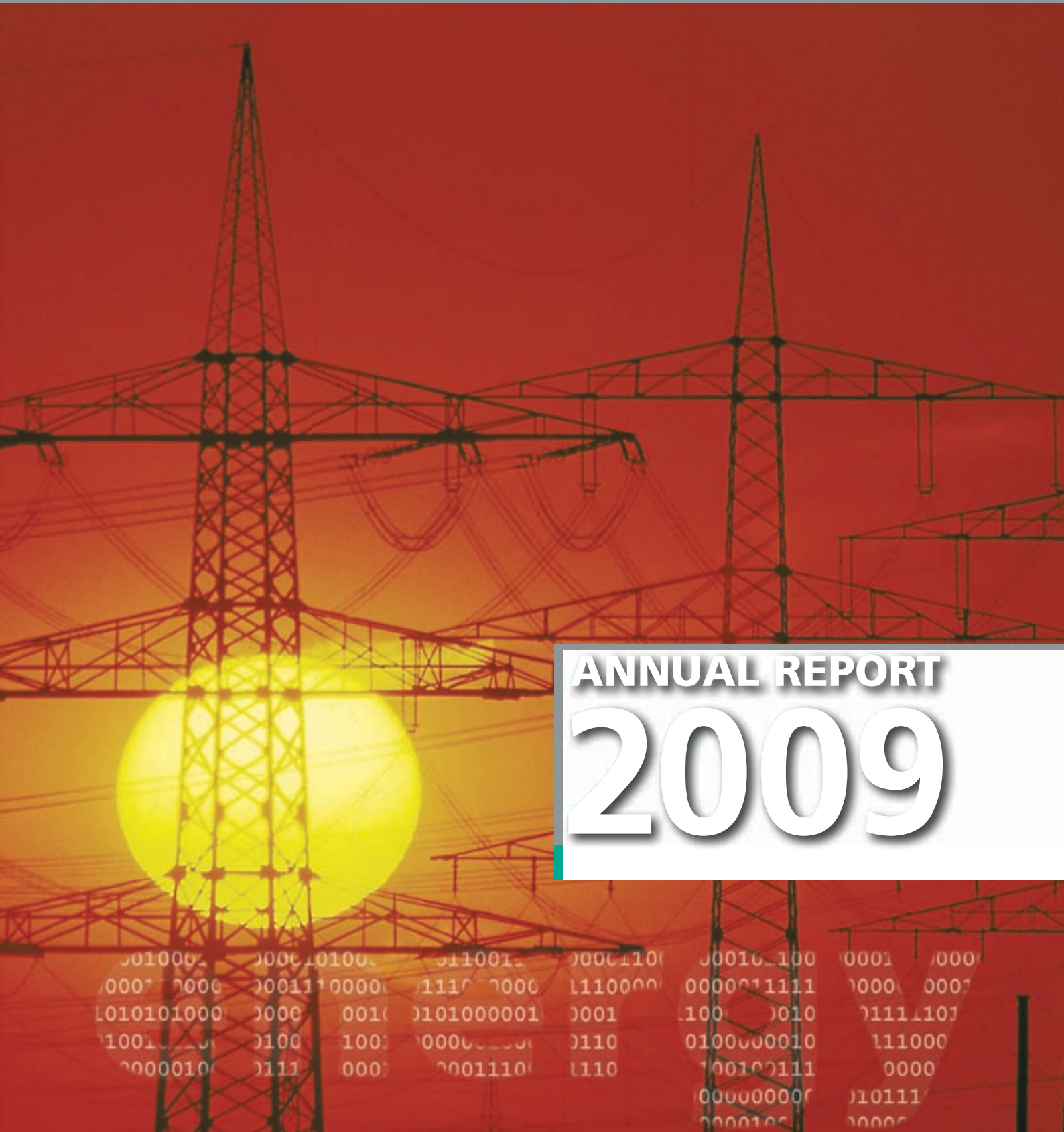




# Fraunhofer

## IESE

FRAUNHOFER INSTITUTE FOR EXPERIMENTAL SOFTWARE ENGINEERING IESE



**ANNUAL REPORT**

**2009**

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# THE FRAUNHOFER INSTITUTE FOR EXPERIMENTAL SOFTWARE ENGINEERING IESE

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Software is a part of our lives. Embedded into everyday equipment, into living and working environments or modern means of transportation, countless processors and controllers make our lives simpler, safer, and more pleasant. We help organizations to develop software systems that are reliable in every aspect, and provide empirical proof of the necessary processes, methods, and techniques, emphasizing engineering-style principles such as measurability and transparency.

Fraunhofer IESE is one of the worldwide leading research institutes in the area of software and systems development. A major portion of the products offered by our collaboration partners is defined by software. These products range from automotive and transportation systems via automation and plant engineering, information systems, health care and medical systems to software systems for the public sector. Our solutions allow flexible scaling. This makes us a competent technology partner for organizations of any size – from small companies to major corporations.

Under the leadership of Prof. Dieter Rombach and Prof. Peter Liggesmeyer, the past decade has seen us making major contributions to strengthening the emerging IT location Kaiserslautern. In the Fraunhofer Information and Communication Technology Group, we are cooperating with other Fraunhofer institutes on developing trend-setting key technologies for the future.

Fraunhofer IESE is one of 59 institutes of the Fraunhofer-Gesellschaft. Together we have a major impact on shaping applied research in Europe and contribute to Germany's competitiveness in international markets. The institute is officially a "Selected Landmark 2009" of the Germany-wide initiative "Germany – Land of Ideas"



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# EDITORIAL

## OVERCOMING THE CRISIS WITH ENERGY

Dear reader,

Overcoming the crisis with energy – this could be the motto of Fraunhofer IESE for the year 2009. All over the world, the financial market crisis and the fear of possible consequences for national economies dominated the news. Although it is true that this crisis and, in its wake, the postponement of major research projects with some industry partners, did not leave us unaffected either, in retrospect we can describe the year 2009 as a year that brought important impulses for our research institute.

We have, for instance, invested about one million euros into establishing the basis of a new research area at Fraunhofer IESE. "Smart Energy" is the name of this new research area under the leadership of our deputy director Prof. Dr. Frank Bomarius. What intelligent energy management and software engineering have in common, and how even you might be able to benefit from this in the future, will be presented in more detail on the following pages.

Despite the crisis in the automotive industry, Fraunhofer IESE managed to get another boost of energy from it. In 2009, we were involved in the key project ePerformance together with Audi Venture GmbH and actively supported this industry partner in developing and testing a fundamentally new safety concept for electric vehicles of the future.



Prof. Dr. Dieter Rombach



Prof. Dr. Peter Liggesmeyer

On the other hand, 2009 also represented the year in which we managed to further improve the tried-and-true: One example is another two-year extension we got from the Fraunhofer-Gesellschaft for the successful innovation cluster "Digital Commercial Vehicle Technology". "Success through collaboration" has proven to be true in this case, which can be seen not only in the numerous collaboration partners from industry, but also in the first-ever joint award for the Fraunhofer Center Kaiserslautern as a Selected Landmark of Ideas 2009.

We are facing the year 2010 with great confidence, since the opening of the Innovation Center Kaiserslautern together with Fraunhofer ITWM and TU Kaiserslautern promises to deliver long-term success. And as winner in the BMBF "Spitzencluster" (Cluster of Excellence) competition, we were able to secure a major success for our institute and for the IT hub Kaiserslautern with the topic "Software Innovations for the Digital Company".

Beyond this, however, this annual report is once again a reflection of the diversity of software-related technologies and applications.

Wishing you informative reading –

*Dieter Rombach*

Dieter Rombach

*P. Liggesmeyer*

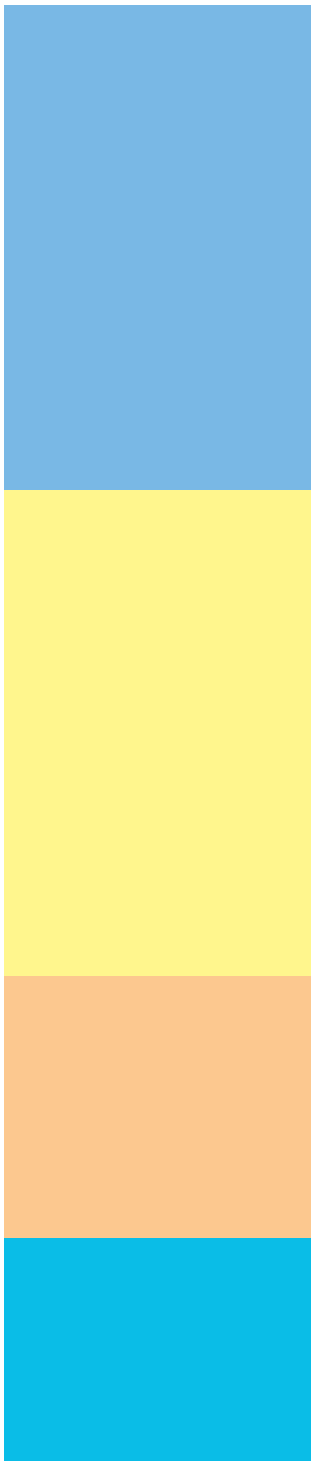
Peter Liggesmeyer

*P.S.: This report including the detailed appendix is also available as an ePaper on CD-ROM or at [www.iese.fraunhofer.de](http://www.iese.fraunhofer.de).*

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# PROFILE OF FRAUNHOFER IESE

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# HIGHLIGHTS IN 2009

## FROM SOLAR CELLS TO THE INTERNET OF ENERGY

Over the next few years, the Fraunhofer Institute for Experimental Software Engineering IESE will establish a future-oriented energy management concept with strategic investments of more than one million euros at its site in Kaiserslautern. Work will focus especially on high-performance, safe software systems for use in plants for decentralized power generation or for renewable energies. A research and demonstration facility, consisting of solar plant, combined heat and power plant, electric vehicles, and computer-supported control centers for integrated energy management, shall be created at the Fraunhofer Center in Kaiserslautern for this purpose. Major funding for this project will come from the federal government's economic stimulus package as well as from subsidies of the Rhineland-Palatinate Ministry of Environmental Affairs.

"In the research facility at the Fraunhofer Center, we will combine a future-oriented power-controlled cogeneration plant with modern photovoltaics. Even the waste heat from our computer centers will flow into the system as a "source of energy"', says Prof. Frank Bomarius from Fraunhofer IESE. The core of the plant – and a major subject of research – will be a computer-controlled energy management system with intelligent software controls.

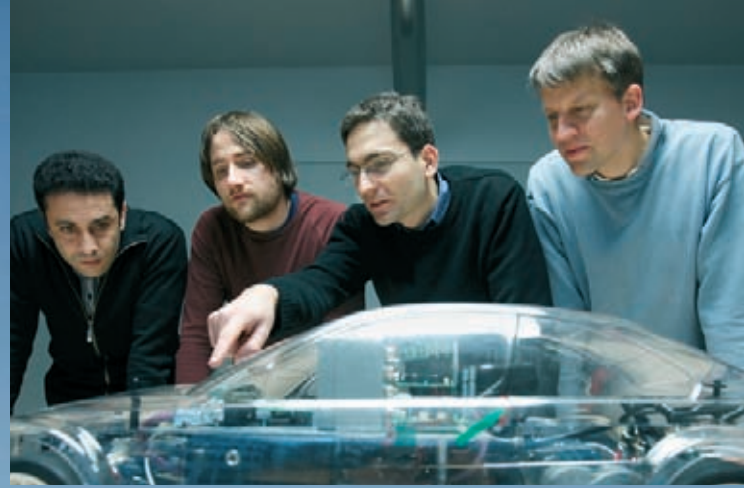
As to size, the entire setup will be comparable to a small industrial business, with the test user being the institute itself. "In this way, we can show small businesses what their energy management could look like in the future, respectively which products and services will be in demand in this area in the future."

In addition, the integration of a fleet of electric vehicles into the energy concept shall be evaluated. Software platforms that are suitable for energy management systems, interfaces with devices and facilities, as well as approaches for automating energy management and for user interaction will be the first research topics in the context of this project.

For project manager Bomarius at least, only such system concepts will be eligible that fulfill the highest requirements: "Future energy management systems will be much more complex than current ones. On the basis of our industry-proven know-how, we will develop concepts and methods that ensure that these facilities will function perfectly, will have the maximum degree of safety, and will be self-organizing to a certain extent without any user input." The scientists at Fraunhofer IESE also want to use the research facility at the Fraunhofer Center to optimize non-functional characteristics such as the usability of energy management systems.

Decentralized energy generation from regenerative energies offers to provide an escape from the dilemma between decreasing resources and increasing consumption. At the same time, it also leads to huge control engineering problems, which are reflected in increased energy costs. In order to find a sensible balance between energy demands and the respective energy offers, a network must be created between all generators and consumers using Internet technology. By exchanging information, they can all collaborate in an economically and ecologically optimized manner. The so-called "Internet of Energy" thus created will become one of the life veins of our modern society, together with other central communication networks. The research performed at Fraunhofer IESE will contribute to developing the software that will form the basis of this network.





# TOMORROW'S ELECTRIC VEHICLE – FRAUNHOFER IESE COLLABORATES WITH AUDI

As far as the German federal government is concerned, Germany will soon be one of the world leaders in the area of electric mobility. The Federal Ministry of Education and Research (BMBF) will provide a total of 700 million euros to support this development. One of the projects funded in this context is the network project “ePerformance”, which was initiated by Audi and will be funded by the government with a total of 22 million euros. The Fraunhofer Institute for Experimental Software Engineering IESE in Kaiserslautern will be part of the project as a contractor for Audi Electronics Venture GmbH, and will collaborate in developing an innovative safety concept for the car of the future.

By the year 2020, at least one million electric vehicles shall be put on the road in Germany. Even now, a rapid image change is taking place in this area in our society: from a niche product for technology freaks and particularly environment-conscious customers to an attractive automobile with excellent driving characteristics. This image change is mainly due to electric sports vehicles. The government is convinced that if new functions of an intelligent vehicle are added now, electric vehicles will become more interesting for many people.

This is also a challenge for Audi. The goal of the research project “ePerformance” is to design the electric drive train in a completely new way, to systematically optimize all electric components in a vehicle, and to increase efficiency. The ambitious project intentionally pushes the technological limits, and is thus aimed at high-performance classes. The final result will

be an automobile that is the product of a completely new development while being sportive in the way that is typical for Audi.

In an electric vehicle, many different components must interact optimally and must be perfectly regulated and coordinated. Fraunhofer IESE provides support for the development of the entire safety concept of the car, from the hazard and risk analysis all the way to the safety architecture. According to Prof. Dr.-Ing. Peter Liggesmeyer, the goal is to establish pillars of reference for future generations of electric vehicles. The person in charge of the project is Dr. Mario Trapp, division head at Fraunhofer IESE. Liggesmeyer continues: “Here we can actively participate in designing the future of the automobile, both in terms of concrete safety designs and in terms of the methodology employed.” The funding for Fraunhofer IESE amounts to 425,000.00 euros, distributed over three years.

The German federal government is pursuing an integrated strategy when it comes to electric mobility. The “National Development Plan Electric Mobility” is the first ever means for synchronizing and implementing all measures in a coordinated manner – from education, training, and competence development at universities via the development of batteries, network integration, and energy management all the way to market preparation. In addition to Audi, Robert Bosch GmbH and RWTH Aachen are also participating in the “ePerformance” project.

Further information:  
[www.audi.de/eperformance](http://www.audi.de/eperformance)





# ALLIANCE DIGITAL PRODUCT FLOW MILESTONE ON THE WAY TO THE INTERNET OF THE FUTURE

Together with a consortium of leading German companies and research institutions in the area of information and communication technology, Fraunhofer IESE has founded the alliance "Digital Product Flow".

This was announced by the involved partners on the occasion of the Research Day held in Darmstadt on 5 February 2009.

By combining real product flow and digital data flows, the companies and research institutions plan to significantly increase the efficiency of complex processes in production and enterprise resource planning, while improving quality and precision at the same time.

"One important application area of our research results is logistics", said Andreas Storm, Parliamentary State Secretary at the Federal Ministry of Education and Research. "Higher efficiency of such an Internet of Things is the only way we will be able to fulfill the increasing ecological and economic requirements on logistics. An efficient logistics industry will continue to be the basis of a competitive production site, in the future even more so than today." Overall, the Federal Ministry of Education and Research (BMBF) is providing 17.7 million euros worth of funding to the project. Business and industry are investing a total of 40 million euros into the alliance and, beyond that, into the technologies.

Storm: "Our strengths lie in the areas of products, goods, and production. With the Internet of Things, Germany has a chance to take over a leading role in designing the Internet of the Future and its applications". At the end of 2008, the federal research ministry had launched the research platform G-Lab, thereby creating the basis for developing the technical foundation for the Internet of the Future.

The Internet of Things had already been one of the major topics at the 3<sup>rd</sup> IT Summit in Darmstadt in November 2008. There, industry, science, and government agreed on bundling this strength with the German expertise in IT support for business processes. "The Research Day is another milestone on the way to the Internet of the Future and a driver for implementing the agreements made at the 3<sup>rd</sup> IT Summit", said Storm.

The other partners of the alliance "Digital Product Flow" are SAP AG, Software AG, INI Graphics Net, TU Darmstadt, the Fraunhofer Institute for Secure Information Technology, the German Research Center for Artificial Intelligence (DFKI), IDS Scheer AG, TU Dresden, the Fraunhofer Institute for Material Flow and Logistics, and the Fraunhofer Institute for Industrial Mathematics. Storm: "By combining the digital world and the real world into the Internet of Things, we have the chance to further strengthen Germany as a world-class competitor in the area of IT support for business processes."

Further information:  
[www.adiwa.net](http://www.adiwa.net)

The logo for ADiWa, featuring the letters 'ADiWa' in a bold, sans-serif font. The 'i' is lowercase and has a dot, while the other letters are uppercase. The logo is set against a light blue background.



## **SOFTWARE TECHNOLOGY MADE IN GERMANY – “SE 2009” AT FRAUNHOFER IESE**

Experiences, innovation, and trends in software and systems engineering were the focus at Fraunhofer IESE in Kaiserslautern at the conference “Software Engineering 2009” in March. “Guaranteed Quality – A Requirement of Industrial Software Development” was the motto of this meeting of experts from research and industry in the context of the well-established professional conference organized by the Gesellschaft für Informatik e.V. Experts from industry and research participated in the high-level, multifaceted conference program, including Prof. Matthias Jarke from RWTH Aachen, who delivered the keynote address.

This time, the Software Engineering 2009 conference as a platform for scientists and users was co-organized by the chair Software Engineering: Dependability of the University of Kaiserslautern and the Fraunhofer Institute for Experimental Software Engineering IESE.

“With its diverse program for scientists and industrial practitioners, the conference made a sustainable contribution to strengthening software technology”, said Professor Peter Liggesmeyer, conference manager and director of Fraunhofer IESE.

The high-quality technical-scientific program put together by a panel of experts was enhanced by invited talks given by leading software engineers from renowned industrial companies. The speakers included Oliver Mäckel from Siemens AG and Dr. Eric Sax from MBTech Group, who reported on their practical experiences especially in the context of the central aspect of software quality assurance.

The large degree of interaction of this conference has a long tradition – in numerous workshops and tutorials held during the first two days of the conference, participants had multiple opportunities to contribute their own expertise and participate in exchanges regarding current trends. A well-established part of the event is the Industry Day: 15 presentations by industrial users from different domains underlined the practical relevance of this conference.

Approximately 200 participants from business, research, and government came to Fraunhofer IESE to attend Software Engineering 2009. In addition to the professional aspects, the attractive social program also deserves mentioning. The conference dinner, for example, took place at the newly renovated Hambacher Schloss – the historical “birthplace of German democracy”.

Further information:  
[www.se2009.de](http://www.se2009.de)

*Prof. Peter Liggesmeyer  
at the opening of SE 2009.*



# Quamoco

## The Benchmark for Software Quality

## SOFTWARE MADE IN GERMANY: NEW SOFTWARE QUALITY STANDARD FOR GERMANY UNDER DEVELOPMENT

As part of a consortium consisting of research institutions and companies, Fraunhofer IESE will develop a quality standard for software products in Germany within the next three years.

The goal: In the future, it shall become possible to assess and prove the performance and feasibility of software. To achieve this, the project members are striving to develop an approach for the qualified certification of software quality, which is expected to lead to the hallmark of quality "Made in Germany" to be established for software, too. In the project Quamoco (Software-Qualität: Flexible Modellierung und integriertes Controlling - Software Quality: Flexible Modeling and integrated Controlling), Fraunhofer IESE is collaborating with Capgemini sd&m, itestra, SAP, Siemens, and Technische Universität Munich.

Quamoco is modeled after other industries, where criteria for quality assessment and detailed standards, adherence to which is sometimes even prescribed by law, have proven their value. Although the software industry has a central economic importance, similar approaches are missing.

Already existing, standardized frameworks for software quality such as ISO 9126 or ISO 25000 are rarely applied directly by software developers, since the criteria listed there are too general and hard to transfer to individual software development projects. Some companies make do with their own quality guidelines; however, they frequently only consider selected quality characteristics.

### **The new quality standard: flexible and applicable in practice**

These are the lessons that the Quamoco project team is trying to learn from: The goal is a software quality standard with a great degree of detail. "Thus we are creating an efficient instrument that is suitable for practical application. Computer scientists will get concrete guidelines for their development process in order to ensure software qualities – such as reliability, safety and security, or maintainability – in a provable manner", says computer science professor Manfred Broy from TU Munich.

This quality standard will take into account a large variety of different software products, such as embedded systems, mainframe applications, entertainment systems, and highly safety-critical control systems. In the project Quamoco, a basic quality standard will be developed, which will be applicable for many domains and will be complemented by exemplary, domain-specific quality standards. "We will realize this for standard software, individual software, information systems, and embedded systems. This will enable our quality standard to be used in a very flexible manner. At the same time, all quality requirements must be integrated completely. This is the balancing act we will have to achieve", says Broy.



### **Clear structure through the meta quality model**

And this is how the project partners are proceeding: In a quality model, they are mapping the characteristics of a successful development process and of high-quality software in a detailed manner. Starting with requirements elicitation and continuing all the way through to quality assurance and maintenance, comprehensive criteria are defined that guarantee high software quality. On a level above this quality model is a meta quality model, which gives all quality characteristics a clear structure. The meta quality model shows causal relationships, that is, how a quality characteristic influences another area of the development process.

### **BMBF funding**

The Federal Ministry of Education and Research (BMBF) provides 3.7 million euros worth of funding for Quamoco as part of the funding program IKT 2020. The industry partners are contributing approx. 2.2 million euros. In addition, the industrial consortium partners are planning to make further investments into research regarding software quality beyond the actual project itself.

Further information:  
[www.quamoco.de](http://www.quamoco.de)

## FRAUNHOFER CENTER KAISERSLAUTERN IS "SELECTED LANDMARK 2009"

Following the success in 2008 of the Fraunhofer Institute for Experimental Software Engineering IESE in the Germany-wide contest "Germany – Land of Ideas", both of the Kaiserslautern Fraunhofer institutes have now won this award jointly.

The award was given for the innovative conference with associated technical exhibit "Digital Commercial Vehicle Technology". The focus of this conference was on the exchange of experience between researchers and users. The conference is part of the innovation cluster "Digital Commercial Vehicle Technology", where the Fraunhofer Institute for Industrial Mathematics ITWM and Fraunhofer IESE together with cluster partners from industry are analyzing and optimizing the digital inner workings of tractors, trucks, and excavators. The goal of the cluster is to expand the knowledge of the high-tech experts from research and industry in a practice-oriented way. In addition, the two Fraunhofer institutes also demonstrated the digital inner workings of heavy machinery to the general public at an Open House, which took place in conjunction with the award ceremony on 28 October 2009.

Under the motto "Smart Giants", the focus was on the successful dialog between research and industry in the context of a conference and technical exhibit on digital commercial vehicle technology at the Fraunhofer Center. For this, the Center received the award "Selected Landmark 2009" in the contest "365 Landmarks in the Land of Ideas".

