic attendees.

<http://www.mead.ch/CoursLAP/ADSD-Program.html> (for the 2006 edition)**Tutorial: Peter Marwedel: Code optimizations for efficient embedded systems (at Manukau Institute of Technology)***Auckland, New Zealand, Nov. 17th, 2005*

The tutorial presented various code transformations aiming at improving the efficiency of embedded software, taking the limited resources of embedded systems into account.

Tutorial: Lothar Thiele: Frameworks for System-Level Analysis of Real-Time Systems - Symta/S and MPA*RTAS 2006 Tutorial IEEE Real-Time and Embedded Technology and Applications Symposium: System-level timing, performance, and power becomes increasingly intractable as the interactions between system parts introduce complex dynamic behaviour that can not be fully overseen by anyone in a design team. The tutorial addressed recent research on composable and extensible analysis methods, and tools.*

Tutorial: Lothar Thiele: Sensor Networks*DATE 2006 Symposium*

This tutorial reviewed basic concepts of wireless sensor networks, including: ad-hoc networking, programming models, power management, in-network processing, development environments and methodologies.

Tutorial: Lothar Thiele and Peter Marwedel: ARTIST2 Spring School in China on Models, Methods and Tools for Embedded Systems*Xi'an, China, April 3rd-15th, 2006*

The tutorial started with an introduction to embedded systems and resource aware generation of software and performance analysis. It also comprised modelling of real-time systems, validation and verification.

<http://www.artist-embedded.org/FP6/ARTIST2Events/Events/ChinaSchool/>

Workshop: Workshop on Distributed Embedded Systems*Leiden, Netherlands, November 2005*

Collaboration with various research groups in the area of performance analysis of embedded systems.

There exist almost no results on comparisons of system level performance estimation and analysis methods for embedded systems in literature. One of the main problems that prevents such results is that there exists no consensus on how these methods should be compared. To overcome this problem, we co-organized an international workshop on distributed embedded systems. The workshop aimed to achieve three goals: first to identify issues and trends of system level performance estimation and analysis of distributed embedded systems, secondly to learn about existing system level performance estimation and analysis methods for embedded systems, and thirdly to establish a set of benchmark applications that can serve as basis for future methods comparisons. <http://www.tik.ee.ethz.ch/~leiden05/>

Workshop: Design Issues in Distributed, Communication-Centric Systems*DATE Conference, Munich, Germany, 10.3.2006*

Organisers: Bruno Bouyssounouse, Rolf Ernst, Lothar Thiele

The workshop presented relevant, innovative, and holistic topics in communication-centric systems, sensor networks, dynamic real-time architecture, distributed computing, minimal operating systems, and self-organisation.

<http://date.eda-online.co.uk/2006/prog/index.php?id=42>

Workshop: New approaches to WCET analysis*York, England 30.7.-5.8.2006*

Organisers: Jan Staschulat, Technical University of Braunschweig, Guillem Bernat Rapita Systems.

The workshop was set up to discuss new approaches to WCET analysis. In particular synergy effects between the SymTAP and the RapiTime approach were examined.

Workshop: Robustness Optimization and Scheduling Anomalies*Linköping, Sweden, August 2006*

Organisers: Petru Eles, Arne Hamann, Razvan Racu

During the workshop recent results of TU Braunschweig concerning system robustness optimization and the detection of scheduling anomalies were presented and discussed. Additionally, a cooperation in the field of simulation pattern generation based on the scheduling anomalies detection algorithms was discussed.

Tutorial: Introduction to Sensor Networks

ARTIST2 PhD Course, University of Linköping, Sweden, May 2006

Speaker: Jan Madsen and Srdjan Capkun from DTU.

Phd course on wireless sensor networks. Organized in cooperation between DTU and Linköping. Participant were from both academia and industry, mainly from Sweden.

Sensor networks have become more and more popular as a solution to various large scale networked applications in very diverse areas. This course is an introduction to the problematic of sensor networks. The course addresses issues such as deployment and localization, routing protocols and operating systems for wireless sensor networks, design methodologies and security issues. <http://www.ida.liu.se/~petel/SN/>

Tutorial: Supporting Predictable Design Using Formal Analysis Techniques

ARTES Summer School, Näslingen, Sweden – August, 2006

ARTES is a Swedish network for real-time research and graduate education, which annually organizes a summer school for leading researchers and graduate students in real-time systems.

The tutorial presented the state of the art in formal performance verification (task and system level), and explained how these techniques can be used to design predictable systems using sensitivity analysis and robustness optimization algorithms.

<http://www.artes.uu.se/events/summer06/>

Tutorial : Frameworks for System-Level Analysis of Real-Time Systems - Symta/S and MPA

Real-Time and Embedded Technology and Applications Symposium (RTAS), San Jose, USA – April, 2006

RTAS is the leading international conference in real-time applications and is co-located with the Embedded Systems Conference.

System-level timing, performance, and power become increasingly intractable as the interactions between system parts introduce complex dynamic behaviour that can not be fully overseen by anyone in a design team. It is agreed that appropriate analysis tools are urgently needed. However, today's dynamic design processes require flexible and extensible tool suites that can cope with and be adapted to changed objectives and new requirements. Furthermore, the trend towards IP reuse and black-box integration introduces another type of complexity as it requires clear interfaces and must cope with only partially available information.

The tutorial addressed recent research on composable and extensible analysis methods, and tools that demonstrate the application in practice. The tutorial was targeted to embedded system architects, component designers, and integrators as well as researchers in these fields.

<http://www.rtas.org/rtas2006/workshop.htm/>

Mini-Keynote: Modular Communication-Centric MPSoC Architectures

MpSoC Summer school, Estes Park, Colorado, August 2006

Speaker: Rolf Ernst

The keynote presented distributed memory access analysis techniques for MPSoC modelling and analysis to leading researchers and industrial managers in System-on-Chip design.

<http://tima.imaq.fr/mpsoc/>

**Invited Presentation: Luca Benini - Application Specific NoC Design
Design Automation & Test in Europe Conference & Exhibition**

Munich, Germany – 06-10 March, 2006.

<http://www.date-conference.com>

Keynote: Luca Benini - NoCs: Vision, Reality, Trends
Special Workshop: on Future Interconnects and Networks on Chip
Munich, Germany – 10 March, 2006.
<http://async.org.uk/noc2006>

Tutorial: Luca Benini – Dynamic Power management
SBCCI: Symposium on Integrated Circuits and Systems Design
Florianopolis, Brazil – 5 September 2005.

Tutorial: Lothar Thiele – Sensor Networks
Design Automation & Test in Europe Conference & Exhibition
Munich, Germany – 06-10 March, 2006.
<http://www.date-conference.com>

Invited Presentation: Tobias Bjerregaard – Modular SoC-Design using the MANGO clockless NoC
International Conference on Parallel Computing (PARCO'05)
Malaga, Spain – 13-16 September, 2005.
<http://www.parco.org>

Workshop : Artist2 Cluster meeting
Bologna, 22-23 May, 2006.
<http://www-micrel.deis.unibo.it/Artist2/artist2.html>

Tutorial: Frameworks for System-Level Analysis of Real-Time Systems - Symta/S and MPA

RTAS 2006 Tutorial IEEE Real-Time and Embedded Technology and Applications Symposium:

Speaker: Lothar Thiele

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As the focus was on distributed embedded systems, the activity is mainly reported in relation to the Communication Centric Systems activity. However, as part of the workshop, the different system models, on which the various performance estimation methods were carried out, were presented and discussed.

<http://www.tik.ee.ethz.ch/~leiden05/>

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Organisers: Bruno Bouyssounouse, Rolf Ernst, Lothar Thiele

The workshop presented relevant, innovative, and holistic topics in communication-centric systems, sensor networks, dynamic real-time architecture, distributed computing, minimal operating systems, and self-organisation.

In relation to the System Modelling Infrastructure, Jan Madsen gave a presentation on Modelling Embedded Network Systems: From MPSoC to Sensor Networks.

<http://date.eda-online.co.uk/2006/prog/index.php?id=42>

Invited presentation: Application Specific NoC Design*DATE Conference, Munich, Germany, 8.3.2006*

Speaker: Luca Benini

Hot-Topic session on system level design of SoC. This invited presentation was part of the special day for 4G wireless.

Keynote: Execution Platforms*SNART Seminar, KTH, Stockholm, Sweden – August, 2006*

Speaker: Jan Madsen

Presentation of the Execution Platform cluster at the Scandinavian ARTIST2 Seminar on Embedded Systems Design, the SNART Seminar 2006. The theme of this seminar was a proactive approach to strengthen Scandinavia's position in Embedded Systems - with an emphasis on topics covered by the ARTIST2 EU/IST Network of Excellence on Embedded Systems Design.

<http://www.snart.org/conference/>

Mini-Keynote: Evolving MPSoC Architectures*MpSoC Summer school, Estes Park, Colorado, August 2006*

Speaker: Jan Madsen

The keynote presented an evolutionary approach to solve the problem of mapping a set of task graphs onto a heterogeneous multiprocessor platform. The objective is to meet all real-time deadlines subject to minimizing system cost and power consumption, while staying within bounds on local memory sizes and interface buffer sizes. The exploration is based on a system level model expressed in ARTS.

<http://tima.imag.fr/mpsoc/>

Invited Presentation : Karl-Erik Årzén, Anders Robertsson, Dan Henriksson, Mikael Johansson, Håkan. Hjalmarsson, Karl Henrik Johansson. Conclusions from the European Roadmap on Control of Computing Systems. In *First International Workshop on Feedback Control Implementation and Design in Computing Systems and Networks*, Vancouver, Canada, April 2006 <http://www.controlofsystems.org/febid2006/>

Keynote : Karl-Erik Årzén. Implementering av reglersystem: utmaningar och forskningsinriktningar (Control System Implementation: Challenges and Research Directions). In Reglermötet 2006 (Swedish Control Conference), Stockholm, June 2006. (<http://www.s3.kth.se/control/reglermote/>)

Invited Participant: Karl-Erik Årzén participated in the Joint EU-US Workshop on Large ICT-Based Infrastructures and Interdependencies: Control, Safety, Security, and Dependability in Wahsington D.C representing ARTIST2.

Invited Lecture by Martin Törngren (KTH) at the ARTES summer school (www.artes.uu.se): “Automotive Embedded Systems – research challenges”, Aug. 24, 2006

Invited Lecture by Martin Törngren (KTH) at Mecel (a Swedish subsidiary of Delphi) : “Cost-efficient and systematic verification of embedded control systems”, June 14, 2006
Performed at the occasion of starting a new national project between Mecel and KTH.

