



IST-214373 ArtistDesign Network of Excellence on Design for Embedded Systems

Jointly-executed Programme of Activities for

# Spreading Excellence

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with inputs from all NoE participants

# Policy Objective (abstract)

The visibility of the ArtistDesign research effort in embedded systems design is now worldwide. This has clearly creating a significantly stronger European embedded systems design community, as witnessed by the positive evolution of major conferences in the area, stronger involvement with industry, and interaction between research teams.

The Jointly-executed Programme of Activities for Spreading Excellence (JPASE) is a cornerstone in this effort.

Changes with respect to Y3 deliverable: entirely new texts throughout the document, except for 1.1., 6.1, 6.2.



# Versions

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# 1. Vision and Strategy for Spreading Excellence - Executive Summary

JPASE

# 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 ArtistDesign meetings, and actively contribute to the implementation of the
   Joint Programme of Activities (JPA). These affiliated partners include industrial, SME,
   academic, and international collaboration 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 ArtistDesign), education; and through the ArtistDesign web pages.
- Targeted towards students
   A particular focus has been placed on the ARTIST Summer Schools this year with a truly
   outstanding programme of lecturers, and the innovation of providing the lectures in video
   form on the Artist website.

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 ArtistDesign 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 ArtistDesign community has pusrsued a very active publishing policy, with a strong presence in scientific journals and conferences, as attested by the extensive list of publications provided in this document. Publication of research is a bottom-up process, which may seem chaotic – but this is intrinsic to research.

# **Tools and Components**

The ArtistDesign 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**

ArtistDesign has a wide array of affiliated industrial and SME partners (see the Thematic and Transversal Activity deliverables). Most of these partners have participated in some way in the ArtistDesign technical meetings and the overall effort. There is strong, high-level industry participation through the various Spreading Excellence events organised by ArtistDesign. Our active involvement in the European Technology Platform ARTEMIS also could have a significant and long-term impact.



We believe that the strong involvement of four main ArtistDesign 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 ArtistDesign meetings, and actively contribute to the implementation of the Jointly-executed Programme of Activities (JPA). These affiliated partners include industrial, SME, academic, and international affiliates.

# **1.3** Scientific and Technical Community in the Large

A description of the ArtistDesign's community's interaction with other research teams is visible in section 2.4 ("2.4 Interaction of the Cluster with Other Communities") of each Cluster deliverable, and in section 2.3 ("2.3 Other Research Teams") in the Transversal Integration Activity deliverable.

Interaction with these other scientific communities is achieved mainly bottom-up through the organisation of scientific events, publications, distribution of tools and components, industrial partnerships (not funded by ArtistDesign), education; and through the ArtistDesign web pages.

Our sponsoring policy aims specifically at enforcing integration of existing scientific events in the area. This is sought in particular through the Embedded Systems Week (<u>http://www.esweek.org/</u>), in which we play a crucial role.

Another concrete example is our action within the DATE conference (<u>http://www.date-conference.com/</u>), 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 ARTIST community now clearly 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 10 years, 9 general chairs of DATE have been leading ARTIST members.

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.

# 1.3.1 International Collaboration

International Collaboration has been one of the central activities pursued within ARTIST since 2003, and is described in detail in this document.

All of the recurring ARTIST International Collaboration events have continued and been expanded within ArtistDesign in 2011. Further details about the schools are available in the section "Organisation of Schools".



# 1.3.2 Publications

The ArtistDesign community is extremely active in publishing in scientific journals and conferences, as attested by the list of joint publications provided in this document.

Joint publications seem to be a reliable measure of integration and building excellence between the partners.

# 1.3.3 Industrial Liaison

ArtistDesign has a wide array of affiliated industrial and SME partners, as described in the deliverables' "Affiliated Partners" sections. Most of these partners participate in some way in the ArtistDesign technical meetings and the overall effort. There is strong, high-level industry participation through the various Spreading Excellence events organised by ArtistDesign.

Our active involvement in the European Technology Platform ARTEMIS also could have a significant and long-term impact. Several ArtistDesign partners, including VERIMAG, BOLOGNA, OFFIS and TU Vienna, are actively involved in the ARTEMIS ETP. The ArtistDesign Strategic Management Board was actively consulted for finalizing the 2011 release of the ARTEMIS Strategic Research Agenda.

In addition, each ArtistDesign partner has an outstanding track record for interaction with industry. Globally, the ArtistDesign consortium has a very strong impact on European R&D in embedded systems. This impact is visible via the achievements in Integrated Projects and STREPs (see below).

# 1.3.4 Links with ARTEMISIA

ArtistDesign has strong links to ARTEMIS, through:

- Representation on the ARTEMIS Industry Association Steering Board:
  - o Joseph Sifakis is the CNRS representative
  - Luca Beninni is the University of Bologna representative
- Partner membership in **ARTEMIS** "**B**" (Research Organisations & Universities) http://www.artemisia-association.org/member\_status
  - Arne Skou is the Aalborg University representative
  - Denis Platter is the CEA representative
  - Joseph Sifakis is the CNRS-Verimag representative
  - o Boudewijn Haverkort is the Embedded Systems Institute representative
  - Rudy Lauwereins is the IMEC representative
  - Jean-Pierre Banâtre is the INRIA representative
  - Eduardo Tovar is the Instituto Superior de Engenharia do Porto representative (Instituto Politécnico do Porto in ArtistDesign)
  - Gunnar Landgren is the KTH representative
  - Bernhard Josko is the OFFIS representative
  - Jan Madsen is the TU Denmark representative
  - o José Carlos Gómez Sal is the University of Cantabria representative
  - o Luca Benini is the University of Bologna representative
  - Farid Ouabdesselam is the Université Joseph Fourier representative



- Strong *informal* links. For example, the ArtistDesign Strategic Management Board was asked to review and comment on the latest edition of the Strategic Research Agenda, published in 2011.
- Strong representation by ArtistDesign partners in ARTEMIS projects,



# 2. International Collaboration

International Collaboration has been one of the central activities pursued within ARTIST since 2003.

JPASE

# 2.1 Major International Collaboration Events organised and funded in Y4

# **NERES 2011**

# http://www.artist-embedded.org/artist/-NERES-2011-.html

November 10-11, 2011 University of Porto, Portugal

Along the past decades, several network communication protocols have been developed with new capabilities, from an ever increasing throughput and support for traffic classes (including guaranteed latency and jitter), to different topologies, integration of heterogeneous segments, extensive use of wireless technologies, openness to dynamic arrival and departures of nodes, openness to larger networks (such as the Internet), etc. If, on one hand, many problems have been solved, with a significant number of successful real-time embedded applications that rely on networking services, on the other hand new problems appeared, or some old problems persist, that still require adequate solutions for harmonization with real-time constraints, e.g., energy-efficient communication (particularly in WSN), networks for nodes with scarce resources, scalability issues in large sensor systems, networking support to middleware and to Quality-of-Service (QoS) adaptation and graceful degradation, support to higher software integration and transition to wireless communication everywhere.

# Time-Predictable and Composable Architectures for Dependable Embedded Systems

http://www.artist-embedded.org/artist/-Time-Predictable-and-Composable-.html

October 9th, 2011 Taipei, Taiwan

Embedded systems must interact with their real-time environment in a timely and dependable fashion. Most embedded-systems architectures and design processes consider "non-functional" properties such as time, energy, and reliability as an afterthought, when functional correctness has (hopefully) been achieved. As a result, embedded systems are often fragile in their real-time behaviour, and take longer to design and test than planned. Several techniques have been proposed to make real-time embedded systems more robust, and to ease the process of designing embedded systems, including

Precision-timed and time-triggered architectures, to make time a first-class citizen of system design. Deterministic architectures for repeatable timing behaviour. Composability, which guarantees that the (non)-functional behaviour of components is unchanged on integration in a larger system.

The aim of this tutorial is to present the state of the art and major approaches to timepredictability and composability, such as BIP, TTA, PRET, PTIDES, Giotto, TipToe, and CompSOC.

# ACESMB 2011

http://www.artist-embedded.org/artist/-ACESMB-2011-.html

October 18th, 2011 Wellington (New-Zealand) (during <u>MoDELS 2011</u>)

The objective of this workshop is to bring together researchers and practitioners interested in model-based software engineering for real-time embedded systems. We are seeking contributions relating to this subject at different levels, from modelling languages and semantics to concrete application experiments, from model analysis techniques to model-based implementation and deployment. Given the criticality of the application domain, we



particularly focus on model-based approaches yielding efficient and provably correct designs. Concerning models and languages, we welcome contributions presenting novel modelling approaches as well as contributions evaluating existing ones.

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# **WSS'11**

http://www.artist-embedded.org/artist/-WSS-11-.html

October 14th, 2011 Taipei (Taiwan), within ESWeek 2011

An increasing amount of software is not written manually any more. Rather, software is synthesized from abstract models of the required functionality. As a result, the effort of generating software is reduced and software verification typically becomes easier. Software synthesis has been implemented in various disperse communities. The workshop aims at bringing the software generation and software synthesis communities together and at identifying research problems which should be addressed by the scientific community.

# WESE 2011

# http://www.artist-embedded.org/artist/-WESE-2011-.html

October 13th, 2011 Taipei (Taiwan), within ESWeek 2011

As embedded system designs grow more complex and the time to market diminishes, quality embedded systems education becomes more and more important. This fifth 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.

# **JTRES - 2011**

#### http://www.artist-embedded.org/artist/-JTRES-2011,1199-.html

# September 26-28, 2011 Kings Manor, York, England

Interest in real-time Java in both the research community and industry has recently increased significantly, because of its challenges and its potential impact on the development of embedded and real-time applications. The goal of the proposed workshop is to gather researchers working on real-time and embedded Java to identify the challenging problems that still need to be solved in order to assure the success of real-time Java as a technology, and to report results and experiences gained by researchers.

# **IRTAW-15**

http://www.artist-embedded.org/artist/-IRTAW-15-.html

September 14-16, 2011 Liébana (Cantabria), Spain

The 15th International Real-Time Ada Workshop (IRTAW-15) will take place on September 14-16 of 2011 in Liébana (Cantabria), Spain, a nice mountain area by the "Picos de Europa" National Park.

# **ARTIST Summer School in Europe 2011**

http://www.artist-embedded.org/artist/-ARTIST-Summer-School-Europe-2011-.html

September 4-9, 2011 Aix-les-Bains (near Grenoble), France

The Summer School offered a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.



# ARTIST Summer School in China 2011

http://www.artist-embedded.org/artist/-ARTIST-Summer-School-in-China-2011-.html

*August 8-12, 2011 IOS/ISCAS - Beijing, China* The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# WCET 2011

http://www.artist-embedded.org/artist/-WCET-2011-.html

July 5th, 2011 Porto, Portugal (in conjunction with <u>ECRTS</u>)

Reliable WCET bounds are a necessary component for the construction and verification of dependable real-time systems. They are an input for doing task CPU allocation, creating task schedules, and performing schedulability analysis.

# Map2MPSoC 2011

http://www.artist-embedded.org/artist/-Map2MPSoC-2011-.html

# June 28-29, 2011 St. Goar, Germany

The aim of the workshop is to provide a forum for brainstorming and road-mapping the future of mapping applications to MPSoCs. Knowledge about constraints and directions for future MPSoC architectures should be collected. Existing mapping techniques should be briefly presented and analyzed. Directions for future research should be proposed and evaluated.

# ARTIST Graduate School on RT Kernels for Microcontrollers - 2011

http://www.artist-embedded.org/artist/-ARTIST-Graduate-School-on-RT,1200-.html

June 13-17, 2011 Pisa, Italy

The course has two main objectives:

- Introducing the most important concepts and methodologies used to develop a real-time embedded system, including fundamentals of real-time scheduling, control and distributed systems;
- Showing how to apply these concepts in practice, using an embedded platform and a realtime operating system to developed simple control applications and make experience with wireless sensor networks.

# UML&AADL'2011

http://www.artist-embedded.org/artist/-UML-AADL-2011-.html April 27th, 2011 Las Vegas, USA (in conjunction with <u>ICECCS 2011</u>) Sixth IEEE International workshop UML and AADL

# **APRES 2011**

http://www.artist-embedded.org/artist/-APRES-2011-.html

April 11th, 2011 Chicago, USA (within <u>CPS Week 2011</u>)

Adaptive embedded systems can respond to environmental changes including hardware/software defects, resource changes, and non-continual feature usage. As such, adaptive systems can extend the area of operations and improve efficiency in the use of system resources. However, adaptability also incurs overhead in terms of system complexity and resource requirements. For example, an adaptive system requires some means for reconfiguration. These means and their mechanisms introduce additional complexity to the design and the architecture of the system, at the same time require additional resources such as computation, power, and communication bandwidth. Consequently, adaptive systems must



be diligently planned, designed, analyzed, and built to find the right tradeoffs between flexibility and complexity.

# **Rigorous Embedded Design 2011**

http://www.artist-embedded.org/artist/-Rigorous-Embedded-Design-2011-.html

April 10th, 2011 Salzburg, Austria (within <u>EuroSys 2011</u>)

The objective of the workshop is to discuss new methodologies for the rigorous design of embedded systems. Through a series of invited talks, the workshop will survey some of the challenges and emerging approaches in the area. A series of design flows will be presented. The workshop will mainly discuss performance analysis, correctness (high confidence and security), code generation, and modeling aspects (including timed scheduling and software/hardware interactions). Those concepts shall be illustrated with examples coming from the aeronautic, automotive, and robotic areas. Interactions between industrials and academic researchers will be facilitated through a series of open discussion sessions (maybe an interaction between theoretical and more practical presentations).

# PPES 2011

http://www.artist-embedded.org/artist/-PPES-2011-.html

# March 18th, 2011 Grenoble, France (within <u>DATE</u>)

The PPES workshop is concerned with critical hard real-time systems that have to satisfy both efficiency and predictability requirements. For example, an electronic controller for a safetycritical system in an automobile needs to react not only correctly to external inputs such as rapid deceleration or loss of grip, but also provably within a given time-span. Although there exist techniques to accurately predict the worst-case execution time of critical embedded systems for complex microprocessors, the current approaches will not scale to future systems. The trend of integrating multiple functions on a single control unit or to use multi-core systems with shared resources saves costs, but introduces lots of interferences between tasks and components.

# 2.2 Previous ARTIST International Collaboration Events organised and funded by the NoE

The following international collaboration events have been organised in the past by ARTIST:

# **WSS'10**

October 29th, 2010 http://www.artist-embedded.org/artist/-WSS-10-.html

An increasing amount of software is not written manually any more. Rather, software is synthesized from abstract models of the required functionality. As a result, the effort of generating software is reduced and software verification typically becomes easier.

- Software synthesis has been implemented in various disperse communities. The workshop aims at bringing the software generation and software synthesis communities together and at identifying research problems which should be addressed by the scientific community.



# WESE'10

October 28th, 2010 http://www.artist-embedded.org/artist/-WESE-10-.html

As embedded system designs grow more complex and the time to market diminishes, quality embedded systems education becomes more and more important. This fifth 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.

# WFCD - 2010

October 24th, 2010 http://www.artist-embedded.org/artist/-WFCD-2010-.html

The workshop aims to discuss recent results on component-based design with emphasis on design frameworks for real-time systems encompassing heterogeneous composition and models of computation. 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.

# Memocode 2010

July 26th, 2010 http://www.artist-embedded.org/artist/-Memocode-2010,1162-.html

The goal of MEMOCODE 2010, the eighth in a series of successful international conferences, is to gather researchers and practitioners in the field of the design of modern hardware and software system to explore ways in which future design methods can benefit from new results on formal methods.

# **ARTIST Summer School in China 2010**

July 18th, 2010 http://www.artist-embedded.org/artist/-ARTIST-Summer-School-in-China-2010-.html

The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# **ARTIST Summer School in Morocco – 2010**

July 11th, 2010 http://www.artist-embedded.org/artist/-ARTIST-Summer-School-in-Morocco-.html

This summer school aims at providing a forum for graduate students, but also postgraduates, researchers, and professors, to get in-depth tutorials covering different aspects of the development cycle of embedded systems. This school is also an opportunity to share and discuss recent advances and trends in this field.

# ARTIST Summer School South-America 2010

May 26th, 2010

http://www.artist-embedded.org/artist/-ARTIST-Summer-School-South-America-.html

This fourth edition of the school seeks to continue strengthening the cooperation between Europe and South America in the area of embedded systems, both at educational and research levels. For this purpose, the goal of the school is to provide state-of-the-art courses



on embedded systems oriented towards advanced students and young researchers. It should also provide a pleasant atmosphere for research-related discussions among the participants.

# WESE'09 – Workshop on Embedded Systems Education

October 15th, 2009 Grenoble, France, within ESWeek 2009 http://www.artist-embedded.org/artist/-WESE-09-.html

As embedded system designs grow more complex and the time to market diminishes, quality embedded systems education becomes more and more important. This fifth 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.

# WFCD - Foundations and Applications of Component-based Design 2009 October 11th, 2009 Grenoble, France, within ESWeek 2009

http://www.artist-embedded.org/artist/-WFCD-2009-.html

The workshop aims to discuss recent results on component-based design with emphasis on design frameworks for real-time systems encompassing heterogeneous composition and models of computation. 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.

# **IRTAW-14**

October 7-9, 2009 Portovenere, Italy http://www.artist-embedded.org/artist/-IRTAW-14-.html

For over 20 years the series of International Real-Time Ada Workshop meetings has provided a forum for identifying issues with real-time system support in Ada and for exploring possible approaches and solutions, and has attracted participation from key members of the research, user, and implementer communities worldwide.

# **ARTIST Summer School in Europe 2009**

September 7-11, 2009 Autrans (near Grenoble), France http://www.artist-embedded.org/artist/-ARTIST-Summer-School-in-Europe-.html

The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# ARTIST School in South America 2009: Embedded Systems Design

August 3-7, 2009 Buenos Aires, Argentina http://www.artist-embedded.org/artist/-ARTIST-SummerSchool-SouthAmerica-.html

The School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# ARTIST Summer School in China 2009

July 19-24, 2009 Tsinghua, China http://www.artist-embedded.org/artist/-ARTIST-Summer-School-in-China-2009-.html



The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# **Runtime Verification 2009**

*June 26-28, 2009 Grenoble, France (within <u>ESWeek</u>) http://www.artist-embedded.org/artist/-Runtime-Verification-.html* 

The objective of RV'09 is to bring scientists from both academia and industry together to debate on how to monitor and analyze the execution of programs, for example by checking conformance with a formal specification written in temporal logic or some other form of history tracking logic.

# WESE'08: WS on Embedded Systems Education

October 23rd, 2008 Atlanta, Georgia - USA (within <u>ESWEEK</u>) http://www.artist-embedded.org/artist/-WESE-08-WS-on-Embedded-Systems-.html

As embedded system designs grow more complex and the time to market diminishes, quality embedded systems education becomes more and more important. This fourth 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.

# Workshop on Foundations and Applications of Component-based Design (WFCD'2008)

October 19th, 2008 Atlanta, Georgia (USA) http://www.artist-embedded.org/artist/-Components-2008-.html

The workshop aims to discuss recent results on component-based design with emphasis on design frameworks for real-time systems encompassing heterogeneous composition and models of computation. 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.

# **ARTIST2 Summer School 2008 in Europe**

September 8-12, 2008 Autrans (near Grenoble), France http://www.artist-embedded.org/artist/-ARTIST2-Summer-School-2008-.html

The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# **ARTIST2 South-American School for Embedded Systems 2008**

August 25-29, 2008 Universidade Federal de Santa Catarina, Florianopolis, Brazil http://www.artist-embedded.org/artist/-ARTIST-2-South-American-School-.html

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



# Artist2 Summer School in China 2008

http://www.artist-embedded.org/artist/-Artist2-Summer-School-in-China-.html July 12-18, 2008 Shanghai, China

ARTIST2 has organized the 3rd edition of a school on Embedded Systems Design in Shanghai. This year, the school was organized in collaboration with the SEI/ECNU and the LIAMA.

# **ARTIST2** meeting on Integrated Modular Avionics

November 12-13, 2007 Roma, Italy http://www.artist-embedded.org/artist/-ARTIST2-meeting-on-Integrated-.html

Integrated Modular Avionics (IMA) has set the principles of standardized components and interfaces of hardware and software in aircraft, applied for the first time in the development of the Airbus A380.

# WESE'07: WS on Embedded Systems Education

http://www.artist-embedded.org/artist/-WESE-07-.html October 4-5, 2007 Salzburg, Austria (within <u>ES Week</u>)

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

# Foundations of Component-based Design

http://www.artist-embedded.org/artist/-Foundations-of-Component-based-.html September 30th, 2007 Salzburg, Austria - within <u>EmSoft</u> / <u>ES Week</u>

Discuss recent results on component-based design with emphasis on design frameworks for real-time systems encompassing heterogeneous composition and models of computation.

# First European-SouthAmerican School for Embedded Systems

<u>http://www.artist-embedded.org/artist/-First-European-SouthAmerican-.html</u> *August 21-24, 2007 Universidad Argentina de la Empresa (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.

# Artist2 / UNU-IIST School in China - 2007

http://www.artist-embedded.org/artist/-Artist2-UNU-IIST-School-in-China-.html August 1-10, 2007 Suzhou (near Shanghai), China

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

# Artist2 - Foundations and Applications of Component-based Design

http://www.artist-embedded.org/artist/-Foundations-and-Applications-of-.html October 26th, 2006 Seoul, South Korea



The workshop gathered researchers from computer science and electrical engineering to discuss recent results on component-based design with emphasis on design frameworks for real-time systems encompassing heterogeneous composition and models of computation. Especially frameworks for handling non-functional and resource constraints, design under conflicting dependability criteria, trade-offs between average performance and predictability.