The main presentation about what the award means for Fraunhofer IESE and the city of Kaiserslautern was given by State Secretary Ebling (Ministry of Education, Science, Youth and Culture of the state of Rhineland-Palatinate). Dr. Klaus Weichel (Lord Mayor of the city of Kaiserslautern) and Prof. Dr. Ulrich Buller, Chairman of the Fraunhofer-Gesellschaft, gave welcoming addresses.

In their presentations, the two institute directors Prof. Dieter Rombach (Fraunhofer IESE) and Prof. Prätzel-Wolters (Fraunhofer ITWM) as well as Ralf Kalmar and Dr. Dreßler stressed the relevance of the innovation cluster "Digital Commercial Vehicle Technology" in Kaiserslautern.

The award "Selected Landmark 2009" was officially presented by director Dieter Bertram from Deutsche Bank Kaiserslautern.

In the afternoon, the motto at Fraunhofer IESE was: "Hands-on science"! The Fraunhofer Center opened its doors to interested visitors with an Open House. Highlights included the Fraunhofer Truck, exhibitions, guided tours, and presentations.

Deutschland  
Land der Ideen



Ausgewählter Ort 2009





## A YEAR OF AWARDS

### Creator of internationally visible beacons – Prof. Dieter Rombach awarded Federal Cross of Merit

Prof. Dieter Rombach, executive director of the Fraunhofer Institute for Experimental Software Engineering IESE in Kaiserslautern, has been awarded the Federal Cross of Merit on Ribbon, which is one of Germany's highest civilian decorations bestowed by the German President. Rombach received this honor from the hands of the Minister President of Rhineland-Palatinate, Kurt Beck, at a ceremony held at the State Chancellery in Mainz on 30 November 2009. In addition to Rombach's outstanding services to software engineering and to the interdisciplinary cooperation of science and business, particularly his great contribution to the quality of the competitiveness of Rhineland-Palatinate and Germany was recognized.

The vision to make the Kaiserslautern region one of the leading IT sites in Europe has become a reality, said the Minister President in his statement. Today, this vision is being filled with life by more than 800 scientists at various institutes, institutions, and university chairs in Kaiserslautern.

Prof. Dieter Rombach, who, as a graduated mathematician, has always been an advocate of systematic processes, saw software and systems development as an engineering task very early in his career. With the first Chair for Software Engineering, which was established in 1992, he has created an internationally visible beacon at the University of Kaiserslautern and for the science hub Kaiserslautern. Beck added that his

achievements have made a major contribution to the image of Rhineland-Palatinate as an active and innovation-oriented state.

In 1996, Prof. Rombach founded Fraunhofer IESE, an applied research institute that enjoys high international reputation today and is considered one of the top addresses for global research and development activities in this area. "His advice and his experiences are sought everywhere", continued Kurt Beck, adding that Rombach regularly works as a consultant, auditor, and advisor for the industry and provides innovative ideas to different institutions, committees, and government entities.

His commitment in establishing a large new European research center for the international agricultural machinery manufacturer John Deere in Kaiserslautern also deserves special emphasis. An additional 200 research and development jobs in Kaiserslautern may be generated from this in the midterm.

Beyond his professional activities, Prof. Rombach is also active in an honorary role for the city of Kaiserslautern, the soccer club 1. FC Kaiserslautern, as well as for the state of Rhineland-Palatinate. As a member of the Round Table involved in the development of PRE-Park and together with different companies, scientists, and the Kaiserslautern Economic Development Agency, he sets the course for the further development of the city. As chairman of the FCK Board of Directors, one of his areas of interest is the integration of sports and science.





### **Honorary Doctorate Degree for Professor Dieter Rombach**

On 16 May 2009, Professor Dr. Dieter Rombach, full professor at the University of Kaiserslautern and executive director of the Fraunhofer Institute for Experimental Software Engineering IESE, received another important award in the context of a festive ceremony. The university of the Finnish city of Oulu awarded him an honorary doctorate degree for his lifetime achievements as a software engineer. With this, the Scandinavian university, known throughout the academic world especially for its research in information and communications technologies, paid tribute to Rombach's contributions to the progress of software engineering as well as to his untiring commitment to interdisciplinary collaboration between globally operating business and research institutions.

Honorary doctorate degrees are awarded relatively seldom, and their award is tied to strict criteria. Candidates must be able to provide evidence of extraordinary scientific, respectively social achievements, and/or must be committed in an exemplary manner to their country, to society, and to the academic community. Professor Dieter Rombach received the degree of a "Doctoris Honoris Causa" as a renowned scientist, in particular for his superior achievements in numerous areas of software and systems development. As one of the leaders in the Fraunhofer-Gesellschaft's IT research community, he is an outspoken champion of efforts to continually improve the technology transfer of scientifically provable software development methods into industrial practice.

As a versatile scientist, Rombach has been connected with the University of Oulu since the early 1990s in the context of continually increasing collaboration, which was intensified through research and development collaborations – also in the context of jointly performed EU projects – as well as through the mutual exchange of scientific staff and ongoing projects with Fraunhofer IESE. In addition, Dieter Rombach has close ties with Finnish academia through his membership in several advisory boards of the VTT Technical Research Centre of Finland and the University of Oulu.

The glamorous customs of the award ceremony go back to traditions dating from the 13<sup>th</sup> century. Despite the ceremonial character of the main event, the program of the University of Oulu also contained cultural and social elements. One striking detail of the ceremony: In addition to the well-known mortarboard cap, the academics to be honored also wore a special sword with the university emblem. According to tradition, the researcher thus symbolizes his or her willingness to actively stand up for scientific truth and knowledge.

The University of Oulu has state-of-the-art equipment, over 17,000 students, and an annual budget of more than 200 million euros, making it the second-largest university in Finland. Information and communication technology figures prominently among its six faculties. This center of science, which is well known far beyond Scandinavia, celebrated its 50-year anniversary last year and continues to be an important research partner of Fraunhofer IESE in Kaiserslautern.

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## **Fraunhofer Locations in the USA**

Brookline, Massachusetts  
Cambridge, Massachusetts  
College Park, Maryland  
East Lansing, Michigan  
Newark, Delaware  
Plymouth, Michigan  
San Jose, California

## **Fraunhofer Locations in Asia**

Bangalore, India  
Beijing, China  
Jakarta, Indonesia  
Selangor D.E., Malaysia  
Seoul, Korea  
Singapore  
Tokyo, Japan

## **Fraunhofer Locations in the Near East**

Dubai, United Arab Emirates

## **Fraunhofer Locations in Europe**

Vienna and Graz, Austria  
Brussels, Belgium  
Porto, Portugal  
Bolzano, Italy

Research of practical utility lies at the heart of all activities pursued by the Fraunhofer-Gesellschaft. Founded in 1949, the research organization undertakes applied research that drives economic development and serves the wider benefit of society. Its services are solicited by customers and contractual partners in industry, the service sector and public administration.

At present, the Fraunhofer-Gesellschaft maintains more than 80 research units in Germany, including 59 Fraunhofer Institutes. The majority of the 17,000 staff are qualified scientists and engineers, who work with an annual research budget of €1.5 billion. Of this sum, more than €1.3 billion is generated through contract research. Two thirds of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. Only one third is contributed by the German federal and Länder governments in the form of base funding, enabling the institutes to work ahead on solutions to problems that will not become acutely relevant to industry and society until five or ten years from now.

Affiliated research centers and representative offices in Europe, the USA and Asia provide contact with the regions of greatest importance to present and future scientific progress and economic development.

With its clearly defined mission of application-oriented research and its focus on key technologies of relevance to the future, the Fraunhofer-Gesellschaft plays a prominent role in the German and European innovation process. Applied research has a knock-on effect that extends beyond the direct benefits perceived by the customer: Through their research and development work, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their local region, and throughout Germany and Europe. They do so by promoting innovation, strengthening the technological base, improving the acceptance of new technologies, and helping to train the urgently needed future generation of scientists and engineers.

As an employer, the Fraunhofer-Gesellschaft offers its staff the opportunity to develop the professional and personal skills that will allow them to take up positions of responsibility within their institute, at universities, in industry and in society. Students who choose to work on projects at the Fraunhofer Institutes have excellent prospects of starting and developing a career in industry by virtue of the practical training and experience they have acquired.

**Executive Board**

**Prof. Dr. Hans-Jörg Bullinger**

President, Corporate  
Management

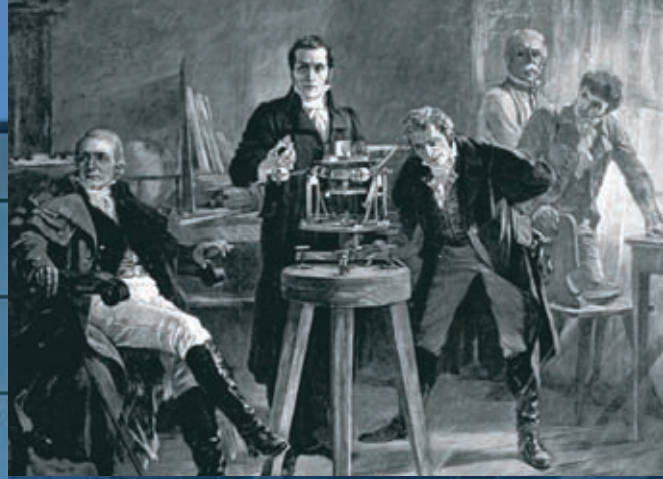
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Senior Vice President, Research  
Planning, Legal Affairs

**Prof. (Univ. Stellenbosch)**

**Dr. Alfred Gossner**

Senior Vice President, Finance  
and Controlling (incl. Business  
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and Real Estate), Information  
Technology, Personnel Affairs



The man behind the name:

**Joseph von Fraunhofer**

The Fraunhofer-Gesellschaft owes its name to Joseph von Fraunhofer (1787-1826), the successful Munich researcher, inventor and entrepreneur. Born of a family of modest means, the glass-grinding apprentice Joseph von Fraunhofer joined the institute for optics headed by privy councillor Joseph von Utzschneider, who put the young researcher in charge of glass manufacturing at the early age of 22. Joseph von Fraunhofer's major developments include new methods of glass production and processing.

The optical instruments he himself developed, such as the spectrometer and the diffraction grid, enabled Fraunhofer to conduct fundamental research in the fields of light and optics. He was the first scientist to measure the spectrum of sunlight and characterize the appearance of the dark absorption strips: the "Fraunhofer lines". His work as an autodidactic researcher earned him great respect in academia and government, leading to the former apprentice becoming a full-fledged member of the Bavarian Academy of Sciences and Humanities.



# FRAUNHOFER IESE AND ITS NETWORK PARTNERS

## International Research Networks

Fraunhofer IESE fulfills its mission of applied research and technology transfer through close collaboration with users of software engineering technology, providers of new technologies, and strategic partners in national and international collaborations. Thus, IESE actively promotes further development of software engineering technology and its transfer into industrial practice.

Fraunhofer IESE is a member in several international research associations. The International Software Engineering Research Network (ISERN) with approx. 40 members from science and industry plays an important role in Fraunhofer IESE's international research collaborations. ISERN is a forum for applied software engineering researchers for exchanging the latest research results and experiences.

Further information:

<http://isern.iese.de>

In addition, Fraunhofer IESE is affiliated with the Center for Empirically Based Software Engineering (CeBASE), a project of the National Science Foundation (NSF) in the United States. Other CeBASE members include FC-MD, the University of Maryland, the University of Southern California, Mississippi State University, and the University of Nebraska-Lincoln.

Bilateral research and exchange programs for students and scientists exist with renowned institutions such as the Experimental Software Engineering Group at the University of Maryland, the Center for Software Engineering at the University of Southern California, the Software Engineering Institute (SEI) of Carnegie Mellon University, Pittsburgh, Carleton University in Toronto, the University of Calgary, Canada, the National ICT Australia Ltd (NICTA), Sydney, and the Software Quality Institute at Griffith University in Australia.

## Publicly-funded Collaborations

Fraunhofer IESE is the coordinator of the national network [software-kompetenz.de](http://software-kompetenz.de), a project funded by the German Federal Ministry of Education and Research.

The mission of [software-kompetenz.de](http://software-kompetenz.de) is to provide German software developing organizations with fast and simple access to the latest and most appropriate methods for developing software according to engineering-style principles. Its primary goals are the establishment of a community of software engineering experts and professional users as well as the creation of an Internet portal that makes the [software-kompetenz.de](http://software-kompetenz.de) partners' expert knowledge accessible to the more than 20,000 software developing companies in Germany. The portal or virtual competence center thus provides the basis for successful knowledge transfer between research and industry.

Further information:

[www.software-kompetenz.de](http://www.software-kompetenz.de)

## Local Research Networks

The Science Alliance Kaiserslautern e.V. is a coalition of ten internationally renowned research facilities in Kaiserslautern. Together they form a highly specialized multidisciplinary network, which provides students, scientists, and cooperation partners from industry, business, and the public sector with innovative solutions based on the newest technologies and methods available.

Members of the Science Alliance are the University of Kaiserslautern, the University of Applied Sciences Kaiserslautern, and eight research institutes, some of which are spin-offs of successful research completed at the University of Kaiserslautern. Their prolific work in the past years has added to the growing reputation of Kaiserslautern as a distinguished location for study, research, and technology.

Further information:

[www.science-alliance.de](http://www.science-alliance.de)



# ISERN

International Software Engineering Research Network



Quality Improvement







### Industrially-funded Collaborations

Fraunhofer IESE's industrial cooperation partners range from global players to small regional companies. They can be grouped into four categories:

- Large national and international organizations looking for support in their mid- to long-term strive for quality improvement in software development.
- Large national and international organizations with their own R&D department, who are looking for competent research partners.
- Medium-sized enterprises, who want to establish improvement programs or who must implement technology changes under very tight budget and schedule constraints.
- Small companies, who want to use proven technology that yields short-term return on investment.

In addition to bilateral collaborations, Fraunhofer IESE and CESE are the organizers of a worldwide consortium consisting of globally operating organizations – the Software Experience Center (SEC). SEC is an association of organizations who want to expand their software engineering competencies on a global scale. In SEC, companies exchange experience across various locations and business areas, and in cooperation with other leading organizations from their own application domain as well as from other domains.

### Specialized Services for SMEs

The speed of modern innovations and the rapid changes of economic constraints place high demands on the management of IT companies. A company that wants to survive in the fierce competition is therefore well advised to continually improve both its own development processes and products and the qualification of its employees.

This is where the Software Technologie Initiative e. V. comes in. It offers all participants the opportunity to receive constant and first-hand information about current developments, trends, and background in the area of software engineering. Numerous events serve to acquire and consolidate applicable knowledge, while also offering the chance for people to get to know each other and to communicate with others. As a living network between research and practice, STI e. V. is the regional platform for direct, unfiltered exchange of knowledge, experience, and information in the area of software development.

Objectives:

- Promotion of software technology in small and medium-sized companies in the region
- Bundling of interests regarding the adaptation of research results in the area of software engineering
- Promotion of innovative software development approaches and their transfer into practice

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*Andreas Schlichting  
(since July 2009)*

[www.sti-ev.de](http://www.sti-ev.de)

# FRAUNHOFER IESE GROUPS AND ALLIANCES

## FRAUNHOFER INFORMATION AND COMMUNICATION TECHNOLOGY GROUP

Shorter innovation cycles have turned IT knowledge into a perishable commodity. The Fraunhofer Information and Communication Technology Group (ICT) provides support in the form of customized solutions, consulting, and contract research for new products and services. The Fraunhofer ICT Group comprises 14 institutes as full members (among them also Fraunhofer IESE) and three associated members, representing a workforce of roughly 3000 employees and a yearly budget of approximately 175 million Euros. Its central office in Berlin serves as a one-stop shop, referring customers to the appropriate contacts.

The complementary focal fields of the participating institutes cover the entire value chain of the ICT industry. The business areas are:

- Medicine
- Automotive
- Production
- Digital Media
- Energy and Sustainability
- Financial Services
- Security
- E-business
- E-Government
- Information and Communication Technologies

The alliance comprises the Fraunhofer Institutes for

- Algorithms and Scientific Computing SCAI
- Applied Information Technology FIT
- Communication Systems ESK (associated member)
- Computer Architecture and Software
- Technology FIRST
- Computer Graphics Research IGD
- Digital Media Technology IDMT
- Experimental Software Engineering IESE
- Industrial Engineering IAO
- Industrial Mathematics ITWM
- Optronics, System Technologies and Image Exploitation IOSB
- Integrated Circuits IIS (associated member)
- Intelligent Analysis and Information Systems IAIS
- Medical Image Computing (MEVIS)
- Open Communication Systems FOKUS
- Secure Information Technology SIT
- Software and Systems Engineering ISST
- Telecommunications / Heinrich Hertz HHI (associated member)

### Contact

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*Prof. Dieter Rombach*







## Chapter 2. Activity

### SE4 SW-Grobenwert

#### Short Description

Das Dokument beschreibt den Prozess der SW-Entwicklung, insbesondere der Nachbereitung der SW-Entwicklung sowie der Integration der SW-Entwicklung in die SW-Entwicklung.

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Das Dokument beschreibt den Prozess der SW-Entwicklung, insbesondere der Nachbereitung der SW-Entwicklung sowie der Integration der SW-Entwicklung in die SW-Entwicklung.

#### Produktions

Das Dokument beschreibt den Prozess der SW-Entwicklung, insbesondere der Nachbereitung der SW-Entwicklung sowie der Integration der SW-Entwicklung in die SW-Entwicklung.

## FRAUNHOFER eGOVERNMENT CENTER

The Fraunhofer eGovernment Center combines the expertise of some Fraunhofer Institutes in the areas of research needed to build up broad-based eGovernment services in Germany and Europe. Each institute has extensive experience in its particular area of technology and related applications, is already working on several applied e-government projects, and is actively involved in the definition of future-oriented, long-term solutions.

The Fraunhofer E-Government Center gives advice to politicians, public administrators and business people on the conception and development of complete, forward-looking and secure eGovernment-solutions and on the realization of service oriented architectures and standards.

The services it offers also include reorganizing business processes, evaluating and advising on technology, developing future-oriented e-government lab scenarios and evolving long-term e-government and security solutions, carrying out projects and quality management, helping with standardization, transferring know-how, and training. The Fraunhofer E-Government Center is completely independent of any vendor-specific solutions and political movements.

Each institute in the eGovernment Center has many years of experience in the area of technologies and applications and is involved in various eGovernment development projects.

As the regional representative of the eGovernment Center in Rhineland-Palatinate, Fraunhofer IESE supports both the public sector and software developing organizations in developing and extending benefit-oriented eGovernment solutions for business, public administration, and citizens. In particular, IESE offers the following services: execution of needs and ROI analyses, independent quality assurance and support of realization projects (with special attention paid to system architecture, usability, and IT security issues), as well as support in developing eGovernment know-how. In order to ensure optimal coverage of the technological and application-relevant issues, projects are performed in cooperation with other institutes of the Fraunhofer eGovernment Center when appropriate.

The Center comprises the Fraunhofer Institutes for

- Applied Information Technology FIT
- Open Communication Systems FOKUS
  - Competence Center ELAN and eGovernment Lab
- Intelligent Analysing- and Information Systems IAIS
- Industrial Engineering IAO
- Experimental Software Engineering IESE
- Information and Data Processing IITB
- Software and Systems Engineering ISST
- Secure Information Technology SIT

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# FRAUNHOFER TRANSPORT ALLIANCE

The Fraunhofer Transport Alliance was formed in March 2003, and currently represents the combined traffic-engineering expertise of nineteen Fraunhofer institutes.

The Fraunhofer Transport Alliance develops adequate technical and conceptual solutions for the public and industry partners and puts these solutions into practice by means of transport-related research.

It creates a new choice in R&D in transport through the bundling of the existing potential and a broad system competency.

Due to their participation in international research programs, member institutes have worldwide contacts with companies and research organizations involved in the fields of transportation engineering and management. The Alliance's office will help you find the right partners.

Fraunhofer IESE is part of the initiative Fraunhofer Automotive, where it actively contributes its experiences with manufacturers and suppliers in automotive software engineering. Specific competencies, in particular, such as mastering the safety and reliability of software, are topics in great demand.

The partners include

- Fraunhofer IIS - Center for Applied Research on Supply Chain Services SCS
- Fraunhofer Institute for Algorithms and Scientific Computing
- Fraunhofer Institute for Industrial Engineering
- Fraunhofer Institut for Building Physics
- Fraunhofer Institute for Structural Durability and System Reliability
- Fraunhofer Institute for Experimental Software Engineering
- Fraunhofer Institute for Factory Operation and Automation
- Fraunhofer Institute for Manufacturing Engineering and Applied Materials Research
- Fraunhofer Institute for Intelligent Analysis and Information Systems
- Fraunhofer Institute for Material Flow and Logistics
- Fraunhofer Institute of Optronics, System Technologies and Image Exploitation
- Fraunhofer Institute for Physical Measurement Techniques
- Fraunhofer Institute for Production Systems and Design Technology
- Fraunhofer Institute for Manufacturing Engineering and Automation
- Fraunhofer Institute for Computer Architecture and Software Technology
- Fraunhofer Institute for Systems and Innovation Research
- Fraunhofer Institute for Industrial Mathematics
- Fraunhofer Institute for Transportation and Infrastructure Systems
- Fraunhofer Institute for Non-Destructive Testing

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# FRAUNHOFER AMBIENT ASSISTED LIVING ALLIANCE

Research into Ambient Assisted Living aims primarily at enabling elderly people to lead independent lives in their own homes, and to provide assistance to people with special needs. Solutions are based on intelligent environments that offer autonomous, proactive, and context-sensitive adaptation to users' needs and to the tasks they wish to perform, helping them to carry out the necessary actions.

The Fraunhofer Ambient Assisted Living Alliance was set up by a group of six Fraunhofer institutes to market complete solutions in this area. The solutions offered include a variety of functions to improve a user's comfort at home and work, or to facilitate social care at home and in nursing homes, and the provision of mobile services. Another focus is that of rehabilitation, preventive healthcare, and solutions to preserve the independence of persons requiring medical care, daily assistance, or help to overcome physical disabilities.

The Alliance pursues the goal of a common system platform that permits seamless integration of diverse solutions and accommodates the evolution of ambient intelligence (Aml) technologies such as communications, power supplies, sensors, and actuators. This results in smart products that are mutually compatible, suitable for mobile applications, and can be integrated into other types of networks on an ad-hoc basis.

The contribution of Fraunhofer IESE is mostly in the area of systematic development of software-intensive systems. For the context of AAL, this includes approaches to the systematic development of integrated AAL solutions with predictable quality, development approaches for adaptable and adaptive systems, system modeling, and analysis, e.g., regarding dependability and usability.