Invited Lecture by Martin Törngren (KTH) at ENEA: “Automotive Embedded Systems; characteristics, trends and challenges”, May 17, 2006

Invited Lecture by Martin Törngren (KTH) at PLM Forum 2006: “Challenges for PLM of Mechatronic Systems”, Stockholm, May 10, 2006. A forum arranged by Technia AB.

Invited panellists at the ARTIST2 workshop: Beyond Autosar, Innsbruck, March 24, 2006 (Karl-Erik Årzén, Werner Offis, Martin Törngren)

Invited participant: Zdenek Hanzalek (CTU) participated in the ARTIST2 Workshop on Requirements for Flexible Scheduling in Complex Embedded Systems, Paris (Massy), 16 June 2006 <http://www.artist-embedded.org/artist/-Requirements-for-Flexible-.html>

Workshop: Interaction between control and embedded electronics in automotive industry Integrated with ARTIST2 Beyond AUTOSAR workshop (<http://www.artist-embedded.org/artist/-ARTIST2-Workshop-Beyond-AutoSar-.html>) and [Modellierung 2006](#)
Innsbrück, Austria – March 23, 2005

Invited Presentation : Karl-Erik Årzén, Anders Robertsson, Dan Henriksson, Mikael Johansson, Håkan. Hjalmarsson, Karl Henrik Johansson. Conclusions from the European Roadmap on Control of Computing Systems. In *First International Workshop on Feedback Control Implementation and Design in Computing Systems and Networks*, Vancouver, Canada, April 2006 <http://www.controlofsystems.org/febid2006/>

Keynote : Karl-Erik Årzén. Implementering av reglersystem: utmaningar och forskningsinriktningar (Control System Implementation: Challenges and Research Directions). In Reglermötet 2006 (Swedish Control Conference), Stockholm, June 2006. <http://www.s3.kth.se/control/reglermote/>

Keynote: Karl Henrik Johansson: Modeling and analysis of hybrid control systems, Modelling and Verifying Parallel Processes (MOVEP), <http://movep.labri.fr/>, Bordeaux, France, June 19-23, 2006

Keynote: Karl Henrik Johansson. Control over wireless networks, 25th Benelux Meeting on Systems and Control, Heeze, The Netherlands, March 13-15, 2006

Keynote : Karl-Erik Årzen - Timing analysis and simulation tools for real-time control. International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS'05), [Erreur ! Source du renvoi introuvable.], Uppsala, Sweden, – September 26 - 28, 2005
<http://www.it.uu.se/formats05/>

Invited Presentation: Anton Cervin - TrueTime: Simulation of Networked Computer Control Systems. Presented at an invited session on hybrid simulation tools at ADHS'06 (2nd IFAC Conference on Analysis and Design of Hybrid Systems) in Alghero, Sardinia, June 2006, [Erreur ! Source du renvoi introuvable.].

Invited Tutorial: Karl-Erik Årzen. TrueTime was presented within the tutorial Advances in Networked Autonomous Vehicles: Technologies, Tools, and Cases at ICRA 2006 (IEEE Conference on Robotics and Automation), Orlando, May 2006

Invited Presentation: Martin Törngren – Challenges for PLM of Mechatronic Systems. PLM Forum 2006, Stockholm, May 10, 2006.
http://www.technia.com/templates/Page_1787.aspx

Invited Presentation: Martin Törngren – Cost-efficient and systematic verification of embedded control systems. Invited Lecture at Mecel (a Swedish subsidiary of Delphi), June 14, 2006, performed at the occasion of starting a new national project between Mecel and KTH.

Invited Presentation: Martin Törngren – Automotive Embedded Systems; characteristics, trends and challenges”, May 17, 2006. Invited Lecture at Enea embedded technology, Sweden.

Invited Presentation: Martin Törngren – Model based development. Invited lecture at Scania “samverkansforum”, Nov. 14, 2005, Scania, Sweden.

ACM Kanellakis 2005 Theory and Practice Award G. Holzmann, R. Kurshan, M. Vardi, and P. Wolper (CFV-ULg) received the ACM Kanellakis 2005 Theory and Practice award for their work on software and hardware verification.

LICS 2006 “Test of time” Award M. Vardi and P. Wolper (CFV-ULg) received the LICS 2006 “Test of time” award for their 1986 paper “An automata-theoretic approach to automatic program verification.

Workshop FORMATS 2005. Paul Pettersson and Wang Yi organized and chaired FORMATS 2005. Uppsala, Sweden, September 29 - October 2, 2005.

Workshop FORMATS 2006. Patricia Bouyer and Eugene Assarine organized and chaired FORMATS 2006, Paris, September 2006.

Tutorial ARTIST2/China Spring school on Embedded Systems Design. Wang Yi lectured in Xian, China, April 4 - 17, 2006.

Summerschool ARTIST2 Summer School on Components & Modelling, Testing & Verification, and Static Analysis of Embedded Systems.
Nässlingen, Sweden, September 29 - October 2, 2005.

- T. Jérón, Test Generation using Model-Checking,
- Gerd Behrmann: Real-Time Verification using UPPAAL
- Brian Nielsen, Off- and On-line testing of Real-Time Systems

<http://www.artist-embedded.org/artist/-ARTIST2-Summer-School-2005-.html>

Keynote in DGA (French Army) Seminar on "Operational challenges in modelling of complex software systems", Toulouse, Nov. 2006. T. Jéron, Testing and test selection

Spring School in IPA Lentedagen on Testing. V. Rusu, Combining formal verification and conformance testing, Landgoed Huize Bergen, Vught, April 19-21 2006
<http://www.win.tue.nl/ipa/activities/springdays2006/index.html>.

Summerschool ARTIST2 Summer School on Components & Modelling, Testing & Verification, and Static Analysis of Embedded Systems. JF Raskin (speaker), Timed Controller Synthesis: Robustness Issues, Nässlingen, Swenden, September 2005.

Summerschool MOVEP'06. JF Raskin (speaker), Timed Controller Synthesis: Robustness Issues, MOVEP'06, Bordeaux, France, June 2006.

Invited speaker at workshop "Cooperation of Decution Tools". B. Boigelot, ,Nancy, France, April 10th 2006.

Keynote at MMB: 13th GI/ITG Conference on Measurement, Modeling, and Evaluation of Computer and Communication Systems J. Tretmans: Model Based Testing: An Attempt to Combine Provable Soundness and Effective Automation and Industrial Applicability. Nurnberg (D), March 27-29 2006. <http://www.mmb2006.org/programme.html>

Tutorial at the IPA Lentedagen on Testing, Vught (NL), April 19-21 2006. Jan Tretmans: Introduction to model-based testing. <http://www.win.tue.nl/ipa/activities/springdays2006>

Tutorial at "Testnet Thema Avond", June 8 2006, Nieuwegein (NL). J. Tretmans. Model-Based Testing <http://www.testnet.org/Produktie/Bibliotheek/Presentaties.html>.

Keynote: Invited talk at workshop on "Games in design and verification" Edinburgh, June 13 2005 (co-located with CAV05). M.I.A. Stoelinga.

Workshop: Dutch National Testing Day. E. Brinksma and M.I.A. Stoelinga (eds). Proceedings of 11th Dutch Testing Day November 11, Enschede, the Netherlands.

Workshop: Workshop on Foundations of Interface Technologies H. Hermanns and J. Rehof and M.I.A. Stoelinga (eds). Proceedings of First Workshop on Foundations of Interface Technologies August 28, San Francisco, USA.

Tutorial at RTSS2005. Tutorial on UPPAAL by Gerd Behrmann, Alexandre David, Kim G. Larsen (Aalborg U.) and Paul Pettersson, Wang Yi (Uppsala U.) The 26th IEEE Real-Time Systems Symposium December 5-8, 2005 Miami, Florida, USA. <http://www.rtss.org/rtss2005>.

Summerschool: International PhD School on Verification of Protocols for Security and Mobility, IT-University, Copenhagen, Denmark, October 9-13, 2006. Gerd Behrmann and Kim G. Larsen: Real Time Validation of Embedded Systems Using UPPAAL. <http://first.dk/VPSM>.

Summerschool ARTES. Kim G. Larsen *Controller Synthesis for Real Time Systems.* Nässlingen, Sweden, August 21-25 2006. <http://www.artes.uu.se/events/summer06/>

Summerschool TAROT on Testing. Kim G. Larsen and Brian Nielsen: Model-based Testing and Validation of Real-Time Systems. June 26 - July 1, Toledo, Spain. <http://www.info-ab.uclm.es/tarot/>.

Summerschool GLOBAN: The global computing approach to analysis of systems. Kim G. Larsen: Model Checking. DTU, Lyngby, Denmark, August 21-25, 2006.
<http://www2.imm.dtu.dk/GLOBAN/>.

Keynote: On the use of formal models for proving cryptographic security notions. Special Session on Formal Approaches to Security.
Cork, Ireland, August 2006.
Veronique Cortier. Information-MFCSIT'06 conference,

Keynote: When reachability-based secrecy implies equivalence-based secrecy in security protocols.
Pisa, Italy, May 18th 2006.
Veronique Cortier. Artist 2 Workshop on Specification and Verification of Secure Embedded Systems.

Keynote: Deciding Protocol Insecurity with Rewriting Techniques.
S. Servolo, Venice – Italy, July 15, 2006
M. Rusinowitch. 1st International Workshop on Security and Rewriting Techniques.

Tutorial: Security protocols.
LORIA, Nancy, France July 3-7, 2006
M. Rusinowitch International School on Rewriting.

Tutorial: Formal Verification of Cryptographic Protocols
Bordeaux, France, June 19-23, 2006.
Steve Kremer. MOdelling and VERifying parallel Processes (MOVEP'06)
<http://movep.labri.fr/>

Workshop: 4th International Workshop on Formal Aspects in Security and Trust.
Hamilton, Ontario, Canada, August 26-27 2006.
The workshop is co-located with Formal Methods 2006. Fabio Martinelli is a co-organizer of the event that fosters the research in security and trust management. The workshop received near 50 submissions and accepted 16 full papers. The papers will be published in LNCS. A special issue on a journal is also planned.