# WESE'06 - Embedded Systems Education

http://www.artist-embedded.org/artist/-EmSoft-06-Workshop-on-Embedded..html October 26th, 2006 Seoul, Korea

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

# ARTIST2 / UNU-IIST Spring School in China 2006

April 3-15, 2006 Xi'an, China http://www.artist-embedded.org/artist/-ARTIST2-UNU-IIST-China-School-.html

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.

# Joint US-EU-TEKES workshop

June 21-22 2006 Helsinki, Finland http://www.artist-embedded.org/artist/Joint-US-EU-TEKES-workshop.html Workshop held under the auspices of NSF, the EU's IST Program and Tekes, the Science and Technology Agency of Finland.

# Artist International Collaboration Days 2003 - Trends in Embedded Systems Design

October 12th 2003 – Philadelphia http://www.artist-embedded.org/artist/Artist-International-Collaboration,452.html

# ACM - Special Issue on Education

http://www.artist-embedded.org/artist/ACM-Special-Issue-on-Education,449.html

This special issue of the ACM Transactions in Embedded Computing Systems aims to provide the basis for integrated undergraduate and graduate curricula covering the essential areas of knowledge for tomorrow's embedded systems engineers and researchers. Guest Editors <u>Alan Burns</u> <u>Alberto Sangiovanni-Vincentelli</u> - UC Berkeley

# **ARTIST International Collaboration Days - 2005**

July 7-8, 2005 Paris, France http://www.artist-embedded.org/artist/ARTIST-INTERNATIONAL-COLLABORATION.html

Component-based Engineering for Embedded Systems Transatlantic Research Agenda on Future Challenges in Embedded Systems Design

# Conference on EU-Korea Collaboration on Embedded Systems

http://www.artist-embedded.org/artist/Conference-on-EU-Korea,450.html



The purpose of this workshop was to identify important topics in the area of Embedded Systems where strong synergy between Korean and EU teams would have the greatest benefit. The aim was to achieve a common understanding and background on which future collaborative actions and joint projects can be based.

Artist International Collaboration Days 2003 - Education in Embedded Systems Design <u>http://www.artist-embedded.org/artist/Artist-International-Collaboration,451.html</u> *October 11th 2003 – Philadelphia* 

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# 3. Organisation of Schools

# 3.1 ARTIST Summer School in Europe 2011

http://www.artist-embedded.org/artist/-ARTIST-Summer-School-Europe-2011-.html

September 4-9, 2011 Aix-les-Bains (near Grenoble), France

The Summer School offered a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

This seventh edition was once again a major event in the field of embedded systems design. Feedback has been quite positive: The technical programme was of high quality with ample time to go into detail on technical topics, the level of off-line discussions and contacts were excellent, and the social programme meshed well with the objectives and context of the school. We had 73 participants and 14 invited speakers. As a result, the school and the ArtistDesign NoE have continued to benefit from a high degree of visibility and recognition.

We wish in particular to thank the speakers for the outstanding quality of the presentations and subsequent discussions. We also wish to thank the European Commission's Information and Communication Technologies (ICT) / 7th Framework Programme

(<u>http://cordis.europa.eu/fp7/ict/</u>), which provided the complementary funding to make the school possible. We were able to increase the capacity to 100 participants and extend the length of the school to 6 days. The social programme allowed much time for informal interaction.

The Summer School offered a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading experts.

# 3.1.1 Overview

The ARTIST Summer School 2011 was held near Grenoble by the magnificent Lac du Bourget and the French Alps in the historic city of Aix-les-Bains. The school was organised by the ArtistDesign European Network of Excellence on Embedded Systems Design, which gathers 31 top European institutions. Artist's mission is to coordinate European research in the area around an ambitious joint research agenda, and to spread excellence through targeted events such as international workshops, schools and seminars.

Artist has a strong tradition in organising top-quality schools. This was the sixth edition of yearly schools on embedded systems design, and is meant to be exceptional in terms of both breadth of coverage and invited speakers.



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# 3.1.2 Speakers & Programme

This school brought together some of the best lecturers from Europe and the USA, in a six-day programme, and was a fantastic opportunity for interaction.



# 3.1.3 Participants

# **Invited Speakers**

Professor Tarek Abdelzaher	University of Illinois at Urbana Champaign	USA
Professor Sanjoy Baruah	University of North Carolina at Chapel Hill	USA
Professor Luca Benini	University of Bologna	Italy
Professot Ratislav Bodik	UC Berkeley	USA
Dr Fabien Clermidy	CEA	France
Professor Peter Druschel	Max Planck Institute for Software Systems	Germany
Professor Rolf Ernst	TU Braunschweig	Germany
Professor Babak Falsafi	EPFL	Switzerland
Professor Martti Forsell	VTT	Finland
Professor Kim Larsen	University of Aalborg	Denmark
Professor Yunhao Liu	Tsinghua University/HKUST	China
Professor Alberto Sangiovanni-Vincentelli	UC Berkeley	USA

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Professor Janos Sztipanovits Professor Dr. Lothar Thiele

Vanderbilt University ETH Zurich USA Switzerland

# Participants

Arifa Bhutto	PhD Student	Aalborg University	Denmark
Timo Jouko Juhani Lilja	PhD Student	Aalto University	Finland
Panagiotis Katsaros	Dr.	Aristotle University of Thessaloniki	Greece
Julien Mottin	Dr	CEA	France
Jean-Pierre Krimm	Dr	CEA	France
Muhammad Ali Awan	Mr	CISTER Research Unit, Porto	Portugal
Kasper Søe Luckow	MSc in Engineering in Software	Aalborg University	Denmark
Ahmed Daghsen	2nd year Phd student	ESTACA Campus Ouest	France
Georgia Giannopoulou	DiplEng.	ETH Zurich	Switzerland
Hardik Shah	Mr.	Fortiss GmbH	Germany
Christian Köllner	DiplInform.	FZI Forschungszentrum Informatik	Germany
Francisco Mendoza	M.Sc.	FZI Forschungszentrum Informatik	Germany
Florian Poelzlbauer	DI(FH)	Graz University of Technology	Germany
Andreas Riel	Dr.	Grenoble Institute of Technology	France
Daisuke Shimbara	Researcher	Hitachi, Ltd., Yokohama Research Laboratory	Japan
Hamdi Ayed	PhD student	INP Toulouse	France
Dorin Maxim	М.	INRIA	France
Gideon Smeding	M. Sc.	INRIA	France
Peter Schrammel	DI	INRIA	France
Waqaas Munawar	M. Sc.	Karlsruhe Institue of Technology	Germany
Amir Aminifar		Linkoping University	Sweden
Ivan Ukhov	Mr	Linkoping University	Sweden
Gabriel Marchesan Almeida	Mr.	LIRMM Laboratory	France
Hang Yin	PhD student	Mälardalen University	Sweden
Andreas Gustavsson	Ph.D. Student	Mälardalen University	Sweden
Rafia Inam	Ms.	Mälardalen University	Sweden
Arvind Rajawat	Associate Professor	Maulana Azad National Institute of Technology, Bhopal	India
Jochen Ulrich Hänger	Diplom-Ingenieur (FH)	Robert Bosch	Germany
Sebastian Hahn	Mr.	Saarland University	Germany
Florian Haupenthal	Mr.	Saarland University	Germany
Ayman Dogui	Phd Students at Supelec (FRANCE)	Supelec (Ecole supérieure d'électricité)	France
Juan Rios	Mr.	Technical University of Denmark	Denmark
Laura Micconi	MSc	Technical University of Denmark	Denmark
Gérard Cristau	Mr	Thales Research & Technology	France
Panagiota Papavramidou	Phd student	TIMA laboratory	France

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Maryam Bahmani	PhD Student (Doctorant)	TIMA Laboratory	France
Hai Wan	Dr.	Tsinghua University	China
Hehua Zhang	Dr.	Tsinghua university	China
Rui Wang	Miss	Tsinghua University	China
Min Zhou	Mr	Tsinghua University	China
Jonas Diemer	DiplIng.	TU Braunschweig, IDA	Germany
Philip Axer	DiplIng.	TU Braunschweig, IDA	Germany
Anton Hattendorf	M.Sc.	TU München / fortiss	Germany
Miguel Telleria	Mr	Universidad de Cantabria	Spain
Juan Maria Rivas	Mr	Universidad de Cantabria	Spain
Luis Filipe Oliveira	Mr.	Universidade do Porto	Portugal
Sergio Ruocco	Dr.	Università degli Studi di Milano- Bicocca	Italy
Cong Liu	Mr.	University of North Carolina at Chapel Hill	USA
Malcolm Mollison	Mr.	University of North Carolina at Chapel Hill	USA
Andreas Simbuerger	Dipl. Inf. (Univ.)	University of Passau	Germany
Ahlem Mifdaoui	Associate professor	University of Toulouse/ ISAE	France
Thi Thieu Hoa Le	Ms	University of Trento	Italy
Bo Yang	Researcher	University of Turku	Finland
Liang Guang	Mr.	University of Turku	Finland
Khalid Latif	Mr.	University of Turku	Finland
Mohammad Fattaholmannan Najafabadi	Mr.	University of Turku	Finland
Amir-Mohammad Rahmani	Researcher PhD Student	University of Turku	Finland
Emad Ebeid	PhD student	University of Verona	Italy
Gareth Andrew Lloyd	Mr	University of York	UK
Paris Mesidis	Mr	University of York	UK
Mark Fairbairn	Mr	University of York	UK
Pontus Ekberg	Mr	Uppsala University	Sweden
Yi Zhang	Ph.D Candidate	Uppsala University	Sweden
Nan Guan	Mr	Uppsala University	Sweden
Martin Stigge	Mr.	Uppsala University	Sweden
Bensalem Saddek	Professor	Verimag Laboratory	France
Paraskevas Bourgos	Mr	Verimag Laboratory	France
Jacques Combaz	Dr	Verimag Laboratory	France
Tesnim Abdellatif	Dr	Verimag Laboratory	France
Pranav Tendulkar	PhD Student	Verimag Laboratory	France
Marius Bozga	Dr	Verimag Laboratory	France
Husni Khanfar	Mr.	Verimag Laboratory	France
Benedikt Huber	Mr.	Vienna University of Technology	Austria



# 3.1.4 Organisation

- Scientific Coordinator: Joseph Sifakis
- Technical Coordinator: Bruno Bouyssounouse
- Programme Committee: <u>ArtistDesign Strategic Management Board</u> (<u>http://www.artist-embedded.org/artist/-Strategic-Management-Board,938-.html</u>)

# 3.1.5 Grants

Participants were charged 850€ for students, 1100€ for non-students (VAT included). The remaining costs are covered by a grant paid for by ArtistDesign.

The registration costs + grant cover:

- Lodging and meals from Saturday dinner to Friday lunch
- Chartered buses to/from Lyon St Exupéry and Geneva airport on Saturday Sept 3rd and Friday Sept 9th.
- Courses NB: Any other costs such as air/train fare to/from Lyon St Exupéry airport or Grenoble city centre, taxis, meals/services not organized by the school must be covered independently by the participants.

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# 3.1.6 Poster for the school

# **ARTIST Summer School**

• Professor Tarek Abdelzaher

in Europe, 2011

- Challenges in Human-centric Sensor Networks
- Professor Sanjoy Baruah Certification-cognizant scheduling in integrated computing environments
- Professor Luca Benini Managing MPSoCs beyond their Thermal Design Power
- Professor Rastislav Bodik Automatic Programming Revisited
- Dr. Fabien Clermidy Designing Network-on-Chip based multi-core heterogeneous System-on-Chip: the MAGALI experience
- Professor Peter Druschel Trust and Accountability in Social Systems
- Professor Rolf Ernst Mixed safety critical system design and analysis

7th Edition Sept 4-9 2011 (6 days) Aix-les-Bains (near Grenoble), France

- Professor Babak Falsafi Towards Dark Silicon and its Implication on Server Design
- Professor Martti Forsell Parallelism, programmability and architectural support for them on multi-core machines
- Professor Kim Larsen Timing and Performance Analysis of Embedded Systems
- Professor Yunhao Liu GreenOrbs: Lessons Learned from Extremely Large Scale Sensor Network Deployment
- Professor Alberto Sangiovanni-Vincentelli Mapping abstract models to architecture automatic synthesis across layers of abstraction
- Professor Janos Sztipanovits Domain Specific Modeling Languages for Cyber Physical Systems: Where are Semantics Coming From?

The Summer School will be held in the historic city of Aix-les-Bains, by the magnificent Lac du Bourget and the French Alps (near Grenoble). The venue features a luxury spa with full services, pool, sauna, hammam, tennis courts and open space. The social programme includes ample time for

discussion, and a visit to the historic city of Annecy with a gala dinner while touring the lake.

• Professor Dr. Lothar Thiele



#### Organisation

- Organised and funded by the ArtistDesign European Network of Excellence on Embedded Systems Design:
- Scientific Director: Joseph Sifakis (VERIMAG Laboratory)
- Technical Coordinator: Bruno Bouyssounouse (VERIMAG Laboratory)
- ArtistDesign Strategic Management Board Steering Committee:

#### ArtistDesign Grants

The NoE provides grants for all persons attending the Summer School, partially covering registration, meals, lodging and transportation.



#### To participate and for further information:

http://www.artist-embedded.org/artist/-ARTIST-Summer-School-Europe-2011-.html (deadline is May 15th 2011)





# 3.2 ARTIST Summer School in China 2011

http://www.artist-embedded.org/artist/-ARTIST-Summer-School-in-China-2011-.html

August 8-12, 2011 IOS/ISCAS - Beijing, China

The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# 3.2.1 Overview

The ArtistDesign European Network of Excellence on Embedded Systems Design will organize the 6th edition of a school on Embedded Systems Design at the Institute of Software, Chinese Academy of Sciences (ISCAS), Beijing, July 18-23, 2010.

This year, the school was organized in collaboration with (in alphabetical order) :

- ARTIST European Network of Excellence
- Chinese Academy of Science
- Danish-Chinese Basic Research Center (IDEA4CPS)
- ECNU, Shanghai
- ISCAS, Beijiing
- LIAMA

It was open in priority to Chinese students. We believe that this has opened significant opportunities for collaboration with Chinese research teams.

# Contents

The school offered a full week consisting of in-depth tutorials on state-of-the-art techniques for the design and analysis of embedded systems given by leading experts.

# Objective

We aimed to provide a forum for young professors, lecturers, researchers, postgraduates (advanced master and PhD students) working in embedded systems as well as engineers from industry with practical background with the development of embedded systems.

# • Targeted Audience

The school is open for participation by any interested participants. However, some previous training and/or experience in fundamentals of computer science as well as knowledge of computer architecture is required. Participants will be selected according to their CVs submitted to the organization committee.

# • Programme and Lecturers

Top European lecturers from the ArtistDesign European Network of Excellence will provide a world-class programme.

# 3.2.2 Speakers & Programme

Top European lecturers from the ArtistDesign European Network of Excellence provided a world-class programme:

# Professor Luis Almeida

# University of Porto, Portugal

Luis Almeida is currently an associate professor at the Electrical and Computer Engineering Department of the University of Porto and a member of the Institute of Telecommunications in

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Porto and of the Electronics and Telematics Engineering Institute of Aveiro in which he coordinated the Electronic Systems Lab between 2003 and early 2008. He is also a member of the IEEE, Computer Society, and particularly of its Technical Committee on Real-Time Systems, member of the IFIP Tecnical Committee on Embedded Systems, member of the Strategic Management Board of the EU/ICT NoE ArtistDesign, leading the Real-Time Networks activity in that NoE, Trustee of the RoboCup Federation and Vice-President of the Portuguese National Robotics Society.

His current interests are real-time communication protocols for embedded systems with an emphasis on mechanisms to support predictable operational flexibility as needed for dynamic QoS management, graceful degradation and open distributed real-time systems in general. He co-authored over 150 refereed publications, 3 patents and 6 book chapters. He regularly participates in the organization and program committees of scientific events in the Real-Time Systems and Robotics communities, including RTSS, ECRTS, DATE, SIES, WFCS, ETFA and RoboCup.

# Abstract:

Distributed real-time systems are becoming pervasive, either in process control, factory automation and more recently, embedded systems. This course will present an introduction to computer networks from a real-time systems perspective. The lectures include an initial presentation of general concepts in networks and then focus on the physical and data link layers, devoting particular attention to the medium access control. Then, the course will address the issue of traffic scheduling and its relationship with medium access control, showing typical schedulability analysis that can be used to derive a priori guarantees of traffic timeliness. A few paradigmatic protocols will then be presented and analyzed, including a reference to the growing interest on wireless communication. Finally, the course will address a few related on-going research efforts, mainly towards flexible real-time communication for adaptive and reconfigurable systems.

# **Professor Karl-Erik Arzen**

# Lund University, Sweden

Karl-Erik Årzén was born in Malmö, Sweden on October 4, 1957.

He received his M.Sc in Electrical Engineering and PhD in Automatic Control from Lund University in 1981 and 1987 respectively. He was appointed as professor in automatic control in 2000. He has also worked for ABB Corporate Research during 1992-1994. His research interests includes real-time systems, real-time and

embedded control, control of computer software systems, discrete event and sequential control, and intelligent control systems. He has published more than 120 journal articles and conference papers.

He is the leader of the Control for Embedded Systems cluster within

the EU/IST Network of Excellence ARTIST2 since 2004. He was the chairman of the IEEE Control System Society Technical Committee on Real-Time Control, Computing, & Signal Processing 1999-2002. He is vice chairman of the IFAC Technical Committee on Real-Time Computing & Control since 2002.

In 2006 he received the Guido Carlo-Stella award from the World Batch Forum for his contributions to manufacturing automation.

# Abstract:

The aim of the course is to give an overview of embedded control systems and of the use of control techniques in computer software systems. The course is intended for an audience having their main background in computer science and engineering. The course consists of five modules, each consisting of two 60 minute hours, with a 15 minute break in between



Course Modules:

Introduction to Feedback Control The role of feedback. Models and linearization. Stability. State-space and input-output models. Pole-placement. State-feedback and observers. Feedforward.

Computer Implementation of Control Systems Discretization of continuous-time control designs. Discrete-time control design. Aliasing. Anti-windup. Mode-handling. Numerics. PID control example. Task models for control.

Interaction between Control and Scheduling Interaction between control design and computer implementation. Temporal robustness. The effects of latencies and jitter on control performance. The Jitter Margin. The Control Server Model. Networked Embedded Control.
 Co-Design Tools TrueTime – co-simulation of real-time kernels, networks, and continuous plants. Jitterbug – analytical temporal robustness evaluation of control loops. Several examples and demos will be shown.

Control of Computer Systems Examples of feedback in computer and communication systems. Queue-length control. Control of web-servers. Feedback scheduling in control systems. Feedback-based resource management.

# Professor Kim Guldstrand Larsen

# University of Aalborg, Denmark

Kim Guldstrand Larsen (1957) is Professor in Computer Science at Aalborg University (1993-), and has been Industrial Professor at Twente University, The Netherlands (2000-2007). He is currently director of CISS, the Centre for Embedded Software Systems, a national centre of excellence within ICT bridging between industry and research (2002-). He is the leader of the Modeling and Validation Cluster within the ArtistDesign European Network of Excellence, and is director of the DaNES project (Danish Network for Intelligent Embedded Systems).

His research interests include modeling, verification, performance analysis of real-time and embedded systems with application and contributions to concurrency theory and model checking. In particular since 1995 he has been prime investigator of the tool UPPAAL and co-founder of the company UP4ALL International. He has published more than 150 publications in international journals and conferences as well as co-authored 6 software-tools.

He is or has been editorial board member of the journals: Formal Methods in System Design, Theoretical Computer Science and Nordic Journal of Computing. He is a member of the steering committee for the ETAPS conference series, the CONCUR conference series, the TACAS conference series and the FORMATS workshop series. He is member of the Royal Danish Academy of Sciences and Letters, Copenhagen, and is member of the Danish Academy of Technical Sciences.

# Abstract:

Model-driven development is a key to dealing with the increasing complexity of embedded systems, while reducing the time and cost to market. The use of models should permit early assessment of the functional correctness of a given design as well as requirements for resources (e.g. energy, memory, and bandwidth) and real-time and performance guarantees. Thus, there is a need for quantitative models allowing for timed, stochastic and hybrid phenomena to be modeled and analyzed.

UPPAAL is a tool for modeling, simulating and verifying real-time and hybrid systems, developed collaboratively by Department of Computer Science at Aalborg University and Department of Computer Systems at Uppsala University since the beginning of 1995 (see

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<u>www.uppaal.com</u>). UPPAAL and the branches CORA and TIGA provide an integrated tool environment for modeling, validation, verification and synthesis of real-time systems modeled as networks timed automata, extended with data types and user-defined functions. The lectures will provide details on the expressive power of timed automata in relationship to embedded systems as well as details on the power and working of the UPPAAL verification engine.

The lectures will also introduce a new highly efficient statistical model checking engine of UPPAAL settling soft-real time performance properties of the type "within T time-units a given request R will have been granted with probability at least P" with a desired level of confidence.

During the lectures the demonstration and application of the UPPAAL tool suite will be given on a number of practical and industrial cases, including schedulability analysis and WCET analysis.

# Professor Jan Madsen

# **Technical University of Denmark**

Jan Madsen is Professor in computer-based systems at DTU Informatics at the Technical University of Denmark. He is Deputy Head of the Department of Informatics and Head of the Section on Embedded Systems Engineering. He is the leader of the Hardware Platforms and Multiprocessor System-on-Chip Cluster within the EU/IST Network of Excellence ArtistDesign and member of the Strategic Management Board of ArtistDesign. He is senior member of IEEE and is currently serving as Vice Chair of IEEE Denmark Section.

His research interests are related to design of embedded computer systems. In particular system-level modeling and analysis of multiprocessor systems, including RTOS modeling and hardware/software codesign. He is generally interested in design methodologies (including CAD tools) and implementations of embedded systems, covering areas of adaptable systems, wireless sensor networks and biochips. He has published more than 110 publications in international journals and conferences as well as co-authored 11 book chapters.