The alliance comprises the Fraunhofer Institutes for

- Computer Architecture and Software Technology FIRST
- Applied Information Technology FIT
- Telecommunications, Heinrich Hertz Institute HHI
- Industrial Engineering IAO
- Digital Media Technology IDMT
- Experimental Software Engineering IESE
- Computer Graphics Research IGD
- Integrated Circuits IIS
- Microelectronic Circuits and Systems IMS
- Manufacturing Engineering and Automation IPA
- Photonic Microsystems IPMS
- Software and Systems Engineering ISST
- Reliability and Microintegration IZM

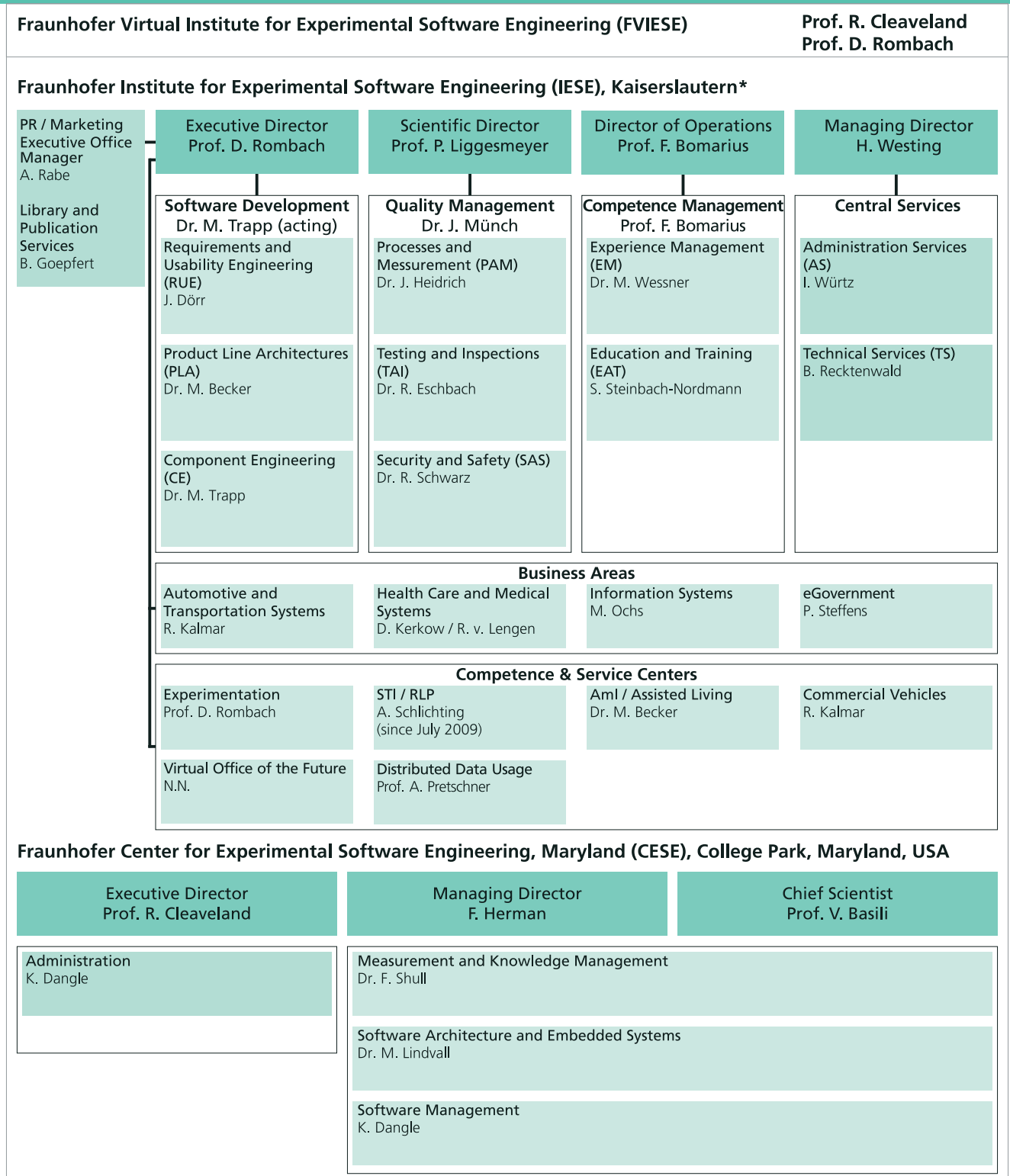
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<http://aal.fraunhofer.de/index.html> *Rolf Hendrik van Lengen*

# ORGANIZATIONAL STRUCTURE



\* As of Dec. 31, 2009



### The Fraunhofer Virtual Institute for Experimental Software Engineering

The Fraunhofer Virtual Institute for Experimental Software Engineering, FVIESE, includes two partner institutions: the Fraunhofer Institute for Experimental Software Engineering (IESE) in Kaiserslautern and the Fraunhofer Center for Experimental Software Engineering, Maryland (CESE) in College Park, Maryland, USA. Both institutions are legally independent entities of Fraunhofer-Gesellschaft e. V. and Fraunhofer USA, Inc., respectively. The institute directors of Fraunhofer IESE and Fraunhofer Center Maryland CESE jointly coordinate FVIESE.

### Departments and Business Areas

To ensure efficient execution of daily operations, the FVIESE institutes – Fraunhofer IESE and CESE – are organized into four departmental units plus staff functions, which constitute the institutes' line structures. The Fraunhofer IESE line structure is complemented by a two-dimensional matrix structure. One dimension is assigned to the "Departments", each of which focuses on a cluster of research themes. The other dimension of the matrix is allocated to so-called "Business Areas", each of which is motivated by a group of related customer problems. The departments are dedicated to developing innovative software engineering methods, technologies, and tools, to proving their benefit, and to systematically packaging their research results. Research is typically carried out within public or Fraunhofer base-funded projects. While the departments thus prepare the ground for technology transfer, the business areas are devoted to applying the technologies in industrial practice and to initiating their large-scale roll-out:

- Automotive and Transportation Systems
- Health Care and Medical Systems
- Information Systems
- eGovernment

The business areas are thus responsible for acquiring, setting up, and monitoring industrial projects, for continuously observing and analyzing market needs, for spotting new business opportunities, and for feeding market requirements back to the departments. Each Fraunhofer IESE scientist belongs to one department and is dynamically assigned to business area projects. Business areas are thus virtual units with no personnel resources of their own (apart from the Business Area Managers), which draw upon the departments for staffing customer projects. One member of the IESE Advisory Board is assigned to each department and to each business area, in order to provide continuous advice and guidance on strategic research and market-related issues.

So-called Competence Centers have been initiated as additional organizational elements connecting staff members from various departments. Their focus is on topic clusters that hold special promise for the future.

Furthermore, due to expanded requirements on flexibility voiced by the business areas, the so-called Competence Development Teams (CDTs) were created, in which new competencies are built up within short periods of time. Established for three years at a time, they are under the direction of a business area and are staffed with researchers from at least two departments. CDTs are funded through public projects and free research capacity of the staff (e.g., in the context of Ph.D. projects).

Competence Development Teams currently exist with a focus on Secure Systems, Safety, Ambient Intelligence Applications, Application-oriented Software Quality, Process Documentation, and Visualization of Software Systems.



# THE ADVISORY BOARD

The Advisory Board consists of representatives of research, industry, and government. The board members support the Institute Directors with advice and counsel.

## Research

**Prof. Dr. Victor Basili**

Institute for Advanced Computer Science  
Department of Computer Science  
University of Maryland  
USA

**Prof. Dr. Manfred Broy**

Institute for Computer Science  
Technical University of Munich

**Prof. Dr. Werner Mellis**

Department of Information Systems  
System Development  
University of Cologne

**Prof. Dr. Jürgen Nehmer**

Department of Computer Science  
University of Kaiserslautern

**Prof. Dr. Helmut Schmidt**

President  
University of Kaiserslautern

**Prof. Dr. Mary Shaw**

Carnegie Mellon University  
Pittsburgh, PA  
USA

## Industry

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Siemens AG  
München

**Dr. Klaus Grimm**

Director Software Technology  
Daimler AG  
Sindelfingen

**Harald Hönninger**

Head of Development  
Research and Advance Engineering  
Robert-Bosch GmbH  
Schwieberdingen

**Dr. Martin Verlage**

Vice Executive Director  
vwd group Technology  
Frankfurt

**Dr. Thomas Wagner**

Head of the Advisory Board  
Former Executive Vice President  
Robert-Bosch GmbH  
Stuttgart

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Mainz

**Brigitte Klempt**

Ministerial Councilor, Ministry of Education, Science, Youth and Culture, Land Rheinland-Pfalz  
Mainz

**Klaus Lütkefedder**

Ministerial Councilor, Ministry for Economics, Transport, Agriculture and Viniculture, Land Rheinland-Pfalz  
Mainz

**Dr. Hans-Ulrich Wiese**

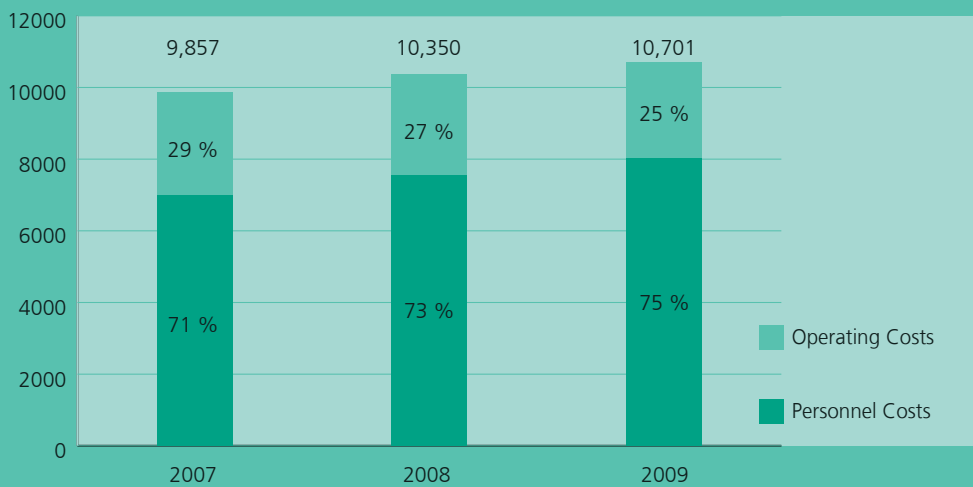
Former member of the Executive Board of Fraunhofer-Gesellschaft e. V.  
Gräfelfing

# PERSONNEL AND BUDGET

Development of Budget (in T euro).



Development of Costs (in T euro).



Development of IESE Personnel.



## Development of Personnel and Budget

Fraunhofer IESE continued its planned growth in 2009, with the search for qualified personnel gaining increasing importance. The cost structure is stable; the proportion of women among the employees was 23%.

In 2010, the institute plans to further increase its scientific staff.



# FRAUNHOFER CENTER FOR EXPERIMENTAL SOFTWARE ENGINEERING, MARYLAND (CESE)

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# NEW PROJECTS IN 2009

The Fraunhofer Center for Experimental Software Engineering, Maryland advances real-world software practices via empirically validated research into software-engineering technologies and processes. It is uniquely expert in processes and technologies for the creation and management of software, and is internationally recognized for its innovative tools for software design, validation, and process management. It strives for global prominence as a purveyor of software best practices to organizations both within, and outside of, the software industry.

CESE focuses its business-development efforts on four industries: aerospace, military, automotive, and medical / health. Customers include government agencies, large multinational companies, and small and medium-sized enterprises in the mid-Atlantic region of the United States. Projects include basic research, technology and process evaluation, and technology and framework development.

In 2009, CESE's largest customer continued to be NASA, which was the source of a mixture of work from basic software-engineering research to software-modernization project assistance. Other key customers include Robert Bosch, Keymind, Social and Scientific Systems, BioFortis, the U.S. National Science Foundation, the System Engineering Research Center, and the US Army.

In 2009, CESE initiated the following high-profile projects:

## **Food and Drug Administration (FDA)**

CESE received funding from the Center for Devices and Radiological Health (CDRH) at the FDA to work with their personnel on developing new methods for certifying the safety of software in medical devices. Software errors account for a growing number of problems in fielded medical devices, ranging from diagnostic / therapeutic radiation devices to implanted insulin pumps, and the FDA is seeking new strategies to improve the efficiency and efficacy of the pre-market device-software reviews it conducts. CESE has deep expertise in model-based software testing and verification for embedded systems, and this has prompted CDRH Center personnel to embark on a pilot study with CESE involving the use of these techniques on the software that controls insulin pumps.

CESE also executed a Cooperative Research and Development Agreement (CRADA) with the FDA to study the use of software, called Software Architecture Visualization and Evaluation (SAVE) and developed by CESE and its German partner Fraunhofer IESE, in software forensics. When medical-device software fails in the field, the FDA is required to investigate the root causes of the problem so that responsibility can be assigned and liability assessed. These tasks are made difficult by the huge volume of software that must be manually inspected. By automatically constructing higher-level views of the structure of the software, SAVE is expected to help FDA inspectors identify those components of the software that should be more closely examined. CESE will be working with FDA personnel to pilot the use of SAVE on an ongoing forensic investigation involving a software failure in a device called an infusion pump.



**NASA**

CESE engineers are working with NASA engineers on a long-term project to upgrade the Space-network Ground Segment (SGS), which comprises the antennas, relay equipment, and software responsible for Earth-based communications with orbiting satellites and other spacecraft. CESE personnel helped NASA devise an in-house cost projection for this several-hundred-million-dollar project; these results were then used by NASA to select contractors for undertaking the project. CESE staff will also help NASA manage these contractors, using technologies developed by CESE researchers to measure and assess progress in system-development efforts.

**University of Maryland (UMD)**

CESE contracted with the UMD to teach graduate-level software engineering courses in the University's professional development program. This program offers master's degrees and graduate certificates in a variety of engineering disciplines, including software engineering. The degree offerings are targeted at professional engineers in the Washington, D.C. area from both government and industry. CESE staff have worked to modernize the offerings in software and received excellent reviews from their students in the autumn of 2009.

**System Engineering Research Center (SERC)**

CESE is a key partner in the SERC, which is a University-Affiliated Research Center (UARC) involving a consortium of research institutions led by the Stevens Institute of Technology. UARCs are tasked with conducting research in the national interest in different fields; the SERC, as its name implies, focuses on systems engineering. Center staff conducted several studies on behalf of the SERC in 2009, including developing a catalog of current industry best practices for software engineering based on data collected in a wide-ranging survey; developing a mathematical model of a well-known system-development process ("Scrum") and conducting analyses of the model; and analyzing the efficacy of different process-support tools for so-called "agile" system-development methods.

**Robert Bosch**

With software researchers at Bosch, CESE scientists undertook studies on the use of different software-testing technologies to check properties of designs of embedded automotive control software. In one part of the project, the effort was concentrated on using automated software testing tools to analyze whether so-called product-line models of engine-control software exhibited the behavior their designers intended. In another part of the project, machine-learning tools were used to extract high-level information about the behavior of a body-electronic controller from low-level testing data.

# PROJECTS WITH PARTNER INSTITUTE AND U.S. UNIVERSITY

CESE's relationship with its parent institute, IESE, revolved around three joint projects.

## **The development of their software-architecture (SAVE) technology**

A U.S. patent application was filed in mid-2008, and paperwork supporting international patent applications was submitted in 2009. CESE and IESE are also finalizing an agreement, the first between a German institute and a USA center, on sharing revenues that result from the commercialization of SAVE.

## **Incorporation of architecture analysis into software-development frameworks**

Another architecture-related project focused on approaches for deploying SAVE-like technologies into actual software-development processes. Current best practices for software development rely on detailed processes for organizing the activities of software engineers. Some of these processes, such as the Capability Maturity Model Integrated (CMMI), have been standardized and are widely used. Identifying how and when to include architecture analysis into these process models is essential for the uptake of technologies like SAVE; IESE and CESE researchers have been studying these questions.

## **Continued work on the GQM+Strategies project**

The goal of that project is to develop an integrated framework linking an organization's business goals ("increase market") to its software-development processes ("perform more manual source-code inspections"). Both CESE and IESE have worked extensively in the past on so-called software-measurement research; the goal of that line of research is to develop measurement programs that provide managers with insight into the progress being made during a software-development effort. GQM+Strategies is a framework for linking this measurement work into the strategic decision-making processes of a business. Originally the brain-child of CESE founder Vic Basili, both IESE and CESE researchers have worked on elaborating the ideas and piloting them in projects with third-party partners.

The Center's relationship with its U.S. Partner, the University of Maryland (UMD), also deepened this year. In addition to the aforementioned course teaching undertaken by CESE personnel, the Center supported four PhD students at UMD, and it also established a new relationship with a Computer Science faculty member in order to use the professor's software-testing expertise on one of its NASA projects. Three CESE scientists were appointed adjunct faculty members in the Computer Science department as well.







## OUTLOOK FOR 2010

Despite the economic turmoil that continues to roil labor markets, CESE is forecasting continued growth in its revenues for 2010, to a budgeted figure of US\$4.56m. This figure is strongly supported by the fact that at the end of 2009, the Center's project backlog was over 90% of its budgeted project income.

The Center is nevertheless forecasting a deficit in 2010 of almost US\$200K, as it embarks on an investment of part of its retained earnings in developing its project portfolio in two of its key industries: defense, and medicine / health. CESE made a similar investment in 2006 in its aerospace business, specifically NASA, and that investment has yielded substantial and ongoing returns. Since that time, the Center grew its annual revenues by over US\$1.5m and added nearly US\$1m to its retained earnings. CESE sees similar opportunities in its defense and medical / health businesses and will use the investment to make strategic hires focused toward those industries.

The Center faces several risks to its budget forecast. In addition to the ones it copes with every year (delays in payment, federal budget uncertainties for CESE's government-agency customers), there is additional concern about the growing size

of the U.S. federal budget deficit and the potential for federal budget cuts that may ensue. CESE estimates the likelihood of such systemic cuts as low for 2010, since the economic recovery is still fragile and 2010 is an election year, but it will continue to monitor the situation for this and coming years.

Another specific risk affecting CESE is the proposed cancellation of NASA's Constellation program. This program was intended to develop launch vehicles for NASA's future manned spaceflight program, and it was under the aegis of this program that a significant portion of CESE's NASA business was funded. Due to program delays and budget overruns, President Obama announced that the program would be discontinued. However, NASA's budget as a whole will be larger in 2010 than in 2009, meaning that there will be funding in other programs outside of Constellation. Also, much of the proposed redistribution of these formerly Constellation-targeted funds will be to other programs headquartered at NASA's Goddard Space Flight Center (GSFC), with whom CESE has had deep and ongoing collaborations. Center personnel are working with their NASA counterparts to ensure that CESE's project work is maintained.

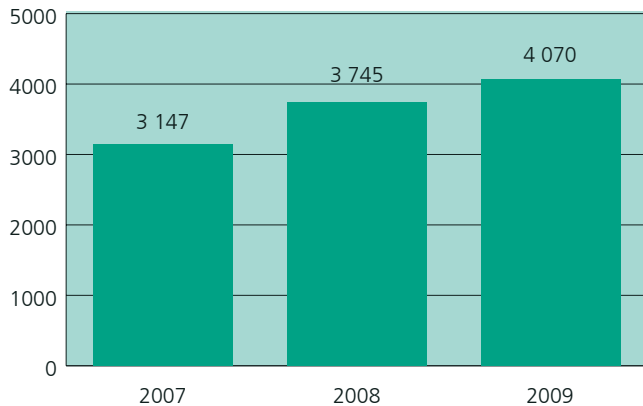


# CESE 2009 FACTS AND FIGURES

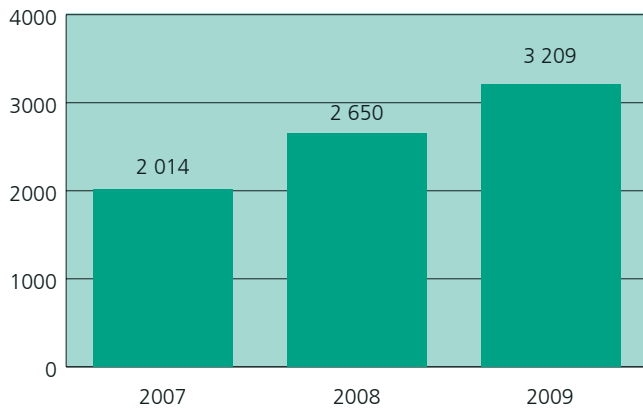
CESE's revenues totaled US\$4.07m for 2009, its largest figure ever and a nearly 10% increase over its 2008 revenues. Approximately 3/4 of this total came from non-Fraunhofer sources. CESE also added US\$300K to its retained-earnings balance in the year. Since 2006, CESE annual revenues have grown by 60%, and its retained earnings have tripled to approximately US\$1.3m.

In January of 2009, CESE moved into its new offices in the M-square development, a technology park established by the University of Maryland (UMD). The new space is 50% larger than the Center's former location and has allowed it to expand its programs, including its hosting of German interns and graduate students from UMD.

As of the end of 2009, CESE had 29 employees, including seven interns and four UMD PhD students. CESE scientists made 40 presentations at technical symposia and published 45 papers in technical journals and conferences. CESE personnel also served on several high-profile program committees for technical meetings and on editorial boards of a number of highly regarded technical journals.



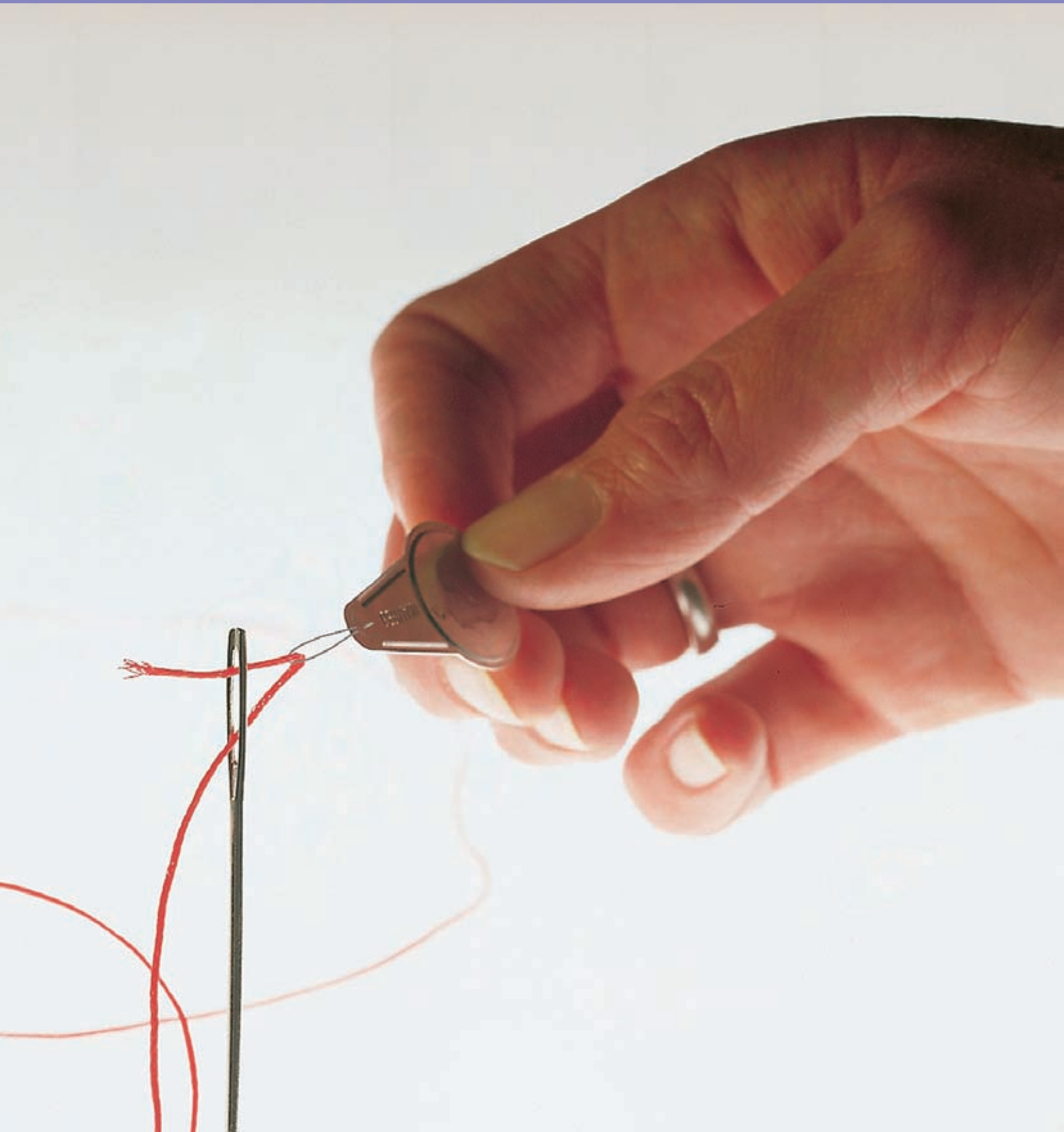
Total revenue (in T US dollars)



Third-party revenue (in T US dollars)



Retained earnings (in T US dollars)



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# SOFTWARE DEVELOPMENT DIVISION

The division **Software Development** offers methods and techniques for the efficient construction of software-intensive systems (resp. families of systems) with predictable quality characteristics.

Starting in January 2010, the division **Software Development** will be restructured in order to enable us to react more efficiently to the needs of partners and customers. In the future, the competencies of the division will therefore be mapped to “Embedded Systems” and “Information Systems”.

The department **Requirements and Usability Engineering** represents the interface to system users or customers. The focus is on real tasks that are to be fulfilled, respectively supported, by a system. An integrative view is taken, which goes beyond the purely functional aspects by also considering attractiveness, usability, and usefulness, in particular, and ultimately translating these into a system specification.