Workshop : Specification and Verification of Secure Embedded Systems
Pisa, Italy- May 18, 2005,
The workshop was co-located with iTrust2006, and was organized by Bruno Bouyssou, Sandro Etalle, Steve Kremer, Yassine Lakhnech, Fabio Martinelli and Marinella Petrocchi. The program included invited talks, regular talks and plenty of time for discussion. The workshop focused on the formal specification and verification of security properties, and in particular on the specification and formal verification of security protocols. Topics included: formal definition and verification of security properties, formal analysis and design of cryptographic protocols, modelling information flow, formal techniques for (mobile) code security, security in real-time/probabilistic systems. language-based security, and theory and application of policy languages and trust management. One of the goals of this open workshop was to bring together the part of the European community working on security.

Workshop: 2nd Workshop on Formal and Computational Cryptography (FCC 2006)*Venice, Italy - July 9, 2006.*<http://www.lsv.ens-cachan.fr/FCC2006/> and <http://hal.inria.fr/FCC2006>

The workshop was co-located with ICALP'06 and was organized by Véronique Cortier and Steve Kremer. The workshop focuses on the relation between the symbolic (Dolev-Yao) model and the computational (complexity-theoretic) model. The workshop included 9 presentations followed by stimulating, technical discussions. With about 50 participants the workshop was the largest ICALP'06 affiliated workshop.

Keynote: Real-time Modle Checking using UPPAAL by Kim G. Larsen. TCS Excellence in Computer Science (TECS) Week 2006, Pune, India, January 3–7 2006,**Workshop: SENVA Meeting on Clusters and Grids for Verification and Performance Evaluation***INRIA Rhône-Alpes - Montbonnot (Isère), France, November 16-17, 2005*

The aim of this workshop was to present algorithms and tools for distributed analysis of concurrent systems. It was arranged by the SENVA project – a joint CWI, INRIA project on safety critical systems. ARTIST2 partners from Aalborg and Brno made contributions to the presentations and discussions.

Workshop: SENVA Meeting on Parallel and Distributed Verification*CWI, Amsterdam, The Netherlands, April 3-4, 2006-09-19*

The workshop was dedicated to algorithms, tools and case studies for parallel and distributed verification. It was arranged by SENVA in collaboration with a Dutch national project and with contributions from the ARTIST2 partners Aalborg and Brno.

Workshop: 5th International Workshop on Parallel and Distributed Methods in verification, PDMC 2006*August 31, 2006, Bonn, Germany*

The PDMC workshop aims to provide a working forum for presenting, sharing, and discussing recent achievements in the field of parallel and distributed verification. The workshop consists of invited talks and a selection from the submitted papers. It was co-located with CONCUR 2006. ARTIST2 partners served as invited speaker, committee mebers and also presented accepted papers.

Tutorial: Tutorial on UPPAAL by Gerd Behrmann, Alexandre David, Kim G. Larsen (Aalborg U.) and Paul Pettersson, Wang Yi (Uppsala U.). The 26th IEEE Real-Time Systems Symposium, <http://www.rtss.org/rtss2005>, Miami, Florida, USA, December 5-8, 2005

Tutorial: Model-based Testing and Validation of Real-Time Systems by Kim G. Larsen and Brian Nielsen. TAROT Summerschool on Testing, <http://www.info-ab.uclm.es/tarot/>, Toledo, Spain, June 26 - July 1, 2006

Tutorial: Verification of UML models by Susane Graf (Verimag). ARTIST2 Summer School on Components & Modelling, Testing & Verification, and Static Analysis of Embedded Systems, Nässlingen, Sweden, September 29 - October 2, 2005.

Tutorial: On-line Testing for Real-time Systems by Brian Nielsen (Aalborg). ARTIST2 Summer School on Components & Modelling, Testing & Verification, and Static Analysis of Embedded Systems, Nässlingen, Sweden, September 29 - October 2, 2005.

Tutorial: Real-time Model Checking by Gerd Behrmann (Aalborg). ARTIST2 Summer School on Components & Modelling, Testing & Verification, and Static Analysis of Embedded Systems, Nässlingen, Sweden, September 29 - October 2, 2005.

6. Artist2 Web Portal

6.1 Objectives and Background Information

The Artist2 Web Portal, complemented by the Artist2 Newsletter, is a major tool for Spreading Excellence within the Embedded Systems Community. Its aim is rather ambitious: to be the focal point of reference for events and announcements of interest to the embedded systems community.

The web portal disseminates information about contacts (Artist2 core and affiliated partners), the Artist2 JPA activities, as well a fairly thorough set of links to sites of interest to the embedded systems community.

As can be seen, a great deal of effort has been put into the web site, both for ergonomics/graphical quality, as for the contents.

The web site includes several features that help keep it coherent and up to date:

- Authorised users (principally, the Artist2 partners) can access the back end of the site to modify and update information directly. The changes are immediately visible on the site, which greatly streamlines the updating process.
- It's possible to track changes and go back to previous versions of individual web pages.
- Events are automatically sorted by date, and transferred to 'Past Events'. When appropriate.
- Structural information (hierarchy of pages) is maintained automatically.
- Ergonomics are set for the entire site. The "look and feel" of the site is always homogeneous throughout the site. It's possible to change these ergonomics, and these changes are applied homogeneously throughout the site, via automated mechanisms.

6.2 Structure

The structure of the Artist2 web site is as follows (visible on the Site Map: <http://www.artist-embedded.org/artist/spip.php?page=plan>). The links below are active.

About the Artist2 NoE

- [Strategic Objectives](#)
- [Approach](#)
- [Joint Programme of Activities \(JPA\)](#)
- [Core Partners](#)
- [Workshops](#)
- [Schools](#)
- [International Collaboration](#)
- [Contributions to Standards](#)
- [State of the Art](#)
- [Related Projects](#)
- [Course Materials](#)
- [Artist2 Newsletter](#)
- [Becoming an Affiliated Partner](#)

- [Site Map](#)

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Participants

- [Strategic Management Board](#)
- [Core Partners](#)
 - [Cluster: Real-Time Components](#)
 - [Cluster: Adaptive Real-Time](#)
 - [Cluster: Compilers and Timing Analysis](#)
 - [Cluster: Execution Platforms](#)
 - [Cluster: Control for Embedded Systems](#)
 - [Cluster: Testing and Verification](#)
- [Affiliated Partners](#)
 - [Affiliated Industrial Partners](#)
 - [Affiliated SME Partners](#)
 - [Affiliated Academic Partners](#)
 - [Affiliated International Collaboration Partners](#)

Research and Integration

- [ARTIST2 Research and Integration Activities](#)
- [Cluster: Real-Time Components](#)
 - [Research and Integration Activities for the "Real Time Components" cluster](#)
- [Cluster: Adaptive Real-Time](#)
 - [Research and Integration Activities for the "Adaptive Real Time" cluster](#)
- [Cluster: Compilers and Timing Analysis](#)
 - [Research and Integration Activities for the "Compilers and Timing Analysis" cluster](#)
- [Cluster: Execution Platforms](#)
 - [Research and Integration Activities for the "Execution Platforms" cluster](#)
 - [Internal Meetings](#)
 - [Execution Platforms Cluster Meeting](#)
- [Cluster: Control for Embedded Systems](#)
 - [Research and Integration Activities for the "Control for Embedded Systems" cluster](#)
- [Cluster: Testing and Verification](#)
 - [Research and Integration Activities for the "Testing and Verification" cluster](#)

Dissemination

- [Workshops](#)
 - [CORDIE'06: Concurrency, Real-Time and Distribution in Eiffel-like Languages](#)
 - [Artist2 - Foundations and Applications of Component-based Design](#)
 - [MARTES 2006](#)
 - [JTRES 2006](#)
 - [WESE'06 - Embedded Systems Education](#)
 - [ARTIST2 Workshop on Timing Analysis in the Industrial Development Process](#)
 - [MoCC - Models of Computation and Communication](#)

- [ARTIST2 Workshop on Requirements for Flexible Scheduling in Complex Embedded Systems](#)
- [ARTIST2 Workshop on Specification and Verification of Secure Embedded Systems](#)
- [ARTIST2 Workshop Beyond AutoSar](#)
- [ARTIST Workshop at DATE'06](#)
- [ARTIST2 Workshop on Execution Platforms / Cluster Meeting](#)
- [ARCS 2007](#)
- [ARTIST2 Workshop on Basic Concepts in Mobile Embedded Systems](#)
- [SCOPES 2007](#)
- [Workshops and Seminars in 2005](#)
 - [ACM-IEEE MEMOCODE'2005](#)
 - [Workshop: Distributed Embedded Systems](#)
 - [WESE'05 - ARTIST2 Workshop on Embedded Systems Education](#)
 - [OSPERT 2005 - Operating Systems Platforms for Embedded Real-Time applications](#)
 - [ARTIST Seminar on Adaptive Real-Time Systems](#)
 - [ARTIST Workshop at DATE'05](#)
 - [HSCC '05 - Hybrid Systems: Computation and Control](#)
 - [First S.Ha.R.K. Workshop](#)
 - [31st EUROMICRO Conference - Special session: Model Driven Engineering \(MDE\)](#)
- [Past Workshops](#)
- [Schools](#)
 - [ADSD 2006: Advanced Digital Systems Design](#)
 - [First European Laboratory on Real-Time and Control for Embedded Systems](#)
 - [FOSAD 2006: 6th International School on Foundations of Security Analysis and Design](#)
 - [ARTIST2 - MOTIVES 2007](#)
 - [ARTIST2 / UNU-IIST Spring School in China 2006](#)
 - [ARTIST2 Graduate Course on Embedded Control Systems](#)
 - [ARTIST2 Summer School 2005](#)
 - [Artist2 / UNU-IIST School in China - 2007](#)
 - [MDD4DRES](#)
- [International Collaboration](#)
- [Publications](#)
- [Contributions to Standards](#)
 - [Modelling](#)
 - [Programming Languages](#)
 - [Operating Systems and Middleware](#)
- [Course Materials](#)

[Embedded System Links](#)

- [Journals](#)
- [Conferences](#)
 - [MEMOCODE 2006](#)
 - [EmSoft'06](#)
 - [DAC 2007](#)
 - [DATE 2007](#)
 - [RTAS 2007](#)
 - [CODES+ISSS 2006](#)

- [ECRTS 2006](#)
- [IST Event 2006](#)
- [ACM LCTES 2006](#)
- [RTSS 2006](#)
- [FM 2006](#)
- [CASES 2006](#)
- [ASP-DAC 2007](#)
- [HSCC'07](#)
- [ECRTS 2007](#)
- [Standards](#)
- [Design, Development, and Validation Tools](#)
- [Main Projects](#)
- [Position Papers](#)
- [Roadmaps](#)
- [Newsletters and Magazines](#)
- [Announcements](#)
 - [Open Positions in Embedded Systems](#)
 - [Other](#)
- [Publications](#)

7. Industrial Liaison

Artist2 has a wide array of affiliated industrial and SME partners. Most of these 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.