Jan Madsen is the lead delegate for Denmark in the Governing Board of the ARTEMIS Joint Undertaking, a pan-European research initiative for public-private partnership in Embedded Systems. He is on the steering committee of InfinIT, a national innovation network on ICT, where he is coordinating the strategic focus area on Embedded Systems. He is principle investigator in SYSMODEL and ASAM (both funded by ARTEMIS JU) and activity leader of Execution Platforms and Chairman of the Steering Board of DaNES (funded by the Danish Advanced Technology Foundation). He is participating in ProCell (NABIIT), programmable biochips, and in Wireless Sensor Network for Climate and Environmental Monitoring together with Delta. He is participating and member of the management board for IDEA4CPS, a new Chinese-Danish Basic Research Center for theoretical foundation for Cyber-Physical Systems (Danish Basic Research Foundation)

He is Program Chair of CODES+ISSS'11 and General Chair of NOCS 2012, and he has been Program Chair of DATE'07 and CODES'00, and General Chair of CODES'01. He is member of the Steering Committee of CODES+ISSS (ESWEEK). He is or has served on numerous program committees, including SIES, ARC, NOCS, LCTES, DAC, CODES+ISSS, ISSS, CODES, RTSS, DATE, SAC, and PARC.

# Abstract:

One of the challenges in modern embedded system design is to map the application onto a platform such that essential requirements are met. In order to do so at an early stage in the



design process, where not all parts have been implemented or even designed, a system-level model of the application executing on the platform is needed. This model should allow for an accurate modeling of the global performance of the system, including the interrelationships among the diverse processing elements, physical interfaces and inter-connections. This course gives an introduction to the problem of mapping applications onto platforms. The course is split in two parts:

**Part 1: Multi-core platforms**. The process of mapping covers the allocation of tasks to processors of the platform and the definition of their execution order, i.e. the task scheduling. The course will focus on task scheduling for parallel systems. It will cover basic architectures for multi-core platforms and how to model these, as well as how to model the application as a parallel program. The course will cover both basic scheduling algorithms (handling static scheduling) and more advanced algorithms, which are able to handle consequences of the, often complex, communication structures of the platform.

**Part 2: Biochips**. Microfluidic biochips are replacing the conventional biochemical analyzers, and are able to integrate on-chip all the necessary functions for biochemical analysis. There are several types of microfluidic biochips, each having advantages and limitations. In flow-based biochips the microfluidic channel circuitry on the chip is equipped with chip-integrated microvalves that are used to manipulate the on-chip fluid flow. By combining several microvalves, more complex units like mixers, micropumps, multiplexers etc. can be built up, with hundreds of units being accommodated on one single chip. In droplet-based biochips, the liquid is manipulated as discrete droplets on an electrode array. For both types of biochip, the synthesis process, starting from a biochemical application and a given biochip architecture, determines the resource allocation, binding, scheduling and placement of the application operations, resembling the mapping process for multi-core platforms. The course will illustrate how techniques and methods from multi-core platforms can be used to solve synthesis and optimization problems of biochips.

# Professor Peter Marwedel

# **Technical University of Dortmund**

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 TU 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 memory and 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 and Springer.

He received the teaching award of his University in 2003, is ACM senior member and an IEEE fellow, due to his contributions to compilation techniques and embedded system design. He is a member of the ArtistDesign 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.

# Abstract:

Cyber-Physical Systems (CPS) are integrations of computation and physical processes [Edward Lee]. Information processing systems in such integrations are called embedded systems. The tutorial will start by describing the key characteristics of embedded systems as well as requirements for their specification techniques and modeling. Different models of computation will be presented. The second part of the tutorial will explain the impact of the integration into cyber-physical systems on hardware and software components. The third part will focus on the mapping of applications onto embedded platforms and techniques for the evaluation of the resulting designs. The fourth and final part will focus on a treatment of optimizations aiming at a reduction of the energy consumption and the worst-case execution time (WCET).

Overall, the tutorial will be structured as follows:

Introduction, motivation, characteristics and modeling techniques Impact of the integration of information processing with physics on hardware and software components

Mapping of applications onto platforms and how to evaluate the resulting designs Optimizations minimizing energy consumption and worst case execution time (WCET)

The presentation will provide a context for the other presentations.

# 3.2.3 Organisation

The school was organized by : (alphabetical order)

- Bruno Bouyssounouse ARTIST, VERIMAG Laboratory
- Vania Joloboff LIAMA/INRIA
- Kim Larsen ARTIST, IDEA4CPS, DaNES, CISS, VKR, Aalborg University
- Huimin Lin IOS/ISCAS, Chinese Academy of Sciences (CAS)
- Jan Madsen ARTIST, Denmark Technical University, IDEA4CPS and DaNES
- Joseph Sifakis ARTIST, VERIMAG Laboratory
- Wang Yi ARTIST, University of Uppsala
- Jian Zhang IOS/ISCAS
- Huibiao Zhu ECNU, East China Normal University

# 3.2.4 Grants

The ArtistDesign NoE paid all costs for the speakers (travel, lodging, meals).

All costs for students were handled locally:

- Registration fees for Master, PhD or Postdoc students amounts to 150 RMB, and 500 RMB for non-students. Registration fees include proceedings for the school, lunches, breaks and social events.
- Housing is provided on demand at Tsinghua's student dormitories at an additional 750 RMB for the duration of the school.
- The costs for speakers are covered by a grant paid for by the European Commission via the ArtistDesign Network of Excellence on Embedded Systems Design.



# 3.2.5 Poster for the School





# 3.3 ARTIST Graduate Courses in Y4

# **ARTIST Quantitative Model Checking Winter School 2012**

http://www.artist-embedded.org/artist/-ARTIST-Quantitative-Model-Checking,1262-.html February 27th - March 1st 2012 Copenhagen, Denmark

The PhD school on quantivative model checking, QMC 2012, is organized by the European Network of Excellence ARTIST Design, the Danish VKR Center of Excellence MT-LAB and the IDEA4CPS research centre and takes place at the IT University Copenhagen from the 27 of February to the 1st of March 2012. It features lectures and other activities by world-renowned experts within the areas of real-time, probabilistic, and hybrid model checking.

# Time-Predictable and Composable Architectures for Dependable Embedded Systems

http://www.artist-embedded.org/artist/-Time-Predictable-and-Composable-.html

October 9th, 2011 Taipei, Taiwan

Embedded systems must interact with their real-time environment in a timely and dependable fashion. Most embedded-systems architectures and design processes consider "non-functional" properties such as time, energy, and reliability as an afterthought, when functional correctness has (hopefully) been achieved. As a result, embedded systems are often fragile in their real-time behaviour, and take longer to design and test than planned. Several techniques have been proposed to make real-time embedded systems more robust, and to ease the process of designing embedded systems, including

Precision-timed and time-triggered architectures, to make time a first-class citizen of system design. Deterministic architectures for repeatable timing behaviour. Composability, which guarantees that the (non)-functional behaviour of components is unchanged on integration in a larger system.

The aim of this tutorial is to present the state of the art and major approaches to timepredictability and composability, such as BIP, TTA, PRET, PTIDES, Giotto, TipToe, and CompSOC.

# ARTIST Summer School on ICT for Future Energy Systems 2011

http://www.artist-embedded.org/artist/-ARTIST-Summer-School-on-ICT-for-.html

July 25-29, 2011 Povo, Trento, Italy

Reducing buildings overall energy consumption, providing smarter power grids and optimizing industrial processes will play a key role in Future Energy Systems.

The school will show how distributed and pervasive sensing, monitoring and control are exploided to achieve this goal and will pose novel research challenges in the development of distributed applications related to generation, storage and efficient use of energy sources.

# **ARTIST Graduate School on RT Kernels for Microcontrollers - 2011**

http://www.artist-embedded.org/artist/-ARTIST-Graduate-School-on-RT,1200-.html

June 13-17, 2011 Pisa, Italy

The course has two main objectives:

- Introducing the most important concepts and methodologies used to develop a real-time embedded system, including fundamentals of real-time scheduling, control and distributed systems;
- Showing how to apply these concepts in practice, using an embedded platform and a realtime operating system to developed simple control applications and make experience with wireless sensor networks.



# 3.4 Previous Schools and Seminars on Embedded Systems Design Organised by ARTIST

The following schools have been organised by Artist FP5, the Artist2 FP6 Network of Excellence, and the ArtistDesign FP7 Network of Excellence:

# Modeling Wizards 2010

September 30th - October 2nd 2010 Oslo, Norway (within MODELS 2010) http://www.artist-embedded.org/artist/-Modeling-Wizards-2010-.html

1st International Master Class on Model-Driven Engineering

# **ARTIST Summer School Europe 2010**

September 5-10, 2010 Autrans (near Grenoble), France http://www.artist-embedded.org/artist/-ARTIST-Summer-School-Europe-2010-.html

The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# **ARTIST Summer School in China 2010**

July 18-23, 2010 Beida (Peking University) - Beijing, China http://www.artist-embedded.org/artist/-ARTIST-Summer-School-in-China-2010-.html

The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# **ARTIST Summer School in Morocco – 2010**

July 11-16, 2010 Rabat, Morocco http://www.artist-embedded.org/artist/-ARTIST-Summer-School-in-Morocco-.html

This summer school aims at providing a forum for graduate students, but also postgraduates, researchers, and professors, to get in-depth tutorials covering different aspects of the development cycle of embedded systems. This school is also an opportunity to share and discuss recent advances and trends in this field.

# **ARTIST Graduate School on RT Kernels for Microcontrollers**

June 14-18, 2010 Scuola Superiore Sant'Anna - Pisa, Italy http://www.artist-embedded.org/artist/-ARTIST-Graduate-School-on-RT-.html

The course had two main objectives:

- Introducing the most important concepts and methodologies used to develop a real-time embedded system, including fundamentals of real-time scheduling, control and distributed systems;
- Showing how to apply these concepts in practice, using an embedded platform and a real-time operating system to developed simple control applications and make experience with wireless sensor networks.



ARTIST Graduate Course: Automated Formal Methods for Embedded Systems – 2010 June 14-22, 2010 DTU - Lyngby, Denmark http://www.artist-embedded.org/artist/-ARTIST-Graduate-Course-Automated,1182-.html

In the lectures, we will introduce a comprehensive set of state-based models as well as automatic procedures for their analysis. The exercise classes will complement this by providing hands-on experience with appropriate verification tools.

# **ARTIST Summer School South-America 2010**

May 26-28, 2010 Gramado, Brazil http://www.artist-embedded.org/artist/-ARTIST-Summer-School-South-America-.html

This fourth edition of the school seeks to continue strengthening the cooperation between Europe and South America in the area of embedded systems, both at educational and research levels. For this purpose, the goal of the school is to provide state-of-the-art courses on embedded systems oriented towards advanced students and young researchers. It should also provide a pleasant atmosphere for research-related discussions among the participants.

# **Quantitative Model Checking 2010**

March 2-5, 2010 IT University Copenhagen, Denmark http://www.artist-embedded.org/artist/-Quantitative-Model-Checking-2010-.html

The PhD school on quantivative model checking, QMC 2010, is organized by the European Network of Excellence ARTIST Design and the Danish VKR Center of Excellence MT-LAB and takes place at the IT University Copenhagen from 2 to 5 March 2010. It features lectures and other activities by world-renowned experts within the areas of real-time, probabilistic, and hybrid model checking.

ARTIST Graduate Course: Automated Formal Methods for Embedded Systems - 2009 June 17-25, 2009 DTU - Lyngby, Denmark

http://www.artist-embedded.org/artist/-Automated-Formal-Methods-2009-.html

The aim of this course was to introduce advanced topics in connection with models, analysis and verification of embedded systems. The course will cover theory and applications, and hands-on experience with state-of-the-art tools.

# **ARTIST Graduate Course on Embedded Control Systems 2009**

*June 8-12, 2009 Scuola Superiore Sant'Anna - Pisa, Italy* <u>http://www.artist-embedded.org/artist/-ARTIST-Embedded-Control-2009-.html</u>

# ARTIST2 Summer School 2008 in Europe

September 8-12, 2008 Autrans (near Grenoble), France http://www.artist-embedded.org/artist/-ARTIST2-Summer-School-2008-.html

The Summer School offers a number of foundational tutorials, accompanied by a selection of lectures on exciting emerging technologies and industrial applications - given by leading scientific and/or industrial experts.

# **ARTIST2 South-American School for Embedded Systems 2008**

August 25-29, 2008 Universidade Federal de Santa Catarina, Florianopolis, Brazil http://www.artist-embedded.org/artist/-ARTIST-2-South-American-School-.html



Second edition of the ARTIST South American School.

# Artist2 Summer School in China 2008

July 12-18, 2008 Shanghai, China http://www.artist-embedded.org/artist/-Artist2-Summer-School-in-China-.html

ARTIST2 has organized the 3rd edition of a school on Embedded Systems Design in Shanghai. This year, the school was organized in collaboration with the SEI/ECNU and the LIAMA.

# **Real-Time Kernels for Microcontrollers: Theory and Practice**

June 23-25, 2008 Pisa, Italy http://www.artist-embedded.org/artist/-Real-Time-Kernels-for-.html

The course on Real-Time Kernels for Microcontrollers aims to introduce the basic concepts of Real-time Systems targeted to Embedded Systems, which are often implemented using microcontrollers. The course will briefly illustrate the theoretical background of real-time scheduling, resource-aware techniques, and wireless communication based upon the IEEE 802.15.4 protocol.

# ARTIST2 Graduate Course on: Automated Formal Methods for Embedded Systems 2008

June 16-24, 2008 DTU - Lyngby, Denmark http://www.artist-embedded.org/artist/-Automated-Formal-Methods-for-.html

In the lectures, we will introduce a comprehensive set of state-based models as well as automatic procedures for their analysis. The exercise classes will complement this by providing hands-on experience with appropriate verification tools.

# ARTIST2 Graduate Course on Embedded Control Systems

May 26-30, 2008 Stockholm, Sweden http://www.artist-embedded.org/artist/-Graduate-Course-on-Embedded-.html

The course provides an account of state of the art theory and techniques that address the connection and integration of the areas of Control systems and Embedded systems.

# First European-SouthAmerican School for Embedded Systems

August 21-24, 2007 Universidad Argentina de la Empresa (UADE), Buenos Aires – Argentina http://www.artist-embedded.org/artist/-First-European-SouthAmerican-.html

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.

# Artist2 / UNU-IIST School in China - 2007

August 1-10, 2007 Suzhou (near Shanghai), China http://www.artist-embedded.org/artist/-Artist2-UNU-IIST-School-in-China-.html

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



#### **ARTIST2 PhD Course on: Automated Formal Methods for Embedded Systems** June 4-12, 2007 DTU - Lyngby, Denmark

http://www.artist-embedded.org/artist/-ARTIST2-PhD-Course-on-Automated,851-.html

In the lectures, we will introduce a comprehensive set of state-based models as well as automatic procedures for their analysis. The exercise classes will complement this by providing hands-on experience with appropriate verification tools.

# **ARTIST2 Graduate Course on Embedded Control Systems**

May 7-11, 2007 Lund, Sweden http://www.artist-embedded.org/artist/-ARTIST-Graduate-Course-on-Embedded-.html

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

# Real-Time Microcontroller Systems: OSEK Standard and experiments on $\mu controller$ devices

March 26-28, 2007 RETIS Laboratory, Scuola Superiore Sant'Anna, Pisa, Italy http://www.artist-embedded.org/artist/-OSEK-Standard-and-Multicore-.html

Training course on Real-Time Systems for Microcontrollers: OSEK Standard and experiments on microcontroller devices *Organised in conjunction with Evidence Srl* 

# **ARTIST2 - MOTIVES 2007**

*February 19-23, 2007 Trento, Italy* http://www.artist-embedded.org/artist/-MOTIVES-2007-.html

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

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

July 10-14, 2006 Pisa, Italy http://www.artist-embedded.org/artist/-First-European-Laboratory-on-Real-.html

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.

# ARTIST2 / UNU-IIST Spring School in China 2006

April 3-15, 2006 Xi'an, China http://www.artist-embedded.org/artist/-ARTIST2-UNU-IIST-China-School-.html

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.



# **ARTIST2 Graduate Course on Embedded Control Systems**

April 3-7, 2006 Prague, Czech Repbulic http://www.artist-embedded.org/artist/-ARTIST2-Graduate-Course-on-.html

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

# ARTIST2 Summer School 2005

September 29th - October 2nd 2005 Nässlingen, Sweden http://www.artist-embedded.org/artist/-ARTIST2-Summer-School-2005-.html

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


## 4. Organisation of Workshops

## 4.1 Workshops organised and funded in Y4 (2011)

#### **NERES 2011**

#### November 10-11, 2011 University of Porto, Portugal

Along the past decades, several network communication protocols have been developed with new capabilities, from an ever increasing throughput and support for traffic classes (including guaranteed latency and jitter), to different topologies, integration of heterogeneous segments, extensive use of wireless technologies, openness to dynamic arrival and departures of nodes, openness to larger networks (such as the Internet), etc. If, on one hand, many problems have been solved, with a significant number of successful real-time embedded applications that rely on networking services, on the other hand new problems appeared, or some old problems persist, that still require adequate solutions for harmonization with real-time constraints, e.g., energy-efficient communication (particularly in WSN), networks for nodes with scarce resources, scalability issues in large sensor systems, networking support to middleware and to Quality-of-Service (QoS) adaptation and graceful degradation, support to higher software integration and transition to wireless communication everywhere.

#### ACES<sup>MB</sup> 2011

#### October 18th, 2011 Wellington (New-Zealand) (during <u>MoDELS 2011</u>)

The objective of this workshop is to bring together researchers and practitioners interested in model-based software engineering for real-time embedded systems. We are seeking contributions relating to this subject at different levels, from modelling languages and semantics to concrete application experiments, from model analysis techniques to model-based implementation and deployment. Given the criticality of the application domain, we particularly focus on model-based approaches yielding efficient and provably correct designs. Concerning models and languages, we welcome contributions presenting novel modelling approaches as well as contributions evaluating existing ones.

#### <u>WSS'11</u>

#### October 14th, 2011 Taipei (Taiwan), within <u>ESWeek 2011</u>

An increasing amount of software is not written manually any more. Rather, software is synthesized from abstract models of the required functionality. As a result, the effort of generating software is reduced and software verification typically becomes easier. Software synthesis has been implemented in various disperse communities. The workshop aims at bringing the software generation and software synthesis communities together and at identifying research problems which should be addressed by the scientific community.

#### WESE 2011

#### October 13th, 2011 Taipei (Taiwan), within ESWeek 2011

As embedded system designs grow more complex and the time to market diminishes, quality embedded systems education becomes more and more important. This fifth 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.



#### <u>JTRES - 2011</u>

#### September 26-28, 2011 Kings Manor, York, England

Interest in real-time Java in both the research community and industry has recently increased significantly, because of its challenges and its potential impact on the development of embedded and real-time applications. The goal of the proposed workshop is to gather researchers working on real-time and embedded Java to identify the challenging problems that still need to be solved in order to assure the success of real-time Java as a technology, and to report results and experiences gained by researchers.

#### IRTAW-15

#### September 14-16, 2011 Liébana (Cantabria), Spain

The 15th International Real-Time Ada Workshop (IRTAW-15) will take place on September 14-16 of 2011 in Liébana (Cantabria), Spain, a nice mountain area by the "Picos de Europa" National Park.

#### WCET 2011

#### July 5th, 2011 Porto, Portugal (in conjunction with <u>ECRTS</u>)

Reliable WCET bounds are a necessary component for the construction and verification of dependable real-time systems. They are an input for doing task CPU allocation, creating task schedules, and performing schedulability analysis.

#### RTN'2011

July 5th, 2011 Porto, Portugal (in conjunction with <u>ECRTS 2011</u>)

#### Map2MPSoC 2011

#### June 28-29, 2011 St. Goar, Germany

The aim of the workshop is to provide a forum for brainstorming and road-mapping the future of mapping applications to MPSoCs. Knowledge about constraints and directions for future MPSoC architectures should be collected. Existing mapping techniques should be briefly presented and analyzed. Directions for future research should be proposed and evaluated.

#### UML&FM'2011

#### June 20th, 2011 Lero, Limerick, Ireland (FM 2011)

The UML and formal methods communities have been working for a number of years to produce a practical (via UML) and rigorous (via formal methods) approach to software engineering.

#### UML&AADL'2011

*April 27th, 2011* Las Vegas, USA (in conjunction with <u>ICECCS 2011</u>) Sixth IEEE International workshop UML and AADL

#### APRES 2011

#### April 11th, 2011 Chicago, USA (within <u>CPS Week 2011</u>)

Adaptive embedded systems can respond to environmental changes including hardware/software defects, resource changes, and non-continual feature usage. As such, adaptive systems can extend the area of operations and improve efficiency in the use of system resources. However, adaptability also incurs overhead in terms of system complexity and resource requirements. For example, an adaptive system requires some means for reconfiguration. These means and their mechanisms introduce additional complexity to the



design and the architecture of the system, at the same time require additional resources such as computation, power, and communication bandwidth. Consequently, adaptive systems must be diligently planned, designed, analyzed, and built to find the right tradeoffs between flexibility and complexity.

#### Rigorous Embedded Design 2011

#### April 10th, 2011 Salzburg, Austria (within <u>EuroSys 2011</u>)

The objective of the workshop is to discuss new methodologies for the rigorous design of embedded systems. Through a series of invited talks, the workshop will survey some of the challenges and emerging approaches in the area. A series of design flows will be presented. The workshop will mainly discuss performance analysis, correctness (high confidence and security), code generation, and modeling aspects (including timed scheduling and software/hardware interactions). Those concepts shall be illustrated with examples coming from the aeronautic, automotive, and robotic areas. Interactions between industrials and academic researchers will be facilitated through a series of open discussion sessions (maybe an interaction between theoretical and more practical presentations).