The department **Product Line Architectures** deals with the definition and assessment of systems and software architectures. The incremental mapping of requirements to the technical solution space is complemented by prototyping to validate architecture designs as well as by reverse engineering for transitioning legacy systems into future scenarios. Custom-tailoring documentation schemas and developing specific architecture styles, as well as architecture assessments, are also part of the range of services we offer.

The department **Component Engineering** stands for the (often model-based) implementation of system components that is consistent with the given architecture. The guiding principle is the component-oriented modeling of all relevant quality characteristics, with the focus being on safety and security, diagnosability, and resource efficiency

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*Dr. Mario Trapp*

# REQUIREMENTS AND USABILITY ENGINEERING (RUE)

## Software to Meet the Highest Demands

In order for a wish to be fulfilled in software development, it must first be voiced in detail. Requirements and Usability Engineering provides the basis for software to do what it is supposed to do, for it to be used without problems, and for it to be adapted to changing requirements.

However, it is not enough to just once capture only the technical requirements. Requirements and Usability Engineering is a multi-step design process, which in the ideal case accompanies software development like the proverbial “red thread”. In this context, Fraunhofer IESE is working on the following main topics, with an orientation towards practical application:

- **Usability from scratch** is ensured by eliciting necessary usability properties in the same way as the functional requirements and maintaining them throughout the process.
- **Non-functional system characteristics** such as efficiency, security and safety, or maintainability can be defined completely and measurably with the help of experience-based models.
- **Incremental Requirements Engineering** takes into account future developments and adaptations of software products by integrating itself into the development process together with change management aspects.
- **Requirements Engineering for product lines** saves time and money during the development of complete software families, since the requirements on commonalities and variants are considered right from the start of the development process and remain valid across the entire product line.
- **Precise specifications of system requirements** as the basis for quality assurance and reliability statements.

## Competence in Software and Systems Engineering

By combining new software engineering methods, respectively such methods that were further developed or adapted upon a customer’s request, in an engineering-style manner, the synergies created by the different processes can be used optimally:

- **Business processes as the starting point:** Regarding its functionality, software must take its orientation from the business processes that are to be supported by it. Thus it appears reasonable to use business process modeling processes in Requirements Engineering. Empirical studies prove the benefits of this procedure.
- **Usability as the goal of construction:** Precise requirements specification and systematic derivation of the navigation paths and interactions lead to software that fulfills the demands of the user, including usability aspects.
- **Software product lines as the basic concept:** Scoping and modeling of variants of a software family in the context of Requirements Engineering result in the rational and consistent design of a product line.
- **Custom-tailored methods as the recipe for success:** Requirements Engineering that is to be suitable in practice is no product to be bought off the rack. An organization’s culture as well as the internal structures of a software developing company are two of many factors that must be taken into account when designing the “ideal” requirements process.





**Products and Services**

Software and Systems Engineering is the key to winning a competitive edge in a hard-fought market. Fraunhofer IESE helps to optimize development processes and increase product variety while assuring quality at the same time:

- **Definition and adaptation to the requirements processes and documents:** The Requirements Engineering processes must live up to the respective situation in the company in order to support and not obstruct the development process. Company- and project-specific adaptation of requirements processes and documents is therefore one of the most important services we offer in this area.
- **NFR identification and specifications that can be validated:** Non-Functional Requirements (NFR) are just as important for the quality of a software system as its functionality. Fraunhofer IESE identifies these requirements early on and anchors them in the development process.
- **Usability checks:** The most modern usability analysis and evaluation processes permit solid evaluation of a system’s usability. Tests performed by Fraunhofer IESE throughout the entire process reveal defects early on and allow their cost-efficient elimination.
- **Usability by construction:** Fraunhofer IESE offers an integrated procedure that already takes usability aspects into account during requirements definition. Through consistent task orientation and the use of usability patterns, usable systems are developed in a particularly cost-efficient way.
- **Scoping of product lines:** Product lines allow efficient software development – provided that the requirements process reliably identifies the functional areas that are relevant for the entire software family. Fraunhofer IESE stands for highly profitable product line technology from the requirements to the finished system.
- **Training sessions, coachings, and more:** The spectrum of services offered by Fraunhofer IESE ranges from training sessions in the area of requirements and usability via stakeholder workshops held prior to the development and creativity workshops for finding ideas to coaching during requirements definition in concrete projects and introduction of innovative technologies.

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# PRODUCT LINE ARCHITECTURES (PLA)

## Custom-Tailored Software

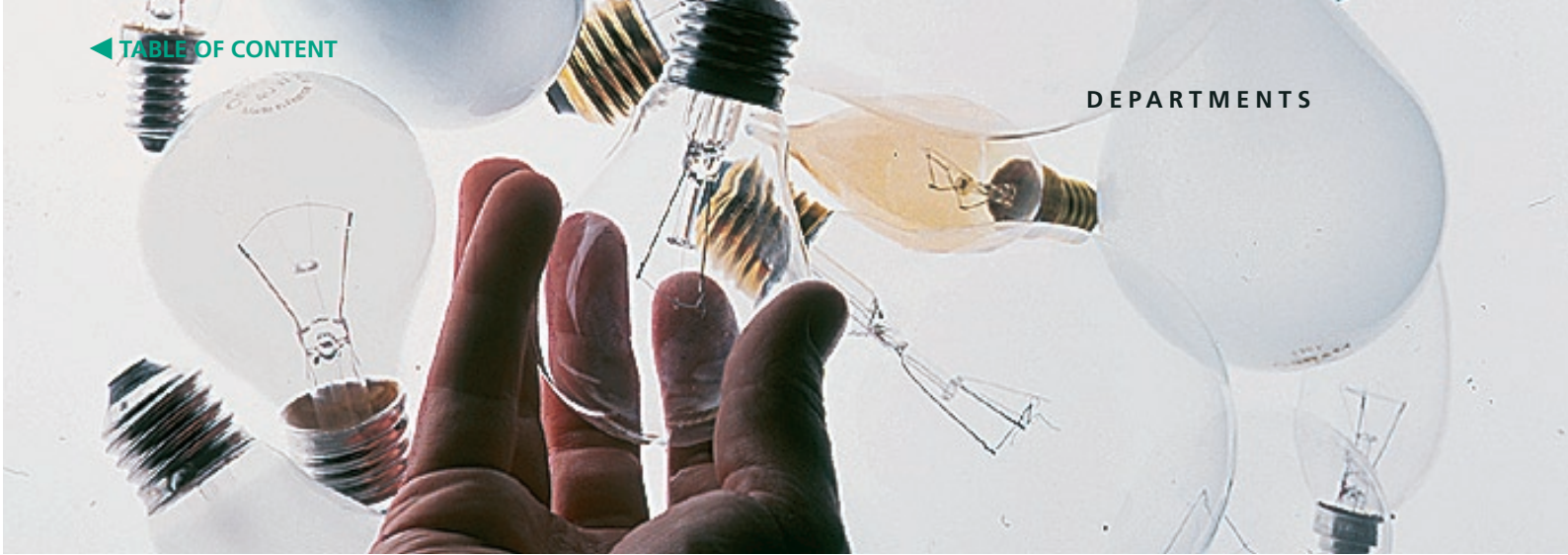
Architectures are the engineering-style blueprints of modern software-based systems. Especially in the case of complex software systems, the underlying architecture is of particular significance; software families can be developed with high efficiency via a product line approach anchored in the architecture and through consistent reuse of already developed artifacts. In order for the practical benefits of product line architectures to take full effect, fundamental advance considerations and goal-oriented accompaniment of the entire development project are necessary. In this context, Fraunhofer IESE is working on the following main topics, with an orientation towards practical application:

- **Development and maintenance of product lines** includes taking into consideration market and customer demands as well as reacting to changes through adaptation of a product line architecture and thus all products derived from it.
- **Architectural patterns and styles** must be flexible enough to already permit tomorrow's product variants today. Suitable processes give preference to the measurable and predictable flexibility of a selected approach over subjective impressions.
- **Systematic variability management** is a central aspect within each product line architecture, since single artifacts of a product line may differ in more or less details. Holistic methods and tool-supported processes provide overview, consistency, and easy adaptability during the development and operation of product line-based software systems.
- **Quality and reuse** are no contradiction if the quality management strategies and techniques used during development are accurately adapted to the product line approach that is being used. Suitable evaluation processes and prediction models capture all characteristics of the system.

## Competence in Software and Systems Engineering

The strength of Fraunhofer IESE's software engineering research lies especially in the engineering-style combination of new software engineering methods, respectively such methods that were further developed or adapted upon a customer's request. Thus, the synergies created by the different processes can be used optimally for developing variant-rich software product families in a cost-efficient and time-saving manner through the use of a consistent product line approach:

- **Definition of product line approaches:** Successful product line engineering is always fundamentally anchored in the respective development organization. Factors such as established practices in an organization, existing organizational structures, or the specific characteristics of the intended product line must be taken into account when creating a custom-tailored solution.
- **Definition and documentation of product line architectures:** Systematic considerations regarding the architecture of a software system on the basis of product lines and their complete documentation cover a major industrial demand for functionality, adaptability, and maintainability.
- **Production-integrated migration support:** By performing integrated, step-wise migration to product line development, advance projects such as feasibility or profitability analyses, or the design of processes for component reuse, take place successively during the course of the development while new products are being developed continuously.
- **Architecture evaluation:** The evaluation of the architectures of existing software-based systems of all kinds under requirements aspects and with regard to customer wishes contributes to a large extent to generating systematic improvement measures.



**Products and Services**

Software and Systems Engineering is the key to gaining a competitive edge in a hard-fought market. The universal methodology offered by Fraunhofer IESE for high-performance system architectures and extremely efficient product development is **PuLSE® – Product Line Software and Systems Engineering**. With PuLSE®, the development of variant-rich software-based system families is possible without interruption of ongoing development, through a multitude of integrated, highly performant features:

- **Advance analyses and goal definition:** The prerequisite for the successful introduction of a product line are various kinds of preparations that can be integrated directly into the production operation with the help of PuLSE® and thus already benefit the ongoing system development. Fraunhofer IESE accompanies system developers in such matters as determination of the usage scenario, identification of commonalities and differences of the intended product variants, or analysis of the change quota during the course of the development process. Additional support is provided by Fraunhofer IESE in the precise definition of goals and the measurement-based calculation of potential improvements.
- **Support for design, migration, and usage:** Comprehensive support is offered by Fraunhofer IESE, from the initial idea via introduction to the company to the daily use of product lines in industrial software and system development. General architecture design and implementation support, variability management, and product line maintenance are part of the range of services offered by Fraunhofer IESE, as are strategies for the step-wise introduction of product-line-based development processes or the optimization of existing development and implementation processes with the use of product line architectures.
- **Success analyses and quality models:** Even what is tried and tested can be improved – for instance, on the basis of organizational experience knowledge that is systematically gathered and packaged. When it comes to design, realization, and documentation, Fraunhofer IESE is the reliable partner for all issues involving evaluation or quantitative analysis of architectures aimed at sustainable improvement of development processes and products.
- **Technology assessment and selection:** Which of the numerous technologies is the right one for a specific system development project? Together with its customers from industry, Fraunhofer IESE analyzes their particular situation under architecture aspects and supports them in selecting suitable modeling and implementation techniques and tools with regard to the best possible use of product line technology.

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# COMPONENT ENGINEERING (CE)

## Motivation

Embedded systems surround us in many areas of our daily lives. They take over ever more complex tasks – mostly due to the intensive use of software. For example, already today, 80% of the innovations found in the automotive industry can only be realized through the use of software.

In addition to the system functionality itself, non-functional characteristics, in particular – such as reliability or resource consumption – sometimes still present unresolved problems. Engineers from all domains are called upon to consider non-functional characteristics during model-based development. This is especially true in the context of the transition from separate development of hardware and software components to integrated development of entire systems.

## Vision

No two embedded systems are alike – therefore, we do not strive for a universal approach to development, but rather develop customized concepts. In doing so, we take into account all domain-specific requirements on the future products as well as development methods and tools that already exist in an organization's environment. Together with model-based development approaches, this makes it possible to efficiently develop complex overall systems with special consideration of non-functional characteristics.

Under the aspect of “virtual development” of embedded systems, methods emerge for the formal modeling of the overall system. These methods do not only allow detailed analyses and simulations of functional system characteristics right from the early development phases, but also, first and foremost, of non-functional ones.

## Competencies

We support application partners from various domains in developing high-quality embedded systems in a cost-efficient manner. Our range of offers includes:

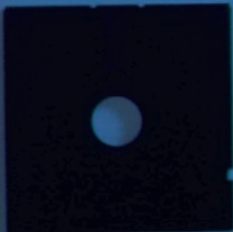
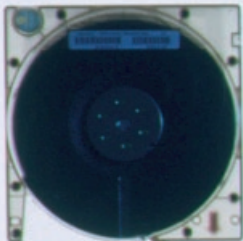
- **Domain-specific component systems:** By adapting component systems and modeling languages to the respective application domain, individual building block systems are created that can be integrated seamlessly with existing methods and tools. In practice, the overall result is higher system quality, reduced development times, and lower development costs.
- **Tool-supported quality assurance of models:** Using our tool INProVE (“Indicator-based Non-functional Property-Oriented Evaluation and Evolution of Software Design Models”), we perform fully automated analyses of design models. Together with our partners’ specialists, we configure application-specific quality indicators that enable an efficient analysis of non-functional characteristics and preserve existing expert knowledge in a sustainable manner.
- **Safety engineering:** Safety and reliability cannot be “tested into” embedded systems after they have been developed. Therefore, we support our partners with methods and techniques for the development of provably safe and reliable systems.
- **Quality assurance at run-time through dynamic adaptation:** Many embedded systems must detect defects at run-time and compensate for them at that time. We support our partners in the engineering-style development of innovative defect treatment mechanisms as a cost-efficient alternative to expensive redundancies in safety-critical applications.

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*Dr. Mario Trapp*



# QUALITY MANAGEMENT DIVISION

The division **Quality Management** offers innovative and proven techniques for achieving and ensuring quality and safety goals in the development of software, systems, and infrastructures. We support companies and organizations in determining quality goals, in the subsequent planning of measures to achieve quality, as well as in the introduction and continuous optimization of these measures in practice. For this purpose, an appropriate quality strategy is derived from an organization's business goals.

The scientific focus of Fraunhofer IESE in the area of Quality Management is on applying a combination of constructively foresighted techniques and analytical checking techniques that is optimized both in an economical sense and in a quality-oriented sense, as well as on the necessary organizational means. Special consideration is given to the cause and effect chain between development processes and the resulting product quality. The processes used are based on proven engineering principles and are customized to the specific constraints of the respective application domains (especially automotive and transportations systems, telecommunications, software for critical systems). Systematic measurement processes support concentration on relevant measurements and permit exact data analyses with regard to business, project, and improvement goals.

Currently, research is being done regarding the adaptation and testing of novel approaches to challenges and trends in software and systems engineering. These include quality assurance in heterogeneous systems (consisting of software, mechanical parts, electrical parts, etc.), globally distributed development, the development of complex "systems of systems", the development of highly adaptive systems, as well as the protection of critical infrastructures from far-reaching damages caused by external and internal influences.

As an independent supplier of professional software quality management and software testing procedures, Fraunhofer IESE offers services and techniques in the areas of **processes and measurement, testing and inspections**, as well as **security and safety**.

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*Dr. Jürgen Münch*

# PROCESSES AND MEASUREMENT (PAM)

## Motivation

Software-intensive systems and services are taking over ever more tasks today and make sure that equipment and facilities function smoothly and safely. In order to develop these systems and services in accordance with given requirements, on time, and in a cost-efficient way, the use of engineering-style processes is indispensable. These include establishing efficient development processes, checking their effectiveness, and continually optimizing the processes.

In this context, the empirical approach pursued by Fraunhofer IESE is particularly important. It provides measurable evidence of the added value of innovative development processes and enables their adaptation to different business goals and constraints. With the objective of achieving higher product quality, cost savings, and faster time to market, Fraunhofer IESE is working on the following main topics, with an orientation towards practical application:

- **Measurement systems and prediction models** bring transparency to IT development, so that potential problems can be detected early on, risks can be minimized, and the quality of products and processes can be improved in a sustainable manner.
- **Process management and process evolution** are the basis for the definition, introduction, and continuous optimization of development processes.
- **Process and product assessments** analyze development processes and products in terms of their strengths and improvement potentials or in terms of their conformity to standards, thus providing the basis for solid decision-making and the implementation of improvement measures.

## Vision

We support companies and organizations in determining quality goals, in subsequently planning measures to achieve quality, as well as in introducing and continuously optimizing these measures in practice. This is done by deriving an adequate quality strategy from an organization's business goals.

The scientific focus of Fraunhofer IESE in the area of processes and measurement is the development of empirically proven techniques, methods, and tools aimed at ensuring the quality and maturity of development processes and, in particular, at sustainably improving those processes and technologies that deal with quality control. Here, special consideration is given to the causal chain between development processes and the resulting product quality. Systematic measurement processes provide support for focusing on relevant measurement data and permit data analyses regarding business, project, and improvement goals.

Current research deals with the adaptation and testing of novel approaches for meeting challenges and trends in software and systems engineering. These include how to ensure quality when different disciplines interact in globally distributed development as well as how to control business goals and IT strategies by means of quantitative measurement processes.





### Competencies

The strength of Fraunhofer IESE lies especially in the engineering-style combination of new software engineering methods, respectively methods developed or adapted upon a customer's request. This enables optimal use of the synergies between different processes. Software and Systems Engineering is one key to gaining a competitive edge in a hard-fought market. Fraunhofer IESE develops and evaluates custom-tailored solutions for optimal software and systems development processes that meet the highest demands in terms of efficiency, documentability, and conformity to standards, and that can be flexibly adapted to new requirements:

- **Goal-oriented measurement:** Customized measurement systems make it possible to focus on relevant measurement data, select suitable measurement processes, minimize data elicitation costs, and provide a quantitative orientation towards business, project, and improvement goals. Regardless of whether your organization is looking for a measurement system based on the well-established GQM approach, business IT alignment with the GQM+Strategies® method, or benchmarking: Fraunhofer IESE is your competent partner in all issues regarding empirical process monitoring.
- **Quantitative control:** Fraunhofer IESE provides support for companies of any size in defining and introducing a comprehensive quality assurance strategy for system development, e.g., on the basis of defect flow models, prediction models for process and product characteristics, or project control centers for the quantitative control of development projects.
- **Domain-specific quality models:** Every software or system development project has specific quality requirements that depend on the respective application domain – custom-tailored quality models take this into account.
- **Effort and cost estimation:** For reliable effort and cost estimations, our offers include the experience- and data-supported CoBRA® method and the Function Point method.
- **Process improvement:** Nowadays, industrial software and systems development is usually done in accordance with defined processes, which can be continually optimized by using proven processes in conjunction with innovative approaches. The process experts at Fraunhofer IESE provide assistance in modeling, defining, analyzing, optimizing, and documenting processes, ensure adherence to process standards, and implement continuous improvement programs in a company's practical operations.
- **Process assessments:** What is good about a development process; what could be improved? Tool-supported assessments answer this question, also in accordance with recognized ISO/IEC standards.

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Dr. Jens Heidrich

# TESTING AND INSPECTIONS (TAI)

## Motivation

Software is increasingly permeating more and more areas of our daily lives. For example, software is nowadays contained not only in many control devices in automobiles and medical products, but also in rail traffic control centers, avionic systems, and industrial automation plants. The same can be said for banking and trade systems and many other areas.

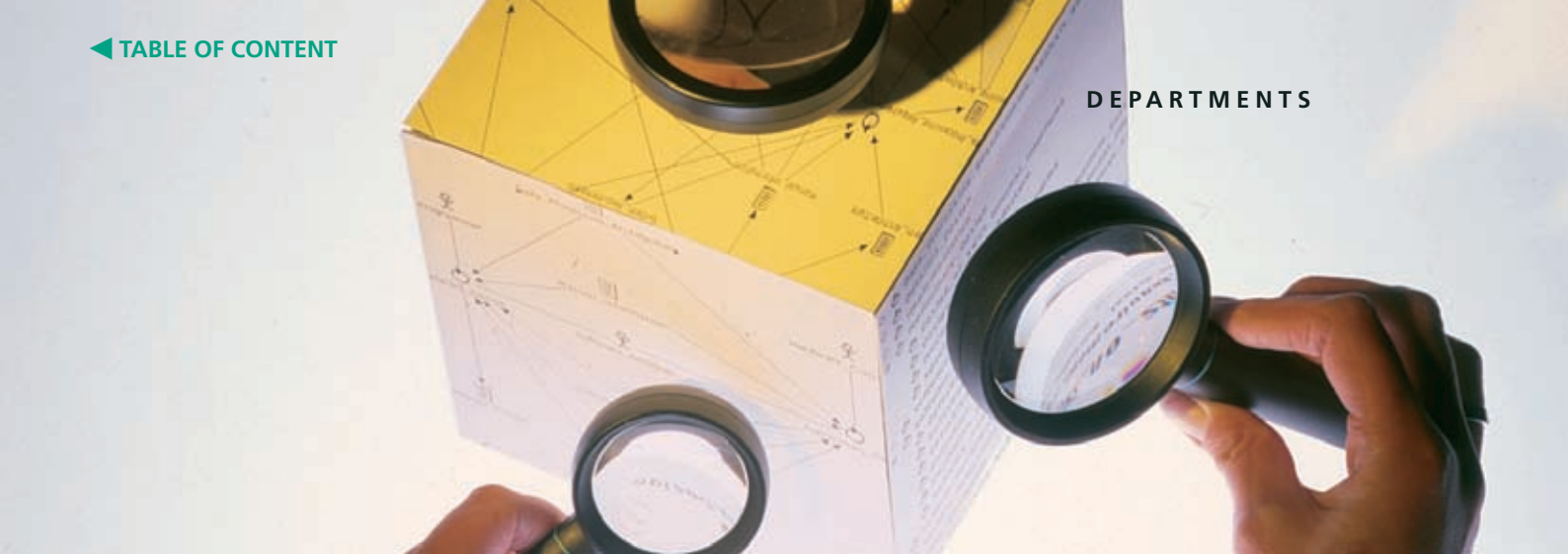
Poor software quality can cause risks and hazards and has a negative impact on user satisfaction. In the worst case, people are severely injured or even killed by faulty software.

Hence, good quality is important for product success. However, software quality is a difficult issue: Neither does “one” software quality exist, nor “one” software product. The quality of software has many facets: Some quality that is important for one product is meaningless for another one.

Quality cannot be ensured by constructive processes and good management alone. It is also necessary to perform analyses in order to check the extent to which the quality goals have actually been fulfilled. Such kinds of measures are often demanded by domain-specific standards.

## Vision

Software quality can only be checked by systematically performing quality assurance measures such as static analyses, testing, and inspections. Get your testing processes assessed by experts from Fraunhofer IESE and learn how good they really are. Or benefit from our competence regarding the introduction of up-to-date, innovative testing technologies. We provide assistance and train your staff. Turn your staff into experts!



**Competencies**

- **Assessment of testing processes:** Our specialists analyze and assess existing testing processes in cooperation with the customer’s staff. On the basis of the results of this assessment, improvement suggestions are developed systematically and their implementation is prepared.
- **Inspections and reviews:** The use of reviews and inspections makes it possible to detect defects and potential problems already during early phases of software and systems development. Our experts introduce structured inspection and review techniques at a customer’s site and use the TAQtIC approach to adapt them to local needs.
- **Introduction of systematic testing processes:** Using the customer’s needs and the requirements of relevant standards as a starting basis, we provide support for the introduction of systematic and individually adapted software testing processes. In addition to training staff in the use of these techniques, we help to set up automated test environments and provide assistance regarding the use of tools.
- **Model-based testing:** Model-based testing processes provide methods for the automated derivation of test cases. This makes it possible that only one test model needs to be managed instead of a whole series of test cases. Fraunhofer IESE offers processes for performing model-based testing on the basis of usage-oriented models or risk-based models.
- **Dependability analyses:** In order to be able to assess the quality of software in a quantitative manner as well, its dependability in real usage can be assessed by means of suitable procedures. For this purpose, we offer procedures that, in addition to the dependability analysis itself, can also assess which influence the individual components have on overall dependability.

