Embedded Systems Institute
PO Box 513
5600 MB Eindhoven
The Netherlands
http://www.esi.nl/

Version 1.04

ESI Symposium 2010

Presentations and information market

December 2nd
Eindhoven
The Netherlands

Editor: Roland Mathijssen

ESI Report Nr 2010-1
2 December 2010

ESI Reports are available via
http://www.esi.nl/publications/reports
(print) ISSN 1876-1607
(online) ISSN 1876-1615

In collaboration with Point One

Empowered by Agentschap NL

Supported by Eindhoven University of Technology

Programme

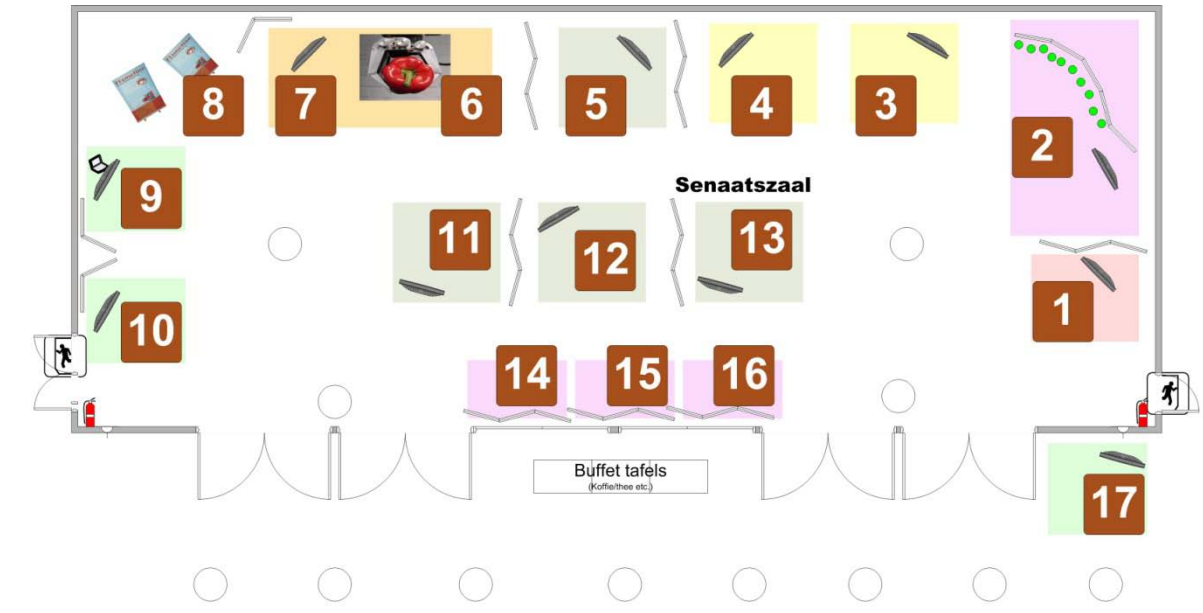
	Blauwe zaal	Collegezaal 4	Collegezaal 5	Senaatszaal
9.00 - 9.30	Registration, coffee & tea			
9.30 - 9.45	**Welcome & opening** Boudewijn Havertkort (ESI)			
9.45 - 10.30	**Keynote presentation** Rolf Ernst (TU Braunschweig)			
10.30 - 11.00	Break and opening of the information market			Information market
Track	***Architecture & New Business***	***Point One***	***System Level Control***	
11.00 - 11.30	Architecture of System of Systems Michael Borth (ESI)	Point-One Emerging Technology Agenda for Embedded Systems Gerard Smit (UT)	Modelling Warehouse Logistics using Agent Organisations Huib Aldewereld (UU)	
11.30 - 12.00	How CAFCR workshops and company processes interact (or not) Hugo van Leeuwen (FEI)	GEODES: Energy Optimisation for Wireless Embedded Systems Koen Holtman (Philips AppTech) Visual Context Modelling (ViCoMo) Egbert Jaspers (ViNotion) Peter de With (TU/e ; Cyclomedia)	Architecture development for high-variability W&D systems Bruno van Wijngaarden (Vanderlande Industries)	
12.00 - 13.30	Lunch and information market			
Track	***System Architecting & Integration***	***Point One (SME's)***	***Model Driven Engineering***	
13.30 - 14.00	Robotized order picking Wouter Hakvoort (Demcon)	Embedded System HW/SW Co-design for harbor surveillance. Jos van Eijndhoven (Vector Fabrics)	Model-Driven Design-Space Exploration Nikola Trcka (TU/e) Martijn Hendriks (RU)	
14.00 - 14.30	Execution views for Large Embedded Systems Trosky Callo (RUG)	Ultrafast development of an Ultra Fast Scanner Hans Spitshuis (CCM)	Phenomenological Modeling Pitfalls Nelis van Lierop (TU/e)	
14.30 - 15.00	Break			
Track	***System Architecting***	***Point One Large companies***	***Awareness & Systems***	
15.00 - 15.30	CAD for System Architecting Hitoshi Komoto (TUD)	Care4Me: Overcoming healthcare dilemmas in an ageing population Frenk Sloff (Philips Healthcare)	Enhancing maritime situation awareness with anomaly detection Jeroen Janssens (UvT) Eric Postma (UvT)	
15.30 - 16.00	Systems architecting and modeling Roelof Hamberg (ESI)	Spits: Strategic Platform for Intelligent Traffic Systems Chris Bannink (Logica)	Towards Systems Health Awareness Arjan van Gemund (TUD)	
16.00 - 16.45	**Keynote presentation** Michiel Peters (Vanderlande Industries)			
16.45 - 17.00	**Closure**			
17.00 - 17.30	Drinks			

Information market room (Senaatszaal)

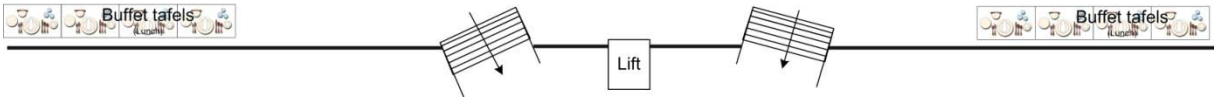
Information market

	On show	Demonstrators
1	Understanding Ship Behavior with the Simple Event Model	Véronique Malaisé Davide Ceolin (VU)
2	MyriaNed - a self organizing, gossiping Wireless Sensor Network	Lex van Gijsel (DevLab)
3	The Octopus Design-Space Exploration Toolset	Martijn Hendriks (RUN) Nikola Trčka (TU/e)
4	CAD for System Architecture	Hitoshi Komoto (TUD)
5	Architectural Scenario Icons Improving communication between technical and non-technical stakeholders	Dirk Verhagen (TU/e)
6	Robotized Order Picking	Wouter Hakvoort Jos Ansink (DEMCON)
7	A Robotic Hand for Grasping in Warehouses	Gert Kragten (TUD) Cory Meijneke (TUD)
8	Banners	
9	Fast track to excellence System architect's development programme	Joris van den Aker (ESI)

	On show	Demonstrators
10	Putting Chaos under control in model-based development of complex systems	Hristina Moneva (ESI)
11	OVERLAY : Performance modeling and design space exploration for embedded mechatronic control systems	Wouter Tabingh Suermondt (ASML)
12	The Modest project Model Based Design and Testing	Jack Kandelaars (Océ)
13	Component-based Development at Philips Healthcare using Verum's ASD Technology	Robert Huis in 't Veld (Philips Healthcare)
14	ITEA2	
15	Artemis-IA	
16	Point One	
17	Running show ESI Way of Working	



Voorhof



Preface

Dear participant,

It is my pleasure to welcome you to the 2010 ESI Symposium!

This is the third year that ESI organises this type of symposium, giving you an overview of its whole research portfolio. This year we have teamed with Point One to bring you an even broader range of applied research report from the field of Embedded Systems. The true value of ESI, with its broad range of projects and activities, is best seen by following the common themes and approaches that run through all of our projects. A general symposium like today's is not only a perfect opportunity for you to be brought up to date with the important research results that ESI with its partners have attained, but also to network with other professionals like yourselves.

In the program today you will find presentations from a selection of ESI's national and European research projects together with results from a number of Point One projects. In addition to these research results, the consolidation and dissemination activities of ESI and its partners will also be shown.

Our symposium would not be complete without renowned keynote speakers. I am delighted to announce that Rolf Ernst (Full Professor at TU Braunschweig) and Michiel Peters (President and CEO of Vanderlande Industries) have kindly agreed to share their vision of the strategic developments going on in a leading European research institute, and a world-wide market-leading high-tech company, respectively

The presentations are complimented by an exciting marketplace with demonstrators and posters. These will give you an excellent overview of the results that have been achieved so far and an opportunity to talk to the researchers.

All in all, I hope that you will find today's program stimulating and rewarding. It will, I'm sure, provide you with the inspiration for future collaboration.

I would like to thank all who have contributed to making this symposium a reality: the keynote speakers, the speakers, the demonstrators as well as the ESI staff. And of course, I thank all the researchers that have worked together with us so well over the last years; it is their work that is being presented here!

Finally, I would like to thank you for attending this symposium. I wish you a pleasant, informative and fruitful day.

Yours Sincerely,

Boudewijn Haverkort
Scientific Director and Chair
Embedded Systems Institute

Contents

Programme **3**
Information market room (Senaatszaal) **4**
Preface **5**
Contents **7**
Presentations **9**
Keynote presentation 1 Embedded Systems Research for Complex Societal Challenges 11
Keynote presentation 2 Experiences of Vanderlande Industries as a Solution Provider 13
1.1 Architecture of Systems-of-Systems 15
1.2 How CAFCR workshops and company processes interact (or not) 17
2.1 Point-One Emerging Technology Agenda for Embedded Systems 19
2.2 GEODES: Energy Optimisation for Wireless Embedded Systems 21
2.3 Visual Context Modelling (ViCoMo) 23
3.1 Modelling Warehouse Logistics using Agent Organisations 25
3.2 Architecture development for high-variability W&D systems 27
4.1 Robotized order picking 29
4.2 Execution views for Large Embedded Systems 31
5.1 Embedded System HW/SW Co-design 33
5.2 Ultrafast development of an Ultra Fast Scanner 35
6.1 Model-Driven Design-Space Exploration 37
6.2 Phenomenological Modeling Pitfalls 39
7.1 CAD for system architecting 41
7.2 Systems architecting and modeling 43
8.1 Cooperative Advanced REsearch for Medical Efficiency (CARE for ME) 45
8.2 SPITS – Strategic Platform for Intelligent Traffic Systems 47
9.1 Enhancing maritime situation awareness with anomaly detection 49
9.2 Towards Systems Health Awareness 51
Information Market **53**
D 1 Understanding Ship Behavior with the Simple Event Model 55
D 2 MyriaNed - a self organizing, gossiping Wireless Sensor Network 57
D 3 The Octopus Design-Space Exploration Toolset 59
D 4 CAD for System Architecture 63
D 5 Architectural Scenario Icons 65
D 6 Robotized order picking 67
D 7 A Robotic Hand for Grasping in Warehouses 69
D 9 Fast track to excellence 71
D 10 Putting Chaos under control 73
D 11 OVERLAY 75
D 12 The Modest project 77
D 13 Component-based Development at Philips Healthcare using Verum's ASD Technology 81
D 14 ITEA2 83
D 15 Artemis-IA 85
D 16 Point One 87
Competence Development Programme **89**
Speakers, authors and demonstrators **97**
Auditorium plan **105**

Presentations

Keynote presentation 1
Embedded Systems Research for Complex Societal Challenges

Prof. Dr.-Ing. Rolf Ernst
Institut für Datentechnik und Kommunikationsnetze
TU Braunschweig
Hans-Sommer-Str. 66
38106 Braunschweig, Germany
r.ernst @ tu-bs.de

Abstract: Embedded systems have developed from individual microcontrollers and locally connected systems using field buses to large scale networked systems communicating over open networks. These open networks combine multiple application domains giving rise to another level of embedded system complexity. The emerging use of the Internet for embedded system networking provides further opportunities. Now, embedded systems cannot only exploit the emerging ubiquitous network topology for communication, they also gain access to the knowledge of Internet based information systems. In turn, information systems can utilize embedded systems as source of information enabling an Internet of Things. As a consequence, applications cannot be seen in isolation any more, but rather form a system of interdependent application systems, often called system-of-systems. Examples are traffic control including car-to-infrastructure communication, ambulant healthcare combining patient monitoring and hospital infrastructure, smart buildings and communities, or smart power grids. Such systems address complex societal challenges, such as green mobility, sustainable energy supply or the changing wellness and healthcare requirements of an aging society.

This development has a tremendous influence on embedded systems technology and services. However, due to the complex interdependencies, defining and prioritizing research topics is not an easy task. The upcoming revision of the ARTEMIS Strategic Research Agenda addresses this challenge by defining relevant scenarios to derive required embedded systems capabilities which, then, lead to concrete research requirements. The talk will explain the approach and elaborate on some of the resulting research requirements, such as mixed critical systems design, or local system autonomy with self-protection and their impact on industrial design processes and services.

About the presenter: *Rolf Ernst is a professor at the Technische Universität Braunschweig. He chairs the Institute of Computer and Network Engineering (IDA) with more than 60 employees covering embedded systems research from computer architecture and real-time systems theory to challenging automotive, aerospace, or smart building applications. He chaired major international events, such as ICCAD or DATE. He is a member of the European ARTEMIS Strategic Research Agenda team and served as an expert for the respective German embedded systems roadmap. He is an IEEE Fellow, a DATE Fellow, served as an ACM SIGDA Distinguished Lecturer, and is a member of the German Academy of Science and Engineering, acatech. His spin-off, Symtavision, provides system level analysis and optimization solutions to automotive and aerospace companies worldwide. He is a member of the advisory board (Beirat) of the German Ministry of Economics and Technology for entrepreneurship programs (www.exist.de) and received the Innovator Award (Technologie-Transfer-Preis) 2008 of the Braunschweig Region Chamber of Industry and Commerce (IHK).*

Keynote presentation 2
Experiences of Vanderlande Industries as a Solution Provider

Dr.ir. Michiel Peters
Managing Director Vanderlande Industries B.V.

Abstract: Vanderlande Industries is a high-tech systems solution provider in the area of logistic systems. Typical applications include airport baggage handling, express parcel sorting systems and warehouse automation systems. Whereas many of our partners in the OEM industry focus on repeated delivery of well-defined systems to their customers, Vanderlande Industries focuses on the delivery of integrated customer specific solutions. Our market requires us to integrate many components from a wide range of suppliers in a customer specific setting, often within a very short period of time, thereby guaranteeing correct and reliable operation for over 15 years. This way of working has serious consequences for our approach and skills in system (of systems) architectures, an approach that is quite different from that of traditional OEM industries, especially regarding the design and integration processes along a number of critical system parameters, regarding product delivery and servicing, but also regarding the capabilities and skills of our staff. Another important issue is maintaining and re-using our expertise from previous customer solutions for future use, which is addressed through a reference architecture that encompasses the system variety appearing in different customer solutions.
In this presentation we address the experiences that have been built on the basis of many highly complex logistics solutions world-wide. This experience may be of value for other high-tech industries, especially those who engage in specialty projects, who need to work with a highly diversified global suppliers and subcontractor base, and are moving towards specialized system-of-systems solutions.

About the presenter: Since April 2009 *Michiel Peters is the President and CEO of Vanderlande Industries. Michiel Peters has served as Director of Operations at Vanderlande Industries since 2004. He formerly worked at companies including Stork Fokker Elmo and McKinsey.*

1.1 Architecture of Systems-of-Systems

A new type of systems – and the changes it brings

Michael Borth
Embedded Systems Institute
Michael.Borth @ esi.nl

Abstract: The embedded systems landscape is changing towards connected cyber-physical systems-of-systems and information-centric systems that are becoming increasingly intelligent. These shifts are linked to many technological visions that address pressing societal concerns, e.g., sustainable mobility, via (i) the convergence of consumer, mobile, and pervasive devices with area monitoring networks, altogether forming ambient intelligence, (ii) the increasing reach, information demands, and decision power of infrastructure systems, and (iii) the integration of professional systems as well as transportation systems into infrastructures and complex control and decision processes.

As a consequence, more and more systems reach their full capabilities as part of systems-of-systems. For these new types of systems, a system architect's role to drive the concepts, visions, and demands of many stakeholders towards a unifying realization of a working system may remain similar to what engineering is use to – but many challenges, processes, tasks, and techniques differ greatly.

This talk provides insights in systems-of-systems architecting based on our experiences in Poseidon. In this project, ESI and the carrying industrial partner Thales aim to discover new ways to build dynamic information-centric systems-of-systems for the maritime safety and security domain. The architecture of Poseidon integrates various communication schemata and types of information sources. It enables flexible adaptations to new system configurations and tasks, and remains robust against many pitfalls and shortcomings that come with the lack of control inherent to systems-of-systems engineering. We use it to illustrate what the progress towards systems-of-systems might entail – and how ESI responds to this challenge, focusing on the major aspects of adaptivity, information-centric operations, situational awareness, and self-reflection.

About the presenter: *Michael Borth joined the Embedded Systems Institute in 2007. His interests focus on information-centric architectures, systems-of-systems, embedded intelligence, and the role of uncertainty - both for the design of complex systems and the advanced information processing within such systems. He is the leading architect of the Poseidon project, contributes to ESI's role within ARTEMIS, and investigates ESI's long-term research agenda.*
Michael Borth graduated in Informatics at the University of Ulm (F.R. Germany) in 1999 with his thesis on the Generation of Bayesian Networks for the Diagnosis of Technical Systems. He subsequently joined Daimler Research and Technology. Here, he worked on information mining for the analysis of complex systems, receiving his Ph.D. in 2004 for his work on Knowledge Discovery on Multitudes of Bayesian Networks. Later he focused on advanced concepts for E/E architectures and architecture development, working in close cooperation with Daimler Advanced Engineering and Mercedes-Benz Development, but also within international consortiums.

ACKNOWLEDGEMENT
This work has been carried out as part of the Poseidon project with Thales Netherlands under the responsibilities of the Embedded Systems Institute. Poseidon is supported by the Dutch Ministry of Economic Affairs under the BSIK program.

1.2 How CAFCR workshops and company processes interact (or not)

Hugo van Leeuwen
FEI Company
hugo.van.leeuwen @ fei.com

Auke van Balen, Lorenz Gelderland, Fred Kiewiet, Bernard van Vlimmeren
FEI Company

Abstract: FEI Company is a leading supplier of Electron Microscopes and Focused Ion Beams, and is constantly seeking to improve the performance of their instruments. In day-to-day business, most architects are heavily involved in the Conceptual and Realization realms, and much less so in the Customer, Application and the Functional realms – to reflect on the CAFCR model that is put forward in the academia with a fair amount of success. In the Eindhoven region, this unbalance between CAF and CR is not uncommon, and has much to do with enormous challenge that is usually associated with CR part, and possibly also with the innate desire that is common to engineers: to engineer.

In the course of 2009 / 2010, a number of FEI architects have engaged in a series of CAFCR workshops that were initiated by one of the authors, organized by ESI and facilitated by Gerrit Muller of ESI. These workshops were focused around the CAF part of the CAFCR model in order for them to get a broader perspective on how our customers work with our instruments, what they need to achieve and thus be successful in their goals. At the same time, internal FEI processes for the conceptualization of the next generation tool(s) were gaining momentum, and interestingly, these processes ran simultaneously and started to interact. This presentation will describe the two processes and their interaction, what benefits were reaped, and will also reflect on where especially CAFCR has strong points and where it possibly has shortcomings.

About the presenter: *Hugo van Leeuwen received his MSc degree in Electrical Engineering at the Technical University in Delft, and then joined Philips Research in 1985 to work on text-to-speech systems, in the course of which earned his PhD in 1989. In 1993 he joined FEI Company (then Philips Electron Optics) as a SW engineer, and with the TEM SW team developed the control software that runs on the present day TEM systems. After the intermediate functions of TEM SW group leader, SW group leader, and R&D manager for Architecture and Imaging, he was appointed Fellow and Principal Systems Architect of FEI Company in 2007, with responsibility Worldwide: USA (Hillsboro), Netherland (Eindhoven) and the Czech Republic (Brno).*

ACKNOWLEDGEMENT
This work has been carried out as a part of the **Condor** project with **FEI Company** under the responsibilities of the Embedded Systems Institute. This project is partially supported by the Dutch Ministry of Economic Affairs under the BSIK program.

2.1 Point-One Emerging Technology Agenda for Embedded Systems

Gerard J.M. Smit
University of Twente dept EEMCS
g.j.m.smit @ utwente.nl

Boudewijn Haverkort
ESI & University of Twente

Abstract: In the Emerging Technology Agenda (ETA) of Point-One the interaction between academia and industry is described. This agenda focuses on the technology domains and the opportunities they offer for industrial innovation, based upon competencies and strengths in the knowledge infrastructure available in the Netherlands. The ETA has multiple aims. On the one hand it must anticipate on the medium-term and long-term technological challenges in the various business fields, on the other hand the ETA gives market opportunities originating from novel technologies within the Point-One technology domains nanoelectronics, embedded systems, and mechatronics.

About the presenter: *Gerard J.M. Smit received his M.Sc. degree in electrical engineering from the University of Twente, Enschede, the Netherlands. He currently is a Full Professor with the faculty of EEMCS, University of Twente, leading the CAES chair, where he is responsible for a number of research projects sponsored by the EC, industry and Dutch government in the field of multimedia and efficient reconfigurable systems. After receiving the M.Sc. degree, he worked for four years at the Research laboratory of Océ, Venlo, the Netherlands. In 1994, he was a Visiting Researcher with the Computer Laboratory, Cambridge University, Cambridge, UK and, in 1998, he was a Visiting Researcher with Lucent Technologies Bell Labs Innovations, Murray Hill, NJ. Since 1999, he has been leading the Chameleon group, which investigates new hardware and software architectures for energy-efficient systems. Currently his research interests include low-power communication, and reconfigurable architectures for energy reduction.*

2.2 GEODES: Energy Optimisation for Wireless Embedded Systems

Koen Holtman
Philips Applied Technologies
Koen.Holtman @ philips.com

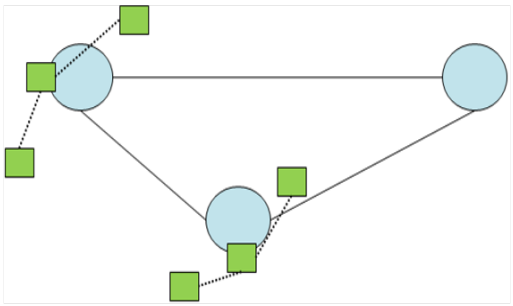
Abstract: The GEODES project (Global Energy Optimisation for Distributed Embedded Systems) is creating design techniques, embedded software, and accompanying tools to realise long power-autonomy for connected embedded systems. It approaches this challenge by considering all system levels, with an emphasis on the global distributed system view. This talk gives an overview of the GEODES project, and highlights some specific topics related to optimising the energy consumption of wireless embedded systems.