#### PPES 2011

#### March 18th, 2011 Grenoble, France (within <u>DATE</u>)

The PPES workshop is concerned with critical hard real-time systems that have to satisfy both efficiency and predictability requirements. For example, an electronic controller for a safetycritical system in an automobile needs to react not only correctly to external inputs such as rapid deceleration or loss of grip, but also provably within a given time-span. Although there exist techniques to accurately predict the worst-case execution time of critical embedded systems for complex microprocessors, the current approaches will not scale to future systems. The trend of integrating multiple functions on a single control unit or to use multi-core systems with shared resources saves costs, but introduces lots of interferences between tasks and components.

#### ArtistDesign Workshop on Real-Time System Models for Schedulability Analysis

#### February 7-8, 2011 Santander, Spain

The main objective of this Workshop was to discuss existing models of real-time systems that focus on representing the timing behaviour and requirements from the perspective of the ability to use schedulability analysis tools. By discussing the limitations of existing models it is possible to propose extensions that can fill the gaps that are required to cover state-of-the-art hardware platforms, operating systems, and scheduling techniques used in practice to develop real-time applications. The results of the workshop will influence a new model, called MAST-2, that tries to enhance the modelling capabilities that are currently present in MAST. They will also contribute to the future evolution of the MARTE UML profile for real-time and embedded systems.

#### Synchronous Programming of Device Drivers for Global Resource Control in Embedded Operating Systems

#### January 27th, 2011 Lyon, France

In embedded systems, controlling a shared resource like the bus, or improving a property like power consumption, may be hard to achieve when programming device drivers individually. There is a need for global resource control, taking decisions based on a centralized view of the devices' states. In this presentation, we study power consumption in sensor networks, where the nodes are small embedded systems powered by batteries. We concentrate on the hardware/software architecture of a node, where significant gains can be achieved by controlling the consumption modes of the various devices globally. The architecture we



propose involves a simple adaptation of the application level, to communicate with the hardware via a control layer. The control layer itself is built from a set of simple automata: the drivers of the devices, whose states correspond to power consumption modes, and a controller that enforces global properties. All these automata are programmed using a synchronous language, whose compiler performs static scheduling and produces a single piece of C code. We explain the approach in details, demonstrate its use with either Contiki or a traditional multithreading operating system, and report on our experiments.

## 4.2 Workshops announced in 2012

The following workshops have requested to be announced on the ARTIST website. Of course they receive no funding for this, but they will continue to be announced on the future "ADSIG" website.

#### SeNAml 2012

#### March 19-23, 2012 Lugano, Switzerland

Smart spaces, pervasive computing and ambient intelligence are different terms to allude to the capabilities of systems to 'adapt' and 'respond', in order to provide the right service in a timely, unobtrusive and friendly manner. When conceiving a smart system, it is key to define how to seamlessly, effectively and securely it will interact with the user, both to gather the appropriate information to work and to provide the required service. To date, most practical interaction strategies in smart spaces have relied in the use of mobile devices as mediators (e.g. mobile augmented reality). Recently also a number of methods based on natural interfaces (such as tangible ones in smart objects) have been proposed and demonstrated. This workshop focuses on advances in technologies and concepts enabling novel interaction models to link the physical and virtual world layers in smart spaces, to create innovative applications which make intensive use of ambient and personal information to deliver value to their users. Our goal is to organize a forum for attendees to share experiences and discuss novel ideas for easy, friendly and effective interaction and applications in smart spaces.

#### MAP2MPSoC / SCOPES 2012

May 15-16, 2012 Schloss Rheinfels, St. Goar, Germany

The workshop on Software and Compilers for Embedded Systems (SCOPES) and the workshop on Mapping of Applications to MPSoCs (Map2MPSoC) will organize a joint Map2MPSoC/SCOPES workshop in 2012.

The Map2MPSoC/SCOPES workshop will feature a combination of research papers and research presentations (details see below). The research papers will also be published in the ACM digital library. The workshop will be held in cooperation with ACM SIGBED and EDAA.

The workshop structure (presentations followed by intensive discussions) allows for an interactive atmosphere in which industrial and academic representatives can exchange new ideas and trends in the area multi-processor mapping and code generation.

#### AHS 2012

#### June 25-28, 2012 Nuremburg, Germany

The purpose of the conference is to bring together leading researchers from the adaptive hardware and systems community to exchange experiences and share new ideas in the field. The conference expands the topics addressed by the precursor series of NASA/DoD Conference on Evolvable Hardware, held between 1999 and 2005, with a broader scope. This



includes a variety of hardware and system adaptation methods and targeting more industry participation. The NASA/ESA series started with the AHS-2006 conference held in Istanbul, Turkey, and continued annually with AHS-2007 conference held in Edinburgh, UK, AHS-2008 conference held in Noordwijk, The Netherlands, AHS-2009 conference held in San Francisco, USA, AHS-2010 conference held in Anaheim, USA, and AHS-2011 conference held in San Diego, USA.

#### EIAC-RTESMA'12

#### July 2-5, 2012 Kgs. Lyngby, Denmark

The objective of this workshop is to present ongoing industrial/academic current work on the modelling and analysis of real time and embedded systems. A particular attention will be given on successful stories in the integration and assessment on the exploitation of R&D improvements on industrial designs. Partners from collaborative projects are solicited to present industrial experiences of collaborations with tools providers and academics.

#### ReCoSoC'2012

#### July 9-11, 2012 York, UK

ReCoSoC is an informal workshop aiming to encourage technical and scientific exchanges between senior academics and young researchers in the area of reconfigurable and communication-centric systems-on-chip.

In 2012, ReCoSoC will be held at the historic city of York, United Kingdom. Workshop sessions will be held at the newly inaugurated Heslington East campus of the University of York.

#### WCET 2012

#### July 10th, 2012 Pisa, Italy

Reliable WCET bounds are a necessary component for the construction and verification of dependable real-time systems. They are an input for doing task CPU allocation, creating task schedules, and performing schedulability analysis.



## 4.3 Previous ARTIST Workshops organised and funded by the NoE

JPASE

- 4.3.1 Previous ARTIST Workshops in 2010
- <u>Synchron 2010</u> November 29th -December 3rd 2010 Villa Clythia, Fréjus - France
- <u>UML&FM'2010</u> November 16th, 2010 Shanghai, China
- <u>WSS'10</u> October 29th, 2010 Scottsdale, Arizona (USA), within <u>ESWeek 2010</u>
- <u>WESE'10</u> October 28th, 2010 Scottsdale, Arizona (USA), within <u>ESWeek 2010</u>
- <u>WFCD 2010</u> October 24th, 2010 Scottsdale, Arizona (USA), within <u>ESWeek 2010</u>
- <u>ACES<sup>MB</sup> 2010</u> October 4th, 2010 Oslo, Norway (in conjunction with <u>MoDELS 2010</u>)
- <u>FIT 2010</u> August 30th, 2010 Paris, France (associated with <u>CONCUR 2010</u>)
- <u>WCET 2010</u> July 6th, 2010 Brussels, Belgium (in conjunction with the <u>22nd Euromicro</u> <u>Conference on Real-Time Systems</u>

- <u>OSPERT 2010</u> July 6th, 2010 Brussels, Belgum (in conjunction with <u>ECRTS10</u>)
- <u>ARTIST HW Platforms and MPSoC</u> <u>Technical Meeting</u> July 6-7, 2010 IMEC, Leuven, Belgium
- <u>Mapping Applications to MPSoCs 2010</u> June 29-30, 2010 St. Goar, Germany
- <u>GREEMBED 2010</u> April 12th, 2010 Stockholm, Sweden, (in conjunction with CPSWEEK 2010)
- <u>FESA 2010</u> April 12th, 2010 KTH, Stockholm (Sweden) (within <u>CPS Week</u>)
- <u>WARM 2010</u> organised and funded by ARTIST April 12th, 2010 Stockholm, Sweden (within <u>CPS Week</u>)

- 4.3.2 Previous ARTIST Workshops in 2009
- <u>Synchron 2010</u> November 29th -December 3rd 2010
- · UML&FM'2010 November 16th, 2010
- · WSS'10 October 29th, 2010
- · WESE'10 October 28th, 2010
- <u>ARTIST Summer School Europe 2010</u> September 5-10, 2010
- · FIT 2010 August 30th, 2010
- · <u>Memocode 2010</u> July 26-28, 2010
- ARTIST Summer School in China 2010 July 18-23, 2010

- ARTIST HW Platforms and MPSoC Technical Meeting July 6-7, 2010
- Mapping Applications to MPSoCs 2010 June 29-30, 2010
- <u>ARTIST Graduate School on RT Kernels for</u> <u>Microcontrollers</u> June 14-18, 2010
- <u>ARTIST Graduate Course: Automated</u> <u>Formal Methods for Embedded Systems -</u> <u>2010</u> June 14-22, 2010
- <u>ARTIST Summer School South-America</u> <u>2010</u> May 26-28, 2010
- · GREEMBED 2010 April 12th, 2010

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- · ARTIST Summer School in Morocco 2010 July 11-16, 2010
- · WCET 2010 July 6th, 2010
- · OSPERT 2010 July 6th, 2010

- · FESA 2010 April 12th, 2010
- · WARM 2010 April 12th, 2010
- · Quantitative Model Checking 2010 March 2-
- 5, 2010
- 4.3.3 Previous ARTIST Workshops in 2008
- <u>Mapping of Applications-to MPSoCs -</u> <u>ArtistDesign Working Meeting</u> *November 27-28, 2008*
- Embedded Systems: Industrial Applications <u>'08</u> November 12-13, 2008
- <u>WS on Multicores: Theory and Practice</u> October 28th, 2008
- <u>UML&FM'08</u> October 27th, 2008
- WESE'08: WS on Embedded Systems Education October 23rd, 2008
- <u>Workshop on Foundations and Applications</u> of Component-based Design (WFCD'2008) October 19th, 2008
- <u>ACES<sup>MB</sup> 2008</u> September 29th, 2008
- <u>ARTIST2 Summer School 2008 in Europe</u> September 8-12, 2008
- <u>ARTIST2 South-American School for</u> <u>Embedded Systems 2008</u> August 25-29, 2008
- <u>Artist2 Summer School in China 2008</u> July 12-18, 2008
- MoCC 2008 July 3-4, 2008
- WCET'08 July 1st, 2008
- OSPERT 2008 July 1st, 2008

- Movep'08 June 23-27, 2008
- <u>Real-Time Kernels for Microcontrollers:</u> <u>Theory and Practice</u> June 23-25, 2008
- <u>COMES 2008</u> June 17-18, 2008
- <u>ARTIST2 Graduate Course on: Automated</u> <u>Formal Methods for Embedded Systems</u> <u>2008</u> June 16-24, 2008
- <u>Mapping Applications to MPSoCs 2008</u> June 16-17, 2008
- <u>ARTIST2 Graduate Course on Embedded</u> <u>Control Systems</u> May 26-30, 2008
- <u>ArtistDesign Workshop on Design for</u> <u>Adaptivity</u> May 13-14, 2008
- DataFlow Modeling for Embedded Systems <u>2008</u> May 5th, 2008
- APRES'08 April 21st, 2008
- <u>SLA++P'2008</u> April 5th, 2008
- <u>ARTIST2 Timing Analysis activity meeting</u> <u>2008</u> March 13th, 2008
- <u>ArtistDesign Automotive Systems Day 2008</u> March 12th, 2008
- ATESST Open Workshop March 3rd, 2008



## 4.3.4 Previous ARTIST Workshops in 2007

- <u>Synchron 2007</u> November 26-30, 2007
- <u>ARTIST2 meeting on Integrated Modular</u> <u>Avionics</u> November 12-13, 2007
- <u>WESE'07: WS on Embedded Systems</u> <u>Education</u> October 4-5, 2007
- Foundations of Component-based Design September 30th, 2007
- <u>Between Control and Software</u> (in honor of Paul Caspi) September 28th, 2007
- <u>First European-SouthAmerican School for</u> <u>Embedded Systems</u> *August 21-24, 2007*
- <u>Artist2 / UNU-IIST School in China 2007</u> *August 1-10, 2007*
- FCC 2007 July 4-5, 2007
- <u>ARTIST WS: Tool Platforms for ES</u> <u>Modelling, Analysis and Validation</u> July 1-2, 2007

#### 4.3.5 Previous ARTIST Workshops in 2006

- <u>ARTIST2 Workshop on Basic Concepts in</u> <u>Mobile Embedded Systems</u> December 4-5, 2006
- <u>ARTIST2 Workshop on Timing Analysis in</u> <u>the Industrial Development Process (ISoLA</u> <u>2006)</u> November 17th, 2006
- <u>MoCC Models of Computation and</u> <u>Communication</u> November 16-17, 2006
- <u>Artist2 Foundations and Applications of</u> <u>Component-based Design</u> October 26th, 2006
- <u>WESE'06 Embedded Systems Education</u> October 26th, 2006
- ATVA China 2006 October 23-26, 2006
- First European Laboratory on Real-Time and Control for Embedded Systems July 10-14, 2006
- <u>CORDIE'06: Concurrency, Real-Time and</u> <u>Distribution in Eiffel–like Languages</u> July 4-5, 2006

- <u>ARTIST2 PhD Course on: Automated</u> <u>Formal Methods for Embedded Systems</u> *June 4-12, 2007*
- <u>2nd Int'l ARTIST Workshop on Control for</u> <u>Embedded Systems</u> May 31st -June 1st 2007
- <u>ARTIST2 Graduate Course on Embedded</u> <u>Control Systems</u> May 7-11, 2007
- <u>Towards a Systematic Approach to</u> <u>Embedded System Design</u> *April 20th, 2007*
- NeRES 2007 April 2nd, 2007
- <u>Real-Time Microcontroller Systems: OSEK</u> <u>Standard and experiments on µcontroller</u> <u>devices</u> March 26-28, 2007
- <u>ARTIST2 MOTIVES 2007</u> February 19-23, 2007
- <u>ARTIST2 Workshop on Requirements for</u> <u>Flexible Scheduling in Complex Embedded</u> <u>Systems</u> June 16th, 2006
- <u>ARTIST2 Workshop on Execution Platforms</u> / <u>Cluster Meeting</u> May 22-23, 2006
- <u>ARTIST2 Workshop on Specification and</u> <u>Verification of Secure Embedded Systems</u> *May 18th, 2006*
- <u>ARTIST2 / UNU-IIST Spring School in</u> <u>China 2006</u> April 3-15, 2006
- <u>ARTIST2 Graduate Course on Embedded</u> <u>Control Systems</u> April 3-7, 2006
- <u>ARTIST2 Workshop Beyond AutoSar</u> March 23-24, 2006
- ARTIST Workshop at DATE'06 March 10th, 2006



## 4.3.6 Previous ARTIST Workshops in 2005

- <u>ARTIST2 Summer School 2005</u> September 29th - October 2nd 2005
- <u>WESE'05 ARTIST2 Workshop on</u> <u>Embedded Systems Education</u> September 22nd, 2005
- <u>31st EUROMICRO Conference Special</u> <u>session: Model Driven Engineering (MDE)</u> August 30th - September 3rd 2005
- <u>ACM-IEEE MEMOCODE'2005</u> July 11-14, 2005
- IST/NSF: Transatlantic Research Agenda on Future Challenges in Embedded Systems Design July 8th, 2005

- <u>EU/US: Component-based Engineering for</u> <u>Embedded Systems</u> July 7th, 2005
- <u>ARTIST Seminar on Adaptive Real-Time</u> <u>Systems</u> June 20-23, 2005
- <u>ARTIST Workshop at DATE'05</u> March 11th, 2005
- <u>First S.Ha.R.K. Workshop</u> February 28th -March 4th 2005



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

JPASE

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

## 5.1 Thematic Cluster: Modeling and Validation

#### 5.1.1 Activity: Modeling

**Keynote:** Twan Basten The disappearing computer Devlab Café, Development Laboratories, Eindhoven, the Netherlands, 29 April 2011

Keynote: Jeroen Voeten

Performance prediction and optimization for Wafer Scanners Dutch Model Checking Day 2011, Delft, the Netherlands, 17 June 2011

Keynote: Jozef Hooman

Using a Commercial Model Checker at Philips Healthcare System Validation seminar, University of Twente, the Netherlands, 23 May 2011

#### Keynote: Jozef Hooman

Compositional Model Checking using Verum's ASD:Suite at Philips Healthcare MBSD seminar, Radboud University, Nijmegen, the Netherlands, 1 July 2011

#### Keynote: Jozef Hooman

Experiences with a Compositional Model Checker in the Healthcare Domain International Symposium on Foundations of Health Information Engineering and Systems (FHIES 2011), Johannesburg, South Africa, 30 August 2011

#### Keynote: Sara Tucci

AUTOSAR Timing Extension and a Case Study for Schedulability Analysis ArtistDesign Workshop on Real-Time System Models for Schedulability analysis University of Cantabria 7-8 February 2011

#### Keynote: Sara Tucci

Applying Model Driven Engineering to RTES: Technologies, Standards and Experiences *ES-week Workshop on Time Analysis and Model-Based Design, from Functional Models to Distributed Deployments, Taipei, 2011* 

#### Keynote: Wang Yi

The Digraph Real-Time Task Model, invited talk, Workshop on Rigorous Embedded Design 2011, April 10th, 2011, Salzburg, Austria (within EuroSys 2011).

#### Keynote Lecture: Thomas A. Henzinger

Computational Science versus Computer Science, Ninth Basel Computational Biology Conference (BC2), Basel, Switzerland, June 2011.



#### Keynote Lecture: Joseph Sifakis

Trustworthy Software Systems, int conf on Sensornetworks Sensornets February 2012, Rome

**Keynote Lecture**: Joseph Sifakis Rigorous System Design, VLSI-SoC, October 3–5, 2011, Hong Kong, China

#### Keynote Lecture: Joseph Sifakis

Methods and tools for component-based system design, DATE 2011, Grenoble

**Key Note**: The Major Challenges of the EDA Industry in the Next 5 Years Tel Aviv, May 3, 2011 *Alberto Sangiovanni Vincentelli* gave the key note address at the Israel Executive Forum addressing the future directions of the EDA industry. <u>http://www.israelexecutiveforum.com/agenda.aspx</u>

**Key Note**: 1,000 Electronic Devices Per Living Person: Dream Or Nightmare?, 4th IEEE International Workshop on Advances in Sensors and Interfaces Borgo Egnazia, June 9th, 2011 *Alberto Sangiovanni Vincentelli* gave the opening key note talking about the potential offered by the myriad of sensors, controller and actuators that will be soon available. http://iwasi2011.poliba.it/programme.html

**Key Note**: 1000 electronic devices per person, dream or nightmare, International Electronic Forum, Future Horizon

Seville, October 7th, 2011

*Alberto Sangiovanni Vincentelli* delivered this talk to an audience consisting of CEO, COO and CTO of the semiconductor industry.

**Key Note**: Application Driven Design – New Directions Require New Tools! Tel Aviv, May 4, 2011

Alberto Sangiovanni Vincentelli gave the key note at this conference stressing the need for new tools for system level design. He was awarded at the Conference with the ChipEx Award for exceptional contribution to the semiconductor industry delivered by the Science and Technology Minister of Israel Professor Daniel Hershkovitz (see picture below).

#### Key Note: DAC Workshop

San Diego, June 5<sup>th</sup>, 2011 Alberto Sangiovanni Vincentelli chaired and gave the opening key note talk at the DAC Workshop on Intra and Inter-Vehicle Networking.

Key Note and Workshop: DAC Workshop on Design Analysis and Implementation of Real-Time Systems with Time-Triggered and Event-Triggered Applications San Diego, June 5<sup>th</sup>, 2011

Alberto Sangiovanni Vincentelli chaired and presented the Key Note opening address

#### Invited Lecture:

Haifa, March 8, 2011 Alberto Sangiovanni Vincentelli gave a distinguished seminar talk at Haifa IBM Research attended by all researchers on System and Contract-Based Design.

#### Invited Lecture:

*Lausanne, March 11, 2011 Alberto Sangiovanni Vincentelli* gave a distinguished seminar series talk on Interconnect Everywhere at EPFL.



#### Invited Lecture:

Rome April 28, 2011

*Alberto Sangiovanni Vincentelli* gave a *lectio magistralis* (500 people attending) at the University of Rome on Innovation, Funding New Enterprise and the Importance of a Rich Ecosystem.

#### Lectio Magistralis: What is Important in the Design of Systems

Politecnico di Bari, December 2nd, 2011

*Alberto Sangiovanni Vincentelli* delivered the Lectio Magistralis at the Commencement of Politecnico di Bari about the importance of research in and teaching of system design.

Invited Lecture: Christoph Kirsch,

Virtualizing Time, Space, and Power for Cyber-Physical Cloud Computing, ARTIST Workshop on Rigorous Embedded Design, Salzburg, Austria, April 2011.

#### Invited Lecture: Thomas A. Henzinger,

From Boolean to Quantitative Synthesis, Eleventh Annual Conference on Embedded Software (EMSOFT), Taipei, Taiwan, October 2011.

#### Invited Lecture: Thomas A. Henzinger

Ten Years of Interface Automata, ACM SIGSOFT Impact Paper Award Lecture, 19th Annual Symposium on Foundations of Software Engineering (FSE), Szeged, Hungary, September 2001.

#### Invited Lecture: Thomas A. Henzinger

Quantitative Reactive Models, Workshop on Synthesis, Verification, and Analysis of Rich Models (SVARM), Saarbrucken, Germany, April 2011.

#### Invited Lecture: Thomas A. Henzinger

Formal Methods for Composing Systems, Design Automation and Test in Europe (DATE), Grenoble, France, March 2011.