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# SECURITY AND SAFETY (SAS)

## Motivation

Software-based systems are making our lives more comfortable and more secure; however, we are becoming ever more dependent on information technology being dependable and trustworthy. Increasing complexity and networking make it more difficult to construct systems that are reliable and safe (safety), while at the same time being resistant against spy and manipulation attempts (security).

In the future, the boundaries between Embedded Systems (ES) and Information Systems (IS) will blur: Modern information infrastructures, for instance in the areas of telematics, energy supply, and medical technology, increasingly integrate ES components, sensors, and actors; viceversa, the proportion of information processing is growing in ES components. Hybrid ES/IS systems provide new challenges for the developers regarding functional safety, information security, and data protection. On the one hand, the development and quality assurance methods must keep up with the systems' increasing size and complexity; on the other hand, ever more diverse safety and security risks to which system users are exposed must be considered.

Safeguarding systems that are unsafe or insecure by construction later on usually requires a disproportionately large amount of effort. The goal is thus to consider safety and security requirements as early as possible during system development in order to systematically construct systems that are secure by design. Since a system's security quality is very difficult to quantify using currently available methods, security is often neglected during development.

Fraunhofer IESE is performing research and developing methods to reliably and economically ensure the safety and security of software-based systems.

## Vision

We develop systematic analysis and construction methods that enable security engineering by design on the basis of measurable security indicators. To make this possible, we identify key attributes of a system architecture, a design, and its implementation, which enable dependable conclusions regarding the resulting security.

We design tools for eliciting such attributes, and we develop constructive methods and guidelines for systematically realizing secure systems in a predictable manner. Modular, composable security mechanisms help to master the increasing complexity of modern systems and development processes and to provide standardized solution patterns for recurring security issues.

We analyze system architectures already during early phases of the development and on high levels of abstraction in order to make it possible to master security concerns even in large, extensive system implementations. We include different development artifacts and business processes in this analysis. Architecture-centric views help us to concentrate the effort for security measures on the major points of the system design.

The combination of analytical and constructive security techniques during early phases of the software and systems development results in a significant reduction in the number of potential security weaknesses. The provable gain in security requires only moderate additional effort.

## Competencies

Fraunhofer IESE supports its customers in improving the reliability, safety, and security of its software systems, applications, and networks:

- **Software security engineering:** Our design and implementation guidelines help our partners to avoid typical errors in security design and to improve the development processes for critical systems with proven security assurance methods. In doing so, we take into account the mandatory security standards of the respective application domain in order to ensure that the development of a system is certifiable.
- **Developer training:** We teach our customers the basics of secure software engineering and assist them in introducing appropriate methods and processes. Fraunhofer IESE is one of the founding members of the International Secure Software Engineering Council (ISSECO), which offers pertinent developer certifications.
- **Product and system assessments:** We analyze algorithms, services, or system solutions, and assess their security characteristics in accordance with customized assessment criteria. For the inspection of software architectures and source code, we design novel tools for the effective detection of security vulnerabilities.
- **Tool-supported security audits for networks and network components:** Our specialists support our customers in designing secure network configurations. Analysis tools developed in-house detect even hidden security leaks in web servers, routers, and firewalls, which are easily overlooked in purely manual procedures, despite high effort.

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*Dr. Reinhard Schwarz*



# COMPETENCE MANAGEMENT DIVISION

The division **Competence Management** develops systems for systematically increasing the knowledge of an organization's employees, for using this knowledge better, and for boosting the company-internal innovation process. The division consists of two departments.

The department **Experience Management** develops systems that identify indispensable experience in an industrial context, especially in terms of construction and production, and make it available in a work-process-oriented manner. Through tight integration of experience management all the way to the semi-automatic application of experience in organizational workflows, an organization's performance (e.g., in terms of product and service quality, response time, uniformity) is increased significantly.

The department **Education and Training** develops methods and content for technology-supported continuing education (incl. e-Learning programs), aimed at providing continuing education to employees either on the job, if possible, or near the job. For this purpose, modern technologies (such as Web 2.0) and state-of-the-art didactical knowledge in continuing education is combined into solutions that efficiently raise the stakeholders' level of knowledge and thus boost innovation processes in an organization.

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*Prof. Dr. Frank Bomarius*

# EXPERIENCE MANAGEMENT (EM)

## Successful by Experience

Experience – both the good and the bad variety – exists in any organization. Experience is knowledge that has been tried and proven in practice, and that is an indispensable tool in a software and system developer's daily work. However, it is not sufficient to make an experience and keep it only in your own mind. Knowledge gained from experience must be stored in a suitable form, must be packaged and made available for use by others in order to be really useful. This is where most deficits can be found in a company's daily operation, since goal-oriented Experience Management (EM) requires careful concepts, a systematic process, and consistent integration into the work processes. With the right processes and tools, it is no problem to support, sometimes even automate the capturing and storing of experience, which is being continuously generated during the workflow anyway. In order to make numerous and possibly very small chunks of experience ("experience packages") available to human use in an unobtrusive fashion, Fraunhofer IESE is working on the following main topics, with an orientation towards practical application:

- **Reuse of experience** helps to avoid the situation that processes that have already been proven in operation are not used due to ignorance - in other words, that the wheel keeps getting re-invented over and over again. Additionally, this prevents the repetition of known errors.
- **Validation of experience** captures the application context of an experience together with information on how this experience has proven itself in practice. This facilitates its application in a new case.
- **Cataloging and archiving** help to maintain an overview of the multitude of smaller experience packages, thus preventing the "treasure trove of experiences" from becoming a useless heap of information in the end.
- **Business management considerations** ensure that experience management in a company is a worthwhile investment into the future, for instance, by focusing on the most relevant core issues and by reducing the costs of capturing experience.

## Competence in Software and Systems Engineering

The strength of Fraunhofer IESE's software engineering research reveals itself especially in the case of experience management systems that are unobtrusively integrated into production:

- **Process and tool integration:** Many practical problems and high effort result from a "side-by-side existence" of system or software development process and experience management. Seamless integration, however, reduces effort, helps maintain the overview, and prevents existing experience from remaining unused. Smart tool support enables necessary experience management steps such as collecting and categorizing experience and making it available in an unobtrusive, yet consistent manner.
- **Scaling and adaptation:** There cannot be one single solution for all application scenarios in experience management, since the requirements of software and system developers on the one hand, and the prerequisites of various development processes for the introduction of methods and tools on the other hand, vary too much. High-quality approaches are therefore characterized by the ability to first start off with less functionality and then extend it incrementally according to the requirements at hand.
- **Model-based development of EM systems** permits performing the requirements analysis and design of an experience management system in less than one tenth of the time required with conventional methods.



- **Measurement programs:** Experience management has to be integrated into the workflow and must be efficiently maintained in order to remain ready for use at any time. Suitable tools automatically collect the measurement data necessary for optimization during use. Thus, nothing stands in the way of technical, resp. economic improvement.

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#### Products and Services

Software and Systems Engineering is one key to gaining a competitive edge in a hard-fought market. Fraunhofer IESE offers a comprehensive range of support to software and system developers for efficiently establishing EM systems and thus to systematically capture, maintain, and profitably use an organization's own experience:

- **Methodological design of EM systems:** Fraunhofer IESE offers all services for the establishment of strongly workflow-integrated experience management systems. Our services range from making a vision a reality in workshops – by designing knowledge models, developing intelligent features, e.g., for information search or for clustering entries, and determining the architecture – to evaluating and maintaining the implemented solution.
- **Experience-based Information Systems (EbIS):** Beyond its purely methodological competence, Fraunhofer IESE realizes entire experience-based information systems on behalf of its customers. To establish them, the institute's own product line INTERESTS is used, which combines complete scalability with the advantage of individually adaptable user interfaces.
- **EM products for SMEs:** Small and medium-sized enterprises benefit from experience captured and delivered at the right time. With Fraunhofer IESE's EM solution MIMIR, which is especially tailored to this type of enterprises, a growing knowledge base for a multitude of applications is being created.
- **Knowledge acquisition:** With the help of Fraunhofer IESE's EM experts, gaining experience becomes simpler and more efficient, e.g., through post-mortem analyses for capturing experience from past events. The goal is to automate knowledge acquisition as much as possible.
- **Training sessions and workshops:** In the Knowledge Management seminar, practitioners from industry and service domains learn from Fraunhofer IESE's EM specialists how to recognize, package, and use their company's knowledge.



*Dr. Martin Wessner*

# EDUCATION AND TRAINING (EAT)

## Motivation

In its research projects, Fraunhofer IESE develops innovative knowledge regarding software development methods and processes. One central issue of applied research is the packaging and dissemination of the knowledge gained, so that industry and practical application areas can benefit from it. Building up and developing software engineering competence is essential in many branches of industry, since there are more and more industries where software quality and functionality have an impact on product quality.

For the knowledge transfer from research into practice to be successful, Fraunhofer IESE develops, tests, and evaluates needs-oriented and systematic qualification solutions for software engineering professionals. These center on approaches that enable real-time, flexible, workflow-integrated, and technology-supported learning. The goal is to be able to make the necessary knowledge available in the optimal form in the right place at the right time – as a service in proven Fraunhofer quality.

Our knowledge regarding the design, organization, and execution of qualification measures also forms the core of our research focus “Technology-supported Learning”. Individuals, groups, and networks receive support in innovative technical learning environments to enable them to reach their learning goals. In addition to solutions for software engineering professionals, our research projects also address target groups with special needs, such as older users. Competence is built up on several levels: cognitive knowledge, action and process knowledge for dealing with work and everyday knowledge, as well as motor skills and talents. The goal is to make optimal use of the technological potential of learning and assistance systems with the help of our knowledge regarding software engineering processes and methods.

## Vision

In cooperation with experts from other departments of Fraunhofer IESE, the department Education and Training develops single-day workshops, multi-day intensive training courses, and certification seminars to facilitate the transfer of research results and practical experience to companies. All qualification offers are characterized by a large proportion of examples, exercises, and interaction with the participants. Classical classroom training can be combined with online formats such as vodcasts, webinars, digital tool seminars, and expert chats. Company-specific interests are covered in the most effective and cost-efficient way via customized in-house trainings.

In the near future, research in the area of “Technology-supported Learning” will have to deal with ever more varied forms of learning in all areas of daily life. Media and technology influence our work and life processes. In learning and media worlds that are no longer constrained by boundaries, everybody is learning all the time. The identification of learning opportunities and learning needs is a first step towards the development of innovative learning technologies. This is followed in a second and third step by the extension and adaptation of interfaces and end devices for learning purposes. The engineering competencies of Fraunhofer IESE are used for developing platforms, user interfaces, and interaction media; our experience in media didactics is the basis for the instructional design of the learning applications. Mobile end devices, ambient sensors, and self-learning systems form the basis for user-adaptive solutions.

## Competencies

### ■ Needs and Potentials Analysis

On behalf of our customers, we determine the concrete qualification needs as well as existing employee competencies and create a baseline of existing qualification measures.

### ■ Design of Qualification Solutions

Using either our own needs analysis or one defined by our customer, we design qualification measures that suit the customer's goals and organizational constraints (place, time, budget, number of participants).

### ■ Conception and Design of Technical Learning Environments

Depending on the required learning situation (e.g., goal, availability, content) and the needs of the target group, we create learning environments by designing learning contents, learning interfaces, as well as input and output devices.

### ■ Evaluation of Qualification Programs and Technical Learning Environments

In order to check whether learning goals, respectively competence development goals, are being achieved, we use our methodological knowledge in the area of formative and summative evaluation. Evaluation serves for controlling processes (formative) as well as for checking the effects of the final result (summative). In the area of services, quantitative and qualitative measurement processes are mainly used for providing quality assurance for continuing education and training. In research projects, the effects of novel learning solutions are measured in terms of usage, motivation, goal achievement, and sustainability.

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## IESE Academy

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# AUTOMOTIVE AND TRANSPORTATION SYSTEMS

## **Software Technology for a World in Motion**

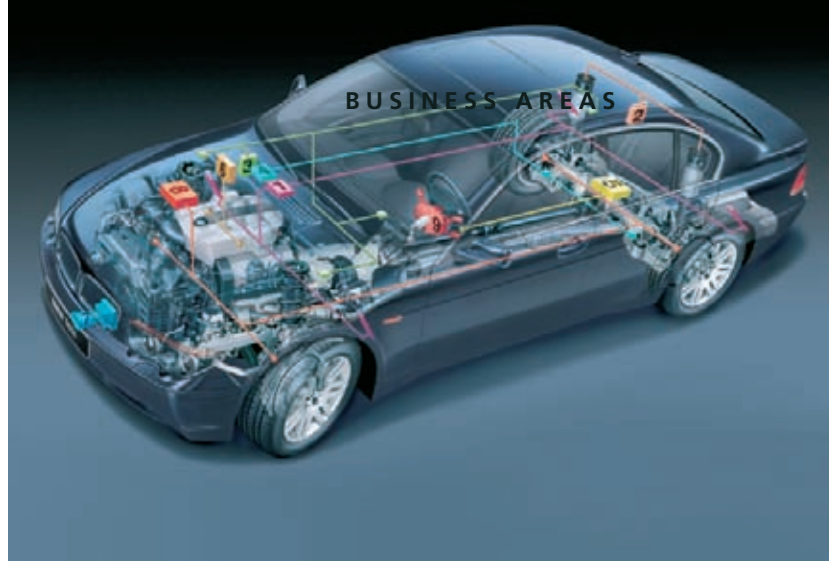
Modern technologies for electromobility as well as for increasing safety or comfort cannot be realized without electronics and software. The business area “Automotive and Transportation Systems” especially aims at manufacturers and users of embedded systems, primarily in automotive and rail technology as well as aerospace. Automotive Software Engineering comprises processes, techniques, methods, and tools adapted specifically to the requirements of the automotive industry.

Automotive Software Engineering defines a holistic approach that includes all development activities, starting from automobile-specific process models on the basis of established standards (ISO/IEC 12207, ISO 26262) and the use of maturity level models (ISO/IEC 15504, Automotive SPICE, CMMI). Product planning is supported through product line engineering and architecture standards (keyword: AUTOSAR), which take into account possible variants as well as technology and market requirements.

Special tasks such as the configuration of a tool chain, the integration of security and safety, the evaluation of software product qualities (ISO/IEC 9126), as well as systematic technology transfer for individual process steps are solved by Fraunhofer IESE.

### **Customer Benefits:**

- Competitive development productivity
- Adherence to quality requirements
- Provable process and product qualities
- Flexible variant management



## Competence in Software and Systems Engineering

Fraunhofer IESE accompanies the manufacturers and users, resp. integrators, of embedded systems for automotive and transportation systems during all phases of software and system development.

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### Automotive Software Development

#### Requirements Management

We help you to plan, structure, and design your specifications, as well as to administer extensive specifications in tools such as DOORS™.

#### Requirements Analysis, Specification-based Quality Assurance

We support you in implementing inspection processes and sequence-based analysis or formal model checking in your organization in a profitable manner.

#### Software Product Lines

We endorse you in adapting software architectures to efficient reuse for different product variants while taking advantage of cost- and quality-relevant effects.

#### Component Design

We back you up in designing your components and show you how to use modern designs and languages such as UML for developing memory- and runtime-optimized software.

### Software Quality Management

#### Software Architecture Evaluation and Restructuring

We support you in evaluating and restructuring your software architecture, taking into account special constraints such as runtime behavior or memory requirements.

#### Checking Techniques for Requirements, Design and Code

Software can already be checked before testing: semi-automatically with the appropriate models (such as state machines) or through structured reviews (software inspections).

#### Software Measurement Systems

We make software quality measurable quantitatively with systematically derived metrics.

#### Cost Estimation

We show you how development expenditures can be estimated with certainty and how risks can be made visible.

#### Security Analysis

We perform well-founded security analyses for software and support you in avoiding weak points (security engineering).

#### Safety Analyses

We design safety analyses for software systems for you that must, for example, fulfill certain SIL levels of ISO/IEC 61508 or ISO 26262, or we provide support.

#### Testing and Test Automation

Many tests can be generated in an automated manner for regression tests. We provide support in designing and implementing suitable concepts such as model-based testing or SIL/MIL/HIL tests.

#### Testing of Distributed Systems

The testing and diagnosis of distributed systems constitute a special challenge. We support you in modeling and planning test processes, in developing test cases, and in evaluating system quality.



Ralf Kalmar

# HEALTH CARE AND MEDICAL SYSTEMS

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## Software-based Systems for Health and Quality of Life

The domain of medical systems faces particular challenges: The market demands innovative products in less and less time, which constantly increases the complexity and networking of the systems. Yet, absolute reliability and safety of the systems and the (embedded) software are required. There is hardly any other area of our daily lives where computer technology is so close to humans, and consequently, mistakes can have very serious effects.

Our software and systems engineering approach supports you all the way from the elicitation of requirements on the medical product to validation. Together with our customers, we develop innovative solutions for software development that efficiently fulfill the requirements of IEC 62304, DIN EN 60601-1-4, and ISO 12207, and provide assistance in systematically implementing them in daily practice. We integrate future-oriented methods and techniques that ensure quality requirements (e.g., in accordance with ISO/IEC9126) efficiently and economically. Safety is the top priority in this respect. We use new methods to support you in performing risk management according to ISO 14971 for software, and to use techniques such as Failure Mode and Effects Analyses (FMEA) and Fault Tree Analyses (FTA) for analyzing software safety. Custom-tailored quality management approaches (e.g., similar to ISO 13485) are defined as supporting processes.

### Your benefits:

- Higher safety of the software and thus of the medical products
- More efficient development and faster time to market
- Reduction of the development and quality assurance costs
- Measurable quality





## Competence in Software and Systems Engineering

Fraunhofer IESE provides support for manufacturers of medical systems during all phases of software and system development.

### Software Development

#### Requirements Management

Domain standards such as IEC 62304 require an appropriate design of requirements and specification documents during development. We support you in eliciting requirements and in developing suitable requirements specifications as well as in managing the requirements.

#### Usability Engineering

With our approach Usable Software Products Based on Innovative Requirements Engineering, we support you in ensuring that usability is considered during development, and in integrating it into the software and systems lifecycle.

#### System and Software Architectures

We support you in the specification and implementation of future-oriented architectures and in the evaluation and re-structuring of your existing software architecture, taking into account special constraints such as runtime behavior or memory requirements.

#### Software Product Lines and Reuse

Systematic reuse, for example in the form of software product lines, helps to decrease a product's time to market. With our PuLSE® approach, we support you in defining and introducing the idea of software product lines, and in defining suitable and safe reuse concepts.

### Software Quality Management

#### Risk Management

Standards demand a lifecycle-wide risk management process, especially also for software. We support you in the standard-conformant implementation of ISO 14971 requirements by defining and implementing a risk management process for software and the corresponding documentation that is adapted to your context.

### Safety Analyses

We support you in selecting and using adapted techniques such as FMEA, FTA, or more recent processes such as component fault trees. In particular, we make these processes applicable to software in medical devices.

### Development Processes

We support you in the standard-conformant definition (e.g., IEC 62304, ISO 12207, V-Modell), structuring, documentation, and implementation of development processes and in the selection of methods, tools, and techniques that are suitable for passing certification procedures.

### Static Quality Checking Techniques

Together with you, we define appropriate and innovative processes for verification in parallel to development.

### Testing of Distributed Systems

We support you in modeling and planning test processes, in developing test cases, and in evaluating system quality.

### Model-based Testing and Test Automation

We support you in the design and introduction of model-based testing techniques for embedded software, focusing in particular on test automation aspects.

### Quality Management

We support you in defining, structuring, and establishing a standard-conformant quality management system for your software development in the style of standards such as ISO 9000-3 or ISO 13485, or the FDA Quality System.

### Software Measurement Systems

Through the use of defined metrics, which we derive in a systematic manner adapted to your demands, quality aspects can be expressed in concrete statements.

# INFORMATION SYSTEMS

## Finance – Software – Defense

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*Michael Ochs*

### Software in the Age of Information

Information systems permeate our daily lives in many areas. Especially in the areas of eCom-merce and eBusiness, we carry out many everyday tasks using online shops, auction platforms, or online banking systems. Company-internal information systems, in particular, such as ERP, CRM or ICIS support and automate business processes and thus perform thousands to millions of transactions each day. Neither operators nor users pay much attention to the technology of these highly complex software-based systems and their multiple interactions, and yet, modern business life is simply inconceivable without functional, secure, and user-friendly software operating in the background. The use of potentials for increasing efficiency and quality in the development and operation of information systems helps to optimize business processes in a sustainable and cost-efficient manner. Information systems are also used in various scenarios in the military sector, for situational assessment, troop control, or fire control. Here, efficiency and quality are also important – even vital.

If information systems work without glitches, their benefit is obvious. If, however, even minor malfunctions may cause major effects and if the systems to be designed are very complex, the only option is to employ engineering-style methods. Otherwise, the risk of major financial losses, incalculable legal consequences, or long-term loss of trust or image is too great – for example, if bank transfers are misrouted, if business-critical or personal data are compromised, or if highly critical operational information does not arrive on time at the required location during military missions.

#### Your benefits:

- Competitive productivity and quality for your IT
- Optimized, manageable and risk-minimizing IT- and software processes
- Verifiable product quality
- Manageable complexity and variants



## Competence in Software and Systems Engineering

Consistent and efficient processes are characteristic of our institute's work, which transfers state-of-the-art scientific findings into a company's practical operations in combination with best practices – ready for the future.

### Software Development

#### Software Product Lines

help to increase product variety while saving resources through consistent reuse at the same time, and rationalize development processes while maintaining constant quality. **With PuLSE® – Product Line Software Engineering**, our customers get brand quality when it comes to designing product lines and profit from lower costs per unit and faster time to market for new products.

#### Requirements and Usability Engineering

ensures that a system demonstrably fulfills a predetermined performance claim of all non-functional properties and is easy to use.

#### Architecture Evaluation

of all kinds of existing software-based systems under requirements aspects and with regard to customer wishes is a major contribution towards generating systematic improvement measures.

#### Requirements Engineering

made simple with Usable Software Products Based on Innovative Requirements Engineering. This user-focused process integrates the demands and organizational goals of industrial customers with the lowest possible effort.

#### Blended Learning

teaches software and system development decision makers and practitioners everything about topics such as the Unified Modeling Language in on-line and face-to-face courses accompanied by coaching in concrete projects. Here, first-hand know-how serves to build the foundation for a company's ability to develop its own systems in an engineering-style manner.

### Software Quality Management

#### Examination of software development and IT operations processes

in order to identify the strengths and weaknesses of such processes, which leads to accurate identification of an organization's improvement potentials. Fraunhofer IESE uses international standards such as CMMI®, ISO 15504/SPICE, V-Modell® XT, or ITILv3 as basis for such analyses and audits.

#### Continuous testing procedures and systematic inspections

integrate the mandatory quality assurance into the running development process. There are significant cost benefits compared to performing quality assurance at the end of system development, due to early elimination of defects and optimized processes.

#### Management of third-party software procurement,

which can be provided either via development through subcontractors or through Commercial-off-the-Shelf products. Both ways entail risks – we minimize these risks inherent in purchasing and subcontracting along the respective process chain.

#### Fraunhofer IESE's tool-supported processes

for checking active network components, for example **CROCODILE®**, the Cisco Router Configuration Diligent Evaluator, detect even hidden security leaks, which would not be found with a purely manual process, despite high effort.

#### Improvement programs

based on measurement data enable optimization steps in development processes on the basis of empirical findings. Thus, even such aspects as the efficiency and acceptance of methods – which are normally hard to quantify – can be captured and evaluated objectively.

# eGOVERNMENT

## **eGovernment Solutions for Public Sector and Business**

The public sector with its more than four million employees represents one of the largest “business sectors” in Germany. It has to balance regulatory constraints, economic feasibility, and quality of service for its customers. Whether new IT solutions meet with success depends most of all on how well the public sector, business, government, and IT collaborate.

Whereas during the early years of eGovernment, the citizen as a customer of the public sector was the main focus of developments, recent years have seen a growing shift of this focus towards the interface between the public sector and business. This is where the highest gains in efficiency are expected.

ROI analyses performed prior to implementation projects ensure a project’s return on investment. Using systematic and integrated requirements management and involving all stakeholders early on creates the prerequisites for high acceptance of a system. The adaption of the process model V-Modell® XT to a development organization and support for a standard-conformant process ensure that projects are performed efficiently. Service-oriented, standards-based architectures allow the integration of legacy systems and guarantee reuse and interoperability.