GEODES intends to cover generally the following factors contributing to power autonomy:

- Power aware protocols
- Power aware operating systems
- Middleware (including middle layers of wireless protocol stacks)
- Low power compilation
- System level modeling (using SystemC)

With respect to middleware for wireless communications, our approach is to support large-size networks that use diverse technologies, rather than a single type of radio. This decision is driven in part by a consideration of power usage versus transmit distance. We can see a split in applicable technologies and methods if we want to optimise for short distance (typically <10 meters) versus long distance communication. At the hardware side, the expected transmit distance influences the optimal choice of the PHY protocol to implement in hardware. At the software side, for short distance communications is it usually vital that software and higher level protocol layers minimize the time that the radio is switched on either in send mode or receive mode. For long distance communications, only the time in send mode needs to be minimised.

These considerations lead to a GEODES architectural model with at least two types of radio nodes, as shown on the right. There are square nodes for short distance communication via a first radio system, and round nodes for long distance communication via a second radio system. The combined square/round nodes act as network bridges. In GEODES, the IP protocol suite is used as the network layer.



GEODES is considering many network use cases: from the transmission of live video feeds between firemen and a fire control center, to the use of stationary fire detection sensors with a very long battery life. If we look at energy consumption, we can roughly distinguish between several regimes, all of which might be present in a GEODES system:

1. The device is powered from the regular electrical grid, or is part of a rescue vehicle with a running motor
2. The device is portable, and has batteries that need to be recharged after a few hours, or a few days, of active use
3. The device is portable, or is a small and cheap stationary device, and its batteries need to last for at least 2 years
4. The device is portable, or is a small and cheap of stationary device, and uses energy scavenging techniques to achieve an 'infinite' power lifetime

As we move down this list, devices have less and less power available for communication. A globally optimised system will necessarily be asymmetric, seeking to move as much communications functionality as possible to the nodes at the top of the list. Nodes of type 4, typically sensor nodes that detect infrequent events like fire, can face the problem that they can only do a limited number of message sending re-tries before the scavenged energy in their capacitor runs out. Therefore, new approaches are needed to maximise the chance that a report about a safety related event is actually received.

More information about the GEODES project is at http://geodes.ict.tuwien.ac.at/

About the presenter: *Koen Holtman is an embedded systems architect at Philips Applied Technologies. His work includes technology tracking and cost optimization for wireless embedded systems. He received a Ph.D. in Software Design from Eindhoven University of Technology, for work performed at CERN, Switzerland. He has been a participant in the GEODES project since the project start in 2008. In GEODES, he works mainly on architecting, standardization, and validation of the results against the state of the art.*

ACKNOWLEDGEMENT
The GEODES project is supported by ITEA under the ITEA2 programme. Dutch participation is additionally supported by the Dutch Government under the PointOne programme.

2.3 Visual Context Modelling (ViCoMo)

Use Context to Improve Image Interpretation

P.H.N. de With
TU/e SPS, VCA group
CycloMedia Technology
P.H.N.de.With @ tue.nl

E.G.T. Jaspers
ViNotion
egbert.jaspers @ vinotion.nl

Abstract: Video and image analysis have taken a large growth in past years and establishes itself now in various market segments. This processing step replaces the human interpretation of video signals that are required in many applications where decisions have to be made such as surveillance, product verification, medical imaging, etc. This relaxes human-cumbersome work while offering a constant quality in grading the image contents.

State-of-the-art system are highly tailored to specific applications and are now at the level of detecting specific objects or events. However, the machine vision is far for human capabilities and fail when the video contents is different than foreseen by the application developer. For example, the car in Figure 1can be detected as an object of interest, but the human immediately notices the difference in the consequences of the chosen parking place of that car. Humans are capable of reasoning with knowledge about the context of the event for the same object.

In the ViCoMo project advanced video-interpretation algorithms on video data are typically acquired with multiple cameras to acquire context information for improved reasoning. By doing so, ViCoMo will significantly improve the intelligence of visual systems. Where state-of-the-art systems will fail, ViComo will faithfully recognizes the behaviour of persons, objects and events.

Figure 1. left) an image of a car parking in front of a house. right) the same car but in a different context. To automatically detect the danger of the approaching tram, the context should be taken into account.

ViCoMo technology will be applied by the project partners for different markets and different types of platforms. During the presentation we will highlight some established areas and the way how analysis systems are implemented. For example we will show the interpretation of human behaviour that is embedded in security cameras and at the opposite site a professional application with multi-core computing for object recognition for large image databases such as for Google Streetview.

About the presenter: *Egbert Jaspers (1969, The Netherlands) received his M.Sc. degree at the Eindhoven University of Technology in 1996. In the same year he started at Philips Research as a scientist in field of video processing and heterogeneous on Architecture Design of Video Processing Systems on a Chip. From 2003 till 2007 he worked as a consultant architect on technical software engineering for Logica and in March 2007 he became director of ViNotion (www.vinotion.nl), a high-tech start-up company that delivers innovative technology based on intelligent video analysis or computer vision.*

About the presenter: *Peter H. N. de With graduated in Electrical Engineering from the University of Technology in Eindhoven. in 1984 and received his Ph.D. degree from the University of Technology Delft, The Netherland in 1992. He joined Philips Research Labs Eindhoven in 1984, where he worked on the first DCT-based compression systems for video recording..He was the leading video compression expert for the DV camcorder standard from 1989-1993. In 1994-1997 he was leading the design of advanced programmable video architectures in Philips Research as a senior TV system architect. In 1997, he was appointed as full professor at the University of Mannheim, Germany, at the faculty Computer Engineering. In 2000-2007, he was with LogicaCMG in Eindhoven as a principal consultant and is professor at the University of Technology Eindhoven, at the faculty of Electrical Engineering, heading the chair on Video Coding and Architectures.. Since 2008 he is with CycloMedia Technology as Vice President Video Technology and professor at the Eindhoven University of Technology. Mr. De With has written and co-authored over 200 international papers on video coding, architectures and their realization and holds over 40 international patents.. Over the years he co-authored papers that achieved a.o. the Chester Sall paper Award, SPIE Investigators Award, ISCE paper award, etc. In January 2007, he was appointed Fellow of the IEEE.. He serves as a technical board member of IEEE ICIP, ICCE, CSVT, SPIE VCIP, and various other working groups.*

3.1 Modelling Warehouse Logistics using Agent Organisations

Organisation-based High-level Control

Huib Aldewereld
Utrecht University – Institute of Information and Computing Sciences
huib @ cs.uu.nl

Marcel Hiel, Frank Dignum
Utrecht University – Institute of Information and Computing Sciences
hiel @ cs.uu.nl, dignum @ cs.uu.nl

Abstract: Traditional control systems for warehouse management are centralised monolithic systems that are highly optimized for a specific situation. However, in the current business environment, where mergers, acquisitions and rapid product development happen frequently, companies are in a continuous state of flux. The warehouses used by these companies (as customer or owner) are therefore subject to a lot of different changes. Examples of such changes range from withdrawal or addition of (types of) products, slow moving products becoming fast moving products (and vice versa) to the addition or removal of hardware.
The hardware that is used in warehouses has been subject to evolution and a component-based approach currently used to create for example, picking stations and conveyor belts. However, this evolution was not reflected in the software that controls these machines and many of warehouse management systems are still centralized and monolithic.
In order to introduce more flexibility, recently multi-agent approaches were proposed as a solution in production and warehouse management. Agents, characterised by properties such as autonomy and pro-activeness serve as an alternative for the centralised approach, potentially alleviating problems in flexibility, robustness and scalability. In order to structure these multi-agent systems and ensure that global business objectives are met agent organisations were introduced. Although agents promise to alleviate problems in flexibility and adaptiveness, design questions such as: How many components should the system consist of? When to use agents? What should be considered as an agent? And how to use an agent-organisation? Let alone the question what all this means for the efficiency of the overall system hamper the commercial usage of agents.
In this talk, we provide a structured overview of a number of design decisions in the domain of the warehouse logistics. These design decisions help developers determine whether an agent-based approach should be considered. To be able to make these design decisions, we distinguish between three aspects of the system, namely the data (information), the business rules (decisions), and the communication between components (and/or agents). Based on these aspects, we specify how to design a warehouse management system based on agents. We use our experience in creating a warehouse management simulation tool to illustrate and clarify these design decisions.

About the presenter: *Dr. Huib Aldewereld received his PhD in 2007 on the subject of "Autonomy vs. Conformity". After his PhD he was Post-doctoral researcher at the Knowledge Engineering group of the University of Maastricht. Nowadays he is back at Utrecht University as researcher. His research is focused on the regulation and organisation of multi-agent systems through norms.*

ACKNOWLEDGEMENT
This work has been carried out as a part of the FALCON project at/with Vanderlande Industries under the responsibilities of the Embedded Systems Institute. This project is partially supported by the Dutch Ministry of Economic Affairs under the BSIK program.

3.2 Architecture development for high-variability W&D systems

Bruno van Wijngaarden
Vanderlande Industries
bruno.van.wijngaarden @ vanderlande.com

Abstract: Market requirements on automated Warehousing and Distribution systems are extensive and cover a range of system aspects. Next to the obvious requirement that the system must support the business process, other requirements address aspects such as system adaptability to business process changes, system robustness (graceful degradation in case of subsystem failure) and system deployment.

The vast requirements space for automated Warehousing and Distribution systems results in a wide range of system variants. The combination of business process complexity and system variability typically leads to a fair share of project specific software development.
Alternatively, where standardized systems are successfully applied, system variability has to be greatly reduced.

Vanderlande Industries aims at standardization on component level to support a high system variability.

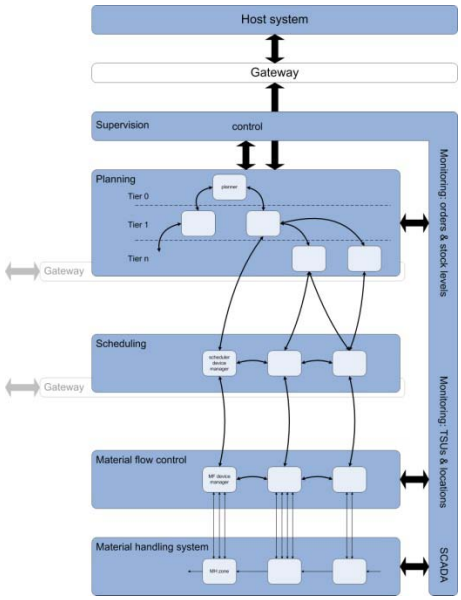


Figure 1 : system architecture

We present the target system architecture for W&D systems (fig.1) and prototype development results for one type of system developed under this architecture: a fully mechanized case picking system for the food retail industry (fig.2)

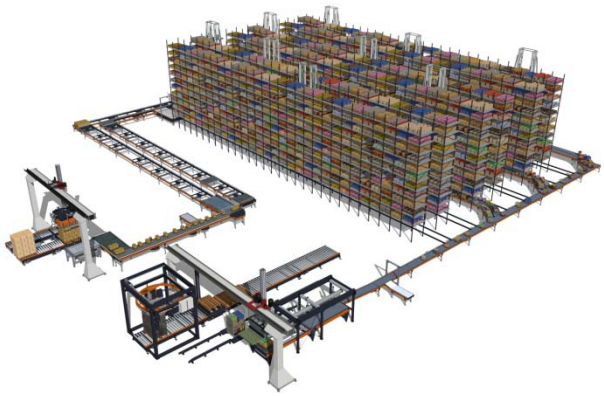


Figure 2 : automated casepicking system (ACP)

About the presenter: *Bruno van Wijngaarden is a systems architect at Vanderlande Industries. He received his Masters degree in Electrical Engineering at the Eindhoven University of Technology.*
He has been designing and implementing automated W&D systems for 20 years. He currently focuses on developing a systems architecture to support product standardization in this field of application.

.

4.1 Robotized order picking

Integration of an arm, hand and vision

Wouter Hakvoort, Jos Ansink en Hernes Jacobs
DEMCON Advanced Mechatronics
wouter.hakvoort @ demcon.nl

Abstract: Can we use robots to do our tedious, unpleasant or dangerous jobs? This issue has been leading for many developments in robot technology. No wonder that the most successful applications of robot technology are tedious and dangerous manipulation tasks in industry.

In warehouses many tasks are automated, but order picking is still human labour. The work is tedious and unpleasant. Moreover, human labor is costly and insufficiently available, especially at peak-times. In future, robot technology should take care of order picking. However, current vision and gripping technology does not come up to human standards. In particular, new technology is required to detect randomly oriented, unsorted objects and to grab soft, non-boxed or irregularly shaped objects. With this in mind, part of the research in the Falcon project considers universal gripping solutions and robust vision [1,2]. The suitability of the research results for automated order picking is shown by a demonstrator setup that is realized by DEMCON. Besides gripping and vision, manipulation is an important task during order-picking. The demonstrator is equipped with a state-of-the-art robot arm to complement the eye and hand.

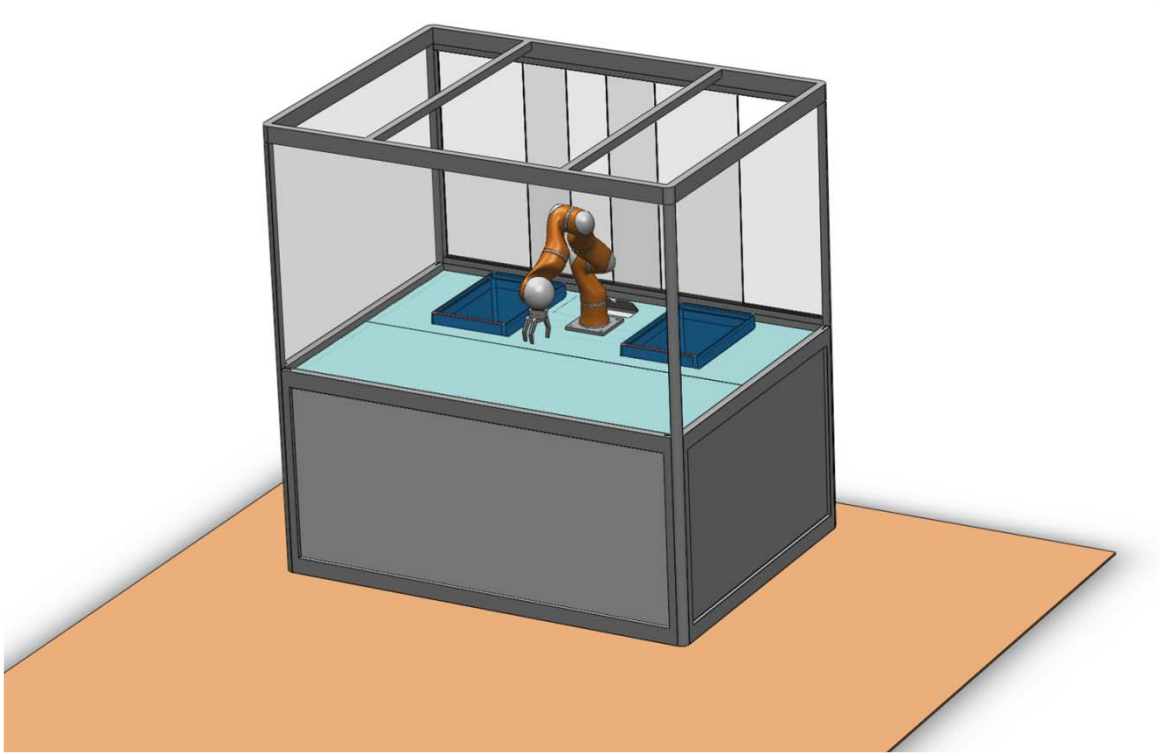
Gripping
The hand of the demonstrator is developed at Delft University of Technology [1]. The design choices are substantiated by newly developed performance metrics that suit to the design requirements of grippers for warehouses. These performance metrics maximize the range of object sizes that can be grasped, and minimize the sensitivity to disturbances during pick and place tasks [3]. The desired behavior of this hand is mainly obtained by the mechanical design of the hand, since the hand is actuated by only one motor and an open loop controller.

Vision
The eyes of the demonstrator are developed at the Delft University of Technology [2]. The vision software searches for keypoints in the image and tries to match these to the keypoints of the objects in a database. The found keypoints are clustered to identify the objects present. Finally the location and orientation of the objects are determined for the subsequent gripping action. Research focuses on the speed of recognition, robustness and accuracy of the position estimate. These aspects are important for adequate integration in an automated order-picking system.

Manipulation
The state-of-the-art KUKA LWR robot arm is used for the demonstrator. This robot has several advantageous properties that make it more suited for order-picking than conventional arms. The seventh axis of the robot enhances the ability to avoid collisions. The low weight allows easy transportation. Grabbed objects can be weighed by the robot using its force sensors. These force sensors can also be used for stiffness control, which enables positioning in inaccurately defined environment without damage. Moreover, the light weight and the force sensors enhance safety for the interaction with humans.

Demonstrator
The hand, eye and arm are important components, but more components are required for the order-picking demonstrator, like the body and brains. Moreover, the components should be interfaced correctly at mechanical, electrical, optical and software level to obtain a functioning demonstrator. DEMCON takes care of the system design, the missing components and the realization of the interfaces. The requirements for adequate order-picking are formulated and translated to the demands on the various components and interfaces. Important requirements for the system are the relative positioning of the components, robustness to ambient light variations, safety, transportability and of course to show the new gripping and vision technology.

The most complex part of the integration is the high-level control system that is used to control the various components. The control system is developed using a step-wise approach going from simple to more complicated tasks. The design of the control system is based on existing components as much as possible. The control system is implemented on a PC and socket-communication is used to interface with the other components. Visualisation and path-planning is implemented using the open source software OpenRave [4].



The result

The main result of the integration project is the demonstrator setup (see figure below). The demonstrator features a unique combination of gripping and vision. This technology enables automated order-picking of irregularly shaped objects like blister. Besides the demonstrator, the transfer of knowledge to the companies involved in the project is an important result.

References:

[1] PhD-research by G. Kragten (TU Delft)
[2] PhD-research by M. Rudinac (TU Delft)
[3] The ability of underactuated hands to grasp and hold objects, Mechanism and Machine Theory, 45:3, pp. 408-425.
[4] http://openrave.programmingvision.com

About the presenter: *Wouter Hakvoort is applied research engineer at DEMCON Advanced Mechatronics, Oldenzaal, the Netherlands. He received the M.Sc. degree (2004) and Ph.D. degree (2009) in Mechanical Engineering from the University of Twente. His PhD research on iterative learning control for LTV systems with applications to an industrial robot was carried out at the Materials Innovation Institute, Delft, the Netherlands. His interests include dynamic modeling and control of mechanic (multibody) systems for mechatronic system design.*

ACKNOWLEDGEMENT

This work has been carried out as a part of the Falcon project with Vanderlande Industries under the responsibilities of the Embedded Systems Institute. This project is partially supported by the Dutch Ministry of Economic Affairs under the BSIK program.

4.2 Execution views for Large Embedded Systems

Trosky B. Callo Arias
Software Engineering and Architecture Group
University of Groningen
Trosky @ cs.rug.nl

Abstract: : In this presentation, we introduce execution views, a set of architectural views to describe and analyze the execution architecture of large embedded systems. Our daily lives depend more and more on embedded systems, from entertainment to communications to transportation to medicine. Nevertheless, these systems must change constantly to continue being useful and competitive in the market. The runtime architecture of this type of systems changes more often that other system aspects. Up-to-date execution views can help architects and designers to get better insights to improve the runtime behavior and performance of large embedded system like the Philips MRI scanner. We construct up-to-date execution views following a reverse architecting approach, which we developed and validated for the Philips MRI scanner. Other development organizations can apply the approach to support the incremental development of other large embedded system.

Execution views can be distinguished as execution profile, resource usage, and execution concurrency views [1]. Each of these views contains models that address different concerns with respect to what a software system does at runtime and how it does it. Figure 1 shows a functional mapping, model, which is part of an execution profile view for the Philips MRI scanner. The models in an execution profile view provide overviews and facilitate the description of details about the runtime of a given system feature, without being overwhelmed by the size and complexity of the system implementation.

Figure 2 shows a model of a resource usage view. Resource usage models provide overviews and facilitate the description of details of how the software elements, e.g. component and process, of a system use the hardware resources at runtime. Figure 3 shows an execution concurrency model, which provides an overview of how the runtime elements of the software embedded in Philips MRI scanner execute concurrently in the start-up of the system. This model in particular enabled a development project that reduced the start-up time of the Philips MRI scanner by 30%. Currently, the model is used as a benchmark to monitor and verify the performance of the system as part of integration and verification tests. Further details about the notations and values of the example models are provide in [1] and in the presentation.