Invited Lecture: Kim G. Larsen

ARTIST Summer School in China, IOS/ISCAS, Beijing, August 8-12, 2011. www.artist-embedded.org/artist/Overview,2239.html

Invited Lecture: Kim G. Larsen ARTIST Summer School, Aix-les-Bains, France, September 4-9, 2011

**Panelist:** Christoph Kirsch, Vehicular Wireless Networks: What should the future hold? International Symposium on Wireless Vehicular Communications (WiVeC), San Francisco, California, September 2011.

Invited Panelist: Kim G. Larsen Microsoft Software Summit , Paris, France, April 14, 2011, research.microsoft.com/enus/events/ss2011

Invited Lecture: Christoph Kirsch,

Virtualizing Time, Space, and Power for Cyber-Physical Cloud Computing, ARTIST Workshop on Rigorous Embedded Design, Salzburg, Austria, April 2011.



#### Invited talk: Kim G Larsen

RED, Rigorous Embedded Systems, Salzburg, Austria, April 10, 2011. www.artist-embedded.org/artist/Programm,2288.html/

#### Tutorial: Twan Basten

Designing Next-Generation Real-Time Streaming Systems.

9th IEEE/ACM International Conference on Hardware/Software-Codesign and System Synthesis, CODES+ISSS 2011. Embedded Systems Week. Taipei, Taiwan, October 9, 2011. http://esweek.acm.org/ and http://www.es.ele.tue.nl/~sander/tutorials/esweek-2011/.

#### Summer School Speaker: Christoph Kirsch

Virtualizing Time, Space, and Power for Cyber-Physical Cloud Computing, Georgia Tech Summer School on Cyber-Physical Systems, Atlanta, Georgia, USA, June, 2011.

#### Tutorial Speaker: Christoph Kirsch

The Logical Execution Time Paradigm, Tutorials on Time-Predictable and Composable Architectures for Dependable Embedded Systems, ESWEEK, Taipei, Taiwan, October 2011.

#### Invited Tutorial: Thomas A. Henzinger

Applications of Games in Quantitative Verification and Synthesis, invited tutorial, Annual GAMES Workshop, Paris, France, September 2011.

#### Tutorial Day: Formal Methods in Computer-Aided Design (FMCAD 2011)

Verimag has organised the Tutorial day of this conferences on the theory and applications of formal methods in hardware and system verification. FMCAD provides a leading forum to researchers in academia and industry for presenting and discussing ground breaking methods, technologies, theoretical results, and tools for reasoning formally about computing systems. It covers formal aspects of computer-aided system design including verification, specification, synthesis, and testing.

http://www.cs.utexas.edu/users/ragerdl/fmcad11

#### 5.1.2 Activity: Validation

#### Keynote: The disappearing computer

Twan Basten – Devlab Café, Development Laboratories, Eindhoven, the Netherlands, 29 April 2011

**Keynote**: Performance prediction and optimization for Wafer Scanners Jeroen Voeten - Dutch Model Checking Day 2011, Delft, the Netherlands, 17 June 2011

**Keynote**: Using a Commercial Model Checker at Philips Healthcare Jozef Hooman - System Validation seminar, University of Twente, the Netherlands, 23 May 2011

**Keynote**: Compositional Model Checking using Verum's ASD:Suite at Philips Healthcare Jozef Hooman - MBSD seminar, Radboud University, Nijmegen, the Netherlands, 1 July 2011

**Keynote**: Experiences with a Compositional Model Checker in the Healthcare Domain Jozef Hooman - International Symposium on Foundations of Health Information Engineering and Systems (FHIES 2011), Johannesburg, South Africa, 30 August 2011



*Keynote:* AUTOSAR Timing Extension and a Case Study for Schedulability Analysis Sara Tucci - ArtistDesign Workshop on Real-Time System Models for Schedulability analysis University of Cantabria 7-8 February 2011

*Keynote:* Applying Model Driven Engineering to RTES: Technologies, Standards and Experiences

Sara Tucci - ES-week Workshop on Time Analysis and Model-Based Design, from Functional Models to Distributed Deployments, Taipei, 2011

*Keynote:* The Digraph Real-Time Task Model, Wang Yi, invited talk, Workshop on Rigorous Embedded Design 2011, April 10th, 2011, Salzburg, Austria (within EuroSys 2011).

#### Keynote Lecture: Thomas A. Henzinger

Computational Science versus Computer Science, Ninth Basel Computational Biology Conference (BC2), Basel, Switzerland, June 2011.

**Invited talk**, Kim G Larsen: The 9th International Workshop on Java Technologies for Realtime and Embedded Systems - JTRES 2011, York 26-28 October 2011. Timing and Performance Analysis of Embedded Software Systems Using Model Checking.

**Invited talk**, Kim G Larsen: De 17e Nederlandse Testdag, 29 November 201. University of Twente, Enschede, The Netherland.

**Invited talk**, Kim G Larsen: ARTIST Summer School, Aix-les-Bains, France, September 4-9, 2011. /wwwtcs.inf.tu-dresden.de/wata2012/

**Invited talk**, Kim G. Larsen: ARTIST Summer School in China, IOS/ISCAS, Beijing, August 8-12, 2011.

www.artist-embedded.org/artist/Overview,2239.html

**Invited talk**, Kim G Larsen; PDMC, 10th International Workshop on Parallel and Distributed Methods in verification, July 14, 2011, Cliff Lodge, Snowbird, Utah. www.pdmc.cz/PDMC11

**Invited Panelist**, Kim G. Larsen: Microsoft Software Summit , Paris, France, April 14, 2011, research.microsoft.com/en-us/events/ss2011

**Invited talk**, Kim G Larsen: RED, Rigorous Embedded Systems, Salzburg, Austria, April 10, 2011. www.artist-embedded.org/artist/Programm,2288.html/

**Invited talk**, Kim G Larsen: iWIGP, International Workshop on Interaction, Games and Protocols, Saarbrücken, Germany, March 27, 2011. www.etaps.org/programme/76-programmeiwigp

**Invited talk**, Kim G Larsen: ROCKS, Rigorous Dependability Analysis using Model Checking Techniques for Stochastic Systems, Workshop, March 26, Saarbrücken, 2011. www.etaps.org/programme/66-programmerocks/

**Invited talk**, Kim G Larsen: World Conference, Development Tools Sessions, Nürnberg, March 3, 2011.



#### Invited Lecture: Christoph Kirsch,

Virtualizing Time, Space, and Power for Cyber-Physical Cloud Computing, ARTIST Workshop on Rigorous Embedded Design, Salzburg, Austria, April 2011.

#### Invited Lecture: Thomas A. Henzinger,

From Boolean to Quantitative Synthesis, Eleventh Annual Conference on Embedded Software (EMSOFT), Taipei, Taiwan, October 2011.

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**Invited Lecture**: Thomas A. Henzinger Quantitative Reactive Models, Workshop on Synthesis, Verification, and Analysis of Rich Models (SVARM), Saarbrucken, Germany, April 2011.

#### Invited Lecture: Thomas A. Henzinger

Formal Methods for Composing Systems, Design Automation and Test in Europe (DATE), Grenoble, France, March 2011.

**Panelist:** Christoph Kirsch, Vehicular Wireless Networks: What should the future hold? International Symposium on Wireless Vehicular Communications (WiVeC), San Francisco, California, September 2011.

## 5.2 Thematic Cluster: Software Synthesis, Code Generation and Timing Analysis

#### 5.2.1 Activity: Software Synthesis and Code Generation

# Tutorial: Mnemee design flow: a framework for memory management and optimization of static and dynamic data in MPSoC system

ARCS 2011, Lake Como, Italy, February 22, 2011

Speakers: P. Marwedel, D. Soudris. S. Stuijk, A. Mallik, D. Cordes, S. Collet, D. Kritharidis This tutorial addressed the Mnemee tool flow that performs source-to-source transformations to automatically optimize the original source code and map it on the target platform. The optimizations aim at reducing the number of memory accesses and the required memory storage of both dynamically and statically allocated data. Moreover the Mnemee tool flow performs optimal assignment of all data on the memory hierarchy of the target platform.

#### Tutorial: MPSoC hardware/software architectural and design challenges/solutions

DATE 2011, Grenoble, France, March 15<sup>th</sup>, 2011

Speakers: G. Vanmeerbeeck, K. Tiensyrja, A. Jantsch, D. Soudris, B. Candaele

Mapping software onto multi-processor platforms requires efficient parallel programming techniques while achieving non-functional requirements. The fundamentals, design steps and alternative programming models to implement such embedded applications onto multi-cores



were discussed in the tutorial. The need to accommodate a large number of applications on these massively parallel computing platforms requires the system engineer to quickly evaluate the performances of application mappings. The tutorial reviewed mainstream evaluation techniques based on simulation, abstract workload and processing capacity models. On-chip and in-package memory organization and efficient data management are key to high performance. The tutorial reviewed various memory architectures and techniques to address space management, cache coherency, memory consistency, and dynamic application specific memory allocation techniques.

#### Keynote: Energy-Efficient Embedded Computing Energy-Aware Computing (EACO) Workshop

Bristol, United Kingdom – July 13-14, 2011

P. Marwedel presented an overview of his group's work on energy models for embedded software, on the life cycle analysis of computing devices and on optimizations for scratch pad memory and GPUs.

http://www.cs.bris.ac.uk/Research/Micro/eaco-2.jsp

#### Tutorial: Embedded System Foundations of Cyber-Physical Systems ARTIST Summer School in China 2011

Beijing, China – August 8-12, 2011

P. Marwedel started the summer school with a full-day tutorial on foundations of cyber-physical systems. He introduced the fundamentals of modeling, embedded system hardware, evaluations of embedded systems and the mapping of applications to platforms. Also, he gave a brief introduction to compilation for explicit memory architectures. The tutorial was based on the second edition of the presenter's text book on embedded systems. The tutorial made sure that the attendees were aware of the prerequisites of the remaining presentations of the summer school.

http://www.artist-embedded.org/artist/Overview,2239.html

## Tutorial: Energy modeling

#### Workshop of Collaborative Research Center SFB 876

Lüdenscheid, Germany - 20.10.2011

This tutorial by P. Marwedel demonstrated global trends on the energy consumption of computing and compared the advantages of measurement-based and model-based predictions of the energy consumption in computing. The potential of saving energy through an exploitation of the memory hierarchy was shown. The tutorial closed with an introduction to the life-cycle assessment (LCA) of the energy consumption of personal computers. http://www.sfb876.tu-dortmund.de

5.2.2 Activity: Timing Analysis

#### Keynote (Björn Lisper): Parametric WCET Analysis Nordic Workshop of Programming Theory

Västerås, Sweden – Oct 28, 2011

The purpose of Worst-Case Execution Time (WCET) analysis is to compute a safe upper bound to the execution time of a sequential program executing uninterrupted on some given hardware. Such bounds are important when verifying the timing requirements on hard real-time systems. WCET analysis has been an active research topic for the last 20 years, and today



there exists a large body of theory, methods, and algorithms. Both academic and commercial tools have emerged during the last decade, and the technique is becoming established in industrial use.

Traditional WCET analysis computes a single number. For programs whose execution time varies strongly with the inputs, a single upper bound may provide very large overestimations in most situations since it has to take the program executions for all possible input values into account. It may then be advantageous to have a parametric WCET analysis, which computes the WCET bound as a symbolic formula in the unknown inputs rather than as a single number. When the formula is instantiated for the specific inputs at hand, the resulting number is likely to provide a much tighter bound for the actual WCET. Thus, it is highly interesting to develop good methods and tools for parametric WCET analysis.

In this talk we first give a short primer to WCET analysis. We then give an account for the past, present, and planned future research at Mälardalen University regarding parametric WCET analysis.

http://www.mrtc.mdh.se/nwpt2011/

## 5.3 Thematic Cluster: Operating Systems and Networks

#### 5.3.1 Activity: Resource Aware Operating Systems

#### Keynotes

- 1. L. Almeida. A Network-centric Perspective on Cyber-Physical Systems. Dagstuhl Seminar on Cyber-Physical Systems, Dagstuhl, Germany, 2-4 November 2011.
- 2. L. Almeida. On Cyber-Physical Systems. EU-US Workshop on Networked Monitoring and Control, Brussels, Belgium, 28 June 2011.
- 3. L. Almeida. When Time Becomes Real. Seminar at the University of Aveiro, within the scope of the MAP-Tele PhD program, 18 Feb 2011.
- 4. Giorgio Buttazzo, "Supporting real-time applications on multicore platforms", Keynote Talk at the 6th IEEE International Symposium on Industrial Embedded Systems (SIES 2011), Vasteras, Sweden, June 15-17, 2011.
- 5. Giuseppe Lipari, "Component-based analysis of real-time systems", Keynote Talk at the 19th International Conference on Real-Time and Networked Systems (RTNS 2011), Nantes, France, September 29-30, 2011.
- Tommaso Cucinotta, "SOOS: Issues in Large Scale Scheduling of Distributed Applications," at the Conference on Computing Architectures, Software tools and nano-Technologies for Numerical and Embedded Scalable Systems (CASTNESS 2011), Rome, January 17-18, 2011.
- Marco Di Natale, "From heterogeneous models to code: Challenges in the development of modern real time automotive software", at the SAE International Vehicle Battery Summit (SAE 2011), Shanghai, China, November 14-15, 2011.
- 8. Marco Di Natale, "From analysis to optimization in the deployment of real-time distributed functions in modern automotive systems", at the Workshop on Software Synthesis (WSS 2011), Taipei, Taiwan, October 14, 2011.



9. Marisol García Valls. "Real-Time Middleware". University Carlos III de Madrid. Master on Aricrat Systems Integration. EADS-UC3M. May 2011.

#### Tutorials

#### 1. Graduate Course on Combinatorial Optimization

Scuola Superiore Sant'Anna, Pisa, Italy – October-November 2011

<u>Objectives</u>: The course covered several techniques of combinatorial optimization, namely complete methods such as Constraint Programming, Integer Linear Programming, Dynamic Programming and incomplete methods that go from simple local search to more sophisticated meta-heuristics. A final lecture on Hybrid Scheduling showed integrated methods for scheduling problems, in particular, allocation and scheduling of task graph applications on MPSoCs.

<u>Organizers:</u> Giorgio Buttazzo (Scuola Superiore Sant'Anna), Michela Milano (Univ. of Bologna, Italy).

#### 2. ARTIST Graduate Course on Real-Time Kernels for Microcontrollers

Scuola Superiore Sant'Anna, Pisa, Italy – June 13-17, 2011

<u>Objectives</u>: The course was aimed at providing the fundamentals concepts of real-time computing systems, including scheduling, resource management and timing analysis; introducing the OSEK/VDX standards, taking as a reference implementation the Erika Enterprise kernel; showing how to apply such concepts in practice, with examples based on the Flex platform and the Microchip dsPIC DSC microcontrollers; teaching participants how to develop simple control applications using Erika Enterprise with code generation from functional models.

<u>Organizers:</u> Giorgio Buttazzo (Scuola Superiore Sant'Anna), Pau Marti (Technical University of Catalonia, Barcelona, Spain), Ettore Ricciardi (ISTI-CNR, Pisa).

URL: http://www.artist-embedded.org/artist/-ARTIST-Graduate-School-on-RT,1200-.html

#### 3. Graduate Course on Android Framework

Scuola Superiore Sant'Anna, Pisa, Italy – November-December 2011

<u>Objectives</u>: The course explained how to develop Android systems: from application bound entities, to the innovative (pseudo-)distributed IPC model, going through the key features of this framework; understanding how quality applications for Android should be developed. The framework analysis showed how an sample feature has been designed from the Java API down to the Android driver stub, enabling the student to extend the Android framework and to export its dedicated SDK.

<u>Organizers</u>: Giorgio Buttazzo (Scuola Superiore Sant'Anna), Alberto Panizzo (Amarula Solutions, Italy).

#### 4. Workshop on Real-Time System Models for Schedulability Analysis

University of Cantabria, Santander, Spain - February 7-8, 2011

<u>Objectives</u>: Present existing models of real-time systems, and propose extensions to fill the gaps that are required to cover state-of-the-art hardware platforms, operating systems, and scheduling techniques used in practice to develop real-time applications.

Organizers: Michael González Harbour (Universidad de Cantabria).





## 5. 15th International Real-Time Ada Workshop (IRTAW-15)

Liébana (Cantabria), Spain, September 2011

The 15th International Real-Time Ada Workshop (IRTAW-15) took place on September 14-16 of 2011 in Liébana (Cantabria), Spain. Since the late Eighties the International Real-Time Ada Workshop series has provided a forum for identifying issues with real-time system support in Ada and for exploring possible approaches and solutions, and has attracted participation from key members of the research, user, and implementer communities worldwide. Recent IRTAW meetings have significantly contributed to the Ada 2005 standard and to the proposals for Ada 2012, especially with respect to the tasking features, the realtime and high-integrity systems annexes, and the standardization of the Ravenscar profile. This particular meeting was organized by the University of Cantabria and received 22 participants from different countries in Europe and North America. The discussions were centred around multiprocessor real-time scheduling, multiprocessor resource control protocols, language profiles, application frameworks, and concurrency in Ada 2012. Some of the results of the workshop were submitted to the standardization bodies producing the Ada 2012 standard, and some others were captured in the proceedings to generate new work for future standardization phases.

URL: http://www.artist-embedded.org/artist/IRTAW-15,2204.html

#### 5.3.2 Activity: Scheduling and Resource Management

**Keynote:** Integrating Real-Time Analysis into Design Flows **Speaker:** Michael González Harbour, Universidad de Cantabria 2nd International Workshop on Analysis Tools and Methodologies for Embedded and Realtime Systems (WATERS) Porto, Portugal, July 2011 <u>http://retis.sssup.it/waters2011/</u>

#### Tutorial : MAST: Predicting Response Times in Event-Driven Real-Time Systems, by Michael González Harbour, Universidad de Cantabria The Ada Connection

Edinburgh, UK – June, 2011

This tutorial was focused on modelling the timing behaviour of event-driven real-time systems and on the methods used to guarantee the predictability of their response times. It started by looking at simple single processor systems scheduled with fixed priorities, and then it progressed through dynamic scheduling and distributed systems. The tutorial gave a practical introduction to the use of the MAST modelling and analysis tools for schedulability analysis. It also reviewed new features that are being added to MAST such as hierarchical partitioned scheduling and advanced flexible scheduling techniques that allow protection among different components of a complex application. The tutorial is designed to help real-time system designers in learning about advanced modelling methods and tools, and to provide practical experience with using the MAST toolset. http://conferences.ncl.ac.uk/adaconnection2011/

**Tutorial:** Real-time middleware – Master course on Airborne Software **Speaker:** Marisol García-Valls of Universidad Carlos III de Madrid UC3M-EADS Master on Aircraft Systems Integration *Leganés, Madrid, Spain - May-June 2011.* 

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#### Events in 2012

Giuseppe Lipari, Pisa, is **Track Chair** for the track on Real-time, Networked and Dependable Systems, at the ACM Design and Automation Conference (DATE 2012), March 2012, Dresden, Germany.

Marco Di Natale, Pisa, is **Track Co-Chair** for the track on Transportation and Energy, at the ACM Design and Automation Conference (DATE 2012), March 2012, Dresden, Germany.

Marco Di Natale, Pisa, is **Program Chair** of the 18th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2012), Beijing China, April 16-19 2012.

Robert Davis, York, is **Program Chair** of the 24th Euromicro Conference on Real-Time Systems (ECRTS 2012), Pisa Italy, July 13-16 2012. Butazzo, Pisa, is **General Chair**.

Marco Di Natale, Pisa, is **Track Co-Chair** for the track on Real-Time and (Networked) Embedded Systems, at the 17th International Conference on Emerging Technologies and Factory Automation (ETFA 2012), September 17 - 21, 2012, Krakow, Poland.

#### 5.3.3 Activity: Real-Time Networks

Keynote talk: Lucia Lo Bello, The case for Ethernet in Automotive Communications Event: RTN 2011 – 10<sup>th</sup> Workshop on Real-Time Networks

Porto, Portugal – 5 September 2011

Addressed challenges faced when trying to build an assurance in the autonomic computing domain (including sensor networks, swarm robotics, systems of systems, cooperating objects etc.).

Invited talk: Luis Almeida, A Network-centric Perspective on Cyber-Physical Systems Event: Dagstuhl Seminar on Cyber-Physical Systems Dagstuhl, Germany – 2-4 November 2011 Addressed challenges posed on networks to efficiently support CPS.

Invited talk: Luis Almeida, On Cyber-Physical Systems
Event: EU-US Workshop on Networked Monitoring and Control
Brussels, Belgium – 28 June 2011
Addressed the definition of CPS and the group contributions to that field in terms of networking infrastructure.

Invited talk: Iain Bate, *Designing and Demonstrating Dependability in Autonomic Computing* Institution: ISEP – Polytechnic Institute of Porto *Porto, Portugal – 20 September 2011* 

Addressed challenges faced when trying to build an assurance in the autonomic computing domain (including sensor networks, swarm robotics, systems of systems, cooperating objects etc.).

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### Special Section: Information technology in automation Journal: IEEE Transactions on Industrial Informatics

Vol.7, n.4, – *November, 2011* 

This Special Section was co-edited by Lucia Lo Bello from **Catania** and Georg Frey from Saarland University and contains nine papers focusing on the development, adoption and application of information technology in automation systems and presenting significant research works and new developments in several application domains including communication and middleware technologies.

http://tii.ieee-ies.org/ss/EditPast/1109 Editorial.pdf

#### Track: Industrial Communication Systems Conference name: ETFA 2011 – 16<sup>th</sup> IEEE Conference on Emerging Technologies in Factory Automation

*Toulouse, France – September 5-9, 2011* This track was co-chaired by Lucia Lo Bello from **Catania**. http://www.etfa-2011.org/

**Tutorial :** Luis Almeida, *Real-Time Communication for Embedded Systems* **Institution:** Course at ENSIAS, Ùniversity Mohammed V *Rabat, Morrocco – 19-21 December, 2011* 

20 hour course covering the concepts, techniques, technologies and applications of real-time networks.