### **Your benefits:**

- Needs-oriented and secure software systems
- Implementation of eGovernment strategies on the basis of empirically determined priorities
- Asset protection through future-proof, interoperable technologies
- Transparent design and development decisions

## **Competencies in Systems Engineering**

Fraunhofer IESE assists partners from all levels of government and public institutions on their way to becoming a high-performance service provider for business and citizens. It provides advice to the public sector and to business on how to optimize their joint business processes, focusing on proving the benefits for the user. Concentrating on selected business sectors allows responding to their specific requirements and bundling online services in a way that is appropriate for each sector. A wide range of services provides support in planning and realizing needs- and future-oriented eGovernment solutions.



### ROI Analyses

With the use of the screening method developed at Fraunhofer IESE, we support you in identifying, evaluating, and prioritizing process chains between business and the public sector. Extended ROI analyses permit assessing the return on investment of an IT project. Effort estimates performed prior to development projects provide the basis for deciding whether to develop on one's own or join a development alliance.

### Needs Analyses and Subcontractor Support

How well a system is oriented towards the demands of the user is a decisive prerequisite for how well it will be accepted later on. We support you in eliciting these demands by involving all stakeholders and in formulating the functional and non-functional system requirements. Based on these requirements, we develop bidding documents and provide support during the subcontractor process (esp. in accordance with the UFAB regulation).

### Adaptation and Use of the V-Modell® XT

Applying the V-Modell® XT, which was developed with the participation of Fraunhofer IESE, increases the quality of project results while minimizing project costs and risks. We support you in successfully planning and performing projects in accordance with the V-Modell® XT. This also includes the adaptation of the V-Modell® XT to the specifics of your software development organization.

### System and Software Architectures

The use of open standards in the context of Service-oriented Architectures (SOA) ensures the interoperability of your systems. We support you in designing and implementing future-oriented architectures and in evaluating and restructuring your existing software architecture. We develop organization-specific concepts for the introduction and operation of SOA.

### Security

We support you in designing secure software systems, in checking system security in terms of conformity with BSI basic IT protection, and in planning and checking secure IT infrastructures, e.g., by simulating system attacks.

### Usability

Deficiency analyses of your user interfaces based on known usability problems and pilot tests with users from representative user groups permit us to provide a solid empirical assessment of usability. Tests in our "Assisted Living Laboratory" allow us to evaluate the suitability of a given system especially for elderly people.

### Qualification

The introduction of a new system or of new processes always entails comprehensive and sustained qualification for an organization's employees. With the development and introduction of eLearning programs and with the establishment of organizational knowledge and experience management, we create the prerequisites for successfully employing eGovernment solutions.

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 (since December 2009)*



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# JOHN DEERE – HIGH-TECH IN THE COMMERCIAL VEHICLE INDUSTRY

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In modern agricultural technology, products without a substantial proportion of software are no longer conceivable. Current agricultural machinery in general and tractors in particular are usually equipped with a multitude of electronic control devices that take over tasks ranging from engine control via safety-relevant functions to networked agricultural applications. In modern tractors, many of the operating elements that used to be purely mechanical have been replaced by interactive, graphical displays.

The development of such displays, which in the case of John Deere takes place in Zweibrücken and now also in Kaiserslautern, among other places, entails two different kinds of challenges: Since the displays must take over ever more complex tasks, the complexity of the software to be developed for these purposes also increases. In addition, a series of display variants must be developed for different types of agricultural machinery and different applications. This means that certain parts of the software must be developed and subjected to quality assurance differently depending on the product, which results in increased effort, particularly in terms of maintenance and further development.

In the context of the innovation cluster “Digital Commercial Vehicle Technology” (DNT), John Deere is therefore collaborating closely with the researchers of Fraunhofer IESE, and in doing so, using the benefits offered by the cluster in several ways: As far as content goes, the focus of the cluster is equally divided among the areas of basic research, method development, and application projects. As a strategic partner, John Deere thus does not only make use of the research results of the commercial vehicle cluster regarding customer-specific application projects, but is also able to influence basic research and method development in such a way that, to the highest degree possible, the research results will fit the issues that are relevant for John Deere.

In the context of the innovation cluster DNT, the challenges offered by the diversity of variants and the increasing complexity of software were addressed in an application project where the researchers of Fraunhofer IESE and their colleagues from John Deere jointly analyzed the software of modern display systems in terms of their architectures. The methods, techniques, and tools used in this project were developed at Fraunhofer IESE. The analyses made it possible to derive improvement measures based on which both the complexity and the diversity of variants can be managed. John Deere was able to incrementally address the derived improvement measures with the aid of Fraunhofer tools.

## Collaboration Partner

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# D-MINT – MODEL-BASED TESTING OF SOFTWARE-INTENSIVE SYSTEMS

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## Further Information

The D-MINT Project  
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Along with the advance of software-intensive systems into more and more areas of our society, the requirements on the functionality of these systems keep growing. Increasing requirements imply growing complexity of these systems, which, in turn, puts pressure on the development schedule and increases error-proneness. In order to remain competitive, high-performance and cost-efficient technologies must be used for development and testing. Model-based test technologies promise to deliver higher performance and more possibilities for automation and thus for cost reduction, since many model types allow deriving test cases directly and sometimes even automatically. The performance of current model-based test approaches is not sufficiently high yet to allow them to be applied on a large scale in industrial practice.

In the European research project D-MINT, Fraunhofer IESE together with 24 partners from six countries has developed innovative model-based test technologies for efficiently testing software-intensive technical systems. D-MINT aims at the development and testing of innovative technologies for model-based testing that can be used to combine a large variety of different system aspects and model types. The integration of the different system aspects and the different system models is especially important for such systems that are implemented partly in software, partly in hardware, or that are being developed by different manufacturers using standard components.

The methods we developed were applied in a total of eight industrial case studies from the areas automotive, telecommunications, automation and control technology in order to demonstrate their added value compared to traditional methods. This makes the D-MINT test framework particularly attractive for industry. For each case study, a demonstrator was set up that is able to illustrate the use of model-based test technologies on real, industry-oriented systems. These demonstrators were displayed at numerous trade fairs and symposiums in order to show the benefits of the D-MINT test technologies to a wide audience. At the final ITEA symposium in Madrid / Spain in October 2009, the project D-MINT received the ITEA Exhibition Award for the presentation of the project results.



One of the methods employed is model-based statistical testing, a technique for the systematic validation of systems. In D-MINT, this technique was expanded and adapted for software-intensive systems in industrial environments. The method allows to systematically build special models for a test from the functional product requirements. Frequent and critical scenarios are annotated in the model and receive special consideration during automated test case generation. Model-based statistical testing also allows predicting product quality, defect content, and remaining risk. In the context of the project, the applicability of this method regarding standard-conformant development and quality assurance in accordance with the standards IEC 61508 and ISO 26262 was demonstrated. Model-based statistical testing was successfully applied in an automotive case study at Daimler and in an automation technology case study at ABB.

### Collaboration Partners

ABB <a href="http://www.abb.de">www.abb.de</a>	iXtronics <a href="http://www.ixtronics.com">www.ixtronics.com</a>
Abo Akademi <a href="http://www.abo.fi">www.abo.fi</a>	Nethawk <a href="http://www.nethawk.fi">www.nethawk.fi</a>
Conformiq <a href="http://www.conformiq.com">www.conformiq.com</a>	Nokia Siemens Networks <a href="http://www.nokiasiemensnetworks.com">www.nokiasiemensnetworks.com</a>
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Innovalia Association <a href="http://www.innovalia.com">www.innovalia.com</a>	Trimek <a href="http://www.trimek.com">www.trimek.com</a>
INSPIRE <a href="http://www.inspire.ag">www.inspire.ag</a>	VTT Technical Research Centre of Finland <a href="http://www.vtt.fi">www.vtt.fi</a>

### FUNDED BY



**Bundesministerium  
für Bildung  
und Forschung**

This project is being funded by the Federal Ministry of Education and Research (BMBWF) under grant number 01 IS 07 001 E.



# DENIT – GERMAN CENTER FOR EMERGENCY MEDICINE AND INFORMATION TECHNOLOGY

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Rheinland-Pfalz  
 MINISTERIUM DES INNEREN  
 UND FÜR SPORT

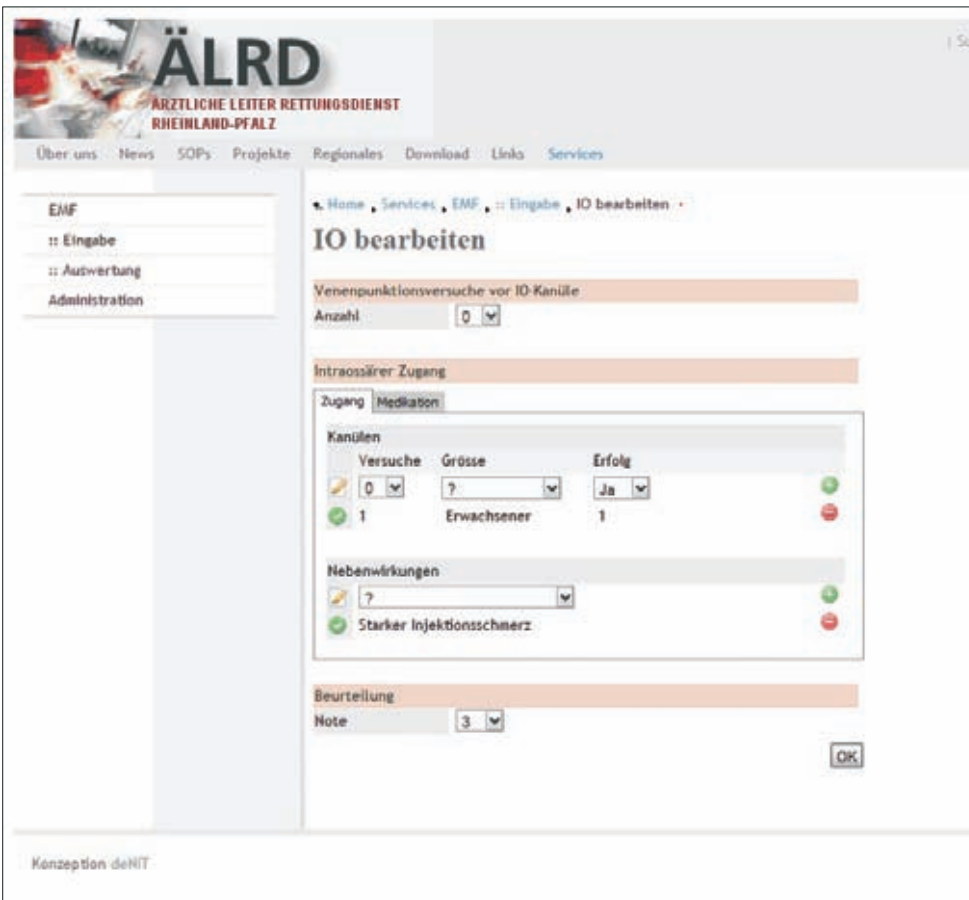
Time-critical and treatment-intensive emergencies occur by the hundreds every day. Overall, there are about 6,000 emergency physician missions in Germany each day – twice as many as 20 years ago. Germany has a nationwide emergency service system with rather short arrival times. Nonetheless, there are many cases where an efficient emergency service mission cannot be guaranteed. Thus, valuable minutes often pass in the dispatch center until a suitable hospital can be found. Furthermore, either out of ignorance or as a makeshift solution, patients are transported to hospitals that are located close by, but do not have the optimal equipment for the diagnosed problem. The reasons for this vary: It is hard to estimate transportation times, it costs time to check on other available hospitals, and the information received then is often incomplete. Experiences made during missions are also rarely used to close gaps identified in the emergency service processes. Since documentation usually only consists of hand-written notes on paper, there is hardly any standardized analysis of missions from the perspective of quality management.

Many of these critical “gaps” could be closed almost seamlessly if up-to-date technology were used systematically. In the optimized emergency service chain from the emergency physician to the hospital, information and communication technology plays a central role. At the Westpfalz-Klinikum in Kaiserslautern, Fraunhofer IESE has therefore established DENIT in order to study reliable process chains, highly dependable system architectures, as well as high-performance infrastructures for logistics and communication in emergency services and to transfer these into practice in emergency medicine.

Setting up databases for emergency medicine mission data is the first step in the planned research and development work. A geo-referential representation of what is happening on site, medical and epidemiological measures, and the benchmarking of the treatment quality by emergency physicians and emergency service missions thus provide the basis for a comprehensive analysis of structure and process data as well as for research into emergency medicine care. Another goal is the integration of a central clinical resource register into an interactive electronic mission documentation system. This system links parameters such as location of the emergency, diagnosis, and current treatment capacities of possible target hospitals, as well as expected times of arrival depending on time of day, weather, traffic, and necessary level of clinical care. Since particularly in rural areas, the number of quickly available emergency physicians continues to decrease, providing decision-making support for emergency service personnel working autonomously at the site of an emergency more frequently and for longer times also becomes increasingly important. In addition to the IT-supported application of standardized process workflows, in the mid-term it must also become possible to offer telemedicine consulting enabled by a videophone connection between the site of the emergency and the target hospital. This will make complex emergency scenarios transparent and easier to understand.



PROJECTS



The EMF is a web-based platform for the feedback of emergency service mission data. Information about the process and result quality of the emergency service is obtained, which forms the basis for deriving optimization measures. The illustration shows the input mask for the application of intraosseous needles.

The very next step will be to optimize the interface between emergency services and hospitals. This would ensure that emergency service protocols and hospital information systems are compatible and would enable telemedicine networking through the transmission of important mission data. In addition to the technical development, funding for such systems as well as their legal status must also be clarified. In light of the highly divided legislative and organizational responsibilities, these issues may be the biggest challenge yet on the way to more efficient emergency medicine care.

Concurrently to this, DENIT will provide further services to industry and the public sector, including, for example, technology transfer in the area of software and systems engineering. In addition, the plan calls for developing special training and education programs for the emergency care system (e.g., serious games).

# LÖSI GMBH – ASSEMBLING YOUR OWN OPERATING SOFTWARE

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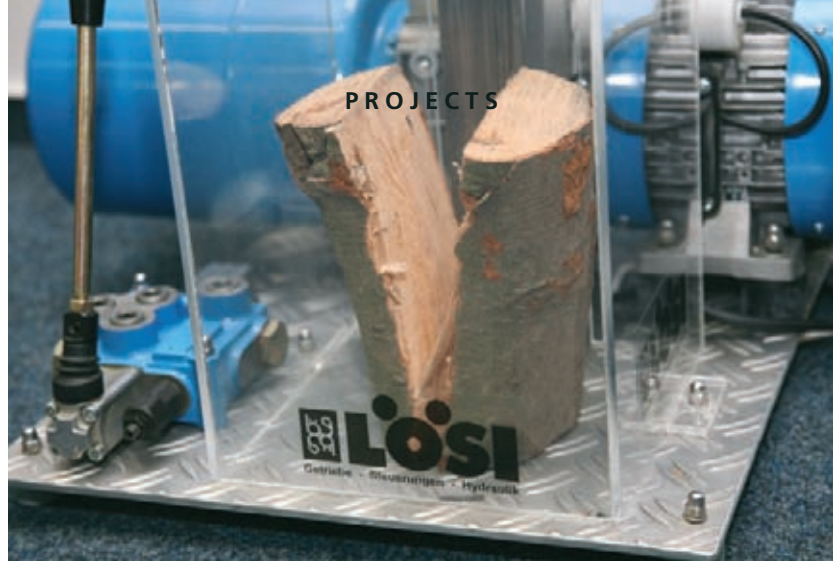
## Further Information

Fraunhofer Innovation Cluster  
DNT  
[www.nutzfahrzeugcluster.de](http://www.nutzfahrzeugcluster.de)

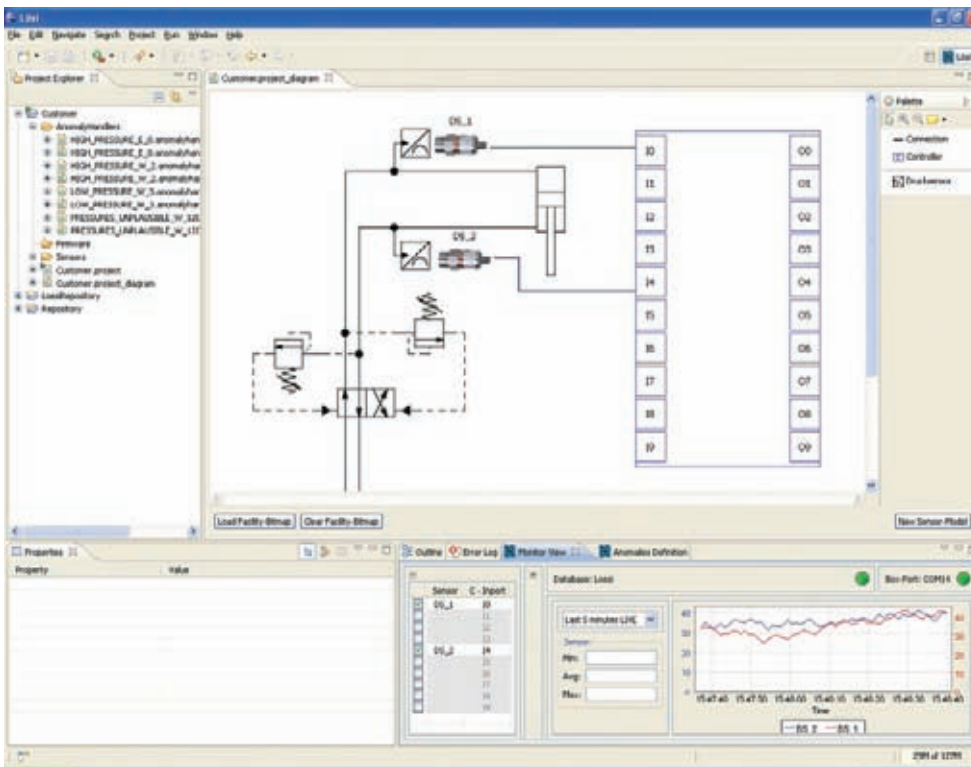
To date, remote maintenance systems that monitor the condition of plants and machinery have required a lot of effort for manual configuration. A new system can be easily and quickly adapted to different plants - without the need for programming skills.

Is the oil pressure in the hydraulic system too high? What is the condition of the rotor blades of the wind power plant? For operators of plants and machinery, it is important to know the answers to such questions at any time – because malfunctions can become very expensive. With the help of a Condition Monitoring system, CM system for short, machines can be monitored remotely: Sensors connected to the machinery continually transmit measurement values to a control box, which captures and stores the data. In the event of defects, the operator is alerted. However, before the CM system is put into operation, it must be adapted to the machinery at hand. To do so requires effort-intensive manual programming work, with costs often in excess of 100,000 euros.

In the future, this will become cheaper and easier: Researchers of the Fraunhofer Institute for Experimental Software Engineering IESE in Kaiserslautern have developed a CM system for LöSi GmbH that can be adapted to different types of machinery without manual programming. “We have developed our own configuration language for this purpose, which is specifically tailored to CM systems”, states project leader Dr. Mario Trapp. “Programming skills are not necessary for working with this language – the engineer creates the operating software simply via drag & drop.” When the user does that, he sees the available tools in the form of graphical illustrations on his monitor, clicks on them with his mouse, and pulls them to the desired location. Let’s say he wants to add a pressure sensor to the operating software: He then just selects the illustration and defines threshold values for the pressures. With the help of an option menu he determines how the system shall react if these values are exceeded. Depending on how serious the malfunction is, the control box can either load deviating measurement values into a central database or inform the plant operator via text message. Another option is to configure an automatic emergency shutdown of the plant or machinery. Once all configurations have been set, a code generator will automatically program the corresponding control box. “Our CM system performs just as well as solutions that were programmed manually, but at much lower costs. The savings potential for the customer is in the five-digit range”, concludes Trapp. Even after installation, the CM software can be changed at any time, for example to add new sensors. In traditional systems, the customer had to put in another order with the manufacturer if he needed any changes to be made to the software. Several customers are already using prototypes of the software.



PROJECTS



**Building block system:**  
 Complex control systems for hydraulic plants can be easily created and tested at the monitor using the configuration software developed in collaboration with Fraunhofer IESE. The individual program code for the embedded control system of the real hydraulic plant is then generated automatically. This happens surprisingly fast – and the quality of the resulting overall system surpasses that of individual development in all respects.

# ViERforES – BETTER SYSTEMS THROUGH VIRTUAL REALITY

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## Further Information

Virtual and Extended Reality  
 for highest safety and reliability  
 of Embedded Systems  
[www.vierfores.de](http://www.vierfores.de)



The vast majority of microprocessors produced worldwide are integrated into embedded systems – from household appliances to commercial aircrafts. Many appliances and devices that we use without reflection every day belong to this category. Embedded systems have huge technical and economic importance; they are never so-called “stand-alone” systems, but are rather integrated into communication relationships with other systems, such as mechanical, hydraulic, pneumatic, electronic, or information technology systems, in a multitude of ways on various levels. These systems are highly responsible for determining the characteristics of safety and security, reliability, and availability, and provide the competitive edge in the domains automotive, medical, energy, production, and material flow technology.

When developing safety-critical systems, one must check the degree to which the two quality characteristics safety (system safety: The system cannot jeopardize its environment) and security (The system cannot be abused), in particular, are fulfilled. The fulfillment of other quality characteristics such as reliability and availability must also be checked. Furthermore, the mutual effects between the different quality characteristics must be looked at, especially in the context of embedded systems. In addition to the difficulty of proving to which extent these characteristics are fulfilled, another problem is the fact that due to the complexity of these systems, it is hardly possible to take all aspects into account. This is where virtual reality can help.

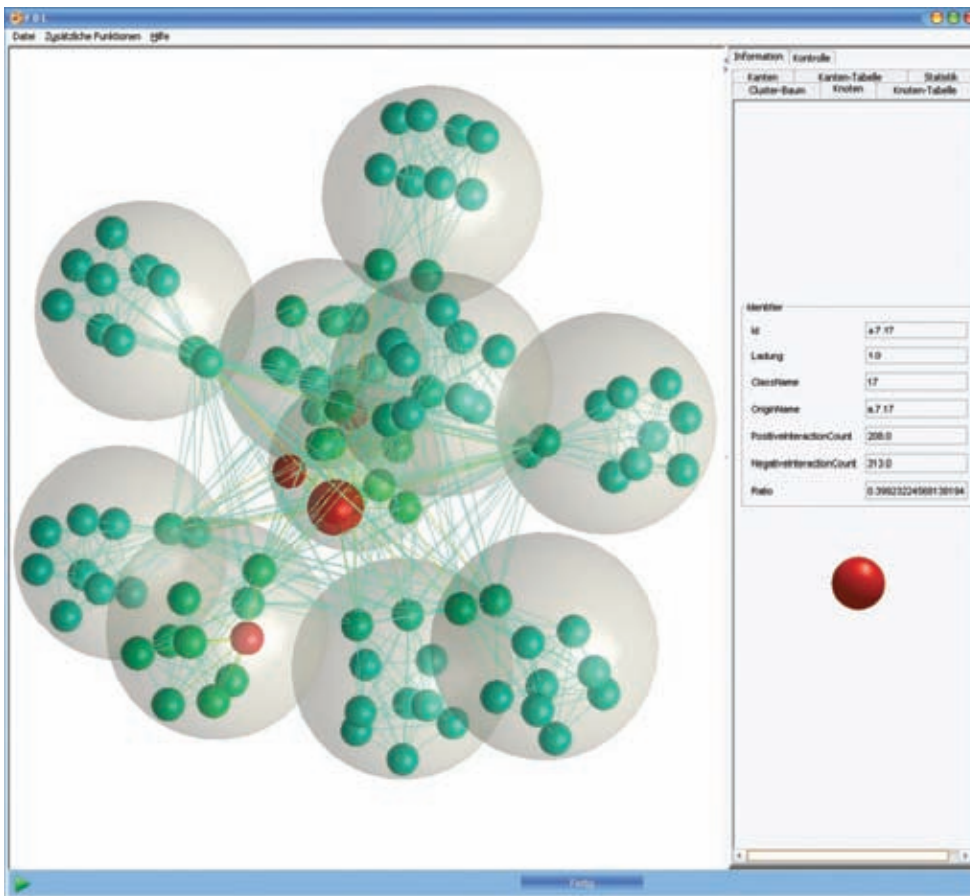
Suitable visualization of these quality characteristics shall enable developers and quality assurers to recognize weaknesses of the system in an explorative manner. It can also help to make informed decisions about which measures are still needed. To do this, large amounts of data need to be visualized. Using these methods, better systems can be developed in the future.