Our active involvement in the European Technology Platform ARTEMIS also could have a significant and long-term impact. Several Artist2 partners, including OFFIS, PARADES, VERIMAG; and TU Vienna, are actively involved in the ARTEMIS ETP, in particular leadership and active contribution to the Working Groups for the Strategic Research Agenda (SRA).

In addition, each Artist2 partner has an outstanding track record for interaction with industry. Globally, the Artist2 consortium has a very 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.

We believe that the strong involvement of four main Artist2 partners in 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.

Here is a non-exhaustive list of highlights of Artist2 impacts on industry.

- SOCRADES Integrated Project
(Service-oriented cross-layer infrastructure for distributed smart embedded devices)
Artist2 play an important role.
- SHAPES Integrated Project
Scalable Software Hardware Architecture Platform for Embedded Systems
<http://shapes.atmelroma.it/wiki/bin/view/ShapesPublic/WebHome>
Artist2 play an important role.
- The activities of the Real Time Components cluster are relevant for those industrial sectors where there is a need for mastering system integration of complex heterogeneous embedded systems. Two sectors are particularly active and have concrete, immediate needs: Aeronautics and Automotive. The teams in this cluster have tight links to leading industrial partners, e.g. through IST-Integrated Project “SPEEDS”, and events such as the “Beyond Autosar” workshop held in Innsbruck this year. Specific effort has been dedicated to interacting with the automotive industry. This effort was made possible thanks to prior personal strong ties that some key participants (including: Werner Damm (OFFIS), Martin Törngren (KTH), Rolf Ernst (U. Braunschweig)) and affiliates (including: Stefan Kowalewski (RWTH Aachen)) of ARTIST2 had with the Autosar consortium.
- The Real Time Components cluster is, through CEA, Cantabria, and Thales, the driving force in the work of developing a profile of the Unified Modeling Language (UMLTM) for MARTE (Modelling and Analysing of Real-Time and Embedded systems).
- Work in the Compilers and Timing Analysis cluster is particularly relevant for industry. Work and tools on Compilation techniques are important for ST Microelectronics, in particular for generating code meeting given non-functional requirements for audio and video processing and data streaming applications in the TV, Set Top box, DVD player and recorder, mobile, base stations, printer and disk drive markets.

- Technology from AbsInt (Timing Analysis activity) is used by Airbus and the Critical Systems industry.
- Dortmund's cooperation with AbsInt (Timing Analysis, Execution Platforms activities) and the Universities of Bologna and Linköping exceeds expectations. Future opportunities include a commercialization of some of the results, for example through COWARE, ACE, AbsInt or ICD, a technology transfer centre located at Dortmund and headed by Peter Marwedel. The latter commercializes compilation techniques for network processors.
- The active participation of key industrial players such as STM and ACE (Compilers activity) is being intensified, and new upcoming research challenges are continuously taken up together by the participants in order to exploit synergy effects right from the start.
- ACE works closely with ST and with Philips having both a commercial relationship with them as well as being co-members of EU project consortia – in one case along with Verimag.
- Within the EmBounded Project (IST-510255) AbsInt is also involved in the development of the Hume compiler, a domain-specific high-level programming language for real-time embedded systems (Timing Analysis activity).
- Furthermore, partners in the Compilers and Timing Analysis cluster are involved in the projects: MORE and SHAPES Integrated Project.
- Work done in the Execution Platforms cluster is relevant for the automotive industry, which is currently in a fast and spectacular evolution towards the intelligent, safe, environmental, interconnected, and economic car.
- Due to ARTIST2 activities involving Real Time Components and Execution Platforms, (e.g. the ARTIST workshop "Beyond AUTOSAR" in Innsbruck) several technical meetings between TU Braunschweig and leading automotive suppliers in the AUTOSAR context held place. A main topic discussed was how compositional performance verification methods can be used in the automotive design process to facilitate the network integration problem. TU Braunschweig was invited to the SAE world congress 2007 in Detroit to present recent results in compositional performance verification.
- Work done in the Execution Platforms cluster is also relevant for the SoC and NoC architectures, where several lower performance computation nodes are cooperating in order to globally achieve the expected performance. The University of Bologna has a strong, ongoing collaboration with ST Microelectronics and FreeScale on these topics. It is co-developing low-power system interconnects, as well as energy-efficient level-one memory architectures for on-chip processor tiles. It is also cooperating with FreeScale, to develop a complete software infrastructure for power management within the Linux operating system. Finally, it is involved in the CLEAN IST Integrated Project.
- Teams from the Control for Embedded Systems cluster have strong working links with Volvo, ABB, Ericsson, and are involved in the IST Projects RUNES, SOCRADES, and ATESSST.
- An Open Repository for Test and Verification Case Studies (<https://bugsy.grid.aau.dk/artist2>) has been set up, and includes case studies from: Danfoss (Aalborg); Ericsson Telebit (Aalborg); Ericsson (Uppsala); Felix Ingrat at the LAAS Laboratory in Toulouse, France (Verimag); TK Systemtest (Aalborg); Skov A/S (Aalborg); ESI (Embedded Systems Institute, Eindhoven).

8. Contributions to Standards

The basic idea for standardisation is to enable open, interoperable systems and to provide means for assessing their quality. Clearly, standards are essential for the design, deployment, and integration of embedded systems. It is widely accepted that existing standards are insufficient to coherently cover the entire system lifecycle. Furthermore, current standards are insufficiently precise, or do not adequately take into account the state of the art;

The JPRA (Joint Programme of Research Activities) defined for ARTIST2 addresses issues that are essential for the definition and further development of standards, such as: “Modelling and Components”, “Verification and Testing”, “Quality of Service Management”, “Semantic Platforms for Design Flow”, “Real-Time Programming Languages”.

ARTIST2 will take the appropriate measures and incentives, to promote and extend industrial standards in the area of embedded systems design, in tight collaboration with core or affiliated industrial partners. Of course, the emergence of standards is a complex process involving many types of players, and is beyond the scope of an NoE. Nonetheless, we have been very active in carrying out the technical work in preparation of advances on standards, in tight collaboration with industry.

The measures and incentives used by the NoE are the following:

- We provide funding to the partners, for activities related to standards, as listed below.
- In the components cluster, we have an activity called “Development of UML for Real-time Embedded Systems”, which specifically addresses this point.
- In June 2005, we have organised a high level event, on “Component-based Systems”, in collaboration with the NSF and selected industrialists from Europe and the USA (see sections 2.2 and 2.3 of this deliverable).

Our activities cover a large number of standards as described below. Many of these activities were already started in a dispersed manner, before the start of the NoE. Through our actions, the NoE has federated the efforts per topic – by identifying key players and setting up meetings and events in which they can interact.

One top new priority for Year2 are the actions around the Autosar standard for automotive applications. We have already planned a workshop on the standard that will take place in Innsbruck, March 23rd - 25th.

This section contains the relevant standards, on which it is anticipated that ARTIST2’s activities will help to shape.

8.1 *Ada Programming Language*

ARTIST2 participant Alan Burns, from the University of York, is member of the “ISO Ada Standardisation body WG9”, and is chair of one of its subgroups (HRG - concerned with the use of Ada in high integrity applications). He is also a member of the Ada Rapporteur Group, which is responsible for maintaining and developing the Ada standard.

ARTIST2 participant Andy Wellings, from the University of York is a member of the Ada Technical Interpretation Committee, which is responsible for maintaining and developing the RTSJ.

Artist partners are developing an ISO standard for the Ada language, addressing many technical areas, including flexible scheduling. It applies mainly to high-integrity applications.

A number of new features have been added to the language to make it more expressive in terms of its real-time features.

Control of resource usage and dispatching has been enhanced.

The type model has been extended to increase support for software engineering in general.

Including into the standard of the Ravenscr profile for deterministic concurrency with a safety critical language

8.2 POSIX, IEEE 1003, ISO/IEC 9945-1 - Portable Operating Systems Interface

<http://standards.ieee.org/regauth/posix/>

Michael Gonzalez Harbour is an Associate Professor in the Department of Electronics and Computers at the University of Cantabria. He works in software engineering for real-time systems. He is a co-author of "A Practitioner's Handbook on Real-Time Analysis". He has been involved in several projects using Ada to build real-time controllers for robots. Michael is an active member of the POSIX real-time working group. He is the Technical Editor of the IEEE POSIX.1d and IEEE POSIX.1j standards. He teaches a graduate-level course on Real-Time Posix at his University and at the Polytechnical University of Madrid, and has given talks and tutorials on this subject at different conferences and workshops.

POSIX is the international standardization of a Unix-like operating system application program interface, with the objective of portability of applications at the source code level. Although initially POSIX was developed for general-purpose computing systems, real-time extensions have been added that make it possible to implement operating systems that can support portability of applications with real-time requirements. Today, most commercial real-time operating systems provide support for the POSIX interfaces.

POSIX is currently developed by two organizations in cooperation: IEEE, a well-known professional association, and X/Open, an industrial consortium. ARTIST2 core partner University of Cantabria has been actively participating in the POSIX real-time Working Group of IEEE for the past 12 years, and is deeply involved in the maintenance of the approved standards, and the development of new extensions, in particular those that will make it possible to have more flexible scheduling policies available to applications.

The ARTIST2 NoE, and particularly the cluster "Adaptive Real-Time", is a privileged forum for elaborating new extensions for flexible scheduling, adapting them to the needs of embedded real-time applications, and influencing operating system vendors to implement the new services.

An example of this, already organized by ARTIST2 partners, is the Advanced Real-Time Operating System Services workshop (ARTOSS), held in July 2003. ARTIST2 will organize similar events, and the conclusions from the discussions will be submitted by University of Cantabria to the POSIX Working Group.