**Tutorial:** Luis Almeida, *Real-Time Communication for Embedded Systems* **Institution:** Institute of Software – Chinese Academy of Sciences **Event:** ArtistDesign Summer School in China 2011 *Beijing, China – 11-12 August 2011* 

6 hour course covering the concepts, techniques, technologies and applications of real-time networks.

http://www.artist-embedded.org/artist/Overview,2239.html

**Tutorial :** Luis Almeida, *Real-Time Traffic Scheduling*, **Event:** Course within the Master on Control Engineering, Automation and Robotics *Universidad del Pays Vasco, Bilbao, Spain – 3-4 May, 2011* 

6 hours of lectures covering techniques for message scheduling on networks and on the challenges of flexible communication.

**Tutorial :** Luis Almeida, *When Time becomes real*, **Event:** Seminar within the MAP-Tele PhD program *Universidade de Aveiro, Portugal – 18 Feb, 2011* 

2 hour lecture introducing Distributed Real-Time Embedded Systems. <u>www.map.edu.pt/tele/</u>



**Tutorial :** Nuno Pereira, *Densely Instrumented Energy-Efficient Physical Infrastructures* **Event:** Advanced School on ICT for future energy systems *Trento, Italy – 25-29 July, 2011* 

Dedicated to applications of pervasive sensing technologies for densely instrumented energyefficient physical infrastructures.

http://events.unitn.it/en/futureenergy2011

## 5.4 Thematic Cluster: Hardware Platforms and MPSoC

5.4.1 Activity: Platform and MPSoC Design

**Invited Talk**: Trusted MpSoC Platforms for Safety Related Applications (Rolf Ernst, TU Braunschweig) Coolchips Symposium Yokohama, Japan – April 20 - 22, 2011(per video conference)

COOL Chips is an International Symposium initiated in 1998 to present advancement of lowpower and high-speed chips. The symposium covers leading-edge technologies in all areas of microprocessors and their applications. http://www.coolchips.org/

**Keynote:** Embedded Systems - the Neural Backbone of Society (Rolf Ernst, TU Braunschweig) ARTEMIS Strategic Research Agenda Symposium *Brussels, Belgium – May 18, 2011* 

The technology of Embedded Systems is adding intelligence to all kind of objects. Due to the openness of the Internet, Embedded Systems will also be able to "get access to information systems and in turn the information systems get access to the Embedded Systems which now enables the internet of things". With communication, Embedded Systems have gained a strategic role and networked Embedded Systems are now considered the neural system of the digital society. Keynote speaker Prof. Rolf Ernst from the TU Braunschweig spoke about embedded systems as the neural backbone of society.

http://www.artemis-ia.eu/sra\_home

**MiniKeynote**: MpSoC for safety critical applications – from multicore to manycore (Rolf Ernst, TU Braunschweig) 11<sup>th</sup> EDAA/IEEE Forum on Embedded MPSoC and Multicore *Beaune, France – July 8, 2011* 

In 2010 Prof. Ernst gave a short introduction on requirements and design methods for MpSoC in safety critical applications. The focus was on interference of safety critical and non-critical applications via shared resources and the corresponding requirements imposed by safety standards. In many-core systems interference is even stronger due to multi-hop NoCs and memory hierarchies. The talk in 2011 gave an overview on first results of a research platform under development as part of the European ARTEMIS project RECOMP.

http://www.mpsoc-forum.org/previous/2011/agenda.html



**Invited Talk**: Formal Performance Analysis in Automotive Systems Design – A Rocky Ride to New Grounds

(Rolf Ernst, TU Braunschweig)

23rd IEEE Conference on Computed Aided Verification (CAV) Symposium Snowbird, Utah, USA – July 20, 2011

CAV 2011 was the 23<sup>rd</sup> in a series dedicated to the advancement of the theory and practice of computer-aided formal analysis methods for hardware and software systems. The conference covered the spectrum from theoretical results to concrete applications, with an emphasis on practical verification tools and the algorithms and techniques that are needed for their implementation. The talk given by Prof. Ernst focused on performance challenges in automotive design. Formal performance analysis methods for automotive design were presented and major obstacles from theory to industrial application were highlighted.

http://www.cs.utah.edu/events/conferences/cav2011/

**Presentation**: IDAMC NoC – Efficient Quality-of-Service Support for Mixed-Critical Networkson-Chip RECOMP Technical Day *Porto, Portugal - August 29, 2011.* 

Jonas Diemer (TU Braunschweig) gave a presentation on the Network-on-Chip used in the IDAMC platform.

**Panel Session**: ARTEMIS, from successful R&D to cutting-edge Innovation (Rolf Ernst, TU Braunschweig) ARTEMIS Strategic Research Agenda Symposium *Brussels, Belgium – October 4, 2011* 

In the panel session held at the European Parliament Rolf Ernst talk about the key role of embedded systems in industrial innovation. Furthermore it highlighted the benefits of ARTEMIS from the previous research projects on embedded systems e.g. FP6 and FP7. http://www.artemis-ia.eu/jti\_programme

#### Invited Talks:

1. Timing Analysis of Ethernet AVB for Real-Time Systems (Jonas Diemer)

2. Combining Security with Reliability using Multi-core (Philip Axer)

Symtavision News Conference

Braunschweig, Germany - October 5, 2011

The SymTA/S NewsConference is an annual event organized by the Symtavision GmbH that brings together engineers, managers, technology experts and researchers in the field of embedded real-time systems. This year continued with the successful implementation of a technical day with parallel practice and research tracks. TU Braunschweig was invited to present current research results on real-time analysis methods for multi-core systems.

Jonas Diemer (TU Braunschweig) gave a presentation on the timing analysis of Ethernet AVB. Philip Axer (TU Braunschweig) gave a presentation on the challenges of reliability and security in multicore systems for safety-critical applications



#### Invited Talk: Resilient Real Time OS

(Rolf Ernst, TU Braunschweig) CODES+ISSS 2011

Taipei, Taiwan – October 9 - 14, 2011

Prof. Ernst gave a talk in the Special Session Design and Architecture for Dependable Embedded Systems of the Embedded System Week event. As Moore's Law advances to sub-50nm technology nodes, reliability of integrated circuits becomes an inherent problem: effects like electro-migration, SEUs (Single-Event Upsets), thermal effects due to increased power density and others all have a negative impact on reliability either in form of transient or permanent faults or degrading system characteristics (aging effects). The reliability problem can be addressed at various levels of abstraction. The special session aimed at addressing the interdependency between the various levels of abstraction. http://www.esweek.org/

**Invited Talk**: Multicore Architectures for Mixed Safety Critical Applications – Challenges and Opportunities (Polf Ernst, TH Braunschweig)

(Rolf Ernst, TU Braunschweig) SafeTRANS Industrial Day Hamburg, Germany – November 08, 2011 http://www.safetrans-de.org/en\_11\_Industrial\_Day.php

**Tutorial / Invited Talk**: Multi-Core and Many-Core for Mixed-Critical Systems - Denial of Service and other Performance Challenges (Mircea Negrean, Rolf Ernst, TU Braunschweig) BoCSE (Bosch Conference on Systems and Software Engineering) *Ludwigsburg, Germany – November 15 – 17, 2011* 

The talk was part of a tutorial at the 4<sup>th</sup> BoCSE-Conference. The conference organized by Bosch brings toghether engineers, managers, technology experts from different departments of the company, from other companies and from academia. In 2011 the event had over 600 participants. The focus of the given presentation was on challenges which arise in case of integrating applications with different criticalities/different safety requirements on multi-core and many-core systems.

#### Invited Talk: The mixed criticality challenge to embedded system platforms (Rolf Ernst, TU Braunschweig) ICT.OPEN

Veldhoven, Netherlands – November 14 - 15, 2011

ICT.OPEN is the principal ICT and Computer Science research conference in the Netherlands. It features plenary key notes and invited speakers, as well as selected oral and poster presentations. The state of art in ICT and Computer Science research is presented and discussed and therefore ICT.OPEN aims to be the place to be for everybody involved or interested in ICT and Computer Science research.

The talk discussed challenges in the design of mixed critical systems with a focus on multi-core architecture. First solutions proposed in major projects which address the mixed-criticality challenge in the larger context of automotive electronics and smart buildings have been presented.

http://www.nwo.nl/nwohome.nsf/pages/NWOP 8M3AYV



#### Invited Talk: Synthesis and optimization in mixed critical systems (Rolf Ernst, TU Braunschweig) SOMRES Workshop 2011 *Vienna, Austria – November 29, 2011*

The Workshop on Synthesis and Optimization Methods for Real-time Embedded Systems (SOMRES) was part of the 32nd IEEE Real-Time Systems Symposium (RTSS). The event was organized with Artist partners. Prof. Ernst gave a talk on synthesis and optimization in mixed critical systems.

http://www.artist-embedded.org/artist/SOMRES-20111.html and http://retis.sssup.it/synthesys/

#### Lothar Thiele, Iuliana Bacivarov: Thermal Aware Mapping for MPSoCs

DAC Workshop on Multiprocessor System-on-Chip for Cyber Physical Systems: Programmability, Run-Time Support, and Hardware Platforms for High Performance Embedded Applications.

DAC 2011. Thursday, June 9, 2011, Time: 8:30 AM — 5:00 PM

#### Invited Talk: Lothar Thiele ETH Zurich: Temperature-aware Scheduling

ARTIST Summer School September 4-9, 2011

Aix-les-Bains (near Grenoble), France

Power density has been continuously increasing in modern processors, leading to high on-chip temperatures. A system could fail if the operating temperature exceeds a certain threshold, leading to low reliability and even chip burnout. There have been many results in recent years about thermal management, including (1) thermal-constrained scheduling to maximize performance or determine the schedulability of real-time systems under given temperature constraints, (2) peak temperature reduction to meet performance constraints, and (3) thermal control by applying control theory for system adaption. The presentation will cover challenges, problems and approaches to real-time scheduling under temperature constraints for single- as well as multi-processors.

Mini-keynote: "<u>Hardware support for online resources management</u>" (Raphaël David, CEA LIST) + Program Co-Chair

International Forum on Embedded MPSoC and Multicore, MPSoC'2011 Beaune, France, July 4-8, 2011

The MPSOC event brings together key R&D actors from the different fields required to design embedded Multiprocessor SoC (MPSoC) and Multi-core SoC. In 2011, Raphaël David serves as program chair and in his talk he presented some of the main challenges regarding dynamic management of parallel systems and discussed the Hardware Synchronizer resource and its usefulness for advance MPSoC.

http://www.mpsoc-forum.org/previous/2011/program.html

# Tutorial: "Dynamic management of Embedded Multi-core architectures" (Raphaël David, CEA LIST)

Asia South Pacific Design Automation Conference, ASP-DAC'2011

Yokohama, Japon, January 25-28, 2011

Tutorial dedicated to present solutions for dynamically managing computing resources in MPSoC architectures as well as hardware supports for accelerating this management. Focus



on CEA LIST experience (SCMP, Platform 2012 architectures and the related acceleration modules).

**Invited Talk, Petru Eles,** Scheduling and Optimization of Fault-Tolerant Embedded Systems ACM SIGPLAN/SIGBED Conference on Languages, Compilers, Tools and Theory for Embedded Systems (LCTES 2011), Chicago, IL, USA, 12-14 April 2011 (in conjuction with CPS Week 2011)

#### Abstract

This work addresses the issue of design optimization for fault-tolerant hard real-time systems. In particular, our focus is on the handling of transient faults using both checkpointing with rollback recovery and active replication. Fault tolerant schedules are generated based on a conditional process graph representation. The formulated system synthesis approaches decide the assignment of fault-tolerance policies to processes, the optimal placement of checkpoints and the mapping of processes to processors, such that multiple transient faults are tolerated and the timing constraints of the application are satisfied. We propose a fine-grained transparent recovery, where the property of transparency can be selectively applied to processes and messages. Transparency hides the recovery actions in a selected part of the application so that they do not affect the schedule of other processes and messages. While leading to longer schedules, transparent recovery has the advantage of both improved debuggability and less memory needed to store the fault-tolerant schedules.

**Keynote**: De Micheli, Giovanni – Nanosystems: devices, circuits, architectures and applications.

International SoC Design Conference (ISOCC)

Jeju, Korea, November 17 – 18, 2012

<u>Abstract:</u> Much of our economy and way of living will be affected by nanotechnologies in the decade to come and beyond. Mastering materials at the molecular level and their interaction with living matter opens up unforeseeable horizons. This talk deals with how we will conceive, design and use nanosystems, i.e., integrated systems exploiting nanodevices. Whereas switching circuits and microelectronics have been the enablers of computer and communication systems, nanosystems have the potentials to realize innovative computational fabrics whose applications require broader hardware abstractions, extended software layers and with a much higher complexity level overall. The abstraction of computation, the nanosystem architecture, the technological feasibility envelope and the multivariate design optimization problems pose challenging and disruptive research questions that this talk will address.

http://www.isocc.org/keynote/sub\_04\_1.asp

**Tutorial**: Model-based MPSoC Architecture Synthesis for Highly-demanding Embedded Applications (Jan Madsen, DTU, Menno Lindwer, Silicon Hive (Intel), Lech Jozwiak, TUe) *Grenoble, France - march. 2011* 

This tutorial focuses on mastering the automatic architecture synthesis and application mapping for heterogeneous customizable multi-processor systems-on-chip (MPSoCs) based on configurable and extensible application-specific instruction-set processors (ASIPs). The tutorial presents the results of our analysis of the main problems that have to be solved and challenges to be faced in design of such heterogeneous customizable MPSoCs for modern demanding applications. In particular, it discusses the problems of multi-objective optimal architecture synthesis and application mapping, adequate exploitation of multiple design trade-offs, and coherent development of computing, communication and memory sub-systems for complex real-time MPSoCs. It proposes the model-based semi-automatic architecture synthesis methods and EDA-tools that enable effective and efficient solution of these

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problems.

**Summer school**: Platform-Based Design: From Multi-Core Platforms to Biochips and beyond (Jan Madsen, DTU)

Artist Summer School in China

Beijing, China, August 8-12, 2011

One of the challenges in modern embedded system design is to map the application onto a platform such that essential requirements are met. In order to do so at an early stage in the design process, where not all parts have been implemented or even designed, a system-level model of the application executing on the platform is needed. This model should allow for an accurate modeling of the global performance of the system, including the interrelationships among the diverse processing elements, physical interfaces and inter-connections. This course gives an introduction to the problem of mapping applications onto platforms and how it can be extended to the design of complex biochips.

**Tutorial**: Digital Microfluidic Biochips: Functional Diversity, More than Moore, and Cyberphysical Systems (Krishnendu Chakrabarty, Duke University, USA; Paul Pop, DTU; Tsung-Yi Ho, National Cheng Kung University Tainan, Taiwan)

*Taipei, Taiwan - 9.11.2011* 

Advances in droplet-based "digital" microfluidics have led to the emergence of biochip devices for automating laboratory procedures in biochemistry and molecular biology. These devices enable the precise control of nanoliter-volume droplets of biochemical samples and reagents. As a result, non-traditional biomedical applications and markets (e.g., high-throughout DNA sequencing, portable and point-of-care clinical diagnostics, protein crystallization for drug discovery), and fundamentally new uses are opening up for ICs and systems. However, continued growth (and larger revenues resulting from technology adoption by pharmaceutical and healthcare companies) depends on advances in chip integration and design-automation tools.

http://www2.imm.dtu.dk/~pop/codes+isss02tu-chakrabarty.html

**Keynote** : A Time-predictable Micoprocessor: the Patmos Approach (Martin Schoeberl, DTU) 11<sup>th</sup> International Forum on Embedded MPSoC and Multicore

Beaune, France, july 4-8, 2011

Current processors are optimized for average case performance, often leading to a high worstcase execution time (WCET). Many architectural features that increase the average case performance are hard to be modeled for the WCET analysis. We present Patmos, a processor optimized for low WCET bounds rather than high average case performance. Patmos is a dualissue, statically scheduled RISC processor. The instruction cache is organized as a method cache and the data cache is organized as a split cache in order to simplify the cache WCET analysis. To fill the dual-issue pipeline with enough useful instructions, Patmos relies on a customized compiler. The compiler also plays a central role in optimizing the application for the WCET instead of average case performan.

http://www.mpsoc-forum.org/previous/2011/index.html

**Invited Talk**: The Self-Healing Computer (Jan Madsen, DTU) Seminar in the Danish Engineering Association *Copenhagen, Denmark, September 14, 2011* 

The basic concepts and implementation of the eDNA technology was presented to an audience of engineers from the Danish industry.



**Invited Talk**: Recent Research and Emerging Challenges in the System-Level Design of Digital Microfluidic Biochips (*Paul Pop, Elena Maftei, Jan Madsen, DTU*) SOCC 2011, Taipei, Taiwan

"Digital" biochips are manipulating liquids as droplets on an array of electrodes. So far, researchers have assumed that microfluidic operations are executing on modules, formed by grouping adjacent electrodes. However, operations can execute by routing droplets on any sequence of electrodes. This paper presents recent work on digital biochip synthesis. http://www.ieee-socc.org/SOCC2011/Program/program.html

**Keynote**: Many-core Interconnection Networks Trends: Fast, Vertical, Asynchronous (Luca Benini, UNIBO) International Workshop on System-Level Intercnnect Prediction 2011. http://www.sliponline.org/

Invited talk: Going up: 3D integration and many-core SoCs (Luca Benini, UNIBO) 3D Integration Workshop For High Performance Computing Systems http://eeweb.poly.edu/hli/3D-Workshop/Home.htm

#### 5.4.2 Activity: Platform and MPSoC Analysis

**Invited Talk**, Lothar Thiele ETH Zurich: Temperature-aware Scheduling ARTIST Summer School September 4-9, 2011 *Aix-les-Bains (near Grenoble), France* 

**Invited Talk**, Petru Eles, Scheduling and Optimization of Fault-Tolerant Embedded Systems ACM SIGPLAN/SIGBED Conference on Languages, Compilers, Tools and Theory for Embedded Systems (LCTES 2011), Chicago, IL, USA, 12-14 April 2011 (in conjuction with CPS Week 2011)

**Invited Talk**: Using Compositional Performance Analysis for Obtaining Viable End-to-End Latencies in Distributed Embedded Systems (Jonas Rox, Rolf Ernst, TU Braunschweig) Rigorous Embedded Design 2011 - organized and funded by ARTIST *Salzburg, Austria – April 10<sup>th</sup>, 2011* 

Invited Talk: Formal Performance Analysis in Automotive Systems Design – A Rocky Ride to New Grounds (Rolf Ernst, TU Braunschweig) 23rd IEEE Conference on Computed Aided Verification (CAV) Symposium *Snowbird, Utah, USA – July 20, 2011* http://www.cs.utah.edu/events/conferences/cav2011/

**Invited Talk**: Mixed safety critical system design and analysis (Rolf Ernst, TU Braunschweig) ARTIST Summer School Europe 2011 *Aix-les-Bains (near Grenoble), France – September 4-9, 2011* http://www.artist-embedded.org/artist/Technical-Programme

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Invited Talk: Multicore Architectures for Mixed Safety Critical Applications – Challenges and Opportunities (Rolf Ernst, TU Braunschweig) SafeTRANS Industrial Day Hamburg, Germany – November 08, 2011 http://www.safetrans-de.org/en 11 Industrial Day.php

**Tutorial / Invited Talk**: Multi-Core and Many-Core for Mixed-Critical Systems - Denial of Service and other Performance Challenges (Mircea Negrean, Rolf Ernst, TU Braunschweig) BoCSE (Bosch Conference on Systems and Software Engineering) *Ludwigsburg, Germany – November 15 – 17, 2011* 

**Seminar**: Timing Analysis Workshop (Paul Pop, DTU) Safety-Critical Systems Interest Group, Infinit innovation network on ICT *Lyngby, Denmark* – 15.2.2011 <u>http://scsig15022011.eventbrite.com/</u>

**Tutorial**: Digital Microfluidic Biochips: Functional Diversity, More than Moore, and Cyberphysical Systems (Krishnendu Chakrabarty, Duke University, USA; Paul Pop, DTU; Tsung-Yi Ho, National Cheng Kung University Tainan, Taiwan) *Taipei, Taiwan - 9.11.2011* 

http://www2.imm.dtu.dk/~pop/codes+isss02tu-chakrabarty.html

**Tutorial**: "Dynamic management of Embedded Multi-core architectures" (Raphaël David, CEA LIST) Asia South Pacific Design Automation Conference, ASP-DAC'2011

Asia South Pacific Design Automation Conference, ASP-DAC 201 Yokohama, Japan, January 25-28, 2011

**Keynote**: Computational limits in 3-d integrated systems (Axel Jantsch) International Symposium on Systems on Chip *Tampere Finland, November 2011* 

**Tutorial** : System Level Modeling International Symposium on System-on-Chip *Tampere, Finland, October 31 - November 2, 2011* 

**Tutorial**: Memory architecture and management in a NoC platform. *Design Automation and Test Conference (DATE), March 2011.* Presentation given by Axel Jantsch, KTH

**Tutorial**: Shared memories in multiprocessors. *Lecture at the Shenzhen Summer School on Embedded Systems, July 2011.* Presentation given by Axel Jantsch, KTH.