The goal of this joint project by researchers from Kaiserslautern and Magdeburg is to increase the safety and reliability of complex technical systems with the help of methods from virtual reality and to intertwine the developed methods with various application areas.





## PROJECTS



Visualization of software quality.

### Collaboration Partners

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Fraunhofer Institute for  
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[www.iff.fraunhofer.de](http://www.iff.fraunhofer.de)

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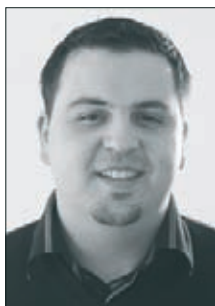
Bundesministerium  
für Bildung  
und Forschung

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# SHIELDS – DETECTING KNOWN VULNERABILITIES FROM WITHIN DESIGN AND DEVELOPMENT TOOLS

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Christian Jung

In the project SHIELDS funded by the European Union, research is performed regarding models, methods, and tools for the systematic support of the software development cycle in the area of IT security. During the course of the project, the methods and tools developed are integrated into the software development cycle and tested with respect to their suitability in practice.

Fraunhofer IESE is in charge of the work package on tool support, where models are developed for mapping the knowledge of security experts as well as methods for adequately using this knowledge. On the basis of the security models, a tool for the performance of software security inspections is created that leads the inspector through the inspection process with the help of appropriate guidance.

Experts with the pertinent specialized knowledge in the area of IT security as well as in the area of secure software development are in great demand. In software development projects, this demand can often only be met by hiring external consultants, which results in high costs. An organization's own software developers often require expensive training before they are capable of taking into account and applying such specialized knowledge in their daily work. By smartly packaging this expert knowledge and providing suitable tool support, IT security know-how can be used by a larger group of developers.

## Further Information

The SHIELDS Project  
[www.shields-project.eu](http://www.shields-project.eu)

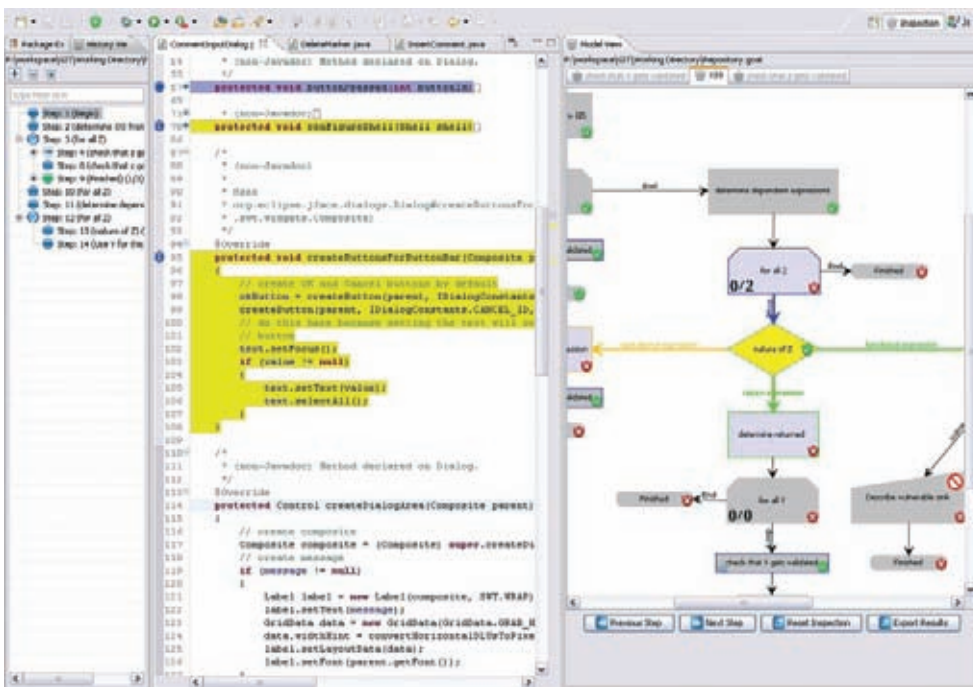


SHIELDS is being funded by the European Commission in the context of the 7th Framework Programme.



The models and methods developed in the project SHIELDS and the tool support envisioned for this project are sketched below:

- Vulnerability Inspection Diagrams (VID) and Security Inspection Scenarios (SIS) serve to detect vulnerabilities and security-critical programming errors. The focus of these models is on inspections of software systems at the end of the respective development cycle. VID- respectively SIS-based security inspections are intended to identify vulnerabilities and related defects in the context of source code analyses. VIDs are a specially developed type of flow diagrams that guide software developers through security-critical inspection scenarios, such as the search for buffer overflows. SIS are an equivalent to VIDs; however, they offer additional information such as examples from practice and best practices in textual form, which provide support particularly for inexperienced software developers and teach them with the help of practical application examples.
- Security Goal Indicator Trees (SGIT) and Guided Checklists (GC) represent indicators for desired security goals of the software product in the form of a tree structure, respectively a checklist. Unlike VIDs and SIS, the focus of these two models is on software artifacts in early development phases, for instance design documents or requirements specifications. These models can thus be used to correct software systems during early development phases, which signifies a major savings potential compared to late corrections towards the end of



*Prototype of the Inspection Tool: The screenshot shows how to work with the Guided Inspection Tool. On the left side, the course of the inspection is depicted; in the center is the software artifact to be checked; and on the right side is the underlying inspection model with the corresponding controls.*

**Collaboration Partners**

Linköpings Universitet  
www.liu.se

SINTEF  
www.sintef.no

European Software Institute  
www.esi.es

Institut TELECOM/TELECOM  
SudParis  
www.int-evry.fr

Montimage SARL  
www.montimage.com

SEARCH-LAB, Ltd  
www.search-lab.hu

TXT E-Solutions Spa  
www.txt.it

the development or even later, in the finished product. SGITs and GCs can also be used constructively, since corresponding security goals are implemented directly and with a high degree of coverage.

In analogy to VIDs and SIS, SGITs and GCs contain the same information, but differ in terms of their presentation as well as in the help offered.

- Fraunhofer IESE is developing the so-called Guided Inspection Tool (GIT), a tool that controls the inspection with the help of these models and systematically guides the software developer through the inspection process in his role as an inspector. The tool enables the inspector to navigate through the source code or other software artifacts in the development environment Eclipse, and to mark and comment relevant sections. In doing so, the inspector follows a path prescribed by the model used and guided by the tool. The tool manages the inspection, captures the results, and packages them in the form of an inspection report.

At the end of the project, our project partner SEARCH-LAB will make a vulnerability database available that will allow users to make use of pre-packaged security models and to provide their own models for other inspectors.

# LEA – LEARNING WHILE AGING – AGING WHILE LEARNING

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Volkshochschule (VHS)  
 Kaiserslautern  
[www.vhs-kaiserslautern.de](http://www.vhs-kaiserslautern.de)

## Further Information

The LEA Project  
[www.lea-projekt.de](http://www.lea-projekt.de)



Compared to past generations, older demographic groups in our society nowadays have a higher level of education and qualification. Today, elderly people have a wide range of interests, a vast variety of competencies, and comprehensive knowledge based on experience. Adult education providers are already offering a rich palette of programs for senior citizens; however, there is a noticeable decline in participation in continuing education programs from the age of around 65.

To date, adult education programs have primarily consisted of classroom events, implying the need to physically go to some classroom. Due to various barriers, this becomes increasingly difficult for the older people. Therefore, approaches based on networking can offer new education potential particularly for the target group of elderly people. In the project “Lernend altern – altern lernen” (Learning while Aging - Aging while Learning, LEA), adult education strategies based on networking and intended to overcome barriers are to be developed and tested in a model region in order to increase the participation of elderly people in education. An important role is played by the new education technologies, which help to integrate education and communication offers into the lives of elderly people.

In this project, the goal is to develop educational programs particularly for elderly people with restricted mobility. Through technical solutions optimally adapted to this target group, even elderly people who are no longer able to leave their homes get a chance to actively participate in the educational programs offered by VHS (Adult Education Center). By creating a network between “home learners” and VHS, both synchronous learning (e.g., through live transmission via video and / or audio) and asynchronous learning (e.g., by making materials available on a learning platform) can take place. This program will be supported by devices that are easy to operate and that enable communication and joint learning, and will also provide technical and educational support through the project partners.

Elderly people with restricted mobility who would like to participate from home in educational programs offered by VHS are therefore the focus of our project work. The future users of the programs are already included in the early stages of development and thus have a direct influence on the selection of suitable devices and didactical methods. The educational programs are then selected in close cooperation with the teachers / course leaders of VHS, packaged, and made available.



Rheinland-Pfalz  
 MINISTERIUM DES INNERN  
 UND FÜR SPORT



Rheinland-Pfalz  
 MINISTERIUM FÜR BILDUNG,  
 WISSENSCHAFT, JUGEND  
 UND KULTUR

This project is funded by the Special Program of the state of Rhineland-Palatinate as well as by RLP-Inform – Multimedia Initiative of the State Government at the Center for IT + Multimedia.



# MWARE – SOFTWARE TECHNOLOGIES FOR MULTICORE PLATFORMS

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This project is being funded by the Fraunhofer-Gesellschaft in the context of a market-oriented strategic preliminary research study (MAVO).

Software systems are becoming more and more complex from one generation to the next, as are the tasks they take over. In order to handle all this, the performance of the hardware platforms on which the software is executed is also increasing. In the past, this was achieved by continually raising a processor's clock rate. Software thus automatically benefitted from this increased performance; it was not necessary to adapt the software to the new hardware platform.

Meanwhile, clock rates have arrived at a natural limit even in the areas of High-Performance Computing and for embedded processors; requirements regarding EM compatibility, energy consumption and the associated waste heat as well as leakage currents do not allow any further significant increase in clock rates. In order to be able to provide the necessary performance for future software systems nonetheless, a new approach is therefore needed.

Today, additional increases in performance are achieved by using parallel platforms; these are platforms that provide several processors or processor cores, which are connected via a bus, a common memory, or a network. In order to be able to make use of the possibilities offered by these parallel platforms, the software to be executed on them must be optimized though. Algorithms must be divided into several tasks that can be executed in parallel and which are then processed concurrently by several computing kernels. For systems with relatively few computing kernels, this can be done manually; however, if the number of computing kernels rises, the distribution of the tasks and communication between the kernels becomes significantly more complicated and can no longer be done efficiently using the methods available today.



In the project MWare, we are developing methods that make it possible to make future parallel platforms efficiently usable for tomorrow's software systems, so that these can continue to fulfill increasing requirements. Fraunhofer IESE is therefore developing technologies that execute existent software on parallel platforms either automatically or with the support of developers. These technologies take into account the specific capabilities of processors, communication costs, locally available memory, as well as access to device interfaces, which might not be possible in the same way from all kernels.

Compared to currently available solutions, developers do not need to have specific knowledge regarding the programming of parallel platforms. This is an advantage that should not be underestimated, since it means that on the one hand, existent and proven solutions can continue to be used, and, on the other hand, software developers can be employed more efficiently for developing and improving visible functions of software instead of spending a lot of effort on manually adapting it to new platforms.

# SIM-TD – SECURE INTELLIGENT MOBILITY – TEST FIELD GERMANY

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Michael Eisenbarth

Ensuring efficient and safe mobility for the long term is one of the major pillars of our modern society. In the context of the project SIM-TD (“Sichere Intelligente Mobilität – Testfeld Deutschland” - Safe Intelligent Mobility - Test Field Germany), a first large-scale trial is taking place regarding communication between vehicles, and a study is being undertaken on how intelligent communication between vehicles and the traffic infrastructure can increase traffic safety and traffic efficiency. Individualized and current information about the traffic environment helps the driver avoid accidents and traffic jams and makes better use of the traffic infrastructure. At the same time, communication between different traffic carriers and with the infrastructure (“car-to-X communication”) makes it possible to optimally route traffic and thus reduce CO<sub>2</sub> emissions in road traffic.

During the project test phase, the test vehicles will be equipped with wireless databoxes (car communication units) customized to the vehicle. They will “communicate” wirelessly (via specially established W-LAN standards) with corresponding data boxes at selected traffic infrastructure points such as traffic lights or signs (road side units). These forward the data received from the vehicles to traffic centers where they are collected and evaluated in order to enable immediate and precise traffic control. At the same time, the information from the roadside units is transmitted to potentially affected vehicles. Each participating driver will thus receive individual information about the flow of traffic ahead on “his” or “her” route. This will make it possible to increase traffic efficiency and traffic safety concurrently.

## Further Information

The SIM-TD Project  
[www.simtd.de](http://www.simtd.de)



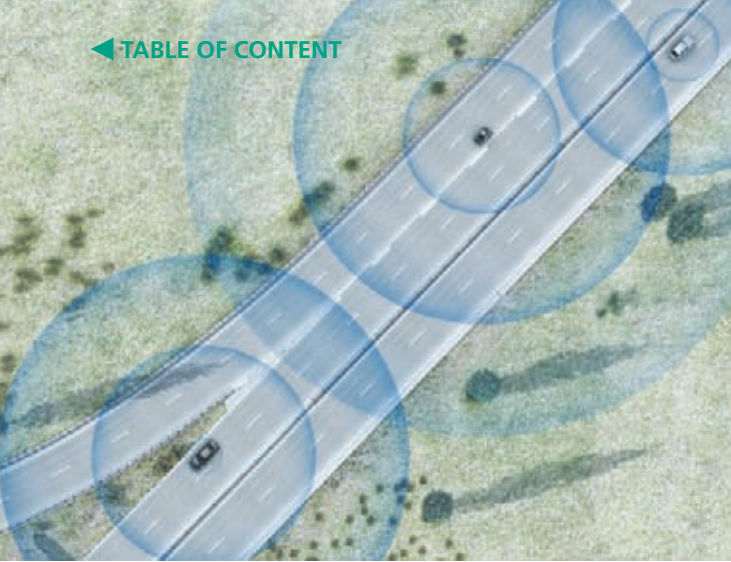
The goal of SIM-TD is to increase traffic safety and traffic efficiency through intelligent vehicle communication. The lessons learned in the field trial regarding car-to-car communication and car-to-infrastructure communication will be used in the standardization of the technology, which will be the basis for a large-scale roll-out on the German and European markets.

## FUNDED BY



Federal Ministry of Economics and Technology  
 Federal Ministry of Education and Research  
 Federal Ministry of Transport, Building and Urban Development





As SIM-TD research partners, the software engineers of Fraunhofer IESE are responsible, in particular, for the management and control of the requirements phase and the processes of the project SIM-TD. This includes, in particular, coordinating and performing the requirements elicitation (incl. stakeholder analyses, developing guidelines, setting up templates, etc.) for the elicitation of the C2X functions from the project partners and ensuring continuous quality assurance of the natural-language requirements definitions (e.g., Use Cases, etc.).

Furthermore, a pertinent infrastructure and requirements management software was evaluated for the creation of the SIM-TD requirements database and is being maintained in parallel to the project. This software, which is managed by Fraunhofer IESE, is mainly used for extracting the requirements from the respective partner specifications and for managing them throughout the course of the entire project. This enables the requirements engineers of Fraunhofer IESE to continually perform quality and consistency checks of the SIM-TD requirements and serves as a basis for further traceability analyses and for the change management process.

### Collaboration Partners

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AUDI AG  
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BMW AG  
[www.bmw.com](http://www.bmw.com)

BMW Group Research and Technology  
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Continental Teves AG & Co. oHG  
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Daimler AG  
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German Research Center for Artificial Intelligence (DFKI)  
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Deutsche Telekom AG  
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Ford Research Center Aachen  
[www.ford.de](http://www.ford.de)

Fraunhofer-Gesellschaft  
[www.fraunhofer.de/](http://www.fraunhofer.de/)

Hessian State Agency for Roads and Transportation (Hessisches Landesamt für Straßen- und Verkehrswesen)  
[www.verkehr.hessen.de](http://www.verkehr.hessen.de)

University of Applied Sciences (Hochschule für Technik und Wirtschaft des Saarlandes) Saarbrücken  
[www.htw-saarland.de](http://www.htw-saarland.de)

Robert Bosch GmbH  
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City of Frankfurt am Main  
[www.frankfurt.de](http://www.frankfurt.de)

Technische Universität Berlin  
[www.tu-berlin.de](http://www.tu-berlin.de)

Technische Universität München  
 Chair of Traffic Engineering and Control  
[www.vt.bv.tum.de](http://www.vt.bv.tum.de)

University of Würzburg  
[www.uni-wuerzburg.de](http://www.uni-wuerzburg.de)

Volkswagen AG  
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# SPES 2020 – SOFTWARE PLATFORM EMBEDDED SYSTEMS 2020

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Dr. Mario Trapp

The national innovation alliance “Software Platform Embedded Systems 2020” is topically oriented towards making cross-domain production processes more professional, mainly along the classical goals of software engineering – productivity and quality. Especially in Germany, the same high demands in terms of productivity and quality must be placed on embedded systems as on other technical systems bearing the quality mark “Made in Germany”. In order to ensure that the image of Germany as a quality site is maintained in the long term also with regard to software products, suitable measures must be developed to prove that “software made in Germany” is a high-quality product.

The aim of this unique innovation alliance in Germany is the development of a future network, hardware, and software architecture that spans application domains, as well as research into novel methods of software and systems engineering in future-relevant application areas.

One of the internationally recognized USPs of Fraunhofer IESE is its expertise regarding empirical validation, which the institute contributes by having the scientific lead of work package 6 (“Evaluation of Empirical Methods”). Another focus is on the model-based development of safe and highly dependable embedded systems. Therefore, Fraunhofer IESE has taken over leadership of work package 4 (“Safety Engineering, Certification and Quality Assurance of Non-Functional Requirements”) and brings its already existent expertise as well as methods and tools to the project.

In collaboration with Robert Bosch GmbH, Fraunhofer IESE is working on the efficient safety certification of platforms and platform-specific software in the context of SPES2020. One major advantage of separating the platform-specific parts of an embedded system from the platform-independent ones is the simplified reuse of the platform, respectively the platform-independent parts of the system, the application. If, however, a platform or an application is reused in a safety-critical environment, the safety of the newly created system must again be proven in its entirety - resulting in high costs. The goal of the work done in the project SPES2020 is to use the modularity of platforms and applications to make it possible to develop part of the safety concept in a modular and thus efficient manner. During the past year, strategies have been developed in cooperation with Robert Bosch GmbH to achieve these goals. In addition, the upcoming (in the automotive sector) platform AUTOSAR was studied to identify challenges and opportunities for modular certification.

In order to increase productivity while ensuring the highest quality at the same time, a development approach is being developed in SPES2020 that is entirely model-based, from the requirements all the way to the implementation. In the context of ZP-AP4, Fraunhofer IESE is collaborating with the University of Kaiserslautern on adapting and integrating safety analyses

## Further Information

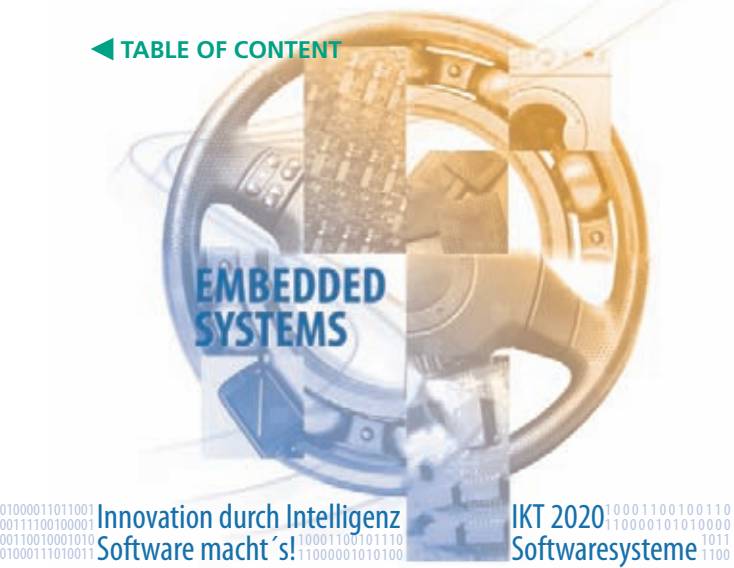
Project Homepage  
<http://spes2020.informatik.tu-muenchen.de>



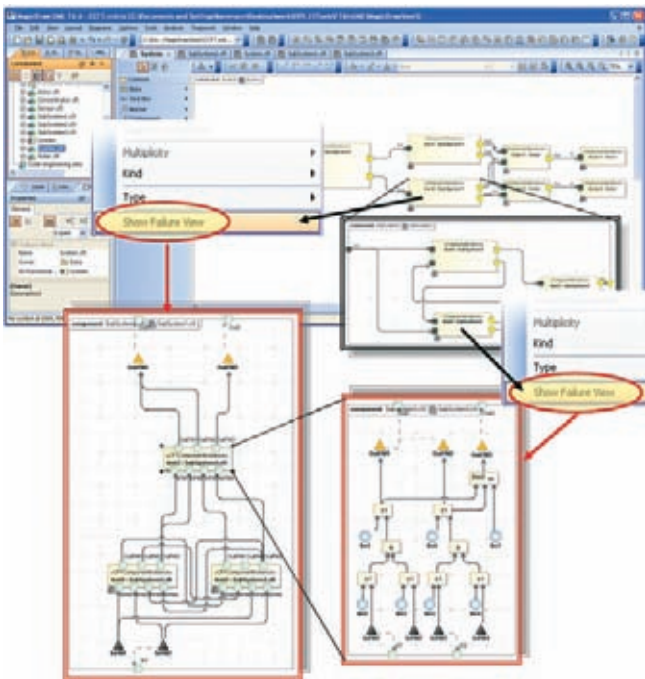
FUNDED BY



Bundesministerium  
für Bildung  
und Forschung



PROJECTS



*Integrative and coupled modeling of fault trees and functional models in MagicDraw*

for model-based development. Thanks to early safety analysis, systematic reuse, and automation of important steps, effort decreases and quality increases. IESE and TU Kaiserslautern are able to build on several years of preliminary work and experience with component fault trees. Parts of the approach are being implemented as a profile in commercial UML/SysML tools (see illustration) and are being validated together with the partners EADS-Deutschland GmbH, Airbus Deutschland GmbH, and Liebherr Aerospace Lindenberg GmbH.

Collaboration Partners

- |  |   |
|--|---|
| Airbus Deutschland GmbH<br><a href="http://www.airbus.com">www.airbus.com</a>  | RWE Energy AG<br><a href="http://www.rwe.com">www.rwe.com</a>                             |
| Berlin Heart GmbH<br><a href="http://www.berlinheart.de">www.berlinheart.de</a>  | SWM Services GmbH<br><a href="http://www.swm.de">www.swm.de</a>                           |
| EADS Deutschland GmbH<br><a href="http://www.eads.com">www.eads.com</a>  | Siemens AG<br><a href="http://www.siemens.com">www.siemens.com</a>                        |
| Embedded4You e.V.<br><a href="http://www.embedded4you.com">www.embedded4you.com</a>  | University of Kaiserslautern<br><a href="http://www.tu-kl.de">www.tu-kl.de</a>            |
| Fraunhofer Institute for Computer Architecture and Software Technology FIRST<br><a href="http://www.first.fraunhofer.de">www.first.fraunhofer.de</a> | Technische Universität München<br><a href="http://www.tum.de">www.tum.de</a>              |
| Hella KGaA Hueck & Co.<br><a href="http://www.hella.de">www.hella.de</a>   | TeCNetGmbH<br><a href="http://www.tecnetgmbh.de">www.tecnetgmbh.de</a>                    |
| IT Power Consultants<br><a href="http://www.itpower.de">www.itpower.de</a>   | TÜV Süd AG<br><a href="http://www.tuev-sued.de">www.tuev-sued.de</a>                      |
| Liebherr Aerospace Lindenberg GmbH<br><a href="http://www.liebherr.com/ae/">www.liebherr.com/ae/</a>   | University of Duisburg-Essen<br><a href="http://www.uni-due.de">www.uni-due.de</a>        |
| OFFIS e.V.<br><a href="http://www.offis.de">www.offis.de</a>   | University of Paderborn<br><a href="http://www.uni-paderborn.de">www.uni-paderborn.de</a> |
| Robert Bosch GmbH<br><a href="http://www.bosch.com">www.bosch.com</a>  | Vector Informatik GmbH<br><a href="http://www.vector.de">www.vector.de</a>                |

# TWK – USER EXPERIENCE AS A KEY TO ONLINE SUCCESS

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*Kizito Mukasa*

A company's business card on the Internet is its website, which must quickly and accurately showcase the core values of the company or its brand in a tangible way. Notwithstanding general agreement on this, successful online communication still poses a major challenge for many companies. Communication with the customer is successful if the user has a positive online experience. However, this is not as simple as just transferring content that was communicated via print media in the past to the Web. The special requirements of this medium must be taken into account. Unlike print media, the Internet offers unlimited space for content, for example, but the user spends less time reading. The Internet reaches a global audience and many different users are accessing the contents concurrently. In addition, navigation through a site is dynamic and has many branches. Thus, it is easily possible for the user to get disoriented if no user guidance is provided.