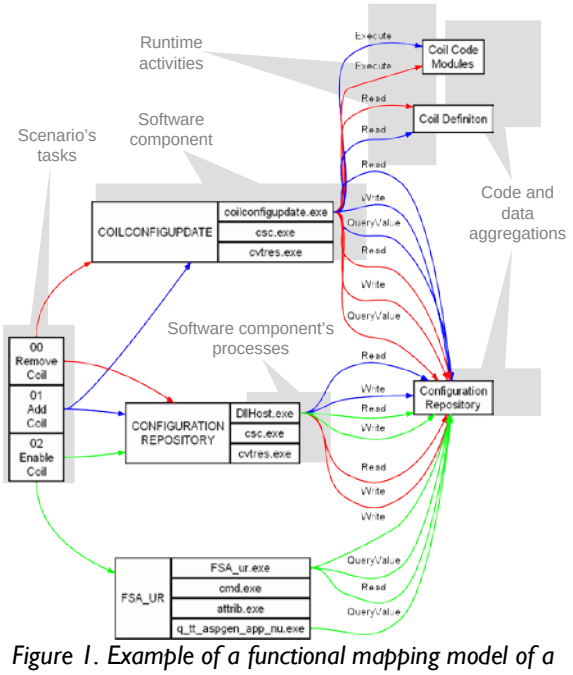


Figure 1. Example of a functional mapping model of a configuration of the Philips MRI scanner

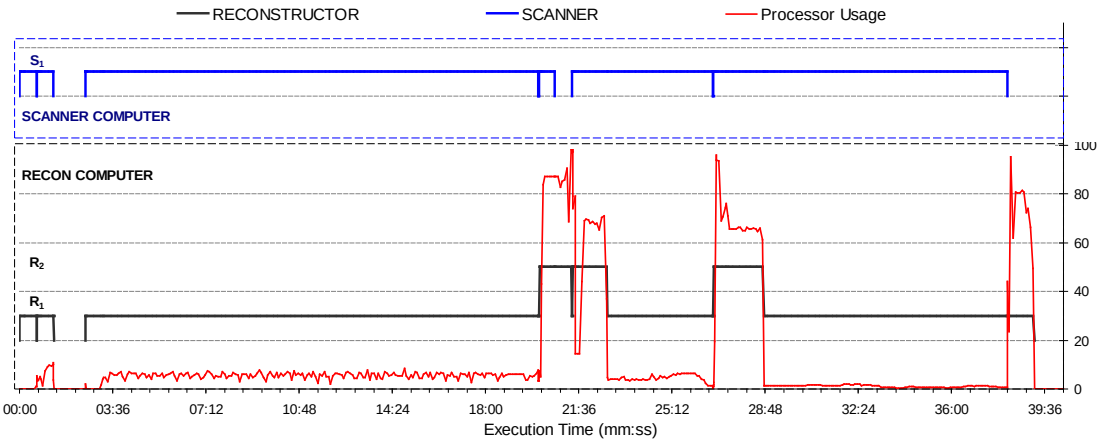


Figure 2. Example of a resource usage model for a data-intensive feature of the Philips MRI scanner

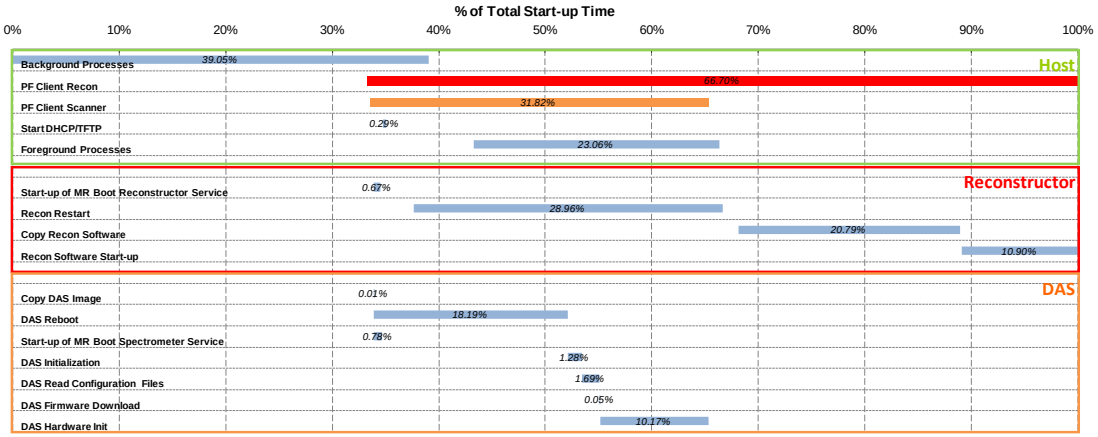


Figure 3. Example of a workflow concurrency model for the start-up of the software embedded in the Philips MRI scanner

References

[1] T. B. Callo Arias, P. Avgeriou, and P. America, Tech. Report: Documenting a Catalog of Viewpoints to Describe the Execution Architecture of a Large Software-Intensive System for the ISO/IEC 42010 Std., March 2010, `http://www.esi.nl/projects/darwin/publications/`

About the presenter: *Trosky B. Callo Arias received an Engineer's degree in informatics and systems from Universidad Nacional San Antonio Abad del Cusco-Peru in 2002, and a Master's degree in computer science from Göteborg University-Sweden in 2005. He is a Ph.D candidate in the Software Engineering and Architecture Group of University of Groningen. His professional interest includes the architecture and design of software solutions for high-tech products, embedded systems, and distributed systems..*

ACKNOWLEDGEMENT

This work has been carried out as a part of the Darwin project at Philips Healthcare under the responsibility of the Embedded Systems Institute. This project is partially supported by the Dutch Ministry of Economic Affairs under the BSIK program

5.1 Embedded System HW/SW Co-design

for 'Watervisie' harbor surveillance

Jos van Eijndhoven
Vector Fabrics BV
Eindhoven, The Netherlands
jos @ vectorfabrics.com

Abstract: The 'Watervisie' project develops a vision application to locate and follow ships in the harbor of Rotterdam. The project consortium consists of five Dutch partners: HITT, TU/e, ViNotion, Port Authorities of Rotterdam, and Vector Fabrics. Reliable recognition of ships requires application research to support diverse ship shapes and to ignore water movements. The initial algorithms show that a high computational workload is to be expected, which is difficult to realize in a compact and cost-effective industrial camera system. A combination of a main stream X86 processor and an FPGA fabric is foreseen to meet requirements on performance and flexibility. Vector Fabrics cooperates in the project with innovative tools to design such an embedded system.

The tooling supports the separation of computationally expensive parts of the application into concurrent threads, and to analyze the data communication patterns between those threads. Some of these threads can be mapped to function-specific accelerators in the FPGA, to exploit a high degree of parallelism. The resulting communication between the X86 processor cores and the FPGA occurs through explicit data streams, as well as through shared memory.

The actual embedded system implementation becomes complex due to diverse compute architecture aspects (e.g. PCI-express protocols, cache coherency, application virtual memory versus FPGA physical memory operation, Linux kernel modules and device drivers, DMA engines, and interrupt-driven operation). Vector Fabrics' tooling and HW/SW components help to create a solution in this complex domain, relieving embedded system builders from the burden to manage all these details.

Although the Watervisie project is still young and there is significant work ahead, the presentation will show the current state of development and the taken direction.

About the presenter: *Jos van Eijndhoven is co-founder and CTO of Vector Fabrics, a high-tech startup founded in 2007. Vector Fabrics develops tools for the design and implementation of multicore, multi-threaded applications and embedded systems. Before that, he worked as principal architect at NXP Semiconductors Research and Philips Research on programmable media processing architectures and compilation tools. He led the Processor Oriented Architectures research cluster for a time, and participated in the regular reviews of Philips' corporate patent portfolio. Prior to this he was senior research member in the Design Automation group at the Eindhoven University of Technology, which included a sabbatical at the IBM Thomas J. Watson Research Laboratory pioneering the research on high level synthesis. He holds 15 patents and co-authored about a hundred scientific publications.*

ACKNOWLEDGEMENT
The Watervisie project is partially supported by the Dutch Ministry of Economic Affairs, Agentschap NL, under the Point-One innovation program as PNE09008

5.2 Ultrafast development of an Ultra Fast Scanner

A case for Model Driven Design

Hans Spitshuis
CCM Centre for Concepts in Mechatronics
hans.spitshuis @ ccm.nl

Abstract: In the beginning of 2009 four complementary partners joined forces to develop an Ultra Fast Scanner within the shortest possible timeframe. The challenge was to develop, from scratch, a fully operational prototype of a scanner for digital pathology within a time frame of 14 months. CCM had the role of system integrator and was responsible for the development of mechanics, mechatronics and control software. The complexity of the product to be developed, the short lead time, the risks associated with the extremely short system integration time and the organizational complexity of a multi-partner, multi-site development project did put some challenging demands on the project approach.

This presentation will show how model driven development was put into practice to cope with these challenges. CCM chose to use the Analytical Software Design* method for modeling, verifying and generating the code for the control software. In the development also extensive use was made of the MathWorks tool chain. We'll show how these model driven design techniques were used in conjunction and we'll go into more details on how they were applied to decrease risks and at the same time improve the quality and productivity of the development. Of course some remarks and pitfalls to avoid when using these approaches will not be forgotten.

About the presenter: *Hans Spitshuis is manager of software- and electronics development at CCM Centre for Concept in Mechatronics. He has more than 20 years of industrial experience. Before he joint CCM, he worked for Philips Electronics and NXP. He has extensive experience as software designer, project and development manager in the development of control systems for advanced production- and mechatronic equipment. He has a BSc in electronics.*

ACKNOWLEDGEMENT
This work has been carried out as a part of the UFS project, in which CCM worked together with Philips Electronics, Prodrive B.V. and Frencken Mechatronics B.V. This project is supported by the Dutch Ministry of Economic Affairs under the Point-One program.

**Analytical Software Design (ASD) is a software development approach, supported by a toolset, from Verum Software Technologies BV.*

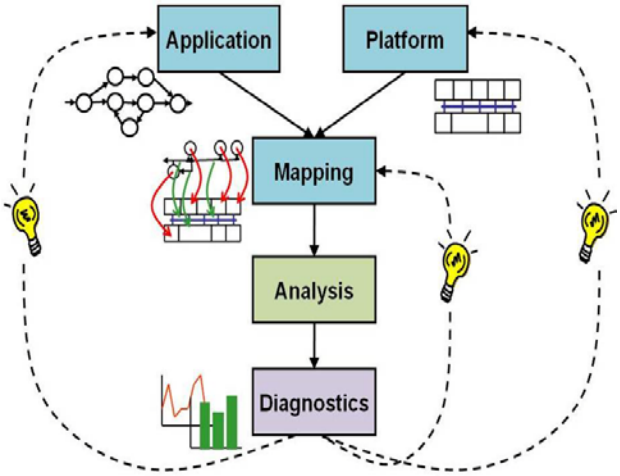
6.1 Model-Driven Design-Space Exploration

Experiences with the Octopus Toolset

Nikola Trcka
Eindhoven University of Technology
n.trcka @ tue.nl

Martijn Hendriks
Radboud University Nijmegen
m.hendriks @ cs.ru.nl

Abstract: An important challenge in the early stages of the design of embedded systems are the many design possibilities that need to be considered. The design spaces usually involve multiple metrics of interest (timing, resource usage, energy usage, cost, etc.) and multiple design parameters (e.g. the number and type of processing cores, sizes and organization of memories, interconnect, scheduling and arbitration policies, etc.). The relation between design choices on the one hand and metrics of interest on the other is often very difficult to establish, due to aspects such as concurrency, dynamic application behavior, and resource sharing. Therefore, a systematic design trajectory is needed to provide high-quality, cost-effective systems.



Model-Driven Design-Space Exploration is a process applied in the early stages of design that first captures design alternatives formally through dynamic models, and that next provides a (semi-)automatic way of producing system configurations satisfying design constraints and optimizing cost and quality. To support this process, we recently developed a generic software framework, called the Octopus toolset [1]. The approach underlying the Octopus toolset follows the well-established Y-chart philosophy [2]. Any embedded system involves the co-development of an application, a platform, and the mapping of the application onto the platform. In the search process, diagnostic information obtained from different types of analysis is used to improve application, platform, and/or mapping.

The aim of this presentation is to show how the model-driven design-space exploration process can be a part of industrial practice, and how it can add to traditional (spreadsheet, back-of-the-envelope) methods that ignore dynamic behavior and typically result in over-dimensioned systems. In the talk, we first motivate and briefly explain the process and the Octopus toolset. We then report on the results obtained from two case studies conducted at Océ Technologies B.V., both tackling the problem of designing data-paths in professional printers. These two realistic case-studies were successfully performed using the Octopus toolset, and required a minimal modeling effort.

1. T. Basten et al. Model-Driven Design-Space Exploration for Embedded Systems: The Octopus Toolset. ISoLA 2010. LNCS 6415, 2010.
2. B. Kienhuis et al. A Methodology to Design Programmable Embedded Systems. The Y-Chart Approach. SAMOS 2001. LNCS 2268, 2002.

About the presenters:

Nikola Trčka *finished his studies in Mathematics for Computer Science at the University of Belgrade, Serbia in 2003. In 2007, he obtained a PhD degree in Computer Science from Eindhoven University of Technology, working in the area of formal methods. In 2008 he became a postdoctoral researcher in the Information Systems group, where his research was focused on developing techniques for (business) process analysis and optimization. He is presently also a postdoctoral researcher in the Electronic Systems group at the Department of Electrical Engineering. His current research interest is to provide methods for efficient design of correct and optimal embedded-systems. Nikola has published around 40 scientific papers.*

Martijn Hendriks *finished his studies in Computer Science at the University of Nijmegen in 2002. In 2006 he obtained a PhD degree in computer science from the University of Nijmegen in the area of formal methods. From 2006 until 2010 he worked as a software engineer in the R&D group of GX Software. Recently, he joined the Model-Based System Development group at the University of Nijmegen as a postdoctoral researcher. His current research focuses on tools and techniques to evaluate and compare system-level design alternatives.*

ACKNOWLEDGEMENT

This work has been carried out as a part of the Octopus project with Océ Technologies under the responsibilities of the Embedded Systems Institute. This project is partially supported by the Dutch Ministry of Economic Affairs under the BSIK program.

The Octopus toolset and the two reported case studies are the results of a joint effort of the Octopus team, including, besides the presenters, Twan Basten, Emiel van Benthum, Marc Geilen, Roelof Hamberg, Fred Houben, Georgeta Igna, Frans Reckers, Sebastian de Smet, Lou Somers, Egbert Teeselink, Frits Vaandrager, Jacques Verriet, Marc Voorhoeve, and Yang Yang.

6.2 Phenomenological Modeling Pitfalls

Hysteresis modeling examples of a magnetic lens

dr. ir. C.M.M. van Lierop
Eindhoven University of Technology / Electrical Engineering Dept. / Control Systems Group
PT4.29 P.O. box 513 5600MB Eindhoven

ir. P.J. van Bree
Eindhoven University of Technology / Electrical Engineering Dept. / Control Systems Group
PT4.16 P.O. box 513 5600MB Eindhoven

Abstract: In the presentation some of the pitfalls of phenomenological modeling are discussed based on examples taken from the Condor research. The Condor research deals with system performance and evolvability. Within this project the FEI electron microscopes are used as an industrial reference case. The presented examples are taken from the research of P.J. van Bree into modeling, identification and control of electromagnetic lenses. However, the lessons learned from the examples are not restricted to the specific application.

In many applications hysteretic behavior is modeled as a bounded uncertainty and, although this introduces some conservatism, it does not result in relevant limitations on the performance. In ultra high precision applications such as the FEI electron microscopes, however, magnetic hysteresis in the magnetic lens system can be a performance limiting factor, since it compromises the reproducibility of setpoints. Magnetic hysteresis is subject to study for over a century. The term Hysteresis (from Greek: ὑστέρησις meaning "to come after", used either of place or time) was introduced by J.A. Ewing in the late 19th century. Although much effort has been invested into deriving physical micromagnetic models it is difficult to translate these to the macroscopic domain without a huge increase of model complexity or loss of generality. Therefore, many phenomenological models (from Greek: φαινόμενον "that which appears" and λόγος "study") have been adopted to describe (subsets of) the macroscopic effects.

The challenge of the iterative process of defining the correct performance criteria of a practical setup which needs to be improved and finding a strategy to improve these criteria based on (a selection of) phenomenological models and experiments, will be discussed. Care has to be taken when a phenomenological modeling approach is used for interpolating or extrapolating results since the underlying physics is not taken into consideration. It is not stated that physical modeling does not present any problems in interpolating of extrapolating results, since these models can be based on the wrong physics and, therefore, produce the correct results only accidentally for a limited set of experiments. However, the pitfalls in defining the wrong experiments and performance criteria based on an incorrect set of model properties are more evident in the phenomenological case. Nevertheless, regardless of the potential pitfalls, many demanding high performance systems such as the FEI electron microscopes can benefit from the phenomenological modeling approach in combination with careful experiment design to gain insight into potential solutions to boost the performance.

About the presenter: *C. M. M. van Lierop was born in Eindhoven, The Netherlands. He received the M.Sc. degree (cum laude) in electrical engineering and the Ph.D. degree in magnetically levitated planar actuator technology from Eindhoven University of Technology, Eindhoven, in 2003 and 2008, respectively. He has been with the Control Systems Group, Eindhoven University of Technology, where he was initially a Postdoctoral Researcher and is currently an Assistant Professor. His main research interests deal with spatial-temporal systems for control, motion control, magnetic bearings, electron microscopy, and MIMO systems.*

ACKNOWLEDGEMENT
This work has been carried out as a part of the Condor project with FEI as the industrial partner under the responsibilities of the Embedded Systems Institute. This project is partially supported by the Dutch Ministry of Economic Affairs under the BSIK program.

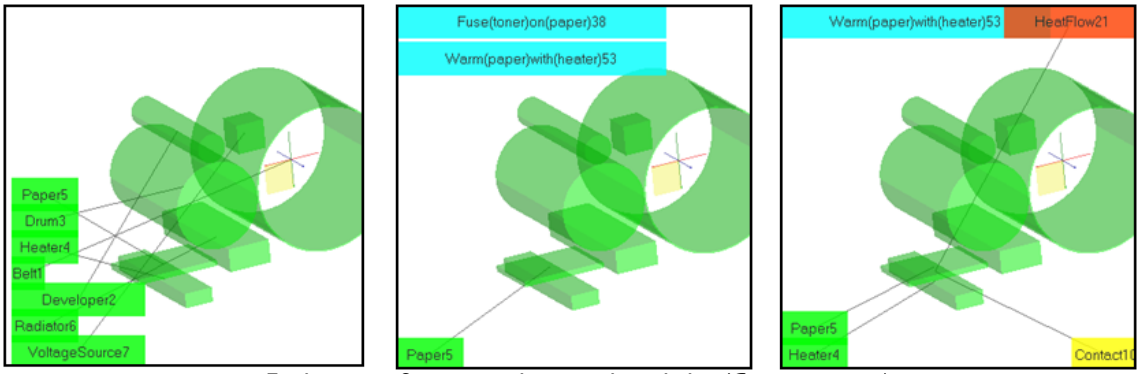
7.1 CAD for system architecting

Effective use of system architecting knowledge in product development

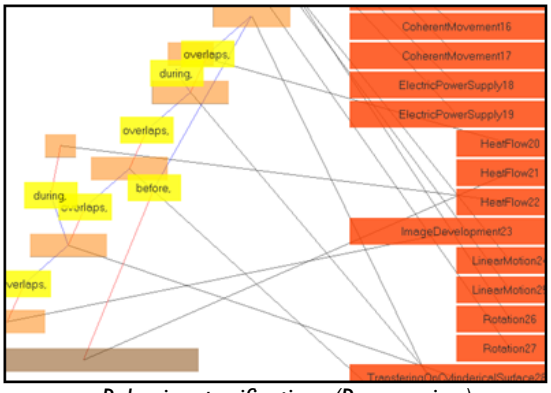
Hitoshi Komoto
Delft University of Technology
h.komoto @ tudeflt.nl

Tetsuo Tomiyama
Delft University of Technology
t.tomiyama @ tudelft.nl

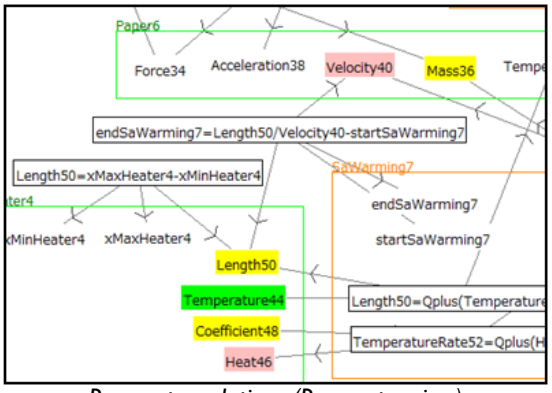
Abstract: In system architecting of mechatronics systems, system architects decompose functions in order to clarify the specifications of subsystems regarding structure and behavior, while considering diverse physical, causal and logical interactions among subsystems. In this presentation, a computer aided design system for system architecting (SA-CAD) is presented. SA-CAD is based on the study of engineering design in the conceptual design stage. This presentation shows how SA-CAD uses conceptual network of the design knowledge such as functions and behaviors in order to generate corresponding parameter relations and evaluate structural and behavioral specifications in system architecting of mechatronics systems.



Exploration of system architecting knowledge (Geometric view)



Behavior specifications (Process view)



Parameter relations (Parameter view)

About the presenter: *Hitoshi Komoto is a postdoctoral research fellow at Delft University of Technology. He received Dipl.-Ing in mechanical engineering from Karlsruhe Institute of Technology in 2004 and PhD from Delft University of Technology in 2009. His research interest is the development of intelligent CAD for complex mechatronics systems and product-service systems.*

ACKNOWLEDGEMENT

This work has been carried out as part of the Octopus project with Océ-Technologies B.V. under the responsibility of the Embedded Systems Institute in Eindhoven, The Netherlands. This project is partially supported by the Netherlands Ministry of Economic Affairs under the Bsik program.

7.2 Systems architecting and modeling

Experiences about a good, but unequal marriage

Roelof Hamberg
Embedded Systems Institute
roelof.hamberg @ esi.nl

Abstract: As of late, model-based methodologies have become very popular in the academic community as well as in high-tech industries. And just as with other new technologies, concepts, or ideas, it is bound to go through the so-called hype-cycle and a major decline will eventually happen. Nevertheless, I would like to stress the fact that models have proven their value in system development for decades already, and they have the potential to leverage this value even further after the hype has faded away. So, what is different at present?
An attempt to frame the acts of architecting and modeling and their relationship will be subject of debate in this talk, being illustrated with a number of examples taken from industrial contexts.

Positioning modeling in the context of system architecting and development has been a research item in the Boderc project, the first ESI industry-as-laboratory project with Océ as main industrial partner. Many other ESI projects followed, but only a few have considered such a high level topic as part of their research. The insights of Boderc were mainly taken up by a few individual researchers and architects, while the non-users mainly were complaining about the lack of concreteness of these insights. However, within ESI further advances in concrete model support in the context of system architecting and development had to wait for the European project Multiform. Meanwhile, taken from the point of view of ESI, reflections on modeling activities outside the context of Boderc, but obviously subject to the very same considerations of relating them to system architecting and development, have become possible. Case material taken from the Falcon and Octopus projects serve as an illustration for this. The reflections and the developments in Multiform together form an interesting set of observations that will provide a solid basis for successful strengthening of model-based system architecting.

About the presenter: *Roelof Hamberg received his MSc and PhD degrees in Theoretical Physics from the Universities of Utrecht and Leiden, respectively. He joined Philips Research in 1992 to work on perceptual image quality modeling and evaluation methods. In 1998 he joined Océ as a developer of in-product control software, shifting his role via digital system architect to department manager. In 2006, he joined ESI as research fellow. His research areas of interest are easy specification, exploration, simulation, and formal reasoning of system behavior, and systems architecting in general.*

ACKNOWLEDGEMENT
This work has been carried out as a part of the **Boderc**, **Falcon**, **Multiform**, and **Octopus** projects with **Océ** and **Vanderlande Industries** under the responsibilities of the Embedded Systems Institute. These projects are partially supported by the Dutch Ministry of Economic Affairs under the TS and BSIK programs and the European Commission under the FP7 program.

8.1 Cooperative Advanced REsearch for Medical Efficiency (CARE for ME)

Overcoming healthcare dilemmas in an ageing population

Frenk M. Sloff
Philips Healthcare / Healthcare Informatics
Best, The Netherlands

Abstract: as the average survival age of the Western population rises, healthcare services are faced with a growing number of chronic diseases requiring long-term treatment. The resulting costs and shortage of personnel present real challenges. This trend is driving healthcare innovation to the limit. Clinical and technological solutions are therefore required to collate medical data and knowledge from different sources and domains in order to address the complete healthcare care cycle of all of those medical conditions.

More treatment for the same cost
Care4Me will develop advanced medical image analysis to provide clinicians with more *functional* and *quantitative* information, enabling earlier and more precise diagnosis. The result will be reduced cost per patient and the capacity to process more patients with the same number of medical staff.
The key technical innovation in Care4Me lies in developing new medical image-processing software capable of extracting relevant image information from very large data sets and combining this with other types of medical data and knowledge. This will enable greater functional and quantitative analysis of medical images and will facilitate earlier diagnosis and person-centric treatment.

Improved medical care
The primary aim of Care4Me is to improve quality and productivity in healthcare using advanced medical imaging and decision-support methods combined with different knowledge sources, from early diagnosis to treatment and monitoring. The project will develop clinical demonstrators for three specific disease areas: *cancer*, and *cardiovascular* and *neurodegenerative* diseases. This will involve innovative medical image-analysis and decision-support systems, which will connect to current hospital information systems using newly developed systems architectures. The series of clinical demonstrators will demonstrate the anticipated improvements from the project in the quality and efficiency of medical care. Different imaging techniques are being considered, including X-ray, computed tomography (CT), magnetic resonance imaging (MRI) and positron emission tomography (PET).