We have been working on two parts of the standard:

IEEE Std 1003.13-2003. IEEE Standard for Information Technology—Standardized Application Environment Profile—POSIX Realtime and Embedded Application Support (AEP)

IEEE Std 1003.26-2003. IEEE Stf for Information Technology - Portable Operating System Interface (POSIX). Part 26: Device Control Application Program Interface (API) [C Language]

Expected next major release date (approx)

2008

Technical area(s) which it addresses

Real-time and embedded operating systems

Very succinct description of the standard itself

POSIX is the standardization of the UNIX operating system at the international level. It describes application program interfaces for the operating system services, with the aim of portability at the source code level. In addition to general-purpose services, it contains optional real-time services.

IEEE Std 1003.13-2003. Defines four profiles (subsets) of the base standard that are appropriate to specific real-time and embedded application environments. The profiles are for small embedded systems, industrial controllers, large embedded systems, and general-purpose computers with real-time requirements.

IEEE Std 1003.26 is an extension to the base standard defining an API for managing and controlling device drivers from the application.

Technical gains

Portability of applications at the source code level
Programming model shared across platforms of different sizes
Portability of programmers because of using the same programming model.

Previous revisions/versions on which it is based

IEEE Std 1003.1-2001
IEEE Std 1003.13-1998

Name of the relevant standardisation body

IEEE, ISO/IEC

Main leader or contact person within this standardisation body, and his/her role

Joseph Gwinn (Raytheon), Chair of the POSIX System Services working Group.

Industrial domains impacted

Real-time and embedded operating systems vendors and users.

Industrial gains

Portability of applications gives technological advantages of being able to support the same product for multiple platforms, and evolve to new software and hardware platforms very easily.

Name of the your team

Universidad de Cantabria

Your and/or your team's roles and responsibilities in the standard definition

Member of the POSIX Real-Time System Services Working Group
 Technical editor of the IEEE 1003.13 Std
 Technical editor of the IEEE 1003.26 Std
 Technical editor of the IEEE 1003.1j Std
 Technical editor of the IEEE 1003.1d Std

Main other ARTIST participants in the standardisation process

Indirect contributions of the partners of the Adaptive Real-Time Action through the group of the University of Cantabria

Main other ARTIST participants in the standardisation process

Very large number of participants (see the list in the actual standards)

8.3 Standards of the Object Management Group (OMG)

The OMG (Object Management Group - <http://www.omg.org/>) is an international consortium, which drives the development of several standards, such as: MDA (Model Driven Architectures), UML (Unified Modelling Language), CORBA (Common Object Request Broker Architecture), and middleware infrastructures.

It is well recognized that all these standards, despite their popularity and the existence of supporting tools and technology, suffer from a lack of precision, and are used in a fragmented manner, with weak coverage of the lifecycle.

ARTIST2 core and affiliated partners from the "Modelling and Components" cluster (CEA, INRIA, Thales, ABB, ARTiSAN, DaimlerChrysler, KU Leuven) but also from other clusters (OFFIS, UPM, Aachen Univ., Bologna Univ., York Univ., Ericsson, Nokia...) are active members of the OMG. Moreover, CEA, INRIA and Thalès already carry out related work with standardisation objectives in the CARROLL common research program.

In this context, the ARTIST activity on "Development of UML for Real-time Embedded Systems" (JPRA-Cluster Integration) provide very sound inputs for the definition of this UML standard for DRES (Distributed Realtime Embedded Systems). This job is expected to be one of the most active topics in the RTESS PTF for the 4 - 5 coming years. The existing UML profiles, such as SPT and QoS, are only the first steps towards a larger profile that will completely encompass embedded systems development.

We believe that an important priority for ARTIST2 should be supporting the development of these standards, to match equivalent efforts for this in the USA. Recently, DARPA and MITRE in the USA have launched special OMG groups such as a group on Model Integrated Computing. They have also taken measures for the adoption of new standards and the adaptation of existing standards to fit the requirements of US industry.

8.3.1 OMG MARTE

The OMG MARTE standard (follow up to the UML scheduling, performance and time profile)

UML profile for modelling real-time systems and their non functional properties, developed mainly with the support of the CARROLL research program (between CEA, INRIA and Thales) with the contribution of Cantabria and *Carleton University*

([Request for Proposal of a (UML Profile for Modeling and Analysis of Real-Time and Embedded systems (MARTE) RFP) / Document 2005-02-06. March 30, 2006 [Online]. Available <<http://www.omg.org/cgi-bin/doc?realtime/2005-2-6> >)

8.3.2 MOF 2.0 QVT (Query / Views / Transformations)(OMG standard)

Didier Vojtisek is research engineer at Inria. He is mainly involved in the development of the compiler and samples of transformations.

Technical area(s) which it addresses

Modelling and Components

Short description of the standard

This standard addresses a technology neutral part of MOF and pertains to: Queries on models, Views on metamodels and Transformations of models.

It aims to define a language with an unambiguous semantic to express those queries, views and transformations on models.

Technical gains

This standard will ease writing of the transformations that are needed in order to implement MDD (Model Driven Development), MDE (Model Driven Engineering) or MDA (Model Driven Architecture) approaches.

Main leader or contact person within this standardisation body, and his/her role

Mariano Belaunde (France Telecom): chairman for the QVT workgroup.

Industrial domains impacted

All the domains that use a MDD, MDE, MDA approaches should benefit from using a standard language to express their transformations.

Industrial gains

It brings interoperability between the various implementation of transformations and Tool-independence. Thus, the industry will be able to capitalize on reusable transformations.

Name of the contact in your team

Didier Vojtisek

Responsibilities in the standard definition

Our team was involved from the beginning of the process and we were coauthor of one the first submission. Since then, we actively follow this standard in order to produce the final submission.

We also provided various collaboration tools in order to help the standardisation process.

Main other ARTIST participants in the standardisation process

THALES: writer of some part of the initial submission

TNI-Valiosys: writer of some part of the initial submission

Main other non-ARTIST participants in the standardisation process

France Telecom, writer of some part of the initial submission and currently leader for the final revised submission

Many other participants in this submission that are still more or less active in the process now. DSTC, International Business Machines, Compuware Corporation, Sun Microsystems, Codagen Technologies Corporation, Softeam, TCS, Kennedy Carter, Interactive Objects Software, Alcatel

8.3.3 UML Profile for Schedulability, Performance, and Time Specification V1.0

<http://www.omg.org/docs/ptc/02-03-02.pdf>

Juan Antonio de la Puente is a full professor at the Technical University of Madrid (UPM). He has been teaching Ada and Real-Time systems for more than 15 years.

Expected next major release date (approx)

This standard is finished

Technical area(s) which it addresses

Adaptive Real-Time

Real-Time Components

Short description of the standard

UML extensions for the description of real-time properties in UML architectures and application of real-time analysis approaches

Technical gains

This standard includes notations for the temporal characterization of UML models. These extension are integrated with real-time analysis solutions such as Rate Monotonic Analysis.

Previous revisions/versions on which it is based

OMG Standard March 2005 (standard ended), Final adopted submission October 2003.

Name of the relevant standardization body

OMG (Object Management Group)

Main leader or contact person within this standardisation body, and his/her role

Alan Moore

Industrial domains impacted

UML Modelling tools vendors, and specially the real-time oriented modelling tools

Model-based real-time software development in general.

Industrial gains

This standard provides solutions to integrate real-time concepts in UML models. It includes notations to standardize the application of real-time technologies in UML. Several tool vendors provide support of this UML profile.

standard 3 looks for solutions to allows the interchange of model-driven based assets in different modelling tools, and make interoperable different modelling tools in the development of model-driven applications.

Name of the your team

Technical University of Madrid

Responsibilities in the standard definition

Review

Main other ARTIST participants in the standardisation process

CEA

Main other non-ARTIST participants in the standardisation process

Submitters: ARTiSAN Software, I-Logix, Ind., Rational Software Corp., Telelogic AB, TimeSys Corporation, Tri-Pacific Software

8.3.4 MDA component: Packaging the MDA artefacts.

Juan Antonio de la Puente is a full professor at the Technical University of Madrid (UPM). He has been teaching Ada and Real-Time systems for more than 15 years.

There is not version available yet.

Technical area(s) which it addresses

Modelling and Components

Short description of the standard

Solutions for the deployment of assets that support the model driven development of software applications.

Technical gains

This is a draft of standard proposal that look for solutions to define a deployment facilities, which integrates artefacts that support general solutions of a model driven development problem, in a single asset.

Main leader or contact person within this standardisation body, and his/her role

Philippe Desfray

Industrial domains impacted

Model-driven development tool vendors and software developers that apply model-driven technologies

Industrial gains

This standard looks for solutions to allows the interchange of model-driven based assets in different modelling tools, and make interoperable

different modelling tools in the development of model-driven applications.

Name of the your team

Technical University of Madrid

8.3.5 UML Profile for Modelling Quality of Service and Fault Tolerance Characteristics and Mechanisms V1.0

Juan Antonio de la Puente is a full professor at the Technical University of Madrid (UPM). He has been teaching Ada and Real-Time systems for more than 15 years.

Technical area(s) which it addresses

Adaptive Real-Time

Real Time Components

Short description of the standard

UML extensions for the description and analysis of Quality of Service properties in software architectures and specially the safety analysis and the application of fault tolerance solutions.

Technical gains

This standard proposes UML extensions for the description of extra-functional properties associates to services in general. UML do no includes notations for the description of quality properties of software in general, these properties have been included traditionally as informal description. These extensions propose solutions for the description of these concepts and integrates the notation with the general description of UML. It includes some solutions for the description of Risk assessment analysis and for the description of fault tolerant based software solutions.

Previous revisions/versions on which it is based

Draft of Adopted submission: June 2004, Final adopted submission September 2004.

Name of the relevant standardisation body

OMG (Object Management Group)

Main leader or contact person within this standardisation body, and his/her role

Miguel A. de Miguel

Industrial domains impacted

UML Modelling tools vendors, and specially the real-time oriented modelling tools
Model-based real-time software development in general.

Industrial gains

This standard provides solutions to integrate QoS and fault-tolerance concepts in UML models. They are notations to standardize the application of these technologies in UML. Tool vendors provide support of this UML profile.

Name of your team

Technical University of Madrid

Responsibilities in the standard definition

Chairs of this standard. Definition of QoS extensions. Redaction of standard proposal.

Main other ARTIST participants in the standardisation process

CEA, Thales: Submitters

Main other non-ARTIST participants in the standardisation process

Submitters: IBM, Ilogix-Inc., Open-IT, ARTISAN, Lockheed Martin, SINTEF, Softeam

8.4 ISO/IEC TR 18037 - Programming Languages - C - Extensions to support embedded processors

Rainer Leupers (Aachen)

Short description of the standard (max 5 lines)

Extensions to the programming language C to offer support for the performance improving features of embedded processors, such as fixed point arithmetic, memory spaces and low-level I/O.