**Invited seminar**: Predictable communication performance in on-chip networks. University of Technology Vienna, June 2011 Presentation given by Axel Jantsch, KTH



Invited Talk: Many-core Interconnection Networks Trends: Fast, Vertical, Asynchronous (Luca Benini, UNIBO) System Level Interconnect Prediction (SLIP) San Diego Convention Center, San Diego, California on June 5, 2011 http://www.sliponline.org/

**Invited Talk**: Going up: 3D integration and many-core SoCs (Luca Benini, UNIBO) 3D Integration Workshop For High Performance Computing System *Abu Dhabi, April 18-19, 2011* http://eeweb.poly.edu/hli/3D-Workshop/Home.htm

**Keynote**: G. De Micheli – Nanosystems: sensors and electronics for rational health monitoring. 4th International Workshop on Advances in Sensors and Interfaces (IWASI) *Savelletri di Fasaro, Brindisi, Italy, June 28-29, 2011.* <u>http://iwasi2011.poliba.it/key4.html</u>

## 5.5 Transversal Integration

### 5.5.1 Transversal Integration Activity: Design for Adaptivity

**Keynote**: Fast and accurate system-level model of a NoC-based MPSoC supporting real-time applications Leandro Soares Indrusiak, University of York International Symposium on System-on-Chip, Tampere, Finland – November 1st 2011 <u>http://soc.cs.tut.fi/2011/Invited\_speakers.php</u>

**Tutorial**: Temperature-aware Scheduling Lothar Thiele, ETH Zurich ARTIST Summer School, September 4-9, 2011, Aix-les-Bains, France

**Tutorial**: Control for Embedded Systems Karl-Erik Årzén, ULUND ARTIST Summer School China, August 8-12, 2011, Beijing, China **Abstract:** The aim of the course was to give an overview of embedded control systems and of the use of control techniques in computer software systems.

**Tutorial**: Real-Time Communication in Embedded Systems Luis Almeida, UPorto ARTIST Summer School China, August 8-12, 2011, Beijing, China



#### 5.5.2 Transversal Integration Activity: Design for Predictability and Performance

Invited Talk: Multicore Architectures for Mixed Safety Critical Applications – Challenges and Opportunities (Rolf Ernst, TU Braunschweig) SafeTRANS Industrial Day *Hamburg, Germany – November 08, 2011* http://www.safetrans-de.org/en\_11\_Industrial\_Day.php

**Invited Lecture**: *Thomas A. Henzinger*: From Boolean to Quantitative Synthesis Eleventh Annual Conference on Embedded Software (EMSOFT) *Taipei, Taiwan, October 2011.* 

**Invited Lecture**: *Thomas A. Henzinger*: Ten Years of Interface Automata ACM SIGSOFT Impact Paper Award Lecture, 19th Annual Symposium on Foundations of Software Engineering (FSE), *Szeged, Hungary, September 2001.* 

**Invited Tutorial**: *Thomas A. Henzinger:* Applications of Games in Quantitative Verification and Synthesis Annual GAMES Workshop *Paris, France, September 2011.* 

**Keynote Lecture**: *Thomas A. Henzinger:* Computational Science vs. Computer Science Ninth Basel Computational Biology Conference (BC2) *Basel, Switzerland, June 2011.* 

**Invited Lecture**: *Thomas A. Henzinger*: Quantitative Reactive Models Workshop on Synthesis, Verification, and Analysis of Rich Models (SVARM) *Saarbrucken, Germany, April 2011.* 

**Invited Lecture**: *Thomas A. Henzinger:* Formal Methods for Composing Systems Design Automation and Test in Europe. (DATE) *Grenoble, France, March 2011.* 

**Keynote**: *Björn Lisper:* Parametric WCET Analysis Nordic Workshop of Programming Theory *Västerås, Sweden– Oct 28, 2011* 

**Tutorial**: Timing and Schedulability Analysis for Distributed Automotive Control Applications International Conference on Embedded Software (EMSOFT) *Taipei, Taiwan, October 2011* 

**Invited Talk**, *Petru Eles*, Scheduling and Optimization of Fault-Tolerant Embedded Systems ACM SIGPLAN/SIGBED Conference on Languages, Compilers, Tools and Theory for Embedded Systems (LCTES 2011) *Chicago, IL, USA, 12-14 April 2011 (in conjuction with CPS Week 2011)* 



## 5.5.3 Transversal Integration Activity: Integration Driven by Industrial Applications

Wireless Innovation Forum. Title: Cognitive radio experimentation world (CREW). Speakers: Pollin, S. and Van der Perre, L. 23-25 June 2011; Brussels, Belgium

IMEC Technology Forum, ITF2011 Smartphone. Title: Exploiting the 3rd dimension. Speaker: Beyne, E 11 July 2011; San Francisco, CA, US

International Microwave Symposium. Title: SAW-less radio transceivers in 40nm CMOS. Speaker: Craninckx, J. 5-10 June 2011; Baltimore, USA

**ESSCIRC Tutorial**. Title: Transceiver design for interference-robust software-defined radios. Speaker: Craninckx, J 14-15 November 2011; Lund, Sweden

**Keynote**: The Major Challenges of the EDA Industry in the Next 5 Years *Tel Aviv, May 3, 2011* Alberto Sangiovanni Vincentelli gave the key note address at the Israel Executive Forum addressing the future directions of the EDA industry. <u>http://www.israelexecutiveforum.com/agenda.aspx</u>

**Keynote**: 1,000 Electronic Devices Per Living Person: Dream Or Nightmare?, 4th IEEE International Workshop on Advances in Sensors and Interfaces *Borgo Egnazia, June 9<sup>th</sup>, 2011* Alberto Sangiovanni Vincentelli gave the opening key note talking about the potential offered

Alberto Sangiovanni Vincentelli gave the opening key note talking about the potential offered by the myriad of sensors, controller and actuators that will be soon available. <u>http://iwasi2011.poliba.it/programme.html</u>

Key Note: 1000 electronic devices per person, dream or nightmare, International Electronic Forum, Future Horizon *Seville, October 7<sup>th,</sup> 2011* 

Alberto Sangiovanni Vincentelli delivered this talk to an audience consisting of CEO, COO and CTO of the semiconductor industry.

Keynote: Application Driven Design – New Directions Require New Tools!

Tel Aviv, May 4, 2011

Alberto Sangiovanni Vincentelli gave the key note at this conference stressing the need for new tools for system level design. He was awarded at the Conference with the ChipEx Award for exceptional contribution to the semiconductor industry delivered by the Science and Technology Minister of Israel Professor Daniel Hershkovitz (see picture below).

Keynote: DAC Workshop

San Diego, June 5<sup>th</sup>, 2011

Alberto Sangiovanni Vincentelli chaired and gave the opening key note talk at the DAC Workshop on Intra and Inter-Vehicle Networking.



**Keynote** and Workshop: DAC Workshop on Design Analysis and Implementation of Real-Time Systems with Time-Triggered and Event-Triggered Applications *San Diego, June 5<sup>th</sup>, 2011* 

Alberto Sangiovanni Vincentelli chaired and presented the Key Note opening address.

#### TED Talk:

*Trieste, June 10, 2011* Alberto Sangiovanni Vincentelli gave a talk on the science and art of design at the TEDxTrieste series. <u>http://www.tedxtrieste.com/wp/?portfolio=alberto-sangiovanni-vincentelli</u>

#### Invited Talk:

*Haifa, March 8, 2011* Alberto Sangiovanni Vincentelli gave a distinguished seminar talk at Haifa IBM Research attended by all researchers on System and Contract-Based Design.

#### Invited Talk:

*Lausanne, March 11, 2011* Alberto Sangiovanni Vincentelli gave a distinguished seminar series talk on Interconnect Everywhere at EPFL.

#### Invited Talk:

Rome April 28, 2011

Alberto Sangiovanni Vincentelli gave a *lectio magistralis* (500 people attending) at the University of Rome on Innovation, Funding New Enterprise and the Importance of a Rich Ecosystem.

#### Lectio Magistralis: What is Important in the Design of Systems

Politecnico di Bari, December 2nd , 2011

Alberto Sangiovanni Vincentelli delivered the Lectio Magistralis at the Commencement of Politecnico di Bari about the importance of research in and teaching of system design. Semi-Plenary Talk: Taming Dr. Frankenstein: Contract-Based Design for Cyberphysical Systems, 2011 Control and Decision Conference *Orlando, Fl, December 12<sup>th</sup>, 2011* 

**Invited Talk**: Using Compositional Performance Analysis for Obtaining Viable End-to-End Latencies in Distributed Embedded Systems (Jonas Rox, Rolf Ernst, TU Braunschweig) Rigorous Embedded Design 2011 - organized and funded by ARTIST *Salzburg, Austria – April 10<sup>th</sup>, 2011* 

**Invited Talk**: Trusted MpSoC Platforms for Safety Related Applications (Rolf Ernst, TU Braunschweig) Coolchips Symposium *Yokohama, Japan – April 20 - 22, 2011(per video conference)* 

**MiniKeynote**: MpSoC for safety critical applications – from multicore to manycore (Rolf Ernst, TU Braunschweig) 11<sup>th</sup> EDAA/IEEE Forum on Embedded MPSoC and Multicore *Beaune, France – July 8, 2011* 



**Invited Talk**: Formal Performance Analysis in Automotive Systems Design – A Rocky Ride to New Grounds (Rolf Ernst, TU Braunschweig)

23rd IEEE Conference on Computed Aided Verification (CAV) Symposium Snowbird, Utah, USA – July 20, 2011

#### Invited Talks:

3. Timing Analysis of Ethernet AVB for Real-Time Systems (Jonas Diemer)

4. Combining Security with Reliability using Multi-core (Philip Axer)

Symtavision News Conference Braunschweig, Germany - October 5, 2011

**Invited Talk**: Multicore Architectures for Mixed Safety Critical Applications – Challenges and Opportunities (Rolf Ernst, TU Braunschweig) SafeTRANS Industrial Day *Hamburg, Germany – November 08, 2011* 

**Tutorial / Invited Talk**: Multi-Core and Many-Core for Mixed-Critical Systems - Denial of Service and other Performance Challenges (Mircea Negrean, Rolf Ernst, TU Braunschweig) BoCSE (Bosch Conference on Systems and Software Engineering) *Ludwigsburg, Germany – November 15 – 17, 2011* 

Invited Talk: The mixed criticality challenge to embedded system platforms (Rolf Ernst, TU Braunschweig) ICT.OPEN Veldhoven, Netherlands – November 14 - 15, 2011 http://www.nwo.nl/nwohome.nsf/pages/NWOP\_8M3AYV

**Keynote**: Energy-Efficient Embedded Computing Energy-Aware Computing (EACO) Workshop *Bristol, United Kingdom – July 13-14, 2011* 

P. Marwedel presented an overview of his group's work on energy models for embedded software, on the life cycle analysis of computing devices and on optimizations for scratch pad memory and GPUs.

http://www.cs.bris.ac.uk/Research/Micro/eaco-2.jsp

Tutorial: Embedded System Foundations of Cyber-Physical Systems

ARTIST Summer School in China 2011

Beijing, China – August 8-12, 2011

P. Marwedel started the summer school with a full-day tutorial on foundations of cyber-physical systems. He introduced the fundamentals of modelling, embedded system hardware, evaluations of embedded systems and the mapping of applications to platforms. Also, he gave a brief introduction to compilation for explicit memory architectures. The tutorial was based on the second edition of the presenter's text book on embedded systems. The tutorial made sure that the attendees were aware of the prerequisites of the remaining presentations of the summer school.

http://www.artist-embedded.org/artist/Overview,2239.html



#### Tutorial : Energy modelling

Workshop of Cooperative research center SFB 876

Lüdenscheid, Germany – October 20<sup>th</sup>, 2011

This tutorial by P. Marwedel demonstrated global trends on the energy consumption of computing and compared the advantages of measurement-based and model-based predictions of the energy consumption in computing. The potential of saving energy through an exploitation of the memory hierarchy was shown. The tutorial closed with an introduction to the life-cycle assessment (LCA) of the energy consumption of personal computers. http://www.sfb876.tu-dortmund.de



# 6. ArtistDesign Web Portal

## 6.1 Objectives and Background Information

The ArtistDesign Web Portal 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 (ArtistDesign core and affiliated partners), the ArtistDesign 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 ArtistDesign 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.

Ergnomics are set for the entire site. The "look and feel" of the site is always homogeneous thoughout the site. It's possible to change these ergonomics, and these changes are applied homogeneously throughout the site, via automated machanisms.

## 6.2 Structure

The structure of the ArtistDesign web site is visible on the Site Map: <u>http://www.artist-embedded.org/artist/spip.php?page=plan</u> ).


# 6.3 Analysis of Visits to the Portal

# 6.3.1 Number of Visits Overall









The main conclusion from this analysis is that visits to the site are largely driven by the ARTIST events organised (workshops, conferences, schools), and that this drives visits to the other sections: "Embedded Systems Links", and "Research and Integration".

Yearly variations do not necessarily imply that the portal has had less impact. For example, if key information (eg: the program or registration or venue) is missing from a workshop page, then it can logically be expected that visitors will return often, generating *more* traffic for what is, finally, *lower* impact and useability.

It is important to note that a deep analysis of the pertinence and effectivity of the web portal would need to go beyond the numerical analysis provided here. The real impact of a website is in whether or not the members of the community find the information relevant, and how it helps them in their daily tasks.



## 6.3.2 Visits Distribution within the site

The tables below show the distribution of visits to the various parts of the portal.

### Year 1

▶ 15. About the Artist2 NoE	1.5%	
▶ 20. Participants	10.8%	
▶ 25. Research and Integration	7.4%	
▼ 30. Dissemination	54.5%	
▶ 20. Workshops	31.7%	
30. Schools and Seminars	19.1%	
60. Publications	2.1%	
70. Contributions to Standards	1.6%	
▼ 35. Embedded System Links	20.4%	
10. Journals	2.5%	
20. Conferences	1.8%	
30. Standards	0.7%	
35. Tools and Platforms	3.7%	
▶ 40. Main Projects	2.7%	
50. Position Papers	1.2%	
55. Roadmaps	0.9%	
60. Newsletters and Magazines	1%	
▶ 70. Announcements	5.6%	
▶ 40. intranet	1.1%	
▶ 70. Artist2 Reviews	3%	
71. ArtistDesign Reviews	0.6%	
76. Reporting on Mobility	0.7%	

#### Year 2

▶ 10. Home Page	1.2%
▶ 15. About the Artist2 NoE	4.7%
▶ 16. About the ArtistDesign NoE	1.8%
▶ 20. Participants	7%
25. Research and Integration	0.4%
* 30. Dissemination	64.2%
▶ 20. Workshops	45.5%
25. Past Workshops	0.3%
▶ 30. Schools and Seminars	15.1%
40. International Collaboration	0.4%
60. Publications	0.6%
▶ 70. Contributions to Standards	1.3%
80. Course Materials Available Online	0.6%
91. Calendar of Events	0.3%
35. Embedded System Links	11.7%
▶ 40. intranet	2.1%
41. Intranet	0.9%
▶ 71. ArtistDesign Reviews	4.9%



# Year 3

▶ 15. About the Artist2 NoE	7.8%	
▶ 16. About the ArtistDesign NoE	1.2%	
▶ 20. Participants	7.6%	
▶ 25. Research and Integration	1.1%	
* 30. Dissemination	63.5%	
▶ 20. Workshops	37.8%	
▶ 30. Schools and Seminars	22.5%	
60. Publications	1.1%	
▶ 70. Contributions to Standards	1.2%	
80. Course Materials Available Online	0.6%	
▶ 35. Embedded System Links	14.4%	
▶ 40. intranet	1.3%	
41. intranet	0.2%	
► 70. Artist2 Reviews	0.8%	

# Year 4

▶ 15. About the Artist2 NoE	6.8%	
▶ 16. About the ArtistDesign NoE	1.3%	1
▶ 20. Participants	7.2%	
▶ 25. Research and Integration	1.3%	
* 30. Dissemination	65%	
▶ 20. Workshops	38.9%	
▶ 30. Schools and Seminars	23.1%	
60. Publications	0.9%	
▶ 70. Contributions to Standards	1.1%	
80. Course Materials Available Online	0.6%	
▶ 35. Embedded System Links	13.9%	
► 40. intranet	1.3%	I]
41. intranet	0.3%	
▶ 70. Artist2 Reviews	0.8%	I]
▶ 71. ArtistDesign Reviews	0.9%	1
76. Reporting on Mobility	0.5%	
99. temp	0.3%	]

Year 4 D4-(2.0)-Y4



# 7. Joint Research Papers in Y4

# 7.1 Thematic Cluster: Modeling and Validation

### 7.1.1 Activity: Modeling

- **[AZ11]** Eric Armengaud, Markus Zoier, Andreas Baumgart, Matthias Biehl, DeJiu Chen, Gerhard Griessnig, Christian Hein, Tom Ritter, Ramin T. Kolagari. Model-based Toolchain for the Efficient Development of Safety-Relevant Automotive Embedded Systems. SAE 2011 World Congress & Exhibition, April 2011, Detroit, USA
- [BFJLLT11] Sebastian S. Bauer, Uli Fahrenberg, Line Juhl, Kim G. Larsen, Axel Legay, and Claus Thrane. Quantitative refinement for weighted modal transition systems. In Mathematical Foundations of Computer Science 2011 - 36th International Symposium, MFCS 2011, Warsaw, Poland, August 22-26, 2011. Proceedings, volume 6907 of LNCS, pages 60–71. Springer-Verlag, 2011.
- **[BJLLS11]** Sebastian S. Bauer, Line Juhl, Kim G. Larsen, Axel Legay, and Jiri Srba. Extending modal transition systems with structured labels. Mathematical Structures in Computer Science, 2011
- [BLLNW11] Sebastian Bauer, Kim G. Larsen, Axel Legay, Ulrik Nyman, and Andrzej Wąsowski. A modal specification theory for components with data. In 8th International Symposium on Formal Aspects of Component Software, Oslo, Norway, September 14-16, 2011, 2011. (Best Paper Award)
- [BDLPY11] Gerd Behrmann, Alexandre David, Kim Guldstrand Larsen, Paul Pettersson and Wang Yi. Developing UPPAAL over 15 years. In Journal: Software - Practice and Experience, 41(2): 133-142 (2011).
- **[BCHK11]** Udi Boker, Krishnendu Chatterjee, Thomas A. Henzinger, Orna Kupferman: Temporal Specifications with Accumulative Values. LICS 2011: 43-52
- **[BFLM11]** Patricia Bouyer, Ulrich Fahrenberg, Kim G. Larsen, and Nicolas Markey. Quantitative modelling and analysis of embedded systems. Communications of the ACM, 2011. Invited paper.
- **[BS11]** Synthesizing Glue Operators from Glue Constraints for the Construction of Component-Based Systems. Simon Bliudze, Joseph Sifakis Software Composition 10th International Conference, SC 2011, Zurich, Switzerland, June 30 July 1, 2011. Proceedings
- [CCH+11] <u>Pavol Cerný</u>, <u>Krishnendu Chatterjee</u>, Thomas A. Henzinger, <u>Arjun Radhakrishna</u>, <u>Rohit Singh</u>: Quantitative Synthesis for Concurrent Programs. <u>CAV 2011</u>: 243-259
- [CCJ\*12] Taolue Chen, Chris Chilton, Bengt Jonsson, Marta Kwiatkowska: A Compositional Specification Theory for Component Behaviours. In Proc. ESOP (European Symp. on Programming) 2012, to appear
- [CHJ11] Krishnendu Chatterjee, Thomas A. Henzinger, Barbara Jobstmann, Rohit Singh QUASY: Quantitative Synthesis Tool. Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2011
- [CHJM+11] Sofia Cassel, Falk Howar, Bengt Jonsson, Maik Merten, Bernhard Steffen: A Succinct Canonical Register Automaton Model, ATVA 2011



- [CHH+11] <u>Krishnendu Chatterjee</u>, Thomas A. Henzinger, <u>Florian Horn</u>: The Complexity of Request-Response Games. <u>LATA 2011</u>: 227-237
- [CKSDLLLW11] Benoit Caillaud, Joost-Pieter Katoen, Falak Sher, Benoit Delahaye, Kim G. Larsen, Axel Legay, Mikkel Larsen Pedersen, and Andrzej Wasowski. Abstract probabilistic automata. In *Proceedings of 12th International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*, 2011
- [CJ11] DeJiu Chen, Rolf Johansson, Henrik Lönn, Hans Blom, Martin Walker, Yiannis Papadopoulos, Sandra Torchiaro, Fulvio Tagliabo, Anders Sandberg: Integrated Safety and Architecture Modeling for Automotive Embedded Systems. e&i elektrotechnik und informationstechnik, Volume 128, Number 6, Automotive Embedded Systems. Springer Wien, 2011. ISSN 0932-383X / 1613-7620.
- [DLSV11] Patricia Derler, Edward Lee and Alberto Sangiovanni Vincentelli, Modeling Cyber– Physical Systems, Proceedings of the IEEE, Vol. 100, n.1, January 2012, invited paper.
- [EJ11] Christian von Essen and Barbara Jobstmann. Synthesizing systems with optimal average-case behavior for ratio objectives. In International Workshop on Interactions, Games and Protocols (iWIGP), pages 17-32, 2011.
- **[EJ12]** Christian von Essen and Barbara Jobstmann. Synthesizing efficient controllers. In International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI), 2012. To appear.
- **[FFMR11]** Ylies Falcone, Jean-Claude Fernandez, Laurent Mounier and Jean-Luc Richier. Runtime Enforcement Monitors: composition, synthesis, and enforcement abilities. -Formal Methods in System Design, 2011
- [FHN+11] Jasmin Fisher, Thomas A. Henzinger, <u>Dejan Nickovic</u>, <u>Nir Piterman</u>, <u>Anmol V.</u> <u>Singh, Moshe Y. Vardi</u>: Dynamic Reactive Modules. <u>CONCUR 2011</u>: 404-418
- [GPQ11] Graf, Susanne and Passerone, Roberto and Quinton, Sophie "Contract-Based Reasoning for Component Systems with Complex Interactions", TIMOBD 2011
- **[HSC+12]** Falk Howar, Bernhard Steffen, Sofia Cassel, Bengt Jonsson: Inferring Canonical Register Automata. To appear in VMCAI 2012
- [LDZS11] C.-W. Lin, M. Di Natale, H. Zeng, A. Sangiovanni-Vincentelli, "Performance analysis of synchronous models implementations on loosely time-triggered architectures," in Work-in-Progress Session of IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS-2011), Chicago, IL, Apr. 2011.
- [MD11] Maenad Deliverable 2011: D3.1.1 Language Concepts Supporting Engineering Scenarios. Public deliverable of the Maenad FP7 project, 2011. http://www.maenad.eu/public\_pw/Maenad\_Deliverable\_D3.1.1\_V1.0.1.pdf (Current release. A new release is scheduled in December 2011)
- [MPS11] M. Maasoumy, A. Pinto, and A. Sangiovanni-Vincentelli. "Model-based hierarchical optimal control design for HVAC systems." In Dynamic System Control Conference (DSCC), 2011. ASME, 2011
- [MPPLS11] Mohammad Mozumdar, Alberto Puggelli, Alessandro Pinto, Luciano Lavagno, Alberto L. Sangiovanni-Vincentelli "A hierarchical wireless network architecture for building automation and control systems", The Seventh International Conference on Networking and Services, pages 178-183, 2011, ISBN: 978-1-61208-133-5, Venice, Italy
- [NC11b] Qureshi, Tahir Naseer; Chen, DeJiu; Lönn,Henrik ; Törngren, Martin: From EAST-ADL to AUTOSAR Software Architecture: A Mapping Scheme, the 5th European