About the presenter: *Frenk Sloff received his master's degree in Astronomy and Theoretical Physics from the University of Leiden, The Netherlands. He is currently manager of Image Guided Intervention research projects at Philips Healthcare in Best. He is also the project manager of the Care4Me ITEA-project, a European consortium with 25 partners from 5 countries (Netherlands, France, Spain, Finland and Greece).*

ACKNOWLEDGEMENT
This work is carried out as a part of the ITEA program (Information Technology for European Advancement). This project is partially supported by the Dutch Ministry of Economic Affairs under the AgentschapNL program.

8.2 SPITS – Strategic Platform for Intelligent Traffic Systems

A solution for ITS

Chris Bannink
Logica
chris.bannink @ logica.com

Ralph von Vignau
NXP Semiconductors
ralph.von.vignau @ nxp.com
Tel: +31 40 27 28456

Abstract: SPITS is an adaptable ITS platform matching the life time of vehicles and able to run consumer, business and government applications enabling fast growth in the market. Nearly all ITS projects focus on applications and not on the system required to run them. The 3 stake holders (consumers, fleet owners and governments) have differing interests and requirements. These must all be possible on one system allowing several parties to benefit from the same investments and enabling large volumes at reasonable prices. Consumers will pay if the services are attractive for them, Fleet owners will invest if they can save fuel and time and governments will invest in the infrastructure if they can improve traffic flow, increase safety and reduce emissions.

Is there an approach that can cover all the requirements and still be affordable? The 3 system components, On Board Unit (OBU) in the vehicle, Road Side Unit (RSU) and Back Office (BO) for providing services, must all be cost effective and have standardized communication channels and protocols. The longevity of the OBU must match the life time of vehicles and secure an affordable platform for cooperative applications supporting ITS into the future. The infrastructure in the form of sensors and RSU's must interface with current solutions and be open for modernization. Services should cater for various providers and levels of data security. Security is an overriding consideration.

There are very few similar solutions. Within SPITS all opportunities are exploited to use consumer technology, low cost interfaces and available standards (ETSI) to design an extendable solution in a way that will allow high volume production. The solution will enable applications to run from all 3 stake holders and be adapted to requirements in an economical way. Investments will be enabled by the 3 stakeholders.

Prototypes of SPITS are currently being designed and are expected to be demonstrated in May 2011. A number of use cases are defined that will be used to verify the system. These applications will cover areas from all 3 stake holders and enable FOT's to use the platform in large numbers. A second generation will be designed to complete some of the issues not resolved in the first phase. Currently these are the safety critical applications requiring communications with very low latency and increased security methods. Malicious attacks can be very damaging to transport systems and lives.

The market potential is large. There are >300M vehicles in Europe. There will be 3 penetration flows within the market, post sales, new cars and up-grades. For this exercise we will presume the price of €350 for an OBU and €6000 for a RSU. The new car growth is yearly 2.6% (7.8M) on average and if 5% of the old cars are post market sales, the yearly market size would be €6.8 B. Yearly up-grades would add a further €1 B. Added to this potential is the income from services which would be growing from year to year. Presuming 30% of vehicles are spending €100/yr this will exceed €9 B.

3 groups of beneficiaries are addressed. The consumer gets new services that provide driving guidance, increased safety and more information for a better driving experience. Fleet services can improve logistics and run more efficiently saving fuel and time. Also with the affordability many smaller companies can also benefit. This will also help reduce emissions in towns. Governments will be able to manage traffic flow

dynamically at much lower cost. They will be able to have both local and wide spread access to vehicles. Especially highways, congested towns and the environment will benefit.
SPITS will enable a new driving experience for everyone. The car is connected to the communications cloud and numerous applications will emerge providing an awareness of his surroundings, warnings of incidents, help if the vehicle breaks down or in emergencies and accidents and weather and road conditions related to his position. Guidance to parking places and toll road payments are easy and the same across Europe. Electro vehicles will receive guidance to best energy saving routes and next charging stations. Cooperative driving will enable getting to a destination faster with less anxiety.

About the presenter: *Chris Bannink, Principal Consultant, Logica*
Chris Bannink (1967) is a Principal Management Consultant at Logica with over 16 years of experience in new business development for a-brands. He is specialized in mobility and e- and m-commerce innovations and is involved in the SPITS-project.com from the start. As a thoughtleader about these topics, he is often asked to speak on several European seminars like e-challenges.org, ICTdelta.eu, ENederlandcongres.nl, OGF23.org, Egee08.eu, etc.
After his studies Journalism and Political Science, he worked as a marketing manager in big Dutch media and telecom companies, where he started several new (online) initiatives. Chris accelerates in new, complex, innovative projects with a commercial and/or technical issue . He can translate a technology push into a marketing pull.
Chris is also an active blogger and columnist on several Dutch blogs about mobile www.mobilecowboys.nl, marketing (Frankwatching.com) Internet (Dutchcowboy.nl) and business news (Nuzakelijk.nl).

ACKNOWLEDGEMENT
This work has been carried out as a part of SPITS project [NXP, TomTom, Logica, TNO, GreenCat, Peek Traffic, Fourtress, Catena, Task24, TU-Eindhoven, TU-Delft, University of Leiden, University of Twente) under the responsibilities of Agentschap NL. This project is partially supported by the Dutch Ministry of Economic Affairs under the High Tech Top Program.

9.1 Enhancing maritime situation awareness with anomaly detection

Jeroen H.M. Janssens, Eric O. Postma
Tilburg center for Cognition and Communication, Tilburg University
PO Box 90153, 5000 LE Tilburg, The Netherlands
jeroen @ jeroenjanssens.com, eric.postma @ gmail.com

Abstract:
Situation awareness is pivotal to decision making in complex, uncertain situations. Information technology may support decision makers to enhance situation awareness. In the context of ESI's Poseidon project, a joint project of Thales Nederland B.V. and several academic partners, we develop three anomaly detection components to support operators in the complex domain of maritime safety and security. These three components operate on a variety of data sources ranging from raw and enhanced vessel data to high-level information such as the national threat level.

The first component is an outlier selection component that processes raw and enhanced vessel data, and is called the Stochastic Outlier Selection (SOS) component. To train and evaluate the SOS component, normal and anomalous data are required. The second component, called Presto, has been developed to allow for the manual creation of anomalies which can be inserted in the data. The third component is the Graphical Model (GM) component and is responsible for integrating the output from the SOS component with high-level information.

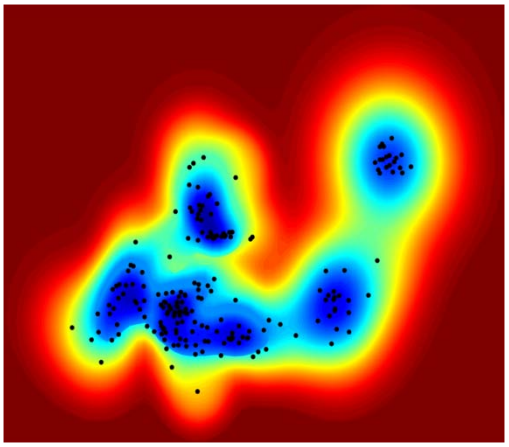


Figure 1 : Density map computed by SOS

The SOS component takes as input an unlabeled data set with trajectories. The component outputs for each trajectory a probability that it is an outlier. We have compared the performance of SOS with other methods such as LOF and LOCI. The results show a superior performance in detecting outliers. Unlike other methods, which return either a traditional probability, a binary classification, or a real value with no upper bound, SOS returns a value between 0 and 1 for each trajectory. This is both intuitive to the operator and allows for easy integration with the Graphical Model component.

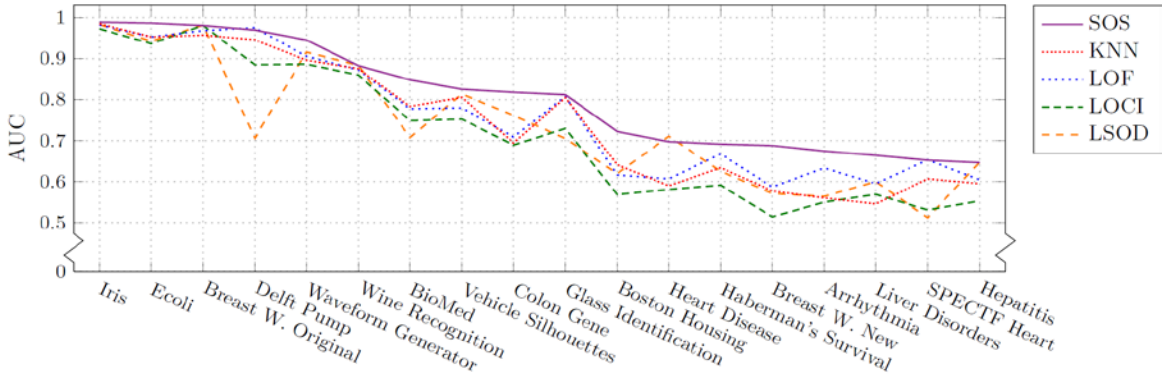


Figure 2 : SOS outperforms other state-of-the-art outlier selection methods

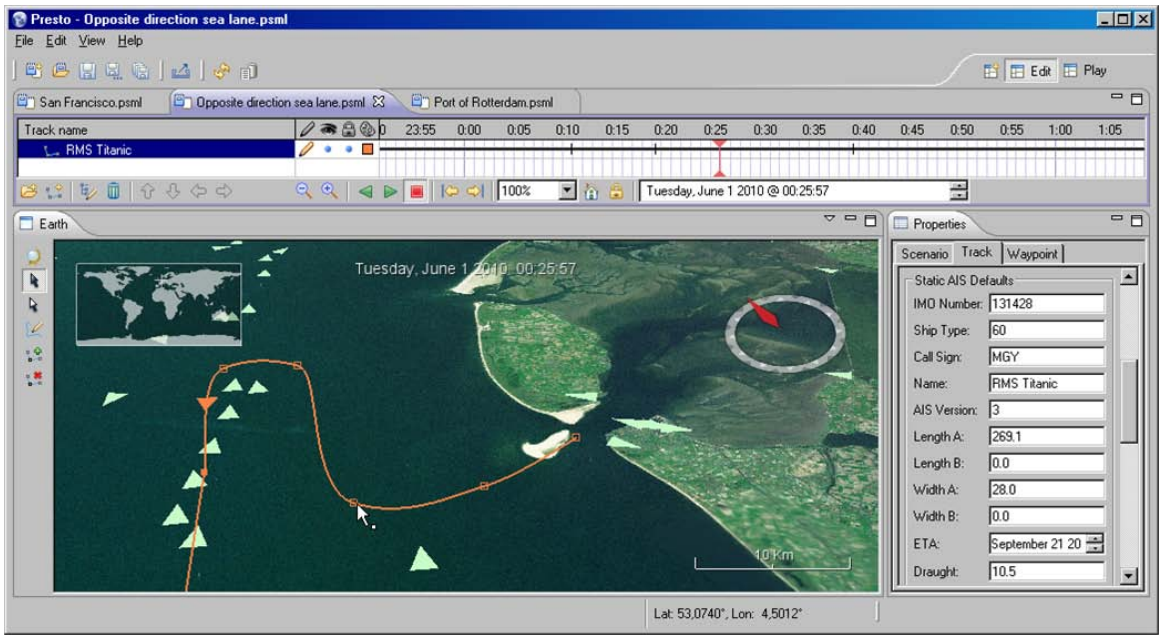


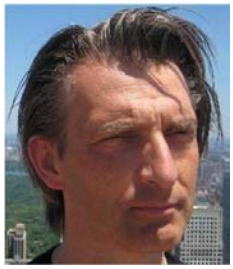
Figure 3 : A screenshot of Presto

Presto is a software application which enables maritime domain-experts to create artificial anomalies. Vessel tracks are drawn on the earth surface. Unlike other scenario simulators (e.g., VR-Forces) which impose restrictive behavioral models, Presto gives the expert total control to create any kind of anomaly. Anomalies can be exported and integrated with the real, original data.

The anomaly detection component for processing high-level information is the Graphical Model (GM) component. This component can integrate the output from the SOS component with a range of other high-level sources, such as the level of suspicion or other indicators obtained from intelligence organizations. The GM component allows for the optimal probabilistic weighing of high-level information sources and provides a probabilistic estimate of how anomalous the situation under consideration is. In addition, the component enables the operator to test various "what-if" scenarios and to examine the effect on the estimate.

In combination, the SOS and GM components enhance situation awareness by providing the operator with a restricted set of potential anomalies. In the presentation, the three components and their incorporation in an integrated "human-in-the-loop" system are discussed.

About the presenter:
Jeroen Janssens *is a Ph.D. student at the Tilburg center for Cognition and Communication (TiCC) since January 2008. He received his B.Sc. degree in Life Sciences in 2006 from the University Maastricht College and his M.Sc. in Artificial Intelligence in 2008 from Maastricht University. His current research interests include machine learning in general and anomaly detection in particular.*



Eric Postma *is professor Artificial Intelligence at the Tilburg center for Cognition and Communication (TiCC) of Tilburg University. His research interests are machine learning, vision, and models of cognition.*

ACKNOWLEDGEMENT
This work has been carried out as a part of the Poseidon project with Thales Nederland B.V. under the responsibilities of the Embedded Systems Institute. This project is partially supported by the Dutch Ministry of Economic Affairs under the BSIK program.

9.2 Towards Systems Health Awareness

Arjan van Gemund, Alberto Gonzalez, Rui Abreu, Eric Piel, Gerd Gross
Faculty of EEMCS, Software Technology Department
Delft University of Technology
http://www.st.ewi.tudelft.nl

Abstract:
Systems health monitoring is the process of periodically performing tests to ensure the system is still operating within specification. When a failure is detected, the system or operator executes a fault diagnosis procedure that provides information on the root cause (fault, defect). Fault diagnosis is typically used for faster online recovery and offline repair, but can also be used to suppress further alarms that are diagnosed as relating to the same root cause.

Fault diagnosis is cost-intensive. Embedded software is currently measured in terms of millions of lines of code. Software developers already spend approximately 80% of development costs on diagnosing and correcting defects, and yet few products of any type other than embedded software are shipped with such high levels of residual defects. While detecting and diagnosing faults at the development stage is feasible provided adequate test oracles are available, once the product is shipped there are typically no built-in failure detection mechanisms available which allow diagnosing the faults that have escaped the testing phase. Nevertheless, given the increasing number of residual defects, failure detection and diagnosis are becoming a critical success factor in systems health awareness.

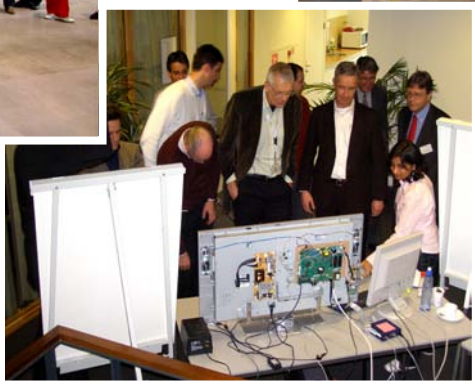
In this talk we present our research on systems diagnosis, in particular on (1) failure detection in the absence of test oracles during system deployment, and (2) sequential fault diagnosis, where the system decides which test to execute in order to improve its health awareness. The first contribution is based on our work in the ESI-led TRADER project on embedded TV software. Our failure detection approach is based on instrumenting the system with generic invariants, rather than the application-specific code that developers write manually. We show that taking this fully automated approach delivers diagnostic performance that is similar to the traditional approach. The second contribution is based on our work in the ESI-led POSEIDON project on (maritime) systems of systems. We show that sequential diagnosis can significantly reduce the number of tests required to obtain sufficient confidence on the system's health. This level of confidence is important in situations where one has to decide whether or not to incur the cost of, e.g., system reconfiguration.

About the presenter: *Arjan J.C. van Gemund received a BSc in Physics, an MSc degree (cum laude) in Computer Science, and a PhD (cum laude), all from Delft University of Technology. He has held positions at the R & D organization of DSM as an embedded systems engineer, and at TNO as a high-performance computing research scientist. Currently, he is at the Electrical Engineering, Mathematics, and Computer Science Faculty of Delft University of Technology, serving as Full Professor. His current research interest is fault diagnosis of hardware and software systems. He has (co)authored over 180 scientific publications, and is (co)recipient of seven best conference paper awards and a best conference demo award.*

ACKNOWLEDGEMENT
This work has been carried out as a part of the TRADER and POSEIDON projects with NXP and Thales, respectively, under the responsibility of the Embedded Systems Institute. These projects are partially supported by the Dutch Ministry of Economic Affairs under the BSIK program.

Information Market

Section numbers are also booth numbers.
(see plan of Auditorium)

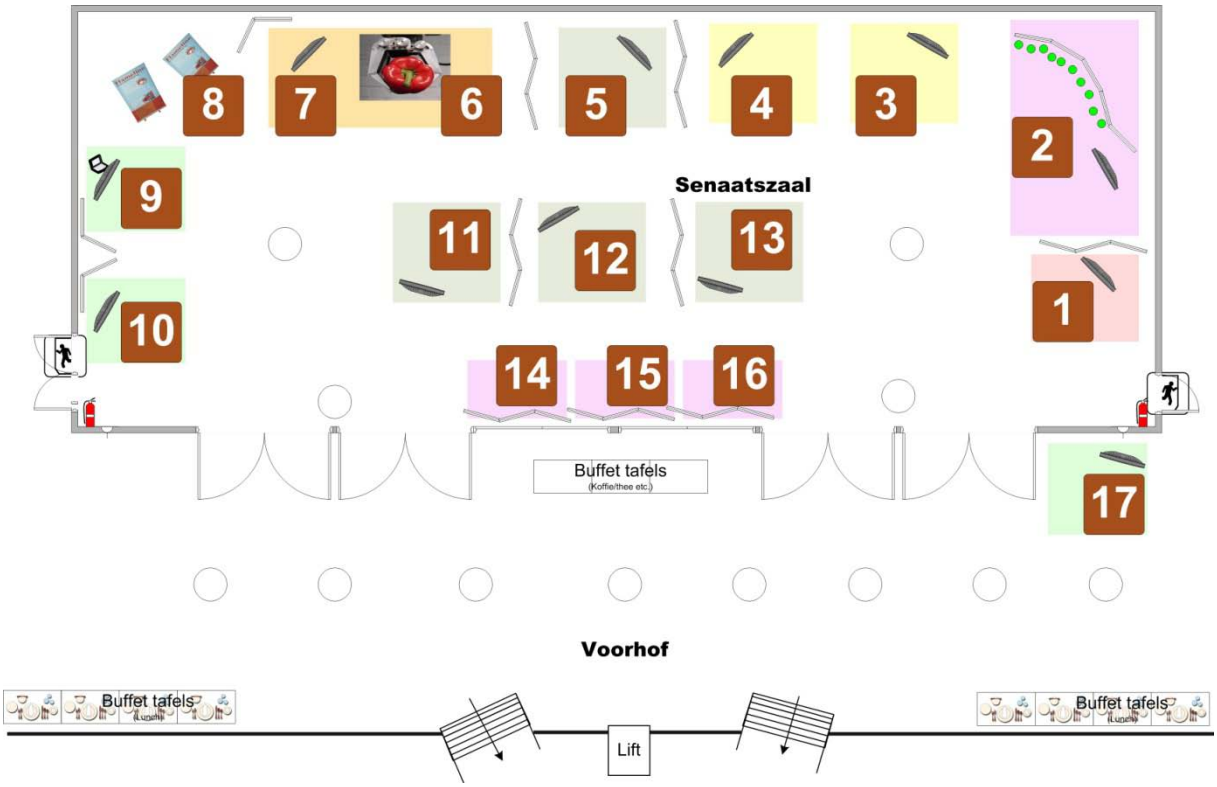


Information market room (Senaatszaal)

Information market

	On show	Demonstrators
1	Understanding Ship Behavior with the Simple Event Model	Véronique Malaisé Davide Ceolin (VU)
2	MyriaNed - a self organizing, gossiping Wireless Sensor Network	Lex van Gijsel (DevLab)
3	The Octopus Design-Space Exploration Toolset	Martijn Hendriks (RUN) Nikola Trčka (TU/e)
4	CAD for System Architecture	Hitoshi Komoto (TUD)
5	Architectural Scenario Icons Improving communication between technical and non-technical stakeholders	Dirk Verhagen (TU/e)
6	Robotized Order Picking	Wouter Hakvoort Jos Ansink (DEMCON)
7	A Robotic Hand for Grasping in Warehouses	Gert Kragten (TUD) Cory Meijneke (TUD)
8	Banners	
9	Fast track to excellence System architect's development programme	Joris van den Aker (ESI)

	On show	Demonstrators
10	Putting Chaos under control in model-based development of complex systems	Hristina Moneva (ESI)
11	OVERLAY : Performance modeling and design space exploration for embedded mechatronic control systems	Wouter Tabingh Suermondt (ASML)
12	The Modest project Model Based Design and Testing	Jack Kandelaars (Océ)
13	Component-based Development at Philips Healthcare using Verum's ASD Technology	Robert Huis in 't Veld (Philips Healthcare)
14	ITEA2	
15	Artemis-IA	
16	Point One	
17	Running show ESI Way of Working	



D 1 Understanding Ship Behavior with the Simple Event Model

Overview
The understanding of a maritime situation, at a given point in time, requires the integration of a range of data and information (type of a ship –tanker, pilot-, place where the ship is –in a harbor, in an anchorage area-, its speed, its history, the position of the other ships around etc.). Current systems give access to these data on different screens or on different layers on the same screen. The interaction between these layers is, however, a crucial source of knowledge. We address this issue in our demo and show a system (a Knowledge Base), which integrates data and information at different layers of abstraction, and allows for powerful queries: queries that combine spatio-temporal and semantic dimensions. A user can therefore, for example, check out for ships of a certain type, with a given history, engaged in a certain type of movement at a certain place. This system enables the understanding of ship behavior. The key for this understanding is the underlying data model: the Simple Event Model (in RDF) and the reasoning capabilities of SWI-Prolog, particularly enhanced with the Semantic Web library and the spatio-temporal package.

Method
Datasets from different sources on the Web (shipping lanes and anchorage areas from Rijkswaterstaat, ship information from Vesseltracker, geographic information from GeoNames etc.) and from sensors (AIS information about ships and their movement) are harvested and represented in a unified RDF framework: with the Simple Event Model. The SWI-Prolog SEM API, the spatio-temporal package and Semantic Web library are then used to index the integrated data and to generate new knowledge: Prolog rules classify the ship(s)' behavior and give a human observer the understanding of a situation.

Benefits
Representing events and behavior in terms of SEM enables for efficient knowledge integration, including the integration of incomplete dataset. We use URIs as global identifiers, which solves the classic database's problem of missing or incorrect key values. This is especially important when there are no true keys, like ship identifying numbers: they could be considered as keys but data integration from the web shows that they are not unique nor unambiguous, and there are multiple identifying systems (IMO, MMSI, Call Sign, name).