Technical gains

The specifications are a 'natural' extension of the C language to support features that used to be available only by assembly programming. The specification is precise enough to be used as a blueprint for future development of embedded hardware and software systems.

Name of the relevant standardisation body

ISO/IEC JTC1 SC22 WG14.

Main leader or contact person within this standardisation body, and his/her role

Willem Wakker, ACE, project editor.

Industrial domains impacted

Embedded software systems

Industrial gains

The use of the specification allows the development and implementation of complex embedded software systems and algorithms in a portable, processor independent fashion.

Responsibilities in the standard definition

Preparation of (a large part of) the specification, reaching consensus amongst the international C working group, editing of the specification.

8.5 ETHERNET Powerlink, current version - 2 (EPL v2)

University of Aveiro

Expected next major release date (approx)

Unknown

Technical area(s) which it addresses

Both adaptive and hard real-time systems

Short description of the standard

Provision of real-time communication services on top of Ethernet COTS with low latency and jitter.

Technical gains

Increased throughput exploring parallel switching paths while maintaining low latency and jitter.

Increased integrity by improved detection and isolation of timing faults.

Handling of dynamic communication requirements.

Seamless integration of EPL and non-EPL nodes in the same segment.

Previous revisions/versions on which it is based

Based on EPL v2

Name of the relevant standardisation body

EPSSG - ETHERNET Powerlink Standardization Group

Main leader or contact person within this standardisation body, and his/her role

Andreas Pfeiffer (B&R Industrie-Elektronik GmbH), member of the EPSSG board of directors

Industrial domains impacted

Industrial automation, large distributed embedded systems

Industrial gains

Higher capacity of the network

Higher integrity of the system

Lower device count

Name of the your team

Univ. Aveiro

Responsibilities in the standard definition

We are ordinary members of EPSSG since mid 2004 and have had a rather passive participation until now. At this point we are starting to participate actively towards a new EPL version.

Main other non-ARTIST participants in the standardisation process

These are the members of the Board of Directors and also represent the institutions/companies that are more active in the standard.

Dr. Edwin Kiel (Lenze Drive Systems GmbH), chairman

Prof. Thomas Müller (Zürcher Hochschule Winterthur)

Andreas Dreher (Hirschmann Automation and Control GmbH)

Prof. Dr. Konrad Etschberger (FH Ravensburg-Weingarten)
Andreas Pfeiffer (B&R Industrie-Elektronik GmbH)

However, the EPSG has now 72 members and users.

8.6 Executable UML Foundation

Didier Vojtisek

Technical area(s) which it addresses

I mainly addresses the "Modelling and Components" cluster and probably will also be useful in "Testing and Verification" and "Execution Platforms" clusters.

Short description of the standard

The objective of this standard is to enable a chain of tools that support the construction, verification, translation, and execution of computationally complete executable models. For the tool chain to link together, the interchanged models must conform to the same meta-model and semantics.

This standard will define a computationally complete and compact subset of UML 2.0 to be known as "Executable UML Foundation"

Technical gains

By pointing out all the variation points that are in UML2.0, this standard will help specifying and testing models at the various phases of a development process

Industrial domains impacted

Industrial domains that use executable models that are expressed or that can be translated into this new Executable UML standard will benefit from it.

In particular the domains that already use UML2.0 to specify their models.

Industrial gains

This standard will enable the collaboration between tools that usually cannot communicate with each other. The end user will be able to build a complete model driven engineering process.

Name of the your team

Didier Vojtisek

Responsibilities in the standard definition

Our team will collaborate to define the standard and implement a prototype.

Main other ARTIST participants in the standardisation process

CEA is one of the main participant who have insisted to define this standard

Thales

Main other non-ARTIST participants in the standardisation process

As this is the very early phases of the standard (no submission yet) we can only cite the participants we are aware of:

Alcatel, CARE Technologies S.A./SOSY Inc., Data Access, France Telecom, I-Logix, Kennedy Carter, Lockheed Martin, Mentor Graphics Corporation, Pathfinder Solutions, Softeam, Telelogic AB

8.7 AUTOSAR Timing Model

Formal performance verification of complex heterogeneous embedded systems in the automotive domain

Creation of a unified global timing model for the open standard for automotive E/E architectures.

Technical Gains

- Easy and reliable integration of functional components from multiple suppliers
- Fast verification of timing requirements of the overall heterogeneous system
- Early architecture exploration

Artist Team: Prof. Ernst (IDA, University Braunschweig)

Role: SymTAVision, an associate partner of IDA, participated in behalf of Ford in the development of the AUTOSAR Timing model. Main contribution was the application of the expertise in system-level timing analysis of Prof. Ernst's working group for the systematic integration of highly specialized requirements to the timing model on different levels of abstraction into the resulting global timing model.

8.8 EAST-ADL 2" UML profile for automotive architecture and component modelling

This is developed within the IST ATESSST project with ARTIST partners CEA and KTH. Based on the AutosarTM meta-model it aims to provide a higher level of system modelling and to better support behavioural modelling aspects.

8.9 Embedded-C

ARTIST2 affiliated partner ACE, represented by Willem Wakker on the ISO C standardisation committee WG14, has been a contributor to the new Embedded-C standard. In providing the opportunity for significant performance improvements for embedded/DSP applications and architectures, European initiated innovation is gaining industry-wide acceptance. A predecessor, DSP-C, is currently used by numerous teams including those at ST and Aachen.

8.10 Matlab-Simulink and Synchronous Languages

Matlab-Simulink has established itself as the de-facto standard for highly engineering-oriented embedded systems industries, such as automobile and aeronautics. Matlab provides high quality support for domain specific and control engineering as well as scientific engineering in general and visualization. Simulink itself, with its add-on Stateflow, provides an integrated description and simulation environment for hybrid systems, both dataflow and state based.

ARTIST2 partners are the founders of synchronous languages, such as Esterel, Lustre, and Signal, which are widely used in the aeronautics/avionics industries. These languages are semantically close to Matlab/Simulink. ARTIST2 partners have developed a semantic framework for graphical notations such as those found in Simulink/Stateflow, and have improved on code generation, formal validation, and architecture generation for Matlab/Simulink.

ARTIST2 research activities – and specifically through the “Hard Real-Time” cluster - will aim to develop results for distributed architecture generation, from Matlab/Simulink specifications. While not contributing directly to a “standard” in the usual sense, this work could provide the basis for improving the existing technology, or even for developing an independent European technology to replace Matlab/Simulink.

9. Staff Mobility

The strongest form of direct collaboration is through visits between core and affiliated participants.

Area of Collaboration: **Generation of component models**
 Cluster: Real Time Components
 Sending Partner: Dortmund (affiliated)
 Receiving Partner: Uppsala (core)
 Person: Harald, Raffelt, M.Sc.
 Technical Work: Further development of the LearnLib Tool, plus preparation for major case study (telecommunications protocol)
 Dates: July 5 - Aug. 24
 Costs: Housing 2 kE, Travel (several trips) 2 kE, Misc. 1 kE

Mälardalen had two MSc students from Univ. des Saarlandes visiting for one week in January 2006. Also, Raimund Kirner from TU Wien visited us for a week in the fall 2005 (Oct 30 – Nov 5).

Area of Collaboration: **Low power real-time systems for multimedia applications.**
 Clusters: Execution Platforms, Compilers and Timing Analysis
 Sending Partner: Peter Marwedel – Dortmund
 Receiving Partner: Petru Eles - ESLAB/Linköping
 Person: Olivera Jovanovic
 Technical Work: Extend current techniques for on-line voltage/frequency scaling to multiprocessor systems.
 Dates: April - November 2006
 Published Work: Journal publication planned

Area of Collaboration: **Feedback scheduling of control systems**
 Sending Institution: UPC (Pau Marti) – ART cluster
 Receiving Institution: LUND (Anton Cervin) – Control cluster
 Persons: Rosa Castane Selga
 Technical Work: Develop new feedback scheduling strategies
 Dates: September – December 2006
 Approximate Costs: Nb people : 1
 Travel : 300 €

Stay: 8,000 € (paid by LUND, salary and accommodation)

Long Range Impact on Integration: Important in order to improve the integration

Published Work: Rosa Castañé, Pau Martí, Manel Velasco, Anton Cervin, Dan Henriksson. Resource Management for Control Tasks Based on the Transient Dynamics of Closed-Loop Systems. In Proceedings of the 18th Euromicro Conference on Real-Time Systems, Dresden, Germany, July 2006.

Further Collaboration Planned: Yes

Area of Collaboration **Tools for embedded control systems**
Sending Institution CTU, CZECH REPUBLIC – Control cluster
Receiving Institution LUND (Karl-Erik Årzén) and KTH (Martin Törngren) – Control cluster
Persons Zdenek Hanzalek
Technical Work Specification of common interface and case studies for design tools TrueTime and Torsche. The scheduling algorithms for FPGAs have been integrated in the concept of the TrueTime tool.
Dates 15.9.2005 – 24.9.2005
Approximate Costs Nb people : 1
 Travel : 250 €
Stay: 1,250 €
Long Range Impact on Integration Important in order to improve the integration
Published Work Martin Törngren, Dan Henriksson, Karl-Erik Årzén, Anton Cervin, Zdenek Hanzalek. Tools Supporting the Co-Design of Control Systems and Their Real-Time Implementation; Current Status and Future Directions. In Proceedings of the 2006 IEEE Computer Aided Control Systems Design Symposium, October 2006.
Further Collaboration Planned Yes

Area of Collaboration **Sensor Networks**
Sending Institution CTU , CZECH REPUBLIC
Receiving Institution KTH
Persons Jiri Trdlicka, Ing.
Technical Work Development of the network flow routing algorithm with real-time constraints. Previous work by Mikael Johansson on optimisation of multi-commodity flows was extended by real-time constraints and experiments have been carried out in Matlab.
Dates 31.5. 2006 -29.8 2006
Approximate Costs Nb people : 1
 Travel : 300 €
Stay: 5,500 €
Long Range Impact on Integration Important in order to improve the integration
Published Work J.Trdlicka, M.Johansson, Z.Hanzalek, Network flow routing algorithm with real-time constraints, internal report to be submitted to appropriate conference
Further Collaboration Planned Yes

Area of Collaboration Real-Time Control

Sending Institution UPVLC, Spain (Pedro Albertos) – Control cluster
 Receiving Institution LUND (Karl-Erik Årzén) – Control cluster
 Persons Pedro Garcia
 Technical Work Development of new delay compensaytion schemes
 Dates Mid June – Mid September 2006
 Approximate Costs Nb people : 1
 Travel : 350 €

Stay: 1,250 €

Long Range Impact on Integration Important in order to improve the integration

Published Work Pedro Garcia, Pedro Albertos, Tore Hägglund. Control of unstable non-minimum phase delayed systems. Accepted for publication in Journal of Process Control.