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Conference on Software Architecture (ECSA 2011), Essen, Germany, 13-16 September 2011

- **[NSV12]** P. Nuzzo, A. Sangiovanni Vincentelli, X. Sun, A. Puggelli, A Methodology for the Design of Analog Integrated Interfaces Using Contracts, IEEE Sensors Journal, 2012, invited paper.
- **[PMPLSV11]** Alberto Puggelli, Mohammad Mozumdar, Alessandro Pinto, Luciano Lavagno, Alberto Sangiovanni-Vincentelli. "A Routing-Algorithm-Aware Design Tool for Indoor Wireless Sensor Networks". Proceedings of the IEEE International Conference on Computing, Networking and Communications (ICNC), Maui, HI, USA, 2012.
- **[RBBC11]** Jean-Baptiste Raclet, Eric Badouel, Albert Benveniste, Benoît Caillaud, Axel Legay and Roberto Passerone. A Modal Interface Theory for Component-based Design. Fundamenta Informaticae, 108(1-2):119-149, 2011.
- [SC11] Anders Sandberg, DeJiu Chen, Henrik Lönn, Rolf Johansson, Lei Feng, Martin Törngren, Sandra Torchiaro, Ramin Tavakoli-Kolagari, Andreas Abele: Model-based Safety Engineering of Interdependent Functions in Automotive Vehicles Using EAST-ADL2. Lecture Notes in Computer Science, Volume 6351, Series: Computer Safety, Reliability, and Security (SAFECOMP), Pages 332-346. Springer Berlin / Heidelberg, 2011. ISSN 0302-9743
- **[SRPL11]** Alena Simalatsar, Yusi Ramadian, Roberto Passerone, Kai Lampka, Simon Perathoner and Lothar Thiele. Enabling Parametric Feasibility Analysis in Real-time Calculus Driven Performance Evaluation. In Proceedings of the International Conference on Compilers, Architectures and Synthesis of Embedded Systems (CASES11), Taipei, Taiwan, October 9-14, 2011.
- [TLHL11] <u>Stavros Tripakis</u>, <u>Ben Lickly</u>, Thomas A. Henzinger, <u>Edward A. Lee</u>: A Theory of Synchronous Relational Interfaces. <u>ACM Trans. Program. Lang. Syst. 33(4)</u>: 14 (2011)
- [ZDGS11] Haibo Zeng, Marco Di Natale, Arkadeb Ghosal, and Alberto Sangiovanni-Vincentelli. Schedule Optimization of Time-Triggered Systems Communicating over the FlexRay Static Segment. IEEE Transactions on Industrial Informatics, Vol. 7, No. 1, February 2011, 1-17.

### 7.1.2 Activity: Validation

### INRIA and Verimag

- **[FFM11]** Y. Falcone, J-C Fernandez, L. Mounier. What can you verify and enforce at runtime?. International Journal on Software Tools for Technology Transfer (STTT), 2011.
- [FMFR11] Y. Falcone, L. Mounier, Fernandez J.-C, J.-L. Richier. Runtime enforcement monitors: composition, synthesis, and enforcement abilities. Formal Methods in System Design, 2011.

### INRIA and ULB

**[KGMM11]** G. Kalyon, T. Le Gall, H. Marchand, T. Massart. Symbolic Supervisory Control of Infinite Transition Systems under Partial Observation using Abstract Interpretation. Discrete Event Dynamic System: Theory and Applications, 2011.



- **[KGMM11b]** G. Kalyon, T. Le Gall, H. Marchand, T. Massart. Decentralized Control of Infinite Systems. Discrete Event Dynamic Systems : Theory and Applications, 21(3):359-393, September 2011.
- **[KGMM11c]** G. Kalyon, T. Le Gall, H. Marchand, T. Massart. Synthesis of Communicating Controllers for Distributed Systems. In 50th IEEE Conference on Decision and Control and European Control Conference, Pages 198-212, Orlando, USA, December 2011.
- **[KGMM11d]** G. Kalyon, T. Le Gall, H. Marchand, T. Massart. Global State Estimates for Distributed Systems. In 31th IFIP International Conference on FORmal TEchniques for Networked and Distributed Systems, FORTE, LNCS, Volume 6722, Pages 198-212, Reykjavik, Iceland, June 2011.

#### INRIA and LSV:

[BBBS11] N. Bertrand, P Bouyer, Th. Brihaye, A. Stainer. Emptiness and Universality Problems in Timed Automata with Positive Frequency. In Proceedings of the 38th International Colloquium on Automata, Languages and Programming (ICALP'11), LNCS, Pages 246-257, Zürich, Switzerland, July 2011.

#### CISS and Uppsala

[BDLPY11] Gerd Behrmann, Alexandre David, Kim Guldstrand Larsen, Paul Pettersson and Wang Yi. Developing UPPAAL over 15 years. In Journal: Software - Practice and Experience, 41(2): 133-142 (2011).

#### **TRENTO and Rennes**

**[RBBC11]** Jean-Baptiste Raclet, Eric Badouel, Albert Benveniste, Benoît Caillaud, Axel Legay and Roberto Passerone. A Modal Interface Theory for Component-based Design. Fundamenta Informaticae, 108(1-2):119-149, 2011.

#### Trento and ETHZ

[SRPL11] Alena Simalatsar, Yusi Ramadian, Roberto Passerone, Kai Lampka, Simon Perathoner and Lothar Thiele. Enabling Parametric Feasibility Analysis in Real-time Calculus Driven Performance Evaluation. In Proceedings of the International Conference on Compilers, Architectures and Synthesis of Embedded Systems (CASES11), Taipei, Taiwan, October 9-14, 2011.

#### CISS and INRIA

- [DLLPW11] Benoit Delahaye, Kim G. Larsen, Axel Legay, Mikkel Larsen Pedersen, and Andrzej Wasowski. Decision problems for interval markov chains. In Proceedings of the 5th International Conference on Language and Automata Theory and Applications (LATA), 2011.
- [CDLLPW11] Benoît Caillaud, Benoît Delahaye, Kim G. Larsen, Axel Legay, Mikkel L. Pedersen, and Andrzej Wasowski. Constraint markov chains. Theoretical Computer Science (TCS), 412(34):4373 4404, 2011.
- [BFJLLT11] Sebastian S. Bauer, Uli Fahrenberg, Line Juhl, Kim G. Larsen, Axel Legay, and Claus Thrane. Quantitative refinement for weighted modal transition systems. In Mathematical Foundations of Computer Science 2011 - 36th International Symposium, MFCS 2011, Warsaw, Poland, August 22-26, 2011. Proceedings, volume 6907 of LNCS, pages 60–71. Springer-Verlag, 2011.



- [DLLMW11] Alexandre David, Kim G. Larsen, Axel Legay, Marius Mikucionis, and Zheng Wang. Time for statistical model checking of real-time systems. In Computer Aided Verification - 23rd International Conference, CAV 2011, Snowbird, UT, USA, July 14-20, 2011., pages 349–355, 2011.
- [DLLMPVW11] Alexandre David, Kim G. Larsen, Axel Legay, Marius Mikucionis, Danny B. Poulsen, Jonas V. Vliet, and Zheng Wang. Statistical model checking for networks of priced timed automata. 2011. In Proceedings of FORMATS 2011.
- [DLLPW11] Benoit Delahaye, Kim G. Larsen, Axel Legay, Mikkel Larsen Pedersen, and Andrzej Wasowski. Apac: a tool for reasoning about abstract probabilistic automata. 2011. To appear in Proceedings of QEST 2011.
- **[BJLLS11]** Sebastian S. Bauer, Line Juhl, Kim G. Larsen, Axel Legay, and Jiri Srba. Extending modal transition systems with structured labels. Mathematical Structures in Computer Science, 2011.
- [LLTW11] Kim G. Larsen, Axel Legay, Louis-Marie Traonouez, and Andrzej Wasowski. Robust specification of real time components. In Uli Fahrenberg and Stavros Tripakis, editors, 9th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS 2011), volume 6919 of Lecture Notes in Computer Science, pages 129– 144, Aalborg, Denmark, September 2011.
- [BLLNW11] Sebastian Bauer, Kim G. Larsen, Axel Legay, Ulrik Nyman, and Andrzej Wąsowski. A modal specification theory for components with data. In 8th International Symposium on Formal Aspects of Component Software, Oslo, Norway, September 14-16, 2011, 2011. (Best Paper Award)
- CISS, INRIA and RWTH
- **[KSDLLPW11]** Joost-Pieter Katoen, Falak Sher, Benoit Delahaye, Kim G. Larsen, Axel Legay, Mikkel Larsen Pedersen, and Andrzej Wasowski. Abstract probabilistic automata. In Proceedings of the 12th International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI), 2011.
- **[KSDLLPW11b]** Joost-Pieter Katoen, Falak Sher, Benoit Delahaye, Kim G. Larsen, Axel Legay, Mikkel Larsen Pedersen, and Andrzej Wasowski. New results on abstract probabilistic automata. In Proceedings of the 11th International Conference on Application of Concurrency to System Design (ACSD), 2011.

# 7.2 Thematic Cluster: Software Synthesis, Code Generation and Timing Analysis

- 7.2.1 Activity: Software Synthesis and Code Generation
- F. Engel, R. Leupers, G. Ascheid, M. Ferger, and M. Beemster. Enhanced structural analysis for C code reconstruction from IR code. *In 14th International Workshop on Software and Compilers for Embedded Systems, pp. 21–27, ACM.* June 2011
- Paul Lokuciejewski, Sascha Plazar, Heiko Falk, Peter Marwedel and Lothar Thiele. Approximating Pareto optimal compiler optimization sequences - a trade-off between WCET, ACET and code size. *Software: Practice and Experience*, May 2011. DOI 10.1002/spe.1079



- Jörg Henkel, Lars Bauer, Joachim Becker, Oliver Bringmann, Uwe Brinkschulte, Samarjit Chakraborty, Michael Engel, Rolf Ernst, Hermann Härtig, Lars Hedrich, Andreas Herkersdorf, Rüdiger Kapitza, Daniel Lohmann, Peter Marwedel, Marco Platzner, Wolfgang Rosenstiel, Ulf Schlichtmann, Olaf Spinczyk, Mehdi Tahoori, Jürgen Teich, Norbert Wehn and Hans-Joachim Wunderlich. Design and Architectures for Dependable Embedded Systems. *In Proceedings of Embedded Systems Week (ESWeek 2011)*, Taipei, Taiwan, October 2011
- Emanuele Cannella, Lorenzo Di Gregorio, Leandro Fiorin, Menno Lindwer, Paolo Meloni, Olaf Neugebauer and Andy D. Pimentel. Towards an ESL Design Framework for Adaptive and Fault-tolerant MPSoCs: MADNESS or not? *In Proceedings of the 9th IEEE/ACM Symposium on Embedded Systems for Real-Time Multimedia (ESTIMedia'11)*, Taipei, Taiwan, October 2011.
- Samarjit Chakraborty, Marco Di Natale, Heiko Falk, Martin Lukasiewyzc and Frank Slomka. Timing and Schedulability Analysis for Distributed Automotive Control Applications. *In Tutorial at the International Conference on Embedded Software (EMSOFT)*, pages 349-350, Taipei, Taiwan, October 2011
- Timon Kelter, Heiko Falk, Peter Marwedel, Sudipta Chattopadhyay and Abhik Roychoudhury. Bus-Aware Multicore WCET Analysis through TDMA Offset Bounds. *In Proceedings of the 23rd Euromicro Conference on Real-Time Systems (ECRTS)*, pages 3-12, Porto / Portugal, July 2011.
- Timon Kelter, Heiko Falk, Peter Marwedel, Sudipta Chattopadhyay and Abhik Roychoudhury. Bus-Aware Multicore WCET Analysis through TDMA Offset Bounds. Technical Report #837, TU Dortmund, Faculty of Computer Science 12, January 2011
- Daniel Cordes, Andreas Heinig, Peter Marwedel and Arindam Mallik. Automatic Extraction of Pipeline Parallelism for Embedded Software Using Linear Programming. *In Proceedings of the Seventeenth IEEE International Conference on Parallel and Distributed Systems (ICPADS 2011)*, Tainan, Taiwan, December 2011.
- Peter Marwedel, Jeff Jackson, Kenneth Ricks (eds.). Proceedings of the Workshop on Embedded Systems Education (WESE), Taipei, Oct. 2011, http://dl.acm.org/citation.cfm?id=2077370.
- Peter Marwedel, Jürgen Teich, Georgia Kouveli, Iuliana Bacivarov, Lothar Thiele, Soonhoi Ha, Chanhee Lee, Qiang Xu and Lin Huang. Mapping of Applications to MPSoCs. *In Proceedings of the International Conference on Hardware/Software Codesign and System Synthesis (CODES+ISSS)*, Taipei, Taiwan, October 2011.
- Oscar Almer and Igor Böhm and Tobias Edler von Koch and Björn Franke and Stephen Kyle and Volker Seeker and Christopher Thompson and Nigel Topham. Scalable Multi-Core Simulation Using Parallel Dynamic Binary Translation. *Proceedings of the International Conference on Embedded Computer Systems: Architectures, Modeling, and Simulation (SAMOS'11)*
- A. Mallik, S. Mamagkakis, C. Baloukas, L. Papadopoulos, D. Soudris, S. Stuijk, O. Jovanovic, F. Schmoll, D. Cordes, R. Pyka, P. Marwedel, F. Capman, S. Collet, N. Mitas and D. Kritharidis: MNEMEE – An automated toolflow for parallelization and memory management in MPSoC platforms, DAC, 2011, (presentation at the user's forum)



### 7.2.2 Activity: Timing Analysis

- S. Altmeyer, and C. Maiza. *Influence of the Task Model on the Precision of Scheduling Analysis for Preemptive Systems – Status Report*. Proceedings of the 2nd International Real-Time Scheduling Open Problems Seminar (RTSOPS), 2011
- S. Altmeyer, R. I. Davis, and C. Maiza. *Cache Related Pre-emption Aware Response Time Analysis for Fixed Priority Pre-emptive Systems* Proceedings of the 32nd Real-Time Systems Symposium (RTSS), 2011.
- [CKR+12] Sudipta Chattopdhyay, Chong Lee Kee, Abhik Roychoudhury, Timon Kelter, Peter Marwedel, Heiko Falk. A Unified WCET Analysis Framework for Multi-core Platforms. Submitted to: 18<sup>th</sup> IEEE Real-time and Embedded Technology and Applications Symposium (RTAS) 2012.
- [KFMCA11] Timon Kelter, Heiko Falk, Peter Marwedel, Sudipta Chattopadhyay and Abhik Roychoudhury. *Bus-Aware Multicore WCET Analysis through TDMA Offset Bounds.* Proc. 23rd Euromicro Conference on Real-time Systems (ECRTS) 2011.
- Stefan Bygde, Björn Lisper, and Niklas Holsti. *Static Analysis of Bounded Polyhedra*, Paul Pettersson and Cristina Seceleanu (eds) Proc. Nordic Workshop of Programming Theory (NWPT), pp. 83-85, Västerås, Sweden, Oct. 2011
- [BLH11] Stefan Bygde, Björn Lisper, and Niklas Holsti. *Fully Bounded Polyhedral Analysis of Integers with Wrapping*, Proc. International Workshop on Numerical and Symbolic Abstract Domains, Venice, Italy, Sep. 2011
- Reinhard von Hanxleden, Niklas Holsti, Björn Lisper, Erhard Ploedereder, Armelle Bonenfant, Hugues Cassé, Sven Bünte, Wolfgang Fellger, Sebastian Gepperth, Jan Gustafsson, Benedikt Huber, Nazrul Mohammad Islam, Daniel Kästner, Raimund Kirner, Laura Kovacs, Felix Krause, Marianne de Michiel, Mads Christian Olesen, Adrian Prantl, Wolfgang Puffitsch, Christine Rochange, Martin Schoeberl, Simon Wegener, Michael Zolda, Jakob Zwirchmayr. WCET Tool Challenge 2011: Report, Chris Healy (ed) Proc. 11th International Workshop on Worst-Case Execution Time (WCET) Analysis (WCET 2011), OCG, Porto, Portugal, July 2011
- D. Grund, J. Reineke, G. Gebhard. Branch target buffers: WCET analysis framework and timing predictability. Journal of Systems Architecture - Embedded Systems Design, volume 57, number 6, 2011.

# 7.3 Thematic Cluster: Operating Systems and Networks

7.3.1 Activity: Resource Aware Operating Systems

### Pisa, TUKL, Lund, Ericsson, Evidence

Enrico Bini, Giorgio Buttazzo, Johan Eker, Stefan Schorr, Raphael Guerra, Gerhard Fohler, Karl-Erik Arzen, Vanessa Romero Segovia, Claudio Scordino, "Resource Management on Multicore Systems: The ACTORS Approach", IEEE Micro, Vol. 31, No. 3, pp. 72-81, May-June 2011.



### Pisa & CTU-Prague

M. Sojka, P. Pisa, D. Faggioli, T. Cucinotta, F. Checconi, Z. Hanzalek, G. Lipari, "Modular Software Architecture for Flexible Reservation Mechanisms on Heterogeneous Resources," Elsevier Journal of Systems Architecture (JSA), Vol. 57, Issue 4, pp. 366–382, April 2011.

### Pisa & UC-Berkeley

- Andrea Sindico, Marco Di Natale, Gianpiero Panci: "Integrating SysML with Simulink using Open-source Model Transformations". SIMULTECH 2011: 45-56.
- Andrea Sindico, Marco Di Natale, and Gianpiero Panci: "Integrating SysML with Simulink using Open-source Model Transformations". Proceedings of the 1st International Conference on Simulation and Modeling Methodologies, Technologies and Applications (SIMULTECH 2011), Noordwijkerhout, The Netherlands, July 29 - 31, 2011.
- Haibo Zeng and Marco Di Natale, "Mechanisms for Guaranteeing Data Consistency and Flow Preservation in AUTOSAR Software on Multi-Core Platforms", Proceedings of the 6th IEEE International Symposium on Industrial Embedded Systems (SIES 2011), Vasteras, Sweden, June 15-17, 2011.
- Haibo Zeng and Marco Di Natale, "Efficient Implementation of AUTOSAR Components with Minimal Memory Usage", Proc. of the Workshop on Synthesis and Optimization Methods for Real-time Embedded Systems (SOMRES 2011), Vienna, Austria, November 30, 2011.

#### Pisa & UC3-Madrid

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- [Pisa+9] Haibo Zeng, Marco Di Natale, Arkadeb Ghosal, Alberto L. Sangiovanni-Vincentelli: "Schedule Optimization of Time-Triggered Systems Communicating Over the FlexRay Static Segment", IEEE Transactions on Industrial Informatics 7(1): 1-17, February 2011.
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# 7.4 Thematic Cluster: Hardware Platforms and MPSoC

### 7.4.1 Activity: Platform and MPSoC Design

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[MTKBTHLXH11] Peter Marwedel, Jürgen Teich, Georgia Kouveli, Iuliana Bacivarov, Lothar Thiele, Soonhoi Ha, Chanhee Lee, Qiang Xu, Lin Huang: Mapping of applications to MPSoCs. CODES+ISSS 2011: 109-118.

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### 7.4.2 Activity: Platform and MPSoC Analysis

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# 7.5 Transversal Integration

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### 7.5.2 Transversal Integration Activity: Design for Predictability and Performance

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- [PMPLSV11] Alberto Puggelli, Mohammad Mozumdar, Alessandro Pinto, Luciano Lavagno, Alberto Sangiovanni-Vincentelli. "A Routing-Algorithm-Aware Design Tool for Indoor Wireless Sensor Networks". Proceedings of the IEEE International Conference on Computing, Networking and Communications (ICNC), Maui, HI, USA, 2012.

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- [RGE12]Jonas Rox, Rolf Ernst, Paolo Giusto, "Using Timing Analysis for the Design of Future Switched Based Ethernet Automotive Networks", in Proceedings Design, Automation and Test in Europe (DATE 12) (to appear)

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- **[SAEFJ11]** Maurice Sebastian, Philip Axer, Rolf Ernst, Nico Feiertag, und Marek Jersak, "Efficient Reliability and Safety Analysis for Mixed-Criticality Embedded Systems" in SAE 2011 World Congress & Exhibition Technical Paper, Detroit, USA, April 2011.
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- [DC11] Joachim Denil, Antonio Cicchetti, Matthias Biehl, Paul De Meulenaere, Romina Eramo, Serge Demeyer, Hans Vangheluwe, Automatic Deployment Space Exploration Using Refinement Transformations, Proceedings of the International Workshop on Multi-Paradigm Modeling at MODELS 2011, October 2011, Wellington, NZ
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