Using SEM as a high-level meta-model allows us to combine in an interoperable way data with very different schemas. For example, we use in this single framework places from GeoNames along with maritime maps from Rijkswaterstaat. The advantage of RDF, the data format of SEM, is that it is easy to link and integrate new information: there is no need to change the schema to add new properties to your data.

SEM, combined with the other packages of SWI-Prolog (spatio-temporal package and Semantic Web library) allow for spatial, temporal and semantic queries on your dataset(s). The new knowledge can also be exported as KML to help a user into getting a rich view of the different aspects of a situation, as our demo shows.

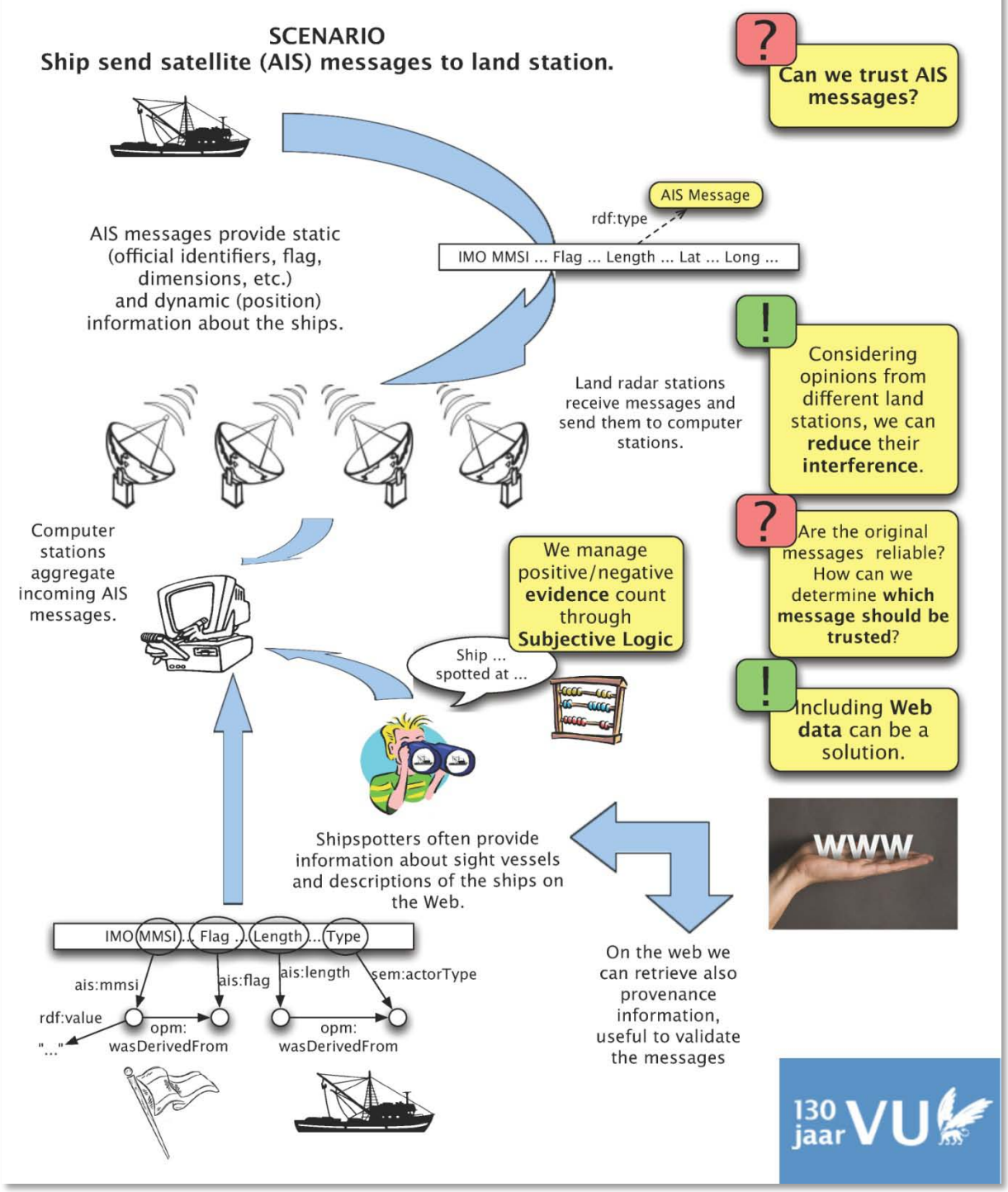
For more information

http://www.few.vu.nl/~wrvhage/ Publication page
http://semanticweb.cs.vu.nl/2009/11/sem/

Willem Robert van Hage	VU Amsterdam	wrvhage @ few.vu.nl
Véronique Malaisé	VU Amsterdam	vmalaise @ few.vu.nl
Davide Ceolin	VU Amsterdam	dceolin @ few.vu.nl
Guus Schreiber	VU Amsterdam	schreiber @ cs.vu.nl

Trusting Web data: a maritime case study

Davide Ceolin Paul Groth Willem Robert van Hage Guus Schreiber



D 2 MyriaNed - a self organizing, gossiping Wireless Sensor Network

Overview

If you sit back on a Sunday afternoon, thinking about the possible application areas for wireless sensor networks, the outcome is stunning. Systems can benefit from situational awareness and context sensitivity which can be accomplished by many sensors, smart communication between them and smart reasoning. Our vision is that in the near future wireless sensor networks (WSN) will become an integral part of our environment. Pervasive or ubiquitous technology will play an increasing role in society, e.g. energy efficiency in buildings, monitoring applications in healthcare and support for elderly people (independent living), indoor localization, monitoring in logistic systems, and many more.

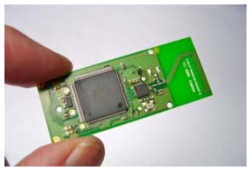
However, a number of topics have to be addressed before WSN can play that integrated role. In most applications the network will consist of a very large number of sensor- and actuator nodes. So the nodes have to be low cost, very low power and small form factor. In order to have a manageable network it has to be robust, scalable or scale free, self organizing and it has to adapt itself to the context in which it is used.

Method

DevLab approach is called **Gossip**, which is inspired by biological processes where many nodes (birds, ants, cells) operate in large distributed systems (resp. flocks, organized colonies, organisms). It is a bottom up approach, where the behavior of a single element (node) will result in emerging behavior of the system (application).

In this demonstration you can see the network **gossiping**. An arbitrary node will broadcast a new message into the network. In general this will be initiated by a new sensor reading. This message will reach a number of nodes, but not all. Because the nodes also re-sent the received information, the information is spread through the network, and eventually the message is "known" by every node in the network. Every node will have this 'behavior', so at any time, every node is familiar with the state of all other nodes in the network, hence the state of the (distributed) system. We call that **shared state**, which reflects the environmental situation that the network is in. So the system is situational aware and is able to adapt itself to the context. Every node will play a role in that environment in many possible ways: act on sensor information, combine information from multiple sensors (sensor fusion), recognize patterns and trends, perform high level reasoning, calculate aggregated data and eventually driving actuators or interact with the user interface.

The communication protocol, which is event driven and based on an energy efficient TDMA schedule, is extended with the gossiping and shared state layers in such a way that the number of nodes is not limited (scale free). Automatic synchronization with the networks heartbeat and dynamic slot allocation in the TDMA schedule enables nodes to join and leave the network while the network (application) is running. This concept has proven to be very robust and forms the basis of many applications that can be build on top of this.



In the demo, the gossiping behavior is visualized by means of a led lighting application, where colors are injected, communicated and shared. The demo also shows that solutions are available for sharing global time, and distributing software updates (on the application as well as the communication level) in a deployed and operating network.

Benefits

By the gossiping approach we are able to build, manage and maintain large scale, distributed, self organizing sensor networks, as a platform for a large variety of applications.

For more information

Lex van Gijsel	DevLab	+31 - 40 - 293 9906	lex.van.gijsel @ devlab.nl
Roland Mathijssen	ESI	+31 - 40 - 247 4720	roland.mathijssen @ esi.nl

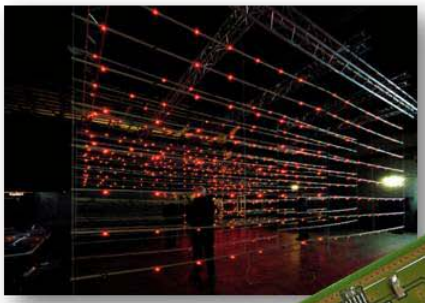
DEVLAB DEVELOPMENT LABORATORIES

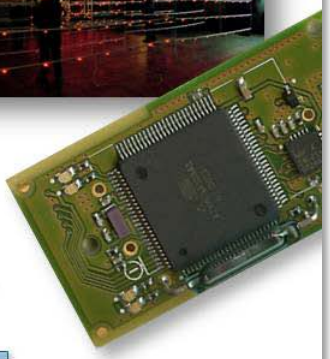
- business creation by collaborative research

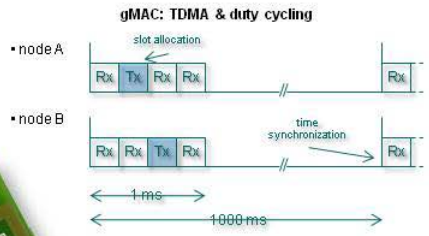
- knowledge flow between universities and industry

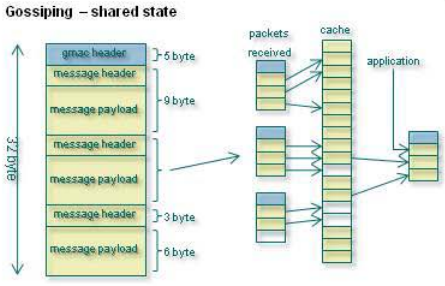
MyriaNed, a gossiping wireless sensor network

- mesh network, no hierarchy, bottom up appraoch
- gossiping protocol with "shared state"
- low power, scale free, dynamic
- runtime software updates: MyriaStadi









ALWEN AMBIENT LIVING WITH EMBEDDED NETWORKS

D 3 The Octopus Design-Space Exploration Toolset

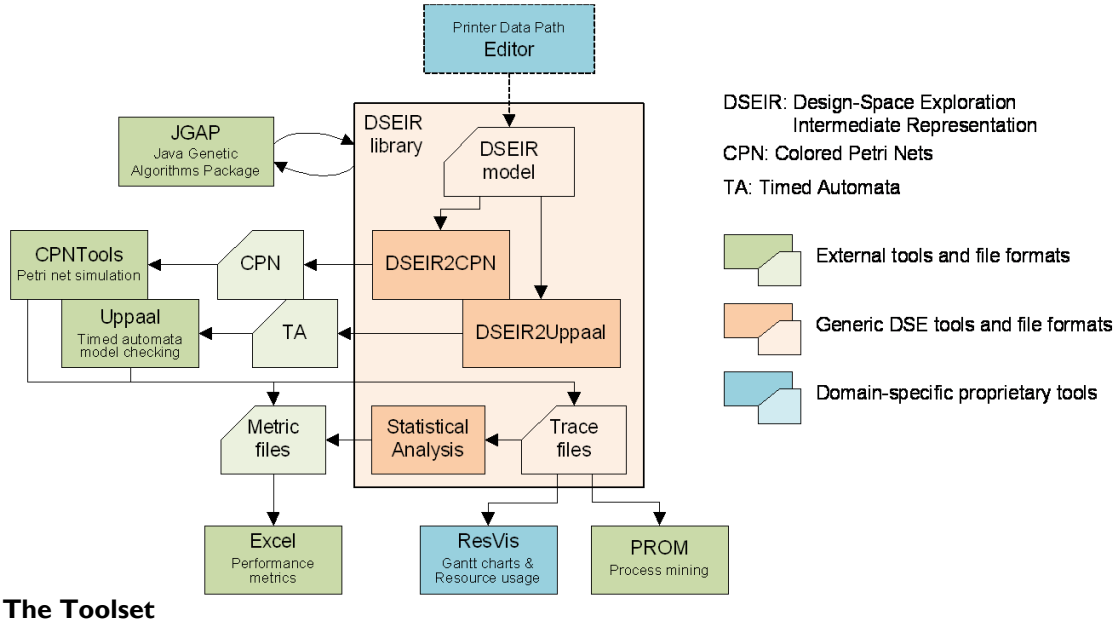
Motivation

An important challenge in the early stages of the design of embedded systems is the many design possibilities that need to be considered. The design space usually involves multiple metrics of interest (timing, resource usage, energy usage, cost, etc.) and multiple design pa-rameters (e.g. the number and type of processing cores, sizes and organization of memories, interconnect, scheduling and arbitration policies, etc.). The relation between design choices on the one hand and metrics of interest on the other hand is often very difficult to establish, due to aspects such as concurrency, dynamic application behavior, and resource sharing. No single modeling approach or analysis tool is fit to cope with all the challenges of modern embedded-system design.

Objectives

The Octopus toolset aims to support model-driven design-space exploration (DSE) during the early phases of system design and has the following objectives:

- Leveraging combined strengths of methods and tools
- Flexible, open, extensible set of tools
- Targeting the high-tech embedded systems domain
- Reuse of tools across application domains
- High-level modeling of design alternatives
- Functional verification and performance analysis
- (Semi-)automatic exploration and synthesis
- Methodological and communication support for designers



The Toolset

The toolset follows the Y-chart approach to DSE, and it is centered around the DSE Interme-diate Representation (DSEIR) library that is specifically designed to support Y-chart-based DSE. The toolset is implemented in the Java language and has a clearly defined API. Its most important features currently are: (i) high-level modeling in the DSEIR language, and (ii) trans-parent, automated connection to formal analysis tools for verification or simulation of DSEIR models. The demo shows the current state of the toolset.

For more information

Twan Basten	ESI Research Fellow, Professor TU/e	a.a.basten @ tue.nl
Martijn Hendriks	Postdoctoral researcher, RUN	m.hendriks @ cs.ru.nl
Lou Somers	Software team leader, Océ	lou.somers @ oce.com
Nikola Trčka	Postdoctoral researcher, TU/e	n.trcka @ tue.nl

Embedded Systems INSTITUTE

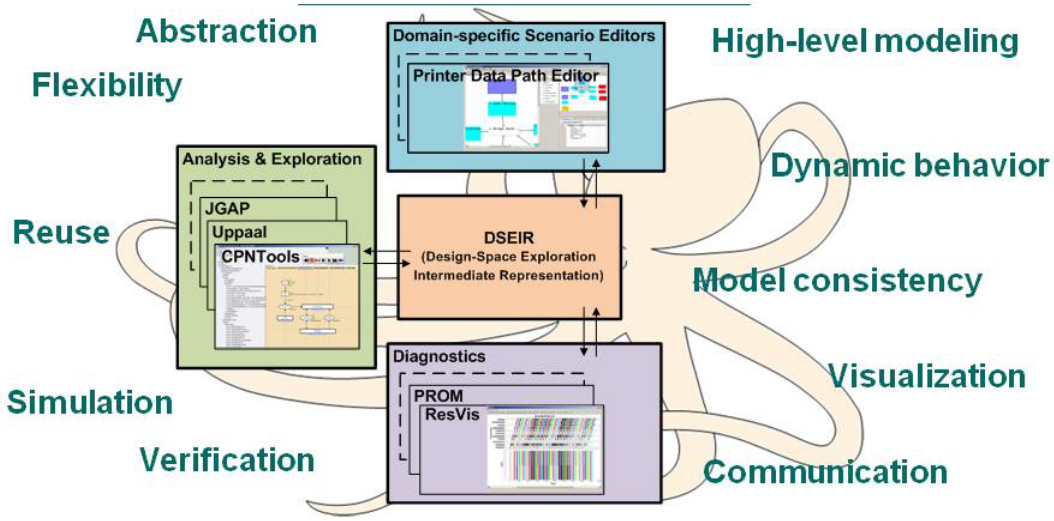
Octopus Toolset – Objectives & Approach

Model-Driven Design-space Exploration Support

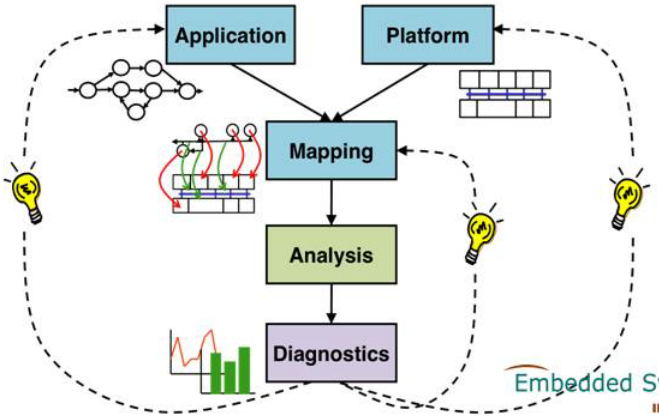
Objectives

- Combining methods and tool
- Flexible, open, extensible set of tools
- Targeting high-tech embedded systems
- Reuse of tools
- High-level modeling
- Functional verification & performance analysis
- (Semi-)automatic exploration and synthesis
- Methodological & communication support

Toolset Architecture



Y-chart Approach



More Information

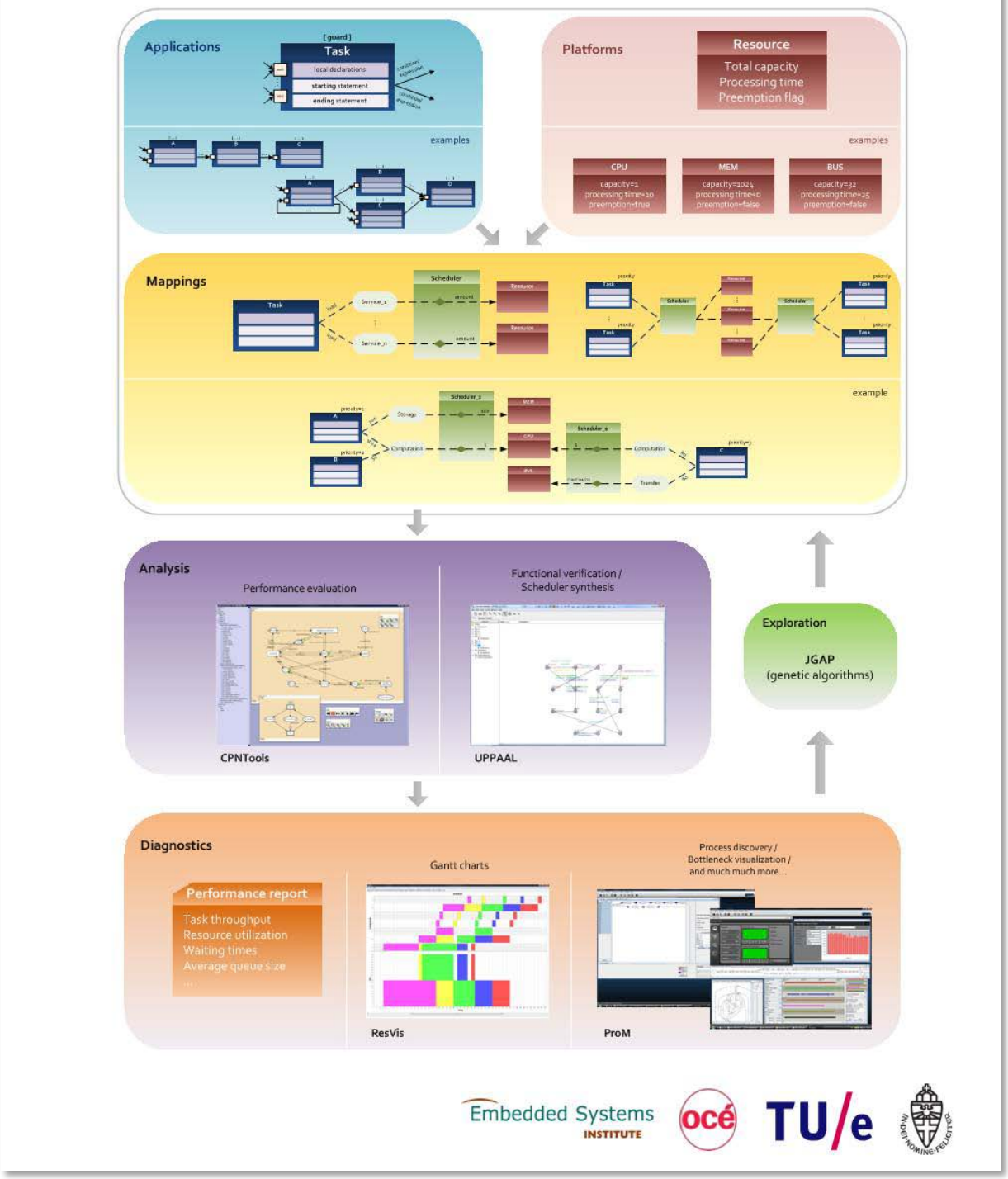
Twan Basten
(ESI, TU/e, a.a.basten@tue.nl)
Martijn Hendriks
(RUN, m.hendriks@cs.ru.nl)
Lou Somers
(Océ, lou.somers@oce.com)
Nikola Trčka
(TU/e, n.trcka@tue.nl)

http://dse.esi.nl

Embedded Systems INSTITUTE

Embedded Systems INSTITUTE

Octopus Toolset – Implementing the Y-chart

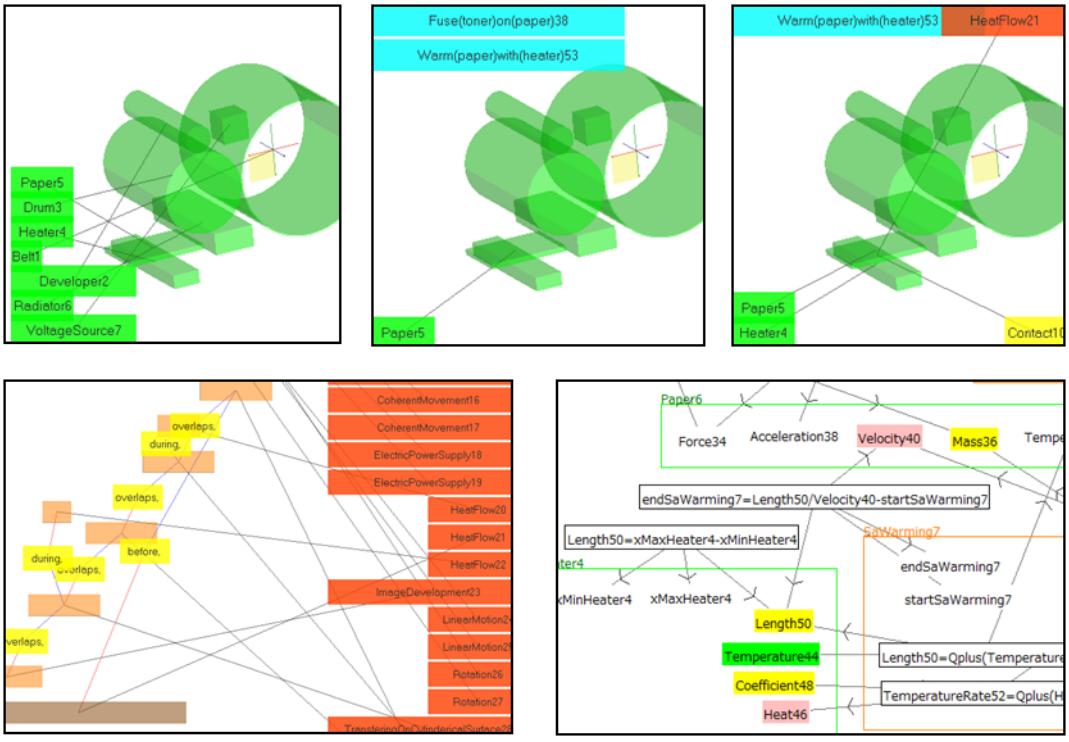


Embedded Systems INSTITUTE océ TU/e

D 4 CAD for System Architecture

Overview

In system architecting of mechatronics systems, system architects decompose functions in order to clarify the specifications of subsystems regarding structure and behavior, while considering diverse physical, causal and logical interactions among subsystems. In this presentation, a computer aided design system for system architecting (SA-CAD) is presented. SA-CAD is based on the study of engineering design in the conceptual design stage. This presentation shows how SA-CAD uses conceptual network of the design knowledge such as functions and behaviors in order to generate corresponding parameter relations and evaluate structural and behavioral specifications in system architecting of mechatronics systems.