José Luis Guzmán, Pedro García, Tore Hägglund, Sebastián Dormido, Pedro Albertos, Manuel Berenguel. "Interactive tool for analysis of time-delay systems with dead-time compensation" In 7th IFAC Symposium on Advances in Control Education, Madrid, Spain, June 2006.

Further Collaboration Planned Yes

Area of Collaboration Embedded control systems

Sending Institution KTH
 Receiving Institution CTU
 Persons Martin Törngren and Bengt Eriksson
 Technical Work Graduate course on Embedded Control Systems
 Dates 3 – 7 April 2006
 Approximate Costs Nb people : 2
 Travel : 600 €

Stay: 1200 €

Long Range Impact on Integration Important in order to improve the integration

Published Work No

Further Collaboration Planned Yes

Area of Collaboration Embedded control systems

Sending Institution LUND
 Receiving Institution CTU
 Persons Karl-Erik Årzén and Anton Cervin
 Technical Work Graduate course on Embedded Control Systems
 Dates 3 – 7 April 2006
 Approximate Costs Nb people : 2
 Travel : 500 €

Stay: 1200 €

Long Range Impact on Integration Important in order to improve the integration

Published Work No

Further Collaboration Planned Yes

Area of Collaboration **Embedded control systems**
 Sending Institution UPVLC
 Receiving Institution CTU
 Persons Pedro Albertos and Alfons Crespo
 Technical Work Graduate course on Embedded Control Systems
 Dates 3 – 7 April 2006
 Approximate Costs Nb people : 2
 Travel : 600 €

Stay: 1200 €

Long Range Impact on Integration Important in order to improve the integration
 Published Work No
 Further Collaboration Planned Yes

Area of Collaboration **Embedded control systems**
 Sending Institution KTH
 Receiving Institution CEA
 Persons Martin Törngren
 Technical Work Joint project discussions with CEA and Volvo
 Dates May 2006
 Approximate Costs Nb people : 1
 Travel : 300 €

Stay: 150 €

Long Range Impact on Integration Joint research projects are important in order to be able to
 implement the vision of the network.
 Published Work No
 Further Collaboration Planned Yes

Area of Collaboration **Embedded control systems**
 Sending Institution KTH
 Receiving Institution LTH
 Persons Carl Johan Sjöstedt
 Technical Work PhD student exchange
 Dates 26-28 April 2006 + 22-24 May 2006
 Approximate Costs Nb people : 1
 Travel : 300 €

Stay: 300 €

Long Range Impact on Integration Important for the future collaboration
 Published Work No
 Further Collaboration Planned Yes

10. Joint Projects and Joint Proposals

The following projects are either ongoing in Year 2, or under proposal.

Please note that this is a subset of the full list, as some proposals are confidential.

Reconfigurable Ubiquitous Networked Embedded Systems (RUNES)

EU IST Integrated Project

Starting Date: 2004-09-01

Artist2 Partners: LUND (Karl-Erik Årzén), KTH (Karl Henrik Johansson)

Main other partners: Ericsson (Andras Toth, coordinator)

Flexible Embedded Control Systems (FLEXCON)

Swedish SSF Project

Starting Date: 2003-01-01

Artist2 Partners: LUND (Karl-Erik Årzén), KTH (Jan Wikander), Mälardalen (Ivica Crnkovic)

Main other partners: University of Skövde (Sten F. Andler)

Hybrid Control (HYCON)

EU IST Network of Excellence

Starting Date: 2004-09-01

Artist2 Partners: LUND (Anders Rantzer), KTH (Karl Henrik Johansson), ETH (Manfred Morari), PARADES (Alberto Sangiovanni-Vincentelli), Univ Twente (Edgar Brinksma), INRIA (Giancarlo Ferrari Trecate)

Main other partners: CNRS (Francois Lamnabhi-Laguerrigue, coordinator)

Advancing Traffic Efficiency and Safety through Software Technology (ATESST)

EU IST STREP

Starting Date: 2006-01-01

Artist2 Partners: KTH (Martin Törngren), CEA (Sebastien Gerard, Francois Terrier), Volvo Technology (coordinator - affiliated partner of ARTIST2), Daimler Chrysler (affiliated partner), ETAS (affiliated partner)

Main other partners: Technical University of Berlin, Mentor Graphics, Siemens-VDO

Dynamically Self-Configuring Automotive Systems (DYSCAS)

EU IST STREP

Starting Date: 2006-01-06

Artist2 Partners: KTH (Martin Törngren), Volvo Technology (coordinator - affiliated partner of ARTIST2), Daimler Chrysler (affiliated partner of ARTIST2)

Main other partners: Enea Embedded Technology AB, Robert Bosch GmbH, University of Greenwich, University of Paderborn, Systemite AB, Movimento AB

Safety critical vehicular systems (SAVE++)

National Swedish project funded by the Swedish Foundation for Strategic Research

Starting Date: 2006-01-01

Artist2 Partners: KTH (Martin Törngren), UU (Wang Yi, Paul Pettersson), MDH (Hans Hansson, Ivica Crnkovic), LIU (Simin Nadjm Tehrani)

SOCRADES - (Service-oriented cross-layer infrastructure for distributed smart embedded devices)

Integrated Project, European Commission, IST program, FP6

Starting Date: 2006-06-01

Artist2 Partners: KTH (Karl-Henrik Johansson, Mikael Johansson), ABB

EUROSYSLIB - European Leadership in System Modelling and Simulation through advanced MODELICA Libraries,

ITEA2 Project proposal under submission

Starting Date: Not yet accepted

Artist2 Partners: LUND (Karl-Erik Årzén, Anders Rantzer), INRIA (Ramine Nikoukhan)

Main other partners: Dassault Systèmes, DLR, EDF, Siemens

Reservation-Based Scheduling in Mobile Terminals

National Swedish proposal under preparation

Starting Date: Not yet accepted

Artist2 Partners: Ericsson (Johan Eker), LUND (Karl-Erik Årzén, Anton Cervin)

Main other partners: None

FRESCOR - Framework for Real-time Embedded Systems based on COnTRACTs,

EU IST STREP 034026

Starting Date: 1 June 2006

Artist2 Partners: Universidad de Cantabria (Michael Gonzalez Harbour), University of York (Alan Burns), Scuola Superiore Sant'Anna (Giorgio Buttazzo), Kaiserslautern Univ. of Tech. (Gerhard Fohler), Univ. Politécnic de Valencia (Alfons Crespo), Czech Tech. Univ. in Prague (Zdenek Hanzalek), ENEA

Main other partners: Thales Communications, EVIDENCE

SAVE

A Swedish project, supported by the Foundation for Strategic Research, with partners: Uppsala, Mälardalen, KTH, Linköping. The goal of SAVE is to establish an engineering discipline for systematic development of component-based software for safety critical embedded systems.

SPEEDS

a concerted effort to define the new generation of end-to-end methodologies, processes and supporting tools for safety-critical embedded system design.

Execution Time Analysis of Time-Critical Embedded Software

<http://www.mrtc.mdh.se/projects/wcet/>

Swedish national funding (KK-foundation), 2006-2008

Keywords: WCET analysis

ARTIST2 participation: Malardalen, Tidorum, AbsInt

PROGRESS Strategic Centre

<http://www.mrtc.mdh.se/progress/>

Swedish national funding (Swedish Foundation for Strategic Research), 2006-2010, research centre with timing analysis of component-based embedded software as one activity

Keywords: WCET analysis, Component-based embedded software

ARTIST2 participation: Malardalen

Execution Time Analysis of Time-Critical Embedded Software (proposal)

(KK-foundation, Swedish national funding) Date: 2006- 2008, Artist2 partners: Malardalen University (B. Lisper), AbsInt (C. Ferdinand), Tidorum (N. Holsti) Significant other Partners: Arcticus Systems AB, CC-Systems AB, IAR Systems AB, Volvo Construction Equipment AB

11. Affiliated Partners in the ARTIST2 Research Activities

ARTIST2 has a very extended family, through its affiliated industrial, SME, academic and international collaboration partners. These are one of our main operational links for concretely spreading excellence outside the Network of Excellence. The affiliated partners have strong relations with the consortium, and they contribute actively to and fully benefit from the NoEs results.

Affiliated partners are not core members in the consortium, but receive support for travelling to Artist2 meetings, and actively contribute to the implementation of the Joint Programme of Activities (JPA). These affiliated partners include industrial, SME, academic, and international affiliates.

At the end of Year 2, the NoE has 30 large industrial affiliated partners, 11 SMEs, 34 academic, and 16 international affiliated partners. All of these partners have participated in one or more of our technical events and work over the course of the Years 1&2. We have also had a very large number of participants from the wider research and industrial communities, who are not listed officially.

We also note a very large increase in the number of affiliated industrial partners, going from 14 at the end of Year1 to 30 presently.

As planned, the Artist2 consortium will continue to increase its affiliated partners. The procedure for joining Artist2 as affiliated partners has been clarified and is described here: <http://www.artist-embedded.org/artist/Becoming-an-Affiliated-Partner.html>

11.1 Affiliated Industrial Partners

Company	Areas of expertise	ARTIST2 Activities	Company Contacts
ABB Automation	Modelling and validation of industrial robotics non-functional properties in industrial control systems	Quantitative Testing and Verification Component Modelling and Composition	Christer Norström,
ABB Automation	real-time control and automation, cases	Real-time techniques in control system implementations Adaptive Real-time, HRT and Control	Göran Arinder
Airbus France	avionics industrial case		Francois Pilarski

	study		
Bosch	Automotive Software Architectures		Dirk Ziegenbein
DaimlerChrysler	Specification, Design and Implementation of automotive systems	Component Modelling and Composition	Matthias Grochtmann
Daimler-Chrysler	automotive systems design	Seeding New Work Directions	Heiko Dörr
EADS	Case study on architecture modelling and schedulability analysis	Platform for Component Modelling and Verification	David Lesens
EDF Recherche et Développement	static analysis and model checking	Quantitative Testing and Verification	Alain Ourghanlian
Ericsson Mobile Platforms	Telecommunication, resource management, multimedia content , case studies	Control in Real-time Computing Adaptive Resource Management for Consumer Electronics Adaptive Real-time, HRT and Control	Johan Eker
Hispano-Suiza (previously: Snecma)	avionics systems design	Semantic Framework for Hard Real-Time Design Flow	Philippe Baufreton
Honeywell Prague Labs	case studies	Design Tools for Embedded Control Real-time techniques in control system implementations	Vladimir Havlena
Infineon	failure rates for hardware components	Diagnosis in Distributed Hard Real-Time Systems	Knut Hufeld
Israeli Aircraft Industries	avionics systems design	Semantic Framework for	Michael Winokur

		Hard Real-Time Design Flow	
Maquet Critical Care	Medical embedded equipment and systems	Provides input and feedback from the medical sector.	Klas Engwall
Motorola A/S	Sven H. Sørensen	Testing and Verification	model driven development and testing
Nokia Mobile Phones Denmark A/S	providing requirements and applications	EP: System Modeling Infrastructure	Peter Mårtensson
Philips Research	Consumer electronics, video streaming	Adaptive Resource Management for Consumer Electronics	Withheld for reasons of confidentiality
Axalto/SchlumbergerSema/AXALTO	Industrial needs wrt. security in embedded systems	Verification of Security Properties	Boutheina Chetali
Siemens Mobile Phones A/S	development of embedded systems using model-driven methodology	Quantitative Testing and Verification	Sven H. Sørensen
STMicroelectronics	low power single-chip multiprocessors providing requirements and applications dynamically controlling power consumption in PMSoC platforms	Design for Low Power EP: System Modeling Infrastructure Resource-aware Design	Roberto Zafalon
SymTAVision GmbH		Communication-centric Systems	Kai Richter
Telelogic	Testing tool provider	Quantitative Testing and Verification	Tommy Ericsson
TERMA A/S	mission-critical systems; model driven development	Testing and Verification	Thomas Hune
Thales	component-based middleware, Co-Chair of MARS group at OMG	QoS aware Components	Virginie Watine

	on CORBA, RTE		
Thalès Research and Technology	standardization and case study from the aerospace or telecommunication domain	Development of UML for Real-time Embedded Systems	Dominique Potier
Volkswagen AG	software integration under real-time constraints	Communication-centric Systems	Fabian Wolf
Volvo	requirements analysis	EP: System Modeling Infrastructure Design Tools for Embedded Control Communication-centric Systems	Magnus Hellring
Volvo Car Corporation	real-time control, networked control, case studies	Design Tools for Embedded Control Real-time techniques in control system implementations	Jakob Axelsson
Volvo Technical Development	real-time control, networked control, cases	Real-time techniques in control system implementations	Henrik Lonn

11.2 Affiliated SME Partners

Company	Areas of expertise	ARTIST2 Activities	Company Contacts
ARTiSAN Software	UML standard evolutions	Component Modelling and Composition Development of UML for Real-time Embedded Systems	Alan Moore
BullDAST	Design Automation Services and Tools		Monica Donno
dSPACE	case studies and development tools real-time control	Design Tools for Embedded Control Real-time techniques	Joachim Stroop

		in control system implementations Semantic Framework for Hard Real-Time Design Flow	
Enea Embedded Technology	Real Time Operating Systems and Testing	Quantitative Testing and Verification	Jan Lindblad
Esterel Technologies	tool provider	Real Time Components	Bernard Dion
Evidence s.r.l.	real-time kernels and OSEK standard	A Common Infrastructure for Adaptive Real-time Systems Flexible Scheduling Technologies Adaptive Resource Management for Consumer Electronics	Paolo Gai
IAR Systems A/S	verification and code generation tool provide	Quantitative Testing and Verification	Henrik Leerberg
LifTech	Industrial Lift Solutions	Adaptive Real Time	Antonio Garrido
Micro/IO	Electronic Engineering Solutions	Adaptive Real Time	Fernando Santos
TNI-ValioSys	tool provider	Semantic Framework for Hard Real-Time Design Flow	
TTTech	diagnostic tools	Diagnosis in Distributed Hard Real-Time Systems	Judith Sattlberger

11.3 Affiliated Academic Partners

Contacts	Institution	Areas of expertise	ARTIST2 Activities
Miroslaw Malek	Humboldt-University of Berlin	Diagnostic algorithms	
Francky Catthoor	IMEC	high-level code optimization	Architecture-aware compilation
Isabelle Puaut	IRISA	Timing-Analysis Tools	Timing Analysis Platform

Geert Deconinck	K.U. Leuven	low power architectures	Design for Low Power
Ivo De Lotto	University of Pavia	Sensory systems, robotics applications, wireless communication, energy-aware computing	
Stefan van Baelen	K.U. Leuven	QoS specifications and negotiation mechanisms	Development of UML for Real-time Embedded Systems QoS aware Components
Ahmed Bouajjani	LIAFA (Paris)	Real-time and hybrid model checking	Quantitative Testing and Verification
Ivica Crnkovic	Mälardalen **	Component models for embedded systems Platform for Component Modelling and Verification	Component Modelling and Composition
Giovanni DeMicheli	EPFL Lausanne	Design Methodology for Embedded Systems, Low Power Design	JPRA communication centric design
Ed Deprettere	University Leiden, The Netherlands	Design Methodology for Embedded Systems, Signal and Image Processing, Algorithm Design and Mapping	JPRA Communication Centric Systems
Donatello Sciuto	Politecnico Di Milano	Design Methodology for Embedded Systems, Low Power Design	
Jan Tretmans	Nijmegen	Testing	Quantitative Testing and Verification
Fabio Martinelli	CNR-IIT	security protocols and trust management	Verification of Security Properties
Laurent Pautet	Paris Telecom	distributed systems real-time middleware, timed contract based behavioural typing, component-based adaptive services in mobile networks	Flexible Scheduling Technologies QoS aware Components
Julian Proenza	University of the Balearic Islands	Dependable and Real- Time Systems	

Michael Rusinowitch	INRIA	formal methods on embedded systems, verification of security properties	Verification of Security Properties
Eugenio Villar, Pablo Sanchez	Universidad de Cantabria	Design and Implementation of Embedded H/S Systems	
Axel Jantsch	Royal Institute of Technology Stockholm	Design Methodology for Embedded Systems	
Luciano Lavagno	Politecnico di Torino	low power circuits system-level design and hardware platforms	Design for Low Power
Lucia Lo Bello	University of Catania	Stochastic analysis of soft real-time tasks in the context of priority-driven soft real-time systems.	
Giuseppe Lipari	Scuola Superiore S. Anna	dynamic priority schemes kernel maintenance	A Common Infrastructure for Adaptive Real-time Systems Flexible Scheduling Technologies
Marius Minea	Timisoara	extraction and abstraction of interfaces	Component Modelling and Composition
Andreas Krall	TU Vienna **	code optimization Program-Analysis Tool	Architecture-aware compilation Compilers Platform
Carlos Delgado Kloos	U. Carlos III of Madrid	QoS Management QoS component infrastructures	A Common Infrastructure for Adaptive Real-time Systems QoS aware Components
Marisol García-Valls	U. Carlos III of Madrid	QoS management	Adaptive Resource Management for Consumer Electronics
Willem-Paul de Roever	U. Kiel	formal methods, stepwise refinement	Semantic Framework for Hard Real-Time Design Flow
Julio Medina	Univ. of Cantabria **	notations and tools for scheduling analysis	Component Modelling and Composition Platform for Component

			Modelling and Verification
Lucia Lo Bello	Univ. of Catania	communication protocol and stochastic scheduling	Flexible Scheduling Technologies
Pau Marti	Universitat Politècnica de Catalunya	control methodologies	A Common Infrastructure for Adaptive Real-time Systems
Lubos Brim	University Brno	distributed model checking	Quantitative Testing and Verification
Sabine Glesner	Technical University of Berlin	Compilers, Verification, Embedded Systems and Software, Formal Semantics	Compilers Platform
Markus Schordan	TU Vienna	alias analysis, source-to-source infrastructures, high-level optimizations, and parallelization	
Bernhard Steffen	University Dortmund **	tool integration platform	Platform for Component Modelling and Verification
Andrea Bondavalli	University of Florence	statistical methods for diagnosis	

** different team from the Artist2 partner

11.4 Affiliated International Partners

Contacts	Institution	Areas of expertise	ARTIST2 Activities
Stephen Edwards	Columbia University	software engineering, formal methods in programming languages, automated testing, component-based approaches	Real Time Components
Mathai Joseph	Tata Research Development & Design Centre (TRDDC), a division of Tata Consultancy Services, Ltd	Formal methods	Real Time Components
Ed Lee	UC Berkeley	systems theory,	Real Time Components

		concurrent models of computation	
Shankar Sastry	UC Berkeley	hybrid Systems, computation and control	Real Time Components
Lui Sha	Univ of Illinois	control of server systems control in embedded computing	Control in Real-time Computing Adaptive Real-time, HRT and Control
P.S. Thiagarajan	Univ of Singapore	models and logics for distributed systems	Semantic Framework for Hard Real-Time Design Flow
Kang Shin	University of Michigan	mobile and wireless networks, security, sensor networks	
Sharon Hu	University of Notre Dame, USA	Power analysis and optimization	Communication-centric Systems
Tarek Abdelzaher	University of Virginia	control of server systems control in embedded computing	Control in Real-time Computing Adaptive Real-time, HRT and Control
John Stankovic	University of Virginia	Real-time computing, embedded computing, operating systems, wireless sensor networks, and large scale distributed computing.	
Zhou Chaochen	Chinese Academy of Sciences	Formal methods	Real Time Components
Giovanni De Micheli	EPFL	Hardware and System Architectures	Execution Platforms, Low Power Design
Xiao Jian Liu	Northwestern Polytechnical University, Xi'an	Real Time Operating Systems	Real Time Components
Zhiming Liu	UNU-IIST	Formal Methods	Real Time Components
Heinz Schmidt	Monash University (Australia)	Software Engineering and Distributed Systems	Real Time Components
Janos	Vanderbilt	Model-Driven	Real Time Components

Sztipanovits	University	Architectures	
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12. Joint Papers

Joint publications reflect deep and lasting integration between participants, while at the same time spreading the results to the wider research community.

This list is unsorted

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