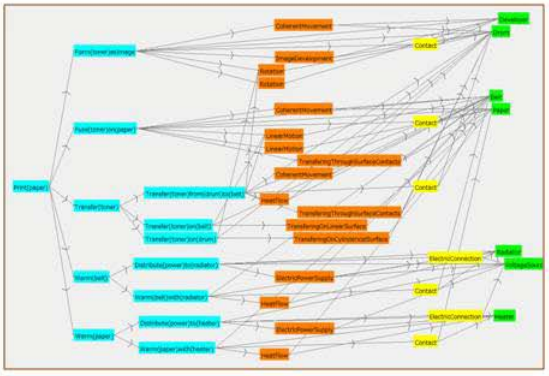
For more information

Hitoshi Komoto	Delft University of Technology	h.komoto @ tudeflt.nl
Tetsuo Tomiyama	Delft University of Technology	t.tomiyama @ tudelft.nl

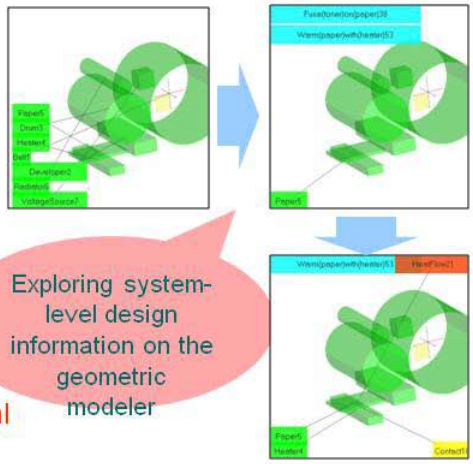
Embedded Systems INSTITUTE

A CAD for system architecting: SA-CAD

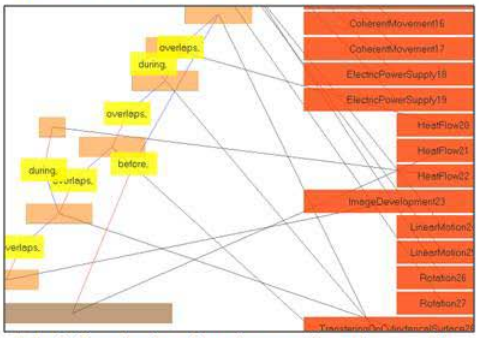
SA-CAD supports multi-disciplinary decomposition of system-level specifications into parameter-level design information representing the structure and behavior of mechatronics systems.



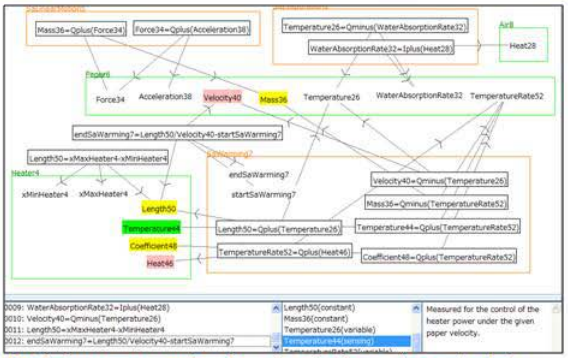
FBS-Modeling: Connecting functions, physical phenomena, system elements, and relations.



Exploring system-level design information on the geometric modeler



Modeling behavioral specifications with the process modeler



Defining parameter-level relations (constraints, conditions, dependencies)

Researcher: Dr. Hitoshi Komoto (h.komoto@tudelft.nl)
Supervisor: Prof. Dr. Tetsuo Tomiyama (t.tomiyama@tudelft.nl)
Intelligent Mechanical Systems
Department of Biomechanical Engineering
Faculty of Mechanical Maritime and Materials Engineering
Delft University of Technology

The parameter-level information will be shared by domain specific models for system verification.

Octopus Project

océ TU Delft

D 5 Architectural Scenario Icons

Improving communication between technical and non-technical stakeholders

The challenge of communicating the need for architectural changes
Try to explain to someone why changing all the parts inside a machine, without any change in appearance or functionality, can be a good investment. It is problems like these that software architects face on a daily basis when working on high-end, expensive machines. Justifying investments in architecture when competing with 'the feature of the day' projects can be hard.
It is important to get support and alignment for these changes, from non-technical stakeholders such as management, supply-chain or marketing. It is however, challenging, to convey the complexity and often far reaching consequences of these architectural changes. The importance of conveying the consequences is high however, as non-technical stakeholders are involved and affected by trade-offs in architectural design.

The concept: Scenario Icons
Starting out from the question "How can we improve communication between architects and non-technical stakeholders surrounding technically driven changes to an interventional X-Ray machines" we have developed a concept which tries to visually explain these changes. Using icons, and a framework to place these icons in, system architects can now construct scenarios of the future in PowerPoint, and show these pictorial scenarios to other stakeholders. For every non-technical stakeholder a set of icons is made available (e.g. supply chain will have icons for production and transportation available). This supports the creation of scenarios tailored towards the stakeholder. Through discussions they can improve the scenarios and get stakeholder's opinions and approval. They can also show these scenarios to management to explain the rationale to choose for a certain scenario; also, it can show why an architectural change is necessary, and why they need to free up resources to run these projects.

Method & Evaluation
We have used User Centered Design methods to create this concept. Based upon interviews and observations 5 concepts were created from which Scenario Icons was chosen as 'the best concept'. Afterwards we used these icons to visualize a real architectural scenario, and gathered qualitative and quantitative feedback (through the USE Questionnaire). The concept was seen as a large improvement over the current way of working.

Benefits
- High level visuals force reduction of what is communicated to the essential
- A uniform language between stakeholders to help with alignment of goals and making implicit assumptions visible
- It saves time in an important place: creating presentation visuals
- Enough freedom to create future scenarios
- The scenarios can also be used as posters, during talks with third-party suppliers, as conversation artefacts, etc.

This work is supported by Kenniswerkersproject Partitura.

For more information
Dirk Verhagen ESI / TU/e +31-6-28313684 d.verhagen @ tue.nl

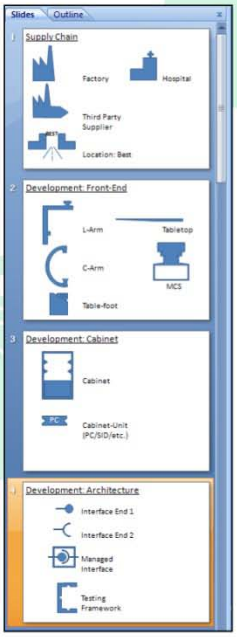
Embedded Systems INSTITUTE

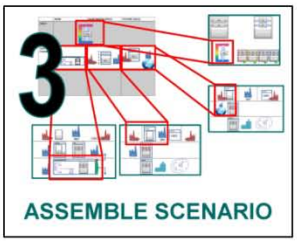
Improving Architectural Communication: Scenario Icons

"I highly suspect that this concept would save me time" – iXR Architect

"You had me at icons (…) Making things visual is much better" – iXR Manager

"This will make our cooperation go smoother" – iXR Supply Chain Employee





Ranking of concepts by iXR architects

11 points | Scenario Icons

4 points | Approach Planner

4 points | Strategy Linker

3 points | Justification Tree

2 points | Issue Tracker

USE Questionnaire results Scenario Icons concept

Construct	Score
Usefulness	4.9
Ease of use	5.1
Ease of learning	6.1
Satisfaction	5.1

1-7 likert scale
>4 = improvement

The Problem

The **communication of architecture** is inherently difficult. When money has to be divided over multiple projects, it is hard to justify investments in architecture over 'feature-investments'.

Often, architectural activities need to be aligned with non-technical stakeholders. However, appreciation of the effort and impact architectural changes have is often lost on these stakeholders.

Our solution aims to reduce communication to the essential through the use of visuals.

The Solution

"*A picture says more than a thousand words*", truer words have never been spoken yet in practice, creating strong visuals is often overlooked.

Through User Centered Design (UCD) methods, working with Philips Healthcare iXR architects, we have designed icons useable in PowerPoint. Next to that we have developed a framework in which the icons can be placed to visualize the influence architecture has on the 'future life' for other stakeholders.

This concept was chosen as the best concept amongst 5 other concepts.

PARTITURA WP1

PHILIPS

D 6 Robotized order picking

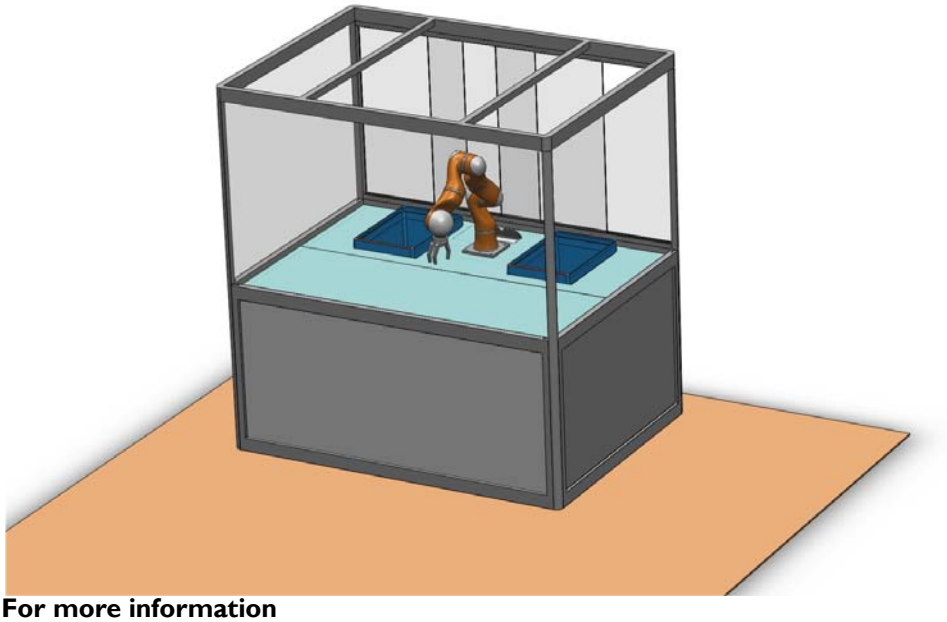
Integration of an arm, hand and vision

In warehouses many tasks are automated, but order picking is still human labour. The work is tedious and unpleasant. Moreover, human labor is costly and insufficiently available, especially at peak-times. In future, robot technology should take care of order picking. However, current vision and gripping technology does not come up to human standards. In particular, new technology is required to detect randomly oriented, unsorted objects and to grab soft, non-boxed or irregularly shaped objects. With this in mind, part of the research in the Falcon project considers universal gripping solutions and robust vision. The suitability of the research results for automated order picking is shown by a demonstrator setup that is realized by DEMCON. Besides gripping and vision, manipulation is an important task during order-picking. The demonstrator is equipped with a state-of-the-art robot arm to complement the eye and hand

Demonstrator

The hand, eye and arm are important components, but more components are required for the order-picking demonstrator, like the body and brains. Moreover, the components should be interfaced correctly at mechanical, electrical, optical and software level to obtain a functioning demonstrator. DEMCON takes care of the system design, the missing components and the realization of the interfaces. The requirements for adequate order-picking are formulated and translated to the demands on the various components and interfaces. Important requirements for the system are the relative positioning of the components, robustness to ambient light variations, safety, transportability and of course to show the new gripping and vision technology.

The most complex part of the integration is the high-level control system that is used to control the various components. The control system is developed using a step-wise approach going from simple to more complicated tasks. The design of the control system is based on existing components as much as possible. The control system is implemented on a PC and socket-communication is used to interface with the other components. Visualisation and path-planning is implemented using the open source software OpenRave



For more information

Wouter Hakvoort	DEMCON Advanced Mechatronics	wouter.hakvoort @ demcon.nl
Jos Ansink	DEMCON Advanced Mechatronics	
Hernes Jacobs	DEMCON Advanced Mechatronics	

D 7 A Robotic Hand for Grasping in Warehouses

For more information

Gert Kragten	TU Delft	g.a.kragten @ tudelft.nl
Cory Meijneke	TU Delft	c.meijneke @ tudelft.nl

Embedded Systems INSTITUTE

A Robotic Hand for Grasping in Warehouses

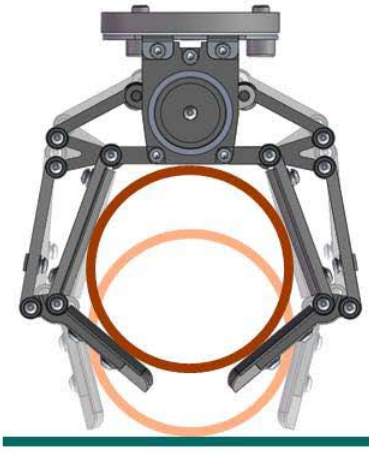
Design Objectives:

- Maximize the range of object sizes that can be grasped
- Minimize the sensitivity to disturbances
- Simple and robust

Achievements:

- **Self-adaptive** to the shape of the objects
- 3 fingers of each 2 phalanges driven by **1 motor** (6 Watt) and **0 sensors** (underactuation)
- **Mechanical 'intelligence'** decides to grasp large objects by a **power grasp** and small objects by a **precision grasp**

Power grasp



Precision grasp

f Icon

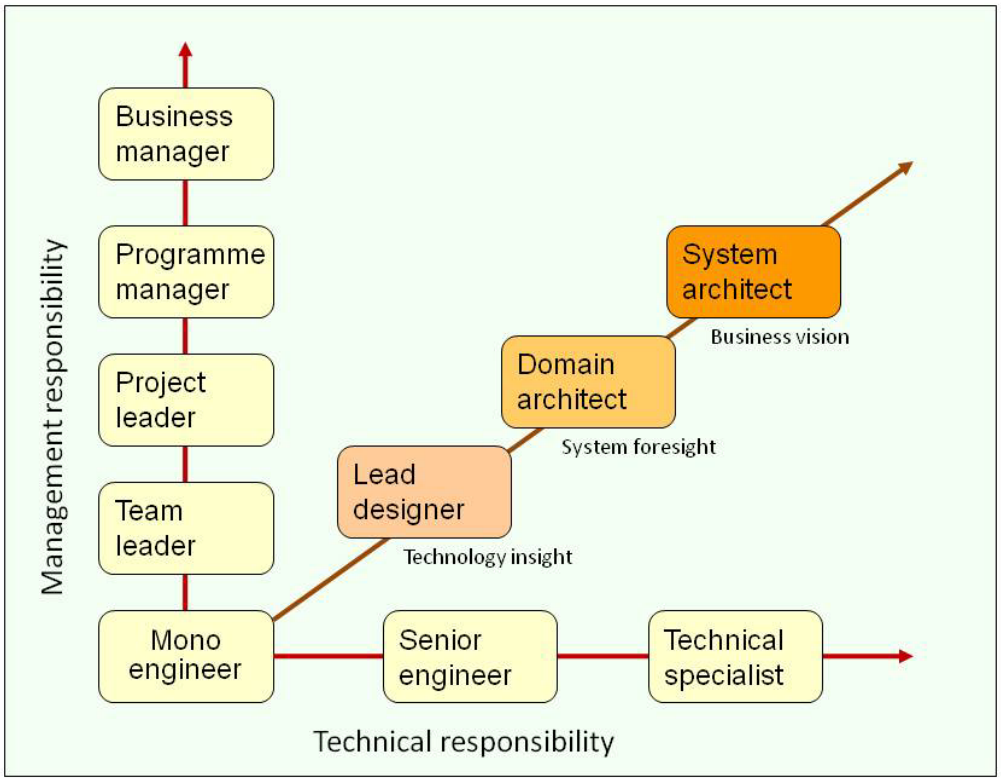
Gert Kragten and Cory Meijneke
g.a.kragten@tudelft.nl, c.meijneke@tudelft.nl

TU Delft Delft University of Technology

D 9 Fast track to excellence

System architect's development programme

The Embedded Systems Institute established a tailor-made training program to help companies develop top-class system architects. It is designed to enable engineers to reach their full potential as well as to enable high-tech companies to get a head start in the global race.



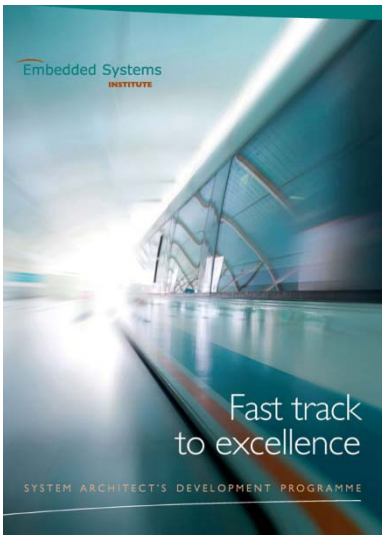
Lead Designer
Education programme for engineers with a college or university education and at least four years of professional experience. It is important that they have the ambition to become a technical leader who directs others in development of high-tech system components.

Domain Architect
Education programme for professionals with typically more than six years experience and already operate at a lead designer level. It is important to take responsibility for the development of a dominant subsystem or technology area in a broader organizational and system context.

System Architect
Education programme for professionals with typically more than ten years experience and already operate at a domain architect level. It is important that they have the ambition to take responsibility for top-level system architecting, including the related strategic design and technology choices, such as for product platforms and product families.

For more information

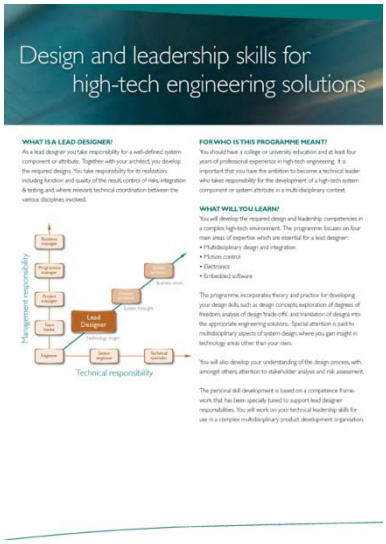
Joris van den Aker ESI 040-2474720 Joris.van.den.aker @ esi.nl


Embedded Systems
INSTITUTE
Fast track
to excellence
SYSTEM ARCHITECT'S DEVELOPMENT PROGRAMME

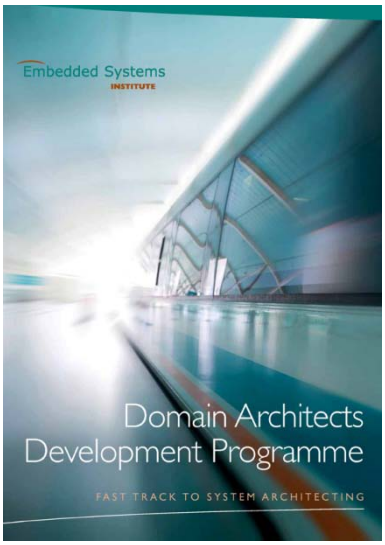

Your head start
in the global race


THE STEP-BY-STEP PROGRAMME
LEAD DESIGNER
DOMAIN ARCHITECT
SYSTEM ARCHITECT
Management responsibility
Technical responsibility


Embedded Systems
INSTITUTE
Lead Designers
Development Programme
FAST TRACK TO SYSTEM ARCHITECTING


Design and leadership skills for
high-tech engineering solutions
WHAT IS A LEAD DESIGNER?
FOR WHO IS THIS PROGRAMME MEANT?
WHAT WILL YOU LEARN?
Management responsibility
Technical responsibility


INDUSTRY
AS CLASSROOM
WHAT FORMAT DOES THE TRAINING TAKE?
FAST FACTS


Embedded Systems
INSTITUTE
Domain Architects
Development Programme
FAST TRACK TO SYSTEM ARCHITECTING


Developing your architectural
and leadership competencies
WHAT IS A DOMAIN ARCHITECT?
SYSTEM ARCHITECTING
PROCESS & ORGANIZATION
PERSONAL SKILLS
THE FOLLOWING MODULES ARE INCLUDED IN THE PROGRAMME:
FOR WHO IS THIS PROGRAMME MEANT?
WHAT WILL YOU LEARN?
TYPICAL SKILLS COVERED:
Management responsibility
Technical responsibility


INDUSTRY
AS CLASSROOM
WHAT FORMAT DOES THE TRAINING TAKE?
'To ensure state-of-the-art training,
the courseware is continuously updated
with the latest advances
from ESI research projects'.
FAST FACTS

D 10 Putting Chaos under control

In model-based development of complex systems

Are you involved in the development of complex systems? How do you link the design decisions taken with the models made to analyze certain aspects of the system? How do you keep track of model assumptions and do they contradict the current system characteristics? How do you know that the analytical results of model experiments are still valid for your current design state? How do you deal with heterogeneous models? How do you keep consistency between all models made as well as their results and the overall system design? And what about if these models are not covering the same system parts?..

We can keep asking such questions... But to us the central question is: do you need help to put order in the design chaos? If yes, come and see us! We will show you a prototype of our Design Framework, where you can manage everything from your decision taking process and rationale down to the concrete models and experiments. It provides a mechanism to deduct the impact of each design decision on the system under design. Furthermore, it supports model and result management while analyzing and experimenting with models throughout the entire design cycle.

The design framework is an architectural backbone for the design flow that can cope with the challenges of model-based design. It provides support at three levels: the design flow level, the design views level, and the modeling level. Through specialization of certain data classes in the framework, support for specific domains, modeling formalisms, and project tracking tools can be connected. The central concept of the framework is to support a system designer in such a way that he or she can focus on the most salient risks and problems, and can keep an overview how that is related to other parts of the system.

At our booth we will present you a first prototype of the design framework, which we will illustrate with a design flow of a Vanderlande Industries' warehouse project. This prototype and demo will enable you to find out how realistic the design framework will be for your situation.

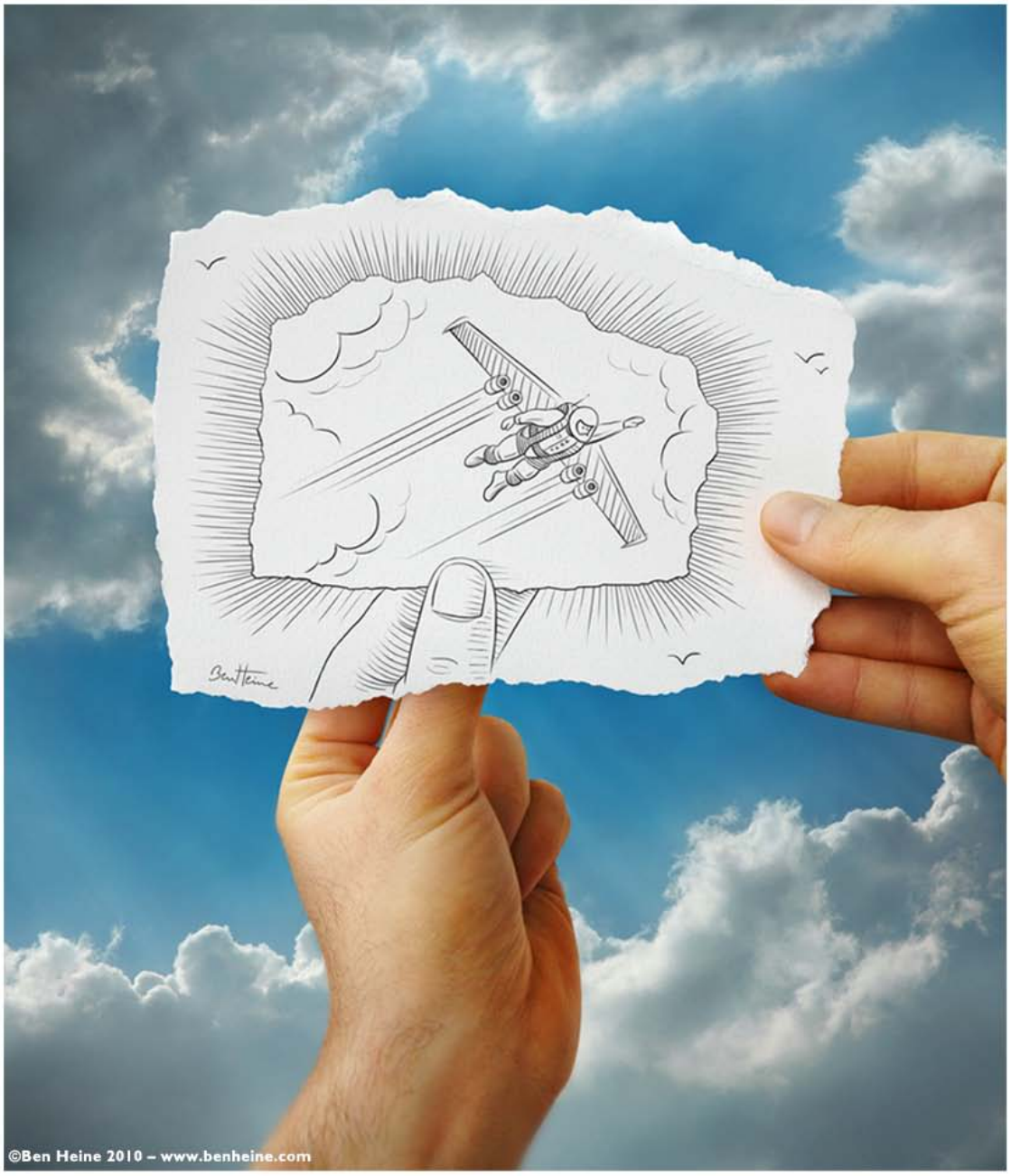
ACKNOWLEDGEMENT
This work has been performed as part of the "**Integrated Multi-formalism Tool Support for the Design of Networked Embedded Control Systems (MULTIFORM)**" project, supported by the Seventh Research Framework Programme of the European Commission. Grant agreement number: INFSO-ICT-224249

For more information

Hristina Moneva	Embedded Systems Institute	Hristina.moneva @ esi.nl
Roelof Hamberg	Embedded Systems Institute	Roelof.Hamberg @ esi.nl
Teade Punter	Embedded Systems Institute	Teade.Punter @ esi.nl

Putting CHAOS under CONTROL

in model-based development of complex systems ...



D 11 OVERLAY

Performance modeling and design space exploration for embedded mechatronic control systems

Overview

In the high-tech industry, there is a trend towards the use of general-purpose platform resources such as CPUs, operating systems and (wireless) communication networks. These resources are typically optimized for average throughput, at the expense of unpredictable and highly variable latencies. In the past this was not a major issue, but current mechatronic applications require very small predictable latencies. Satisfying these latency requirements, by using these general purpose resources, is increasingly difficult since it involves many low-level optimizations. In addition, there is another key problem. Instead of scaling up clock-frequencies, platform performance is now boosted by multi-core and hyper-threading techniques. As a consequence, the straight forward 'free performance lunch' is over, implying that application programs do not automatically benefit anymore from the improved raw platform performance. Techniques, such as increasing the amount of application concurrency and the use of sophisticated model-based design-space exploration techniques, can help. The goal of the KWR Overlay project is to investigate these techniques and explore how they can be applied to the real time performance-critical embedded control systems, developed within ASML. It will be shown that the application of such techniques can lead to a tremendous improvement in application performance. On the symposium, two posters will be displayed. One explains the project approach, while the second shows the results.

For more information

Wouter Tabingh Suermondt	ASML	wouter.tabingh.suermondt @ asml.com
John Gemei	ASML	
Kees Kotterink	ASML	
Jan Stoeten	ASML	
Jan van de Ven	ASML	
Jeroen Voeten	ESI	j.p.m.voeten @ tue.nl
Teun Hendriks	ESI	
Jan Schuddemat	ESI	
Bart Theelen	ESI	

KWR09127: Performance modeling and design space exploration for embedded mechatronic control systems

ASML: John Gemei, Cees van Huët, Kees Kotterink, Jan Stoeten, Wouter Tabingh Suermondt, Jan van de Ven
ESI: Teun Hendriks, Jan Schuddemat, Bart Theelen, Jeroen Voeten

ASML
Embedded Systems INSTITUTE

WP1: System design and qualification

ASML development and engineering landscape

More stringent requirements ...
- Wafer handling and positioning
- Reticle handling and positioning
- Optical path
- Parallel development
- Development lead time

Increasing complexity of technology ...
- Computing: multi core, FPGA, GPU
- Storage: memory access, cache behavior
- Communication: distributed systems
- Cost of goods

Focus on timing performance aspects

Make design choices ...
- Mapping of applications on technology
- Based on craftsmanship
- Implicit
- Qualitative

Does the result perform?
- Integration means verification of design
- Create confidence by building the system
- Adjusting the design is difficult
- Delivery focus result in lead time pressure

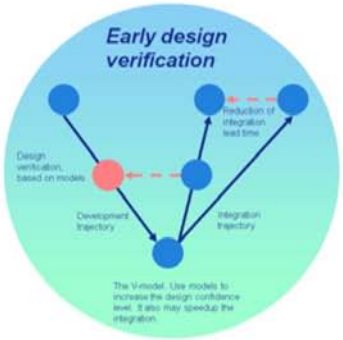
ASML real-time performance issues

- Small scale - and large scale control
- Heterogeneous and homogeneous
- Continuous loop - and event driven supervisory control
- Serial and parallel
- Predictive and non-predictive control
- Multi discipline and mono discipline trade-offs
- Hard real-time and soft real-time
- Fine grain - and coarse grain concurrency

Engineers have to make design decisions within these business driven constraints

ASML

STEP 3: Dissemination



STEP 1: Reverse Engineering

WP3: Design space exploration

Predict the future. Apply the models before realizing the system.

- Prove that the model can be used as first class citizen of a design
- Predict timing performance of alternative mappings, technologies and application strategies

Exploring design alternatives at model level has a small roundtrip time. It also increases the confidence in making the optimal design.

Embedded Systems INSTITUTE

STEP 2 Extrapolation

WP2: Quantitative performance modeling

Predict the past. Can we get insight in our legacy systems and those under development?

- Build a quantitative performance model, based on the Y chart
- Abstract, quantify, formalize, analyze
- Apply the model on various existing performance critical designs
- Identify bottlenecks

Building a model increases the insight knowledge on the current design

Embedded Systems INSTITUTE

D 12 The Modest project

Model Based Design and Testing

Overview

The aim of the MoDesT project (model-based design and testing) is to significantly enforce model-based product development within Océ and to share the achieved results in the network of high-tech companies in the region around Eindhoven.

Multidisciplinary, model-based design methods constitute a sound scientific foundation for making products and their development process more effective, more efficient, and more responsive to societal needs.

The application of models implies a sharp reduction in the number of necessary physical prototypes, thereby accelerating the development process and simultaneously reducing the use of resources. Another good example of the advantages of model-based design is the optimal use of available energy during the process of printing through which the equipment becomes more energy savvy.

It is important to extend the competences that are necessary for the development of future printer systems generations with innovative capabilities. In the project, two groups of research areas and required results have been identified, respectively centered around design and around testing.

The first group can best be described as the left side of the V-cycle. Here techniques and tools are being developed to aid in the development of new products and functions. The work packages include the following topics:

- Model smart system behaviour, extend the multidisciplinary model base, and improve the software synthesis capabilities.
- Develop models in cooperation with the mechanical engineers for paper handling designs and analyze and simulate these models to improve the design in an iterative way. The models will contain the layout of the paper handling as well as the mechatronic control subsystems.
- Enable product platform development by reusing mechatronic systems and subsystems. Part of these systems and subsystems is the functional control software.

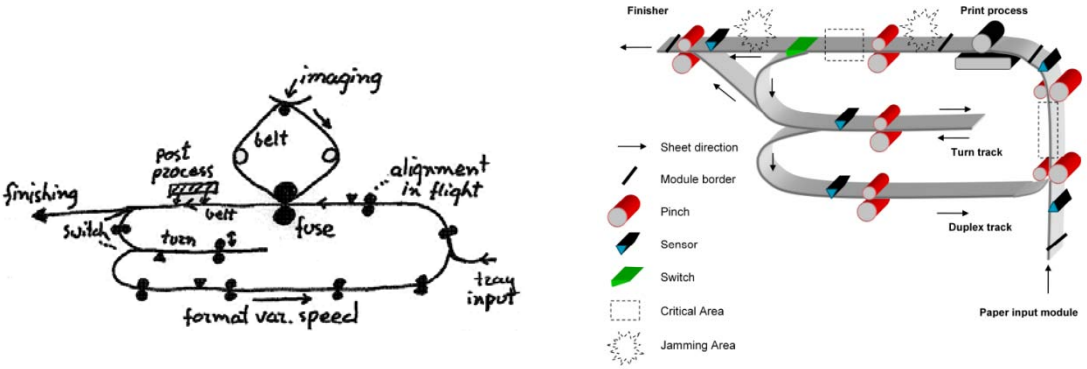


Figure 1: A paper path design sketch and its mock-up.

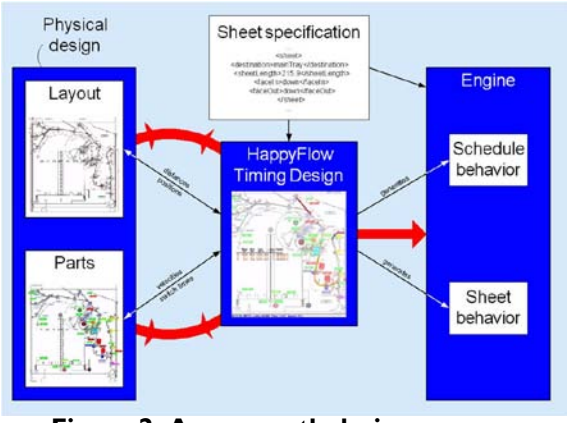


Figure 2: A paperpath design process

The second group of activities provides tools to test and validate new products and functions. The goal is to test the engine software as soon as possible (in the development environment, on a target platform with simulated mechanics, and on a real engine) in an efficient way, both automatically and manually. The work packages target the following topics:

- Realize one Software-In-the-Loop test environment that will be suitable for all Océ printers.
- Develop automatic test tools and share test methods, scripts, and tooling over multiple product development projects. The scope is tests in a simulated environment as well as tests on a real engine.
- Define and share methods and guidelines for creating test cases and reporting.

The results of the project will be visible in a more efficient and shorter product development cycle inspired by improvements and extensions of the tools that support the model-based way of working. A second benefit is the knowledge sharing and dissemination among professionals in the Dutch industrial network.

For more information

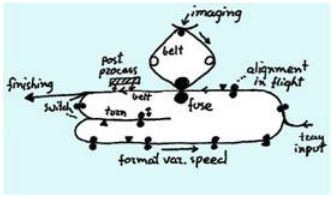
Lou Somers	Océ Technologies	077-3591917	lou.somers @ oce.com
Jack Kandelaars	Océ Technologies	077-3592889	jack.kandelaars @ oce.com
Frans Reckers	Embedded Systems Institute	040-2478205	frans.reckers @ esi.nl

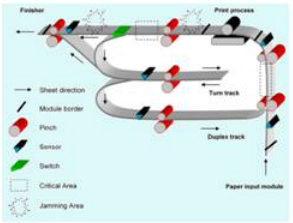
Embedded Systems INSTITUTE

Model Based Design and Testing

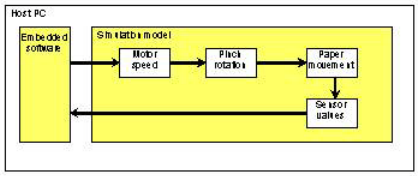
océ

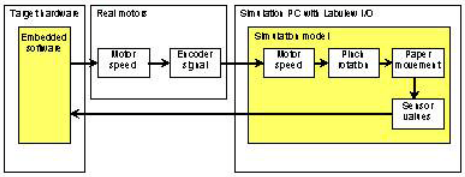
- Model based development will significantly improve the **development process**, the **time to market** and the **product quality**.
- Careful handling of the multi-disciplinary design decisions will improve the **communication** and **process** of the multi-disciplinary design teams.



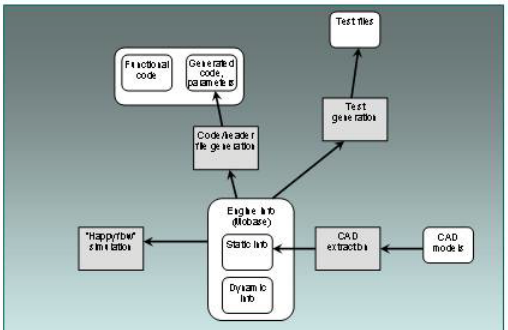


- Addition of simulation models allows for **quick feedback** on design decisions.
- A virtual (simulated) prototype of the product forms the basis for development and **verification/validation** in all technical disciplines.

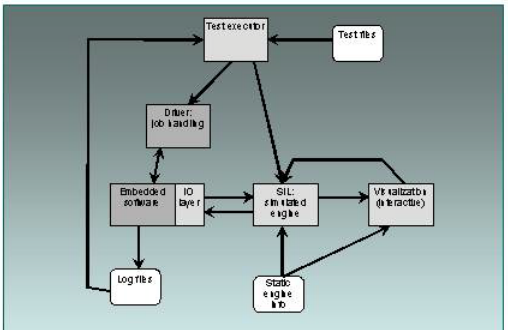




- Addition of **aspect** (behavior, energy, heat) simulation will improve the feedback and the quality of system architecting.
- Models will enable a significant level of design and implementation **synthesis**.



- Capture multidisciplinary design info
- Model behavior
- Define functional components
- Synthesize code

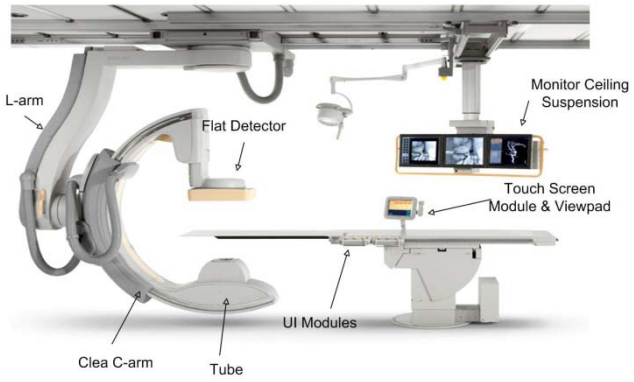


- One Software-in-the-Loop (SIL) environment for all Océ printers
- Test in simulated and real environments
- Test cases and reports

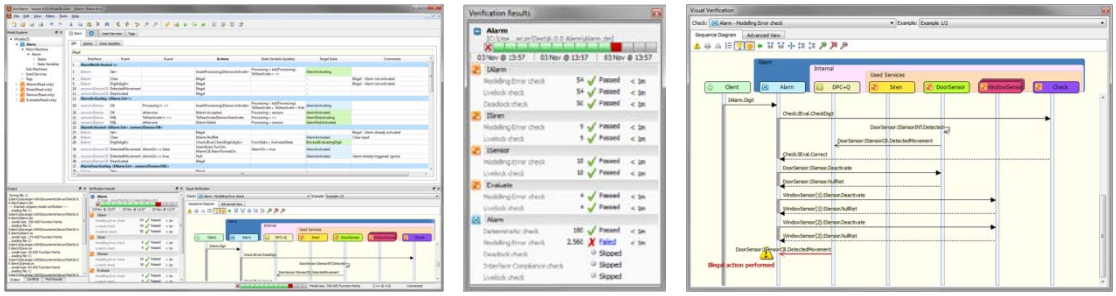
D 13 Component-based Development at Philips Healthcare using Verum's ASD Technology

Overview

The interventional X-ray systems of Philips Healthcare allow minimally invasive intervention. This avoids open heart surgery by using image guided intervention, e.g., to place stents via a catheter. To support new medical procedures, it is important to be able to incorporate medical innovations fast in systems that meet high quality standards. This requires a software architecture that can be adapted and extended easily while still maintaining the high-level of quality without long test and integration times.



To meet these goals, Philips Healthcare, Verum and ESI investigate the use of a component-based development method supported by the ASD:Suite of Verum. We present the lessons learned when applying this approach to a part of an interventional X-ray system. Moreover, we demonstrate the latest version of the ASD:Suite.



The main challenge for the application of ASD at Philips Healthcare is the gradual change from an object-oriented blackboard architecture towards a hierarchical control architecture. The lessons learned concern, for instance:

- The choice of a good starting point
- The decomposition of a complex interface
- Techniques to deal with large numbers of unsolicited events
- Approaches to improve the robustness of the generated code

This work is supported by Kenniswerkersproject Partitura.

For more information

Robert Huis in 't Veld	Philips Healthcare	robert.huisintveld @ philips.com
Jos Langen	Verum	Jos.Langen @ verum.com
Jozef Hooman	ESI	jozef.hooman @ esi.nl

Kenniswerkers project Partitura

Component-based Development

Partners: Philips Healthcare, Verum, ESI

Embedded Systems INSTITUTE

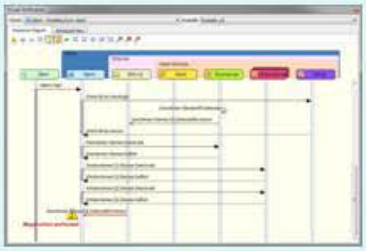
PHILIPS

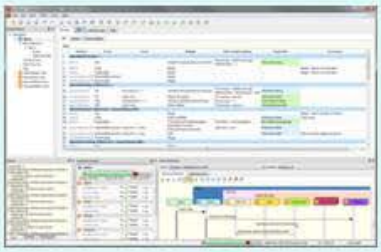
verum

Tools for building mathematically verified software

Aim

- Incorporate innovations fast in systems that meet high quality standards
- Develop architecture that
  - can be adapted and extended easily
  - maintains the high-level of quality
  - avoids long test and integration times





Approach

Use component-based development supported by ASD:Suite of Verum

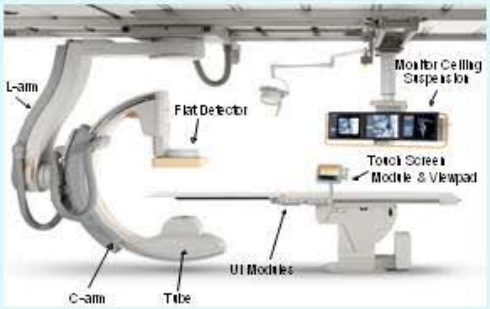
- Complete, state-based interface models
- Mathematically verified design models
- Code generation from design models

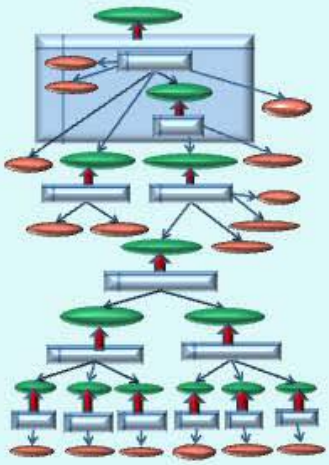
Case study

Control of intervential X-ray system

Challenges:

- Move from existing object-oriented blackboard architecture to hierarchical component-based control architecture
- Many unsollicited events from hardware
- Combination of code generated by ASD and legacy code (COM-based)
- Incorporate ASD in existing development process





Results

- Refactoring of part of existing system into hierarchical component-based architecture which is verified using ASD:Suite
- Guidelines for the decomposition of complex interfaces in ASD – proposal for ASD extension
- Techniques to deal with large numbers of unsolicited events
- Guidelines to improve robustness of generated code – proposal for ASD extension
- Improvemens of ASD:Suite
- Consolidation in Philips Cookbook and Verum's on-line Knowledge Base

D 14 ITEA2

Overview
ITEA 2, the follow-up to the successful ITEA programme, is a strategic pan-European programme for advanced pre-competitive R&D in software for Software-intensive Systems and Services (SiS).

ITEA 2 stimulates and supports projects that will give European industry a leading edge in the area of SiS (in which software represents a significant segment in terms of system functionality, system development cost & risk and system development time).

Our ambition is to mobilise a total of 20,000 person-years over the full eight-year period of the programme, requiring a significant increase in investment . This ambition is based on experience in ITEA, the need to further close the gap in R&D investment (3% of GDP, Lisbon objective) and the ever growing importance of SiS.

As one of the main EUREKA cluster programmes ITEA 2 has close links with other EUREKA projects and the Framework Programmes of the European Commission. Our projects are supported financially by all members of the EUREKA framework.

For more information

ITEA 2 Office	High Tech Campus 69 - 3	+31 (0) 880 036 136	http://www.itea2.org/

D 15 Artemis-IA

Overview
ARTEMIS Industry Association (ARTEMIS-IA) was founded in January 2007 by Daimler, Nokia, Philips, STMicroelectronics, and Thales to support the ARTEMIS Joint Undertaking (ARTEMIS-JU) and to continue the work of the ARTEMIS European Technology Platform. The ARTEMIS JU programme is the first of its kind to bring private-sector research actors together with the European Commission and a large number of contributing Member States

Vision
The vision of ARTEMIS is that embedded systems will realise the dream of ambient intelligence. In which intelligent support for people will be embedded in everyday objects. Large-scale application will increase our quality of life. The result will be to help make life healthier and more secure. And to provide more comfort for Europe's ageing population. ARTEMIS-IA nurtures the ambition to strengthen Europe's position in embedded intelligence and systems and to attain world-class leadership.

ARTEMIS SubProgrammes
During 2007, ARTEMIS-IA developed eight advanced and challenging subprogrammes of key importance for the future of Europe based on the ARTEMIS-ETP Strategic Research Agenda (SRA) published by the ARTEMIS European Technology Programme (ETP) in 2006. The calls of the ARTEMIS-JU in May 2008 and 2009 focused on selected priority areas in embedded systems fundamental to long-term competitiveness.

For more information

ARTEMIS Industry Association	High Tech Campus 69-3C	+31(0)88 0036 188	www.artemisia-association.org

D 16 Point One

Overview
Point-One Association

Point-One is an open association of high-tech industry and knowledge institutes with research and development on nanoelectronics, embedded systems, and mechatronics in the Netherlands. Together, these technology domains are the cornerstone of a global value chain with applications in healthcare, energy, ICT, leisure, transport and security.

The mission of Point-One is to realize Phase2 innovation program "From Good to Great in Dutch Technologies". This program is a joint initiative of the Point-One members and the Ministry of Economic Affairs, aiming at strong economic growth in the Netherlands.

The innovation program has four modules, being international R&D, national R&D, ecosystem support, and university-industry interaction. Point-One maintains active working groups with its members in all modules. The association is supervised by an elected board of executives from participating industries and knowledge institutes.

For more information

Point One	High Tech Campus 69-3C	+31(0)88-5554333	www.point-one.nl

Competence Development Programme


Embedded Systems
INSTITUTE
Fast track
to excellence
SYSTEM ARCHITECT'S DEVELOPMENT PROGRAMME

Your head start in the global race

RECENT YEARS have seen unprecedented change. Globalisation has significantly impacted the characteristics of high-tech industry. Rapid advances in society, science and technology have created many challenging new opportunities, opening the way to highly innovative products. Such products provide enhanced functionality, better cost-performance, and are highly adaptable and interconnected. All of which means technology leadership is now more vital to commercial success than ever before.

THE EXPONENTIAL growth in size and the complexity of this new generation of products is quickly outgrowing our capabilities to create them. There is a continuously growing gap between the available technology and our means to effectively deploy it.

AS A RESULT, there is a fast-growing need to develop systematic practices and professional capabilities for the design and engineering of dependable technology systems and infrastructures. In the area of product development, there is an urgent need for system architects who not only understand the complexities of system design and its associated engineering processes, but also their own guiding role in strategic technology choices. Similarly, there is a growing need for highly qualified engineers, especially those who can deal with the multidisciplinary aspects of product design.

The System Architect's Development Programme helps individuals reach their full potential by equipping them with system-level design & architecting capabilities as well as the necessary personal skills.

THAT IS WHY the Embedded Systems Institute (ESI) has established a tailor-made training programme to help your company develop top-class system architects. It is designed to enable engineers to reach their full potential as well as to enable high-tech companies to get a head start in the global race.

WE CALL IT the "System Architect's Development Programme" and it represents the fast track to top-class system architecting.

THE STEP-BY-STEP PROGRAMME

Depending on the engineer's knowledge, experience and responsibility he/she can benefit from one of three education programmes. By offering a multi-level programme it is possible to support and accelerate the growth from a mono-disciplinary engineer into a multi-disciplinary system architect. The end result is a well-balanced engineering professional who is able to align technology and design choices with product, market and business drivers, and is able to operate on a strategic level.

The three education modules are designed to develop engineers into highly qualified system architects that have a well-balanced understanding of multidisciplinary design, combined with in-depth understanding of product, market and business drivers.

LEAD DESIGNER

This education programme is for engineers with a college or university education and at least four years of professional experience. It is important that they have the ambition to become a technical leader who directs others in the development of high-tech system components.

DOMAIN ARCHITECT

This education programme is aimed at professionals with typically more than six years experience and already operate at a lead designer level. It is important that they have the ambition to take responsibility for the development of a dominant subsystem or technology area in a broader organisational and system context.

SYSTEM ARCHITECT

This education programme is aimed at professionals with typically more than ten years experience and already operate at a domain architect level. It is important that they have the ambition to take responsibility for top-level system architecting, including the related strategic design and technology choices, such as for product platforms and product families.

INDUSTRY AS CLASSROOM

INDUSTRY AS CLASSROOM™

The "Industry as Classroom" format combines theory with on-the-job training and coaching. It involves sharing and exchanging experiences with colleagues from other high-tech industries. The result is a practical training that is focused on real-life cases, applying state-of-the-art knowledge and exploiting the experiences from teachers, coaches and fellow students. This ensures that we not only address the development of knowledge and skills but also how they can be applied to the participant's individual areas of work. This guarantees relevant and highly effective new skills for the companies and individuals involved.

In short, the training concept combines and builds upon three key elements from the participant:

- What you **KNOW** (knowledge)
- What you **DO** (experience)
- Who you **ARE** (personality)

It all adds up to a comprehensive, highly practical, and inspiring route to top-class system architecting.

IN COLLABORATION WITH THE HIGH-TECH SYSTEMS PLATFORM

This system architect's development programme has been established in close collaboration with the High Tech Systems Platform: a consortium of 30+ high-tech companies in the Netherlands that aims to promote and support this sector of industry. It represents the Netherlands' largest and most innovative cluster and employs over 140,000 people, with significant export value and a substantial contribution to the Dutch economy.

Today's high-tech products are highly complex integrations of a variety of technologies. To optimally develop them requires well-trained system architects that have a holistic understanding of the complexities of system-level design and the associated engineering processes in a broad business context.

Embedded Systems INSTITUTE

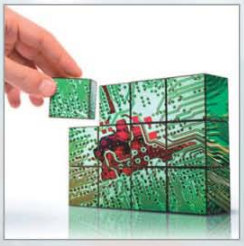
To lead technology without leaving it

NOW, there is a unique, tailor-made development programme for system architects. One that combines the training of technical insight on a multidisciplinary level, builds insight in the relationship between technology and business drivers, and supports the development of the required professional skills.

THE SYSTEM ARCHITECT'S DEVELOPMENT PROGRAMME can be seen as a step-by-step career path accelerator. Alongside the traditional managerial and technical specialty career paths, it opens new opportunities for those who want to take leadership in product innovation but also want to stay close to technology. Importantly, it enables you to advance your career by leading technology without leaving it.

AS A RESULT, the programme follows a carefully chosen mix of objectives:

- Develop your system-level design & engineering capabilities
- Enhance your ability to align design choices with product, market and business drivers
- Develop your relevant personal skills and leadership attributes



The System Architect's Development Programme helps your company realise its innovation goals, by developing top-level system architects that understand the strategic interplay between market, product and technology.

BENEFITS OF THE PROGRAMME

The key benefits of the programme are:

- Support for high-tech industry to improve its speed of innovation and competitiveness
- Accelerated development of architectural and multi-disciplinary design skills
- Technical talent that is well-trained to operate at system level
- Increased numbers of top-class system architects

Embedded Systems
INSTITUTE

SYSTEM ARCHITECT'S DEVELOPMENT PROGRAMME

EMBEDDED SYSTEMS INSTITUTE (ESI)

ESI is a renowned scientific research institute. Its mission is to advance industrial innovation and academic excellence in the area of embedded system engineering.

TU/e Campus, Laplace building 0.10
Den Dolech 2, 5612 AZ Eindhoven
P.O. Box 513, 5600 MB Eindhoven
The Netherlands

T +31(0)40 247 47 20
F +31(0)40 247 20 78
E office@esi.nl
W www.esi.nl

EMPOWERED BY:

SRE

Provincie Noord-Brabant

Ministry of Economic Affairs

DEVELOPMENT PARTNERS

The following parties contributed to the development of the programme:

High Tech Systems Platform

The strategic goals and objectives of the programme have been developed in close cooperation with the High Tech Systems Platform, in the Netherlands.

Stevens Institute of Technology

The School of System Engineering of Stevens Institute of Technology, Hoboken, USA provided general consultancy in programme development and is our partner in a number of system engineering modules within the education programme.

Financing partners

The development of the education programme has been partly funded by the Ministry of Economic Affairs, the Province of North Brabant, and the City Region Eindhoven (SRE), in the Netherlands.

EDUCATION PARTNERS

The following parties contribute to the execution of the programme:

- Stevens Institute of Technology, USA
- Bredemeyer Consulting, USA
- BeteoR Mens en Organisatie, the Netherlands
- Technical University Eindhoven, the Netherlands
- Technical University Delft, the Netherlands
- University of Twente, the Netherlands
- Katholieke Hogeschool Limburg, Belgium
- Erasmushogeschool Brussel, Belgium

Speakers, authors and demonstrators

Rui Abreu
Delft University of Technology
Faculty of EEMCS, Software Technology Department
http://www.st.ewi.tudelft.nl

Joris van den Aker
Embedded Systems Institute
Joris.van.den.aker @ esi.nl

Huib Aldewereld
Utrecht University – Institute of Information and Computing Sciences
huib @ cs.uu.nl

Jos Ansink
DEMCON Advanced Mechatronics

Auke van Balen
FEI Company

Chris Bannink
Logica
chris.bannink @ logica.com

Twan Basten
Embedded Systems Institute
Eindhoven University of Technology
a.a.basten @ tue.nl

Michael Borth
Embedded Systems Institute

P.J. van Bree
Eindhoven University of Technology / Electrical Engineering Dept. / Control Systems Group
PT4.16 P.O. box 513 5600MB Eindhoven

Trosky B. Callo Arias
University of Groningen, Software Engineering and Architecture Group
Trosky @ cs.rug.nl

Frank Dignum
Utrecht University – Institute of Information and Computing Sciences
dignum @ cs.uu.nl

Jos van Eijndhoven
Vector Fabrics BV, Eindhoven, The Netherlands
jos @ vectorfabrics.com

Rolf Ernst
Institut für Datentechnik und Kommunikationsnetze
TU Braunschweig
r.ernst @ tu-bs.de

Lorenz Gelderland
FEI Company

John Gemei
ASML

Arjan van Gemund
Delft University of Technology
Faculty of EEMCS, Software Technology Department
http://www.st.ewi.tudelft.nl

Lex van Gijsel
DevLab
+31 - 40 - 293 9906
lex.van.gijsel @ devlab.nl

Alberto Gonzalez
Delft University of Technology
Faculty of EEMCS, Software Technology Department
http://www.st.ewi.tudelft.nl

Gerd Gross
Delft University of Technology
Faculty of EEMCS, Software Technology Department
http://www.st.ewi.tudelft.nl

Wouter Hakvoort
DEMCON Advanced Mechatronics
wouter.hakvoort @ demcon.nl

Roelof Hamberg
Embedded Systems Institute
roelof.hamberg @ esi.nl

Boudewijn Haverkort
Embedded Systems Institute

Teun Hendriks
Embedded Systems Institute
teun.hendriks @ esi.nl

Martijn Hendriks
Radboud University Nijmegen
m.hendriks @ cs.ru.nl

Marcel Hiel
Utrecht University – Institute of Information and Computing Sciences
hiel @ cs.uu.nl

Koen Holtman
Philips Applied Technologies
Koen.Holtman @ philips.com

Jozef Hooman
Embedded Systems Institute
jozef.hooman @ esi.nl

Robert Huis in 't Veld
Philips Healthcare
robert.huisintveld @ philips.com

Hernes Jacobs
DEMCON Advanced Mechatronics

Jeroen H.M. Janssens
Tilburg center for Cognition and Communication,
Tilburg University
jeroen @ jeroenjanssens.com

E.G.T. Jaspers
ViNotion
egbert.jaspers @ vinotion.nl

Jack Kandelaars
Océ Technologies
077-3592889
jack.kandelaars @ oce.com

Fred Kieviet
FEI Company

Hitoshi Komoto
Delft University of Technology
h.komoto @ tudeflt.nl

Kees Kotterink
ASML

Gert Kragten
TU Delft
g.a.kragten @ tudelft.nl

Jos Langen
Verum
Jos.Langen @ verum.com

Hugo van Leeuwen
FEI Company
hugo.van.leeuwen @ fei.com

C.M.M. van Lierop
Eindhoven University of Technology / Electrical Engineering Dept. / Control Systems Group
PT4.29 P.O. box 513 5600MB Eindhoven

Roland Mathijssen
Embedded Systems Institute
roland.mathijssen @ esi.nl

Cory Meijneke
TU Delft
c.meijneke @ tudelft.nl

Hristina Moneva
Embedded Systems Institute
hristina.moneva @ esi.nl

Michiel Peters
Vanderlande Industries B.V.

Eric Piel
Delft University of Technology
Faculty of EEMCS, Software Technology Department
http://www.st.ewi.tudelft.nl

Eric O. Postma
Tilburg center for Cognition and Communication, Tilburg University
eric.postma @ gmail.com

Teade Punter
Embedded Systems Institute
teade.punter @ esi.nl

Frans Reckers
Embedded Systems Institute
frans.reckers @ esi.nl

Jan Schuddemat
Embedded Systems Institute

Frenk M. Sloff
Philips Healthcare / Healthcare Informatics
Best, The Netherlands

Gerard J.M. Smit
University of Twente dept EEMCS
g.j.m.smit @ utwente.nl

Lou Somers
Océ
lou.somers @ oce.com

Hans Spitshuis
CCM Centre for Concepts in Mechatronics
hans.spitshuis @ ccm.nl

Jan Stoeten
ASML

Wouter Tabingh Suermondt
ASML
wouter.tabingh.suermondt @ asml.com

Bart Theelen
Embedded Systems Institute

Tetsuo Tomiyama
Delft University of Technology
t.tomiyama @ tudelft.nl

Nikola Trčka
Eindhoven University of Technology
n.trcka @ tue.nl

Jan van de Ven
ASML

Dirk Verhagen
TU/e / Embedded Systems Institute
d.verhagen @ tue.nl

Jacques Verriet
Embedded Systems Institute
jacques.verriet @ esi.nl

Ralph von Vignau
NXP Semiconductors
ralph.von.vignau @ nxp.com

Bernard van Vlimmeren
FEI Company

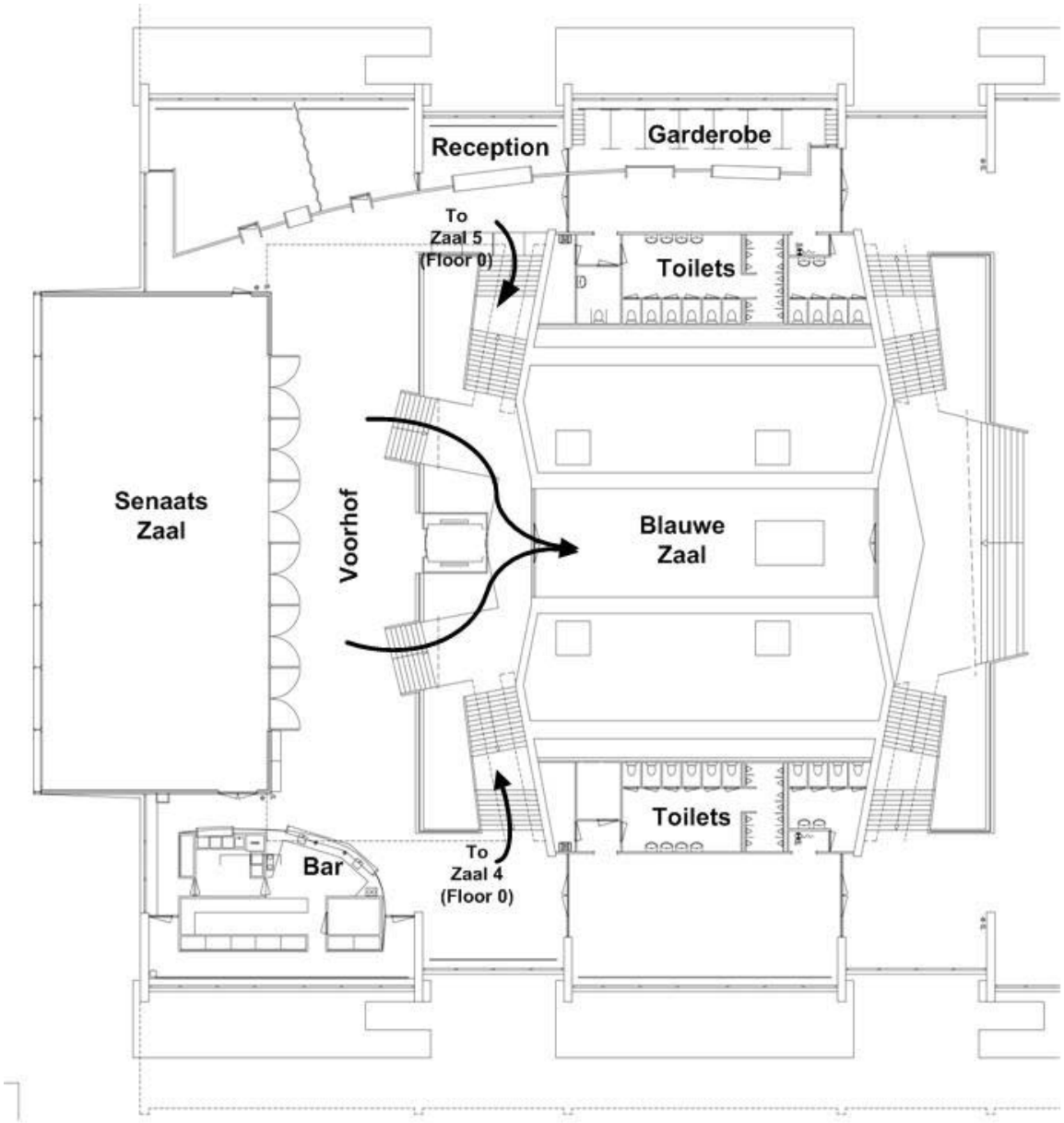
Jeroen Voeten
Embedded Systems Institute
j.p.m.voeten @ tue.nl

Bruno van Wijngaarden
Vanderlande Industries
bruno.van.wijngaarden @ vanderlande.com

P.H.N. de With
TU/e SPS, VCA group
CycloMedia Technology
P.H.N.de.With @ tue.nl

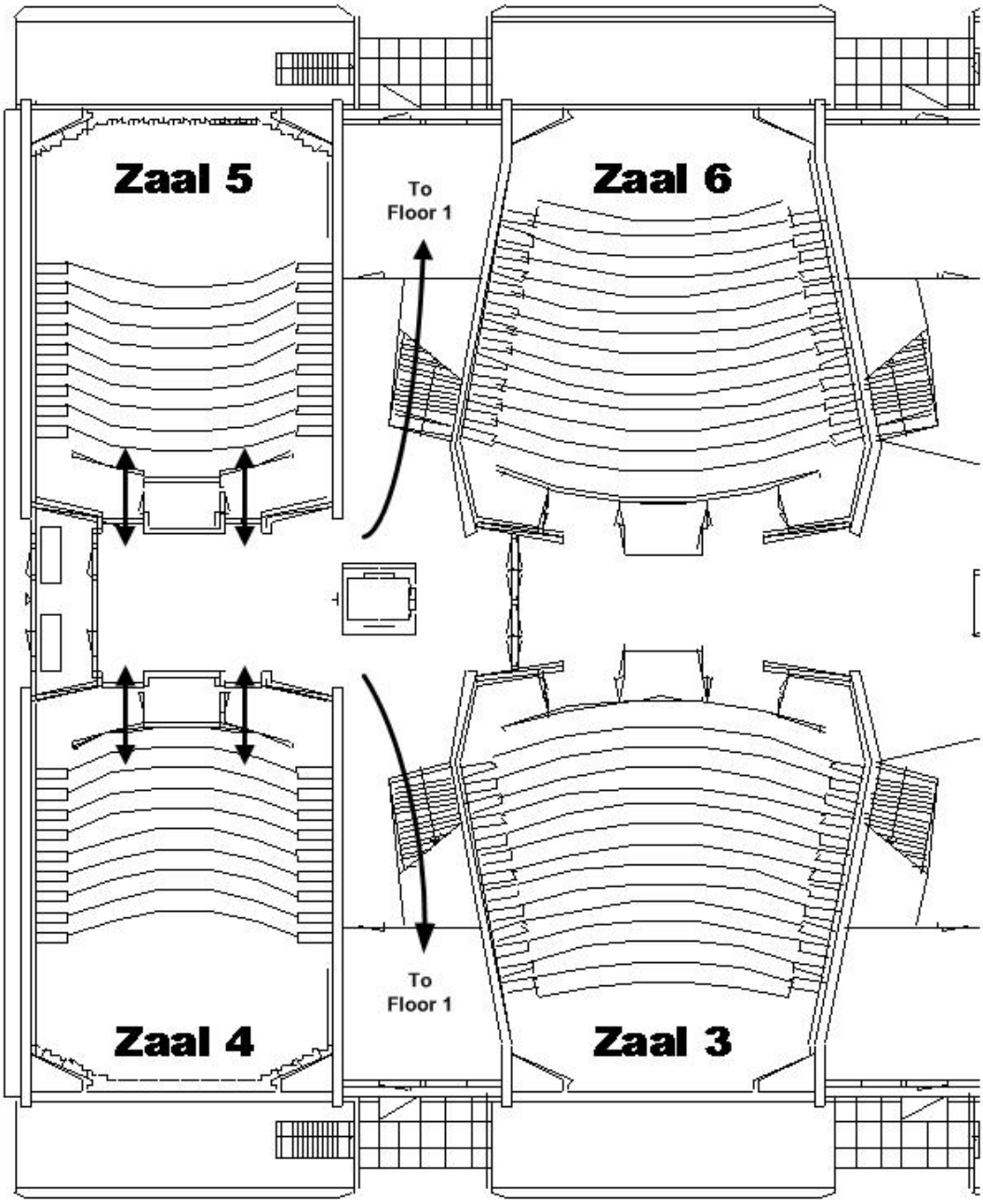
Auditorium plan

Main floor



TU/e Auditorium
Floor 1

Presentation rooms



TU/e Auditorium
Floor 0

Information market room (Senaatszaal)

Information market

	On show	Demonstrators
1	Understanding Ship Behavior with the Simple Event Model	Véronique Malaisé Davide Ceolin (VU)
2	MyriaNed - a self organizing, gossiping Wireless Sensor Network	Lex van Gijsel (DevLab)
3	The Octopus Design-Space Exploration Toolset	Martijn Hendriks (RUN) Nikola Trčka (TU/e)
4	CAD for System Architecture	Hitoshi Komoto (TUD)
5	Architectural Scenario Icons Improving communication between technical and non-technical stakeholders	Dirk Verhagen (TU/e)
6	Robotized Order Picking	Wouter Hakvoort Jos Ansink (DEMCON)
7	A Robotic Hand for Grasping in Warehouses	Gert Kragten (TUD) Cory Meijneke (TUD)
8	Banners	
9	Fast track to excellence System architect's development programme	Joris van den Aker (ESI)

	On show	Demonstrators
10	Putting Chaos under control in model-based development of complex systems	Hristina Moneva (ESI)
11	OVERLAY : Performance modeling and design space exploration for embedded mechatronic control systems	Wouter Tabingh Suermondt (ASML)
12	The Modest project Model Based Design and Testing	Jack Kandelaars (Océ)
13	Component-based Development at Philips Healthcare using Verum's ASD Technology	Robert Huis in 't Veld (Philips Healthcare)
14	ITEA2	
15	Artemis-IA	
16	Point One	
17	Running show ESI Way of Working