Solving these challenges by simply adhering to the generally applicable online guidelines is not sufficient for generating good user experience on the Internet. A systematic procedure is called for when creating a website.

Following the motto "Let the experts do the expert's job!", Technische Werke Kaiserslautern (TWK) asked the usability experts of Fraunhofer IESE to analyze their old website, identify shortcomings, and develop a proposal for a new, user-friendly solution. The relevant TWK brand values such as "trust", "competence", "safety", "proximity to the customer", "modernity", "ecological conscience", and "customer friendliness" were to be made tangible for the visitor on the revised website.

After a heuristic evaluation phase, the Fraunhofer IESE team used the method of user-centered design, UCD, to solve the problem. UCD makes it possible to design better interactive products by placing the users with their requirements and needs into the center of the development process – which is a basic prerequisite for achieving user satisfaction.

A high-fidelity prototype of the new website optimized for the Firefox web browser was developed and evaluated in several usability tests. The result was not only a positive user experience; the new website is now also able to convey all of the company's brand values to its users!

## Collaboration Partner

TWK GmbH  
[www.twk-kl.de](http://www.twk-kl.de)



Before



After

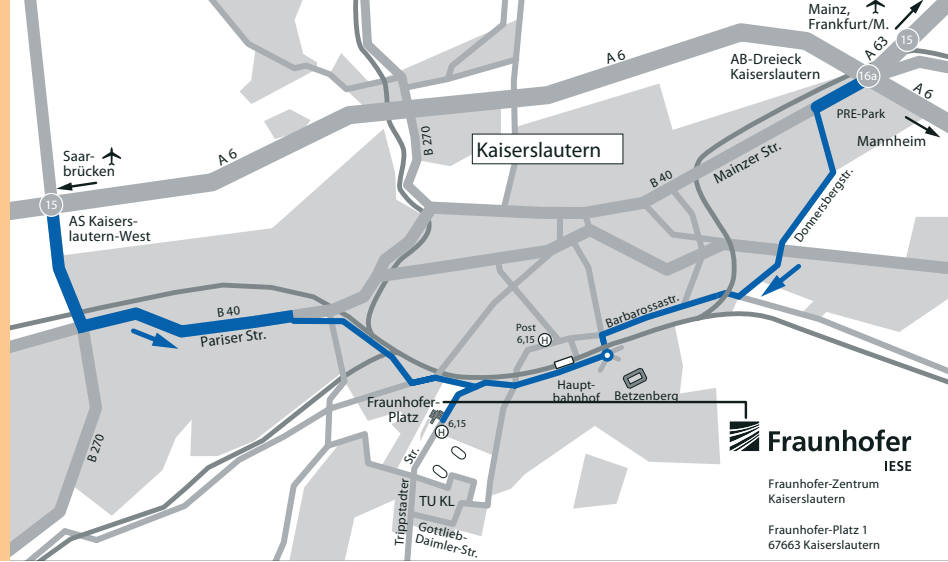




# CONTACT

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# HOW TO FIND US



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## By car

Coming from the West on Autobahn A6, take the exit Kaiserslautern-West (15), then go towards downtown and follow the signs towards the university. Before you get to the university, you will reach the building complex of the Fraunhofer Center a few hundred meters down Trippstadter Strasse, on the right side of the street.

Coming from the East on Autobahn A6, go to the Autobahn Interchange (“Autobahndreieck”) Kaiserslautern, and take the exit Kaiserslautern-Centrum (16a). Then first follow the signs towards Betzenberg Soccer Stadium, then towards the university. It is best to use the detour behind the train station via Zollamtstrasse; at the end of the street, continue straight ahead into Trippstadter Strasse. The building complex of the Fraunhofer Center is located approx. 500m down the street on the right side.

## Getting there by means of electronic navigation:

Since most likely, the Fraunhofer-Platz is not yet listed in most electronic navigation systems, we recommend using “Trippstadter Strasse 125” as the destination instead. The Fraunhofer Center is located directly across the street..

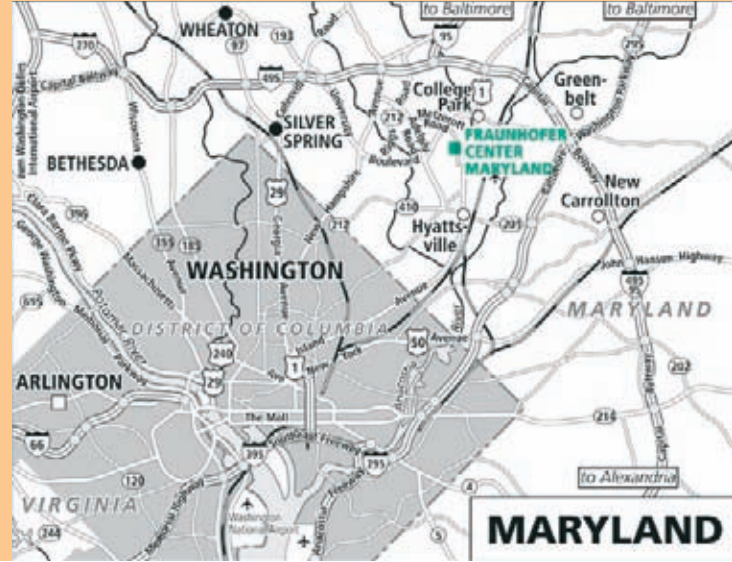
## By rail and bus

Proceed to the main train station, Kaiserslautern Hauptbahnhof, and then either take a taxi or take TWK city bus no. 106 (towards Mölschbach) or no. 115 (towards Universität), getting off at the stop “Fraunhofer-Zentrum”.

## By air

From Frankfurt Rhein Main Airport, either by train (approx. 2 hours) or by rental car (approx. 1.5 hours).





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[www.fc-md.umd.edu](http://www.fc-md.umd.edu)

By Car

**Directions from the North**

Take Interstate 95 (I95) South (East part of Washington Beltway, I495). Take Route 201, Kenilworth Avenue exit. At the end of the exit ramp, go right. Continue past the light for Paint Branch Parkway / Good Luck Road through one more light. Turn right at light for River Road. After crossing over a small bridge, turn right onto University Research Court. Our building is at the end of University Research Court on the right. Go in the front doors in the center of the building. We are on the first floor, past the elevators, and to the left.

**Directions from the South – traveling northbound on Interstate 95 (I95)**

Take I95 North to the Washington Beltway – I 495, going North or towards College Park. Take the exit for Route 50, going west, towards Washington, DC. Take the exit for Route 410, Veterans Highway. At the end of the exit ramp, go right. Continue on 410, crossing through the traffic light at Route 450. The road will come to a “T”, turn left, following the signs for 410. You will pass under the Baltimore/Washington Parkway and through several lights.

At the light for Route 201 Kenilworth Avenue, turn right. Turn left onto River Road. After crossing over a small bridge, turn right onto University Research Court. Our building is at the end of University Research Court on the right. Go in the front doors in the center of the building. We are on the first floor, past the elevators, and to the left.

**Directions from the Washington, DC area**

Take DC-295 North, following signs for the Baltimore/Washington Parkway. Exit at Riverdale Road/Route 410, turning left onto Riverdale Road, which becomes East-West Highway. Go to Route 201 Kenilworth Avenue and turn right. Turn left onto River Road. After crossing over a small bridge, turn right onto University Research Court. Our building is at the end of University Research Court on the right. Go in the front doors in the center of the building. We are on the first floor, past the elevators, and to the left.

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## Further Information

- Annual Report 2009 of Fraunhofer IESE, print version  
(German)
- Annual Report 2009 of Fraunhofer IESE, print version  
(English)
- Annual Report 2009 of Fraunhofer IESE, CD-ROM version  
(German & English)
- Short films of Fraunhofer IESE, DVD, German
- Short films of Fraunhofer IESE, DVD, English
- Fraunhofer IESE: Overview
- The Fraunhofer-Gesellschaft from A-Z
- Annual Report of Fraunhofer-Gesellschaft
- STI Software Technologie Initiative Kaiserslautern e. V.
- Please add my address

A PDF file of the Fraunhofer IESE Annual Report 2009 with  
included Appendix and other publications (press releases,  
previous Annual Reports) are available at

[www.iese.fraunhofer.de](http://www.iese.fraunhofer.de)

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Last Name, First Name

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Company

\_\_\_\_\_

Position

\_\_\_\_\_

Department

\_\_\_\_\_

Address

\_\_\_\_\_

Zip Code / City

\_\_\_\_\_

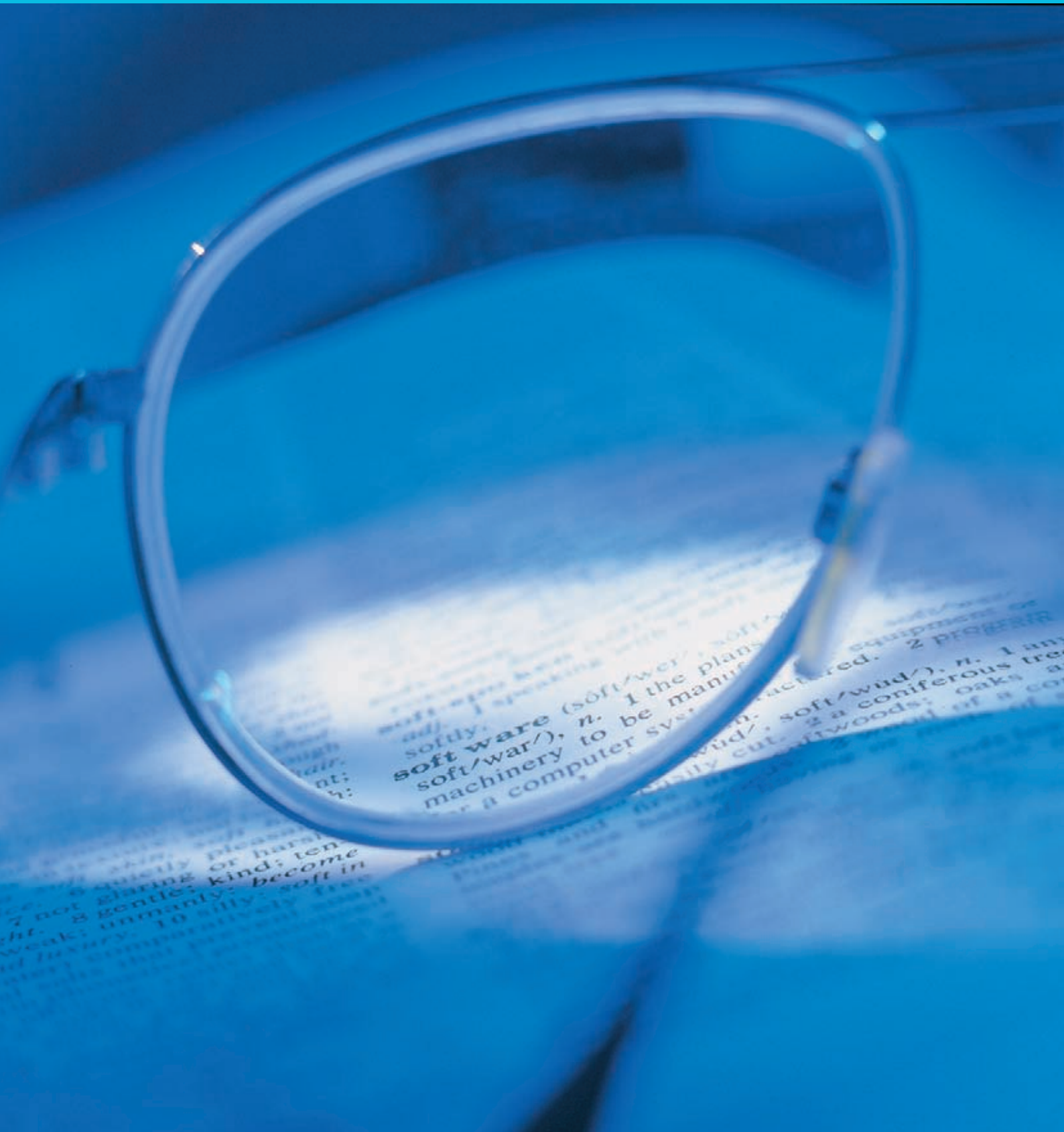
Phone

\_\_\_\_\_

Fax

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E-mail



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# NETWORK IN SCIENCE AND INDUSTRY

## INDUSTRIAL PARTNERS<sup>1</sup>

- 4Soft GmbH, München
- a 3 systems GmbH, Zweibrücken
- Absint Angewandte Informatik
- Acciona Infraestructuras, Alcobendas, Spain
- Adam Opel GmbH, Rüsselsheim
- Airbus Deutschland, Hamburg
- Ansaldo Sts, Genova, Italy
- Astrium, Paris, France
- Atlas Elektronik GmbH, Bremen
- Atos Origin Sociedad Anónima Española, Madrid, Spain
- Audi AG, Ingolstadt
- Audi Electronics Venture GmbH, Gaimersheim
- B2M Software AG, Karlsruhe
- Bernafon AG, Bern, Switzerland
- BMW Group Forschung und Technik GmbH, Munich
- British Telecommunications Plc, London, UK
- C/S Enformasyon Teknolojileri Limited Sirketi, Ankara, Turkey
- Capgemini sd&m AG, Munich
- CIBEK technology + trading GmbH, Limburgerhof
- Continental Teves AG & Co. oHG, Frankfurt
- Critical Software, Coimbra, Portugal
- Danieli Automation, Buttrio, Italy
- Dassault Systèmes, Suresnes, France
- Degudent GmbH, Hanau-Wolfgang
- DELPHI France, Tremblay, France
- Deutsche Lufthansa AG, Frankfurt
- Dräger Medical AG & Co. KG, Lübeck
- ELA Medical SAS, Montrouge, France
- ESRI Geoinformatik GmbH, Kranzberg
- FIDUCIA IT AG, Karlsruhe
- Ford Forschungszentrum Aachen GmbH, Aachen
- Fredhopper, Amsterdam, Netherlands
- Globus SB-Warenhaus Holding GmbH&Co.KG, St. Wendel
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- Hyperware, Munich
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- IDS Scheer, Saarbrücken
- Infinion Technologies, Neubiberg
- INFORA GmbH, Berlin
- Information Society Open To Impairments (E-ISOTIS), Athens, Greece
- Inter online Cooperación 2001, Avilés, Spain
- itelligence AG, Bielefeld
- itestra GmbH, Kaufering
- Japan Aerospace Exploration Agency, Tokyo, Japan
- John Deere AMS Europe, Zweibrücken
- John Deere Moline Technology Innovation Center, Moline, USA
- Josef Witt GmbH, Weiden
- Krauss-Maffei Wegmann GmbH & Co. KG, Kassel
- KSB Aktiengesellschaft, Pegnitz
- LogControl GmbH, Pforzheim
- Lotterie-Treuhandgesellschaft mbH Hessen, Wiesbaden
- LTi DRIVES GmbH, Lahnau
- Medcom Gesellschaft für medizinische Bildverarbeitung mbH, Darmstadt
- Messier-Bugatti, Velizy-Villacoublay, France
- Montimage, Paris, France
- Motorola GmbH, Traunstein
- MPDV Mikrolab GmbH
- Münchner Rückversicherungs-Gesellschaft AG
- Nokia Networks GmbH
- PEPITe S.A., Liège, Belgium
- Philips Consumer Lifestyle Advanced Technology, Eindhoven, The Netherlands
- Philips Electronics Netherlands B.V., Eindhoven, The Netherlands
- Porsche Informatik GmbH, Bergheim, Austria
- PRO DV Software AG, Dortmund
- PTV Planung Transport Verkehr AG, Karlsruhe
- PWD GmbH Personalwirtschaftliche Dienste, Klein Offenseth-Sparrieshoop
- R&D-Ware Oy, Espoo, Finland
- Rolls-Royce plc, Derby, UK
- Sagem Défence Sécurité, Paris, France
- Schenker AG, Essen
- Siemens Healthcare Diagnostics Products GmbH, Schwalbach
- Software AG, Darmstadt
- Sopera GmbH, Bonn
- Süddeutsche Klassenlotterie (SKL), Munich
- Testo AG, Lenzkirch
- THALES, Neuilly sur Seine, France
- TKMS Blohm+Voss Nordseewerke GmbH, Hamburg
- TNM Software GmbH, Neunkirchen
- TQsoft GmbH, Berlin
- T-Systems Multimedia Solutions GmbH, Dresden
- TÜV SÜD Automotive GmbH, Munich
- TXT e-solutions Spa, Milano, Italy
- Tynos, Bremen
- UAB Algoritmu Sistemai, Vilnius, Lithuania
- VDA Verband der Automobilindustrie, Frankfurt
- Vermon SA, Tours, France
- Volkswagen Aktiengesellschaft, Wolfsburg
- VTI Technologies OY, Vantaa, Finland
- Westpfalz-Klinikum GmbH, Kaiserslautern

1) Industrial Partners are located in Germany unless stated otherwise.



- XI'AN TYPICAL EUROPE GmbH, Kaiserslautern
- XING AG, Hamburg
- ZEA Partners, Louvain-la-neuve, Belgium

**NATIONAL RESEARCH PARTNERS**

- Arbeitsgruppe Softwaretechnik, Universität Bremen (Software Engineering Research Group, University of Bremen), Bremen
- Berufsakademie Karlsruhe (University of Cooperative Education Karlsruhe), Karlsruhe
- DESY Deutsches-Elektronen Synchrotron, Hamburg
- Deutsches Forschungszentrum für Künstliche Intelligenz GmbH (DFKI) (German Research Center for Artificial Intelligence GmbH), Kaiserslautern
- Deutsche Hochschule der Polizei (German Police University), Münster
- European Space Agency (ESA), Darmstadt
- Fachbereich Elektrotechnik und Informatik, Fachhochschule Münster (Department of Electrical Engineering and Informatics, Muenster University of Applied Sciences), Münster
- Fachbereich Gestaltung, Folkwang Hochschule (Department of Design, Folkwang University of the Arts), Essen
- Fachbereich Maschinenbau, Fachhochschule Kaiserslautern (Department of Mechanical Engineering, Kaiserslautern University of Applied Sciences), Kaiserslautern
- Fachbereich Physikalische Technik, Fachhochschule Münster (Institute for Physical Technology, Muenster University of Applied Sciences), Steinfurt
- Fachhochschule Furtwangen (Furtwangen University of Applied Sciences), Furtwangen
- Forschungszentrum Informatik (FZI) (Research Center for Information Technologies), Karlsruhe
- Fraunhofer-Verbund Informations- und Kommunikationstechnik (IuK) (Fraunhofer Information and Communication Technology Group), Berlin
- Georg-August-Universität Göttingen (Georg-August-University Göttingen), Göttingen
- Hamburger Informatik Technologie-Center e.V., Universität Hamburg (Computer Science Technology Center of Hamburg, University of Hamburg), Hamburg
- Hasso-Plattner-Institut für Softwaresystemtechnik, Universität Potsdam (Hasso-Plattner-Institute for Software Systems Engineering, University of Potsdam), Potsdam
- Hochschule der Medien (Stuttgart Media University), Stuttgart
- Hochschule für Technik und Wirtschaft des Saarlandes (University of Applied Science), Saarbrücken
- Institut für Informatik IV, Technische Universität München (Institute for Computer Science, Technical University of Munich), Munich
- Institut für Technologie und Arbeit, Technische Universität Kaiserslautern (Institute for Technology and Work, University of Kaiserslautern), Kaiserslautern
- Institut für Technische und Betriebliche Informationssysteme, Otto-von-Guericke-Universität Magdeburg (Department of Technical & Business Information Systems, Otto von Guericke University), Magdeburg
- Lehrstuhl für Software Systeme, Universität Duisburg-Essen (Institute for Computer Science and Information Systems, University of Duisburg-Essen), Essen
- L3S Learning Lab Lower Saxony, Universität Hannover (Learning Lab Lower Saxony, University of Hanover), Hanover
- Oldenburger Forschungs- und Entwicklungsinstitut für Informatik-Werkzeuge und -Systeme OFFIS e.V. (Oldenburg Research and Development Institute for Computer Science Tools and Systems), Oldenburg
- Rheinisch-Westfälische Technische Hochschule Aachen (RWTH Aachen University), Aachen
- Technische Universität Clausthal (Clausthal University of Technology), Clausthal
- Technische Universität Darmstadt (Technical University of Darmstadt), Darmstadt
- Technische Universität Dresden (Technical University Dresden), Dresden
- Technische Universität Kaiserslautern (University of Kaiserslautern), Kaiserslautern
- Thüringer Anwendungszentrum für Software, Informations- und Kommunikationstechnologie GmbH (Thüringen Application Center for Software and Technology of Information and Communication), Ilmenau
- Universität Karlsruhe (University of Karlsruhe), Karlsruhe
- Universität Koblenz-Landau (University of Koblenz-Landau), Landau
- Universität Leipzig (University of Leipzig), Leipzig
- Universität Potsdam (University of Potsdam), Potsdam
- Universität Stuttgart (University of Stuttgart), Stuttgart
- Universität Würzburg (University of Würzburg), Würzburg
- VDI/VE Innovation + Technik GmbH (VDI - The Association of German Engineers), Berlin
- Westpfalz-Klinikum GmbH, Kaiserslautern

**INTERNATIONAL RESEARCH PARTNERS**

- AGE - The European Older People's Platform, Brussels, Belgium
- Aristotle University of Thessaloniki, Thessaloniki, Greece
- Bay Zoltan Foundation for Applied Research, Budapest, Hungary
- Bournemouth University, Poole, UK
- Budapest University of Technology and Economics, Budapest, Hungary
- Building Research Establishment, Watford, UK
- C-Base, Center for Empirically Based Software Engineering, Maryland, USA
- Centre d'Excellence en Technologies de l'Information et de la Communication (CETIC), Charleroi, Belgium
- Centre National de la Recherche Scientifique, Paris, France
- Centro Ricerche Fiat, Torino, Italy
- Chalmers Tekniska Högskola Aktiebolag, Göteborg, Sweden
- Consiglio Nazionale delle Ricerche, Rome, Italy
- DEMOKRITOS, National Centre for Scientific Research, Aghia Paraskevi Attikis, Greece
- Dublin City University, Dublin, Ireland
- Eidgenössische Technische Hochschule Zürich, Zurich, Switzerland
- European Software Institute, Zamudio, Spain
- Experimental Software Engineering Group (UMD/ESEG), University of Maryland, College Park, USA
- Facultés Universitaires Notre-Dame de la Paix, Namur, Belgium
- Fundación Vodafone España, Madrid, Spain
- Gazi Üniversitesi, Ankara, Turkey
- Groupe des Ecoles de Télécom, Institut National de Télécommunications, Évry Cedex, France
- Helsinki University of Technology, Espoo, Finland
- Heriot-Watt University, Edinburgh, UK
- Information Society Open To Impairments, Athens, Greece
- Infovide Spolka Akcyjna, Warsaw, Poland
- Institut National de Recherche en Informatique et Automation, Le Chesnay, France
- Institut National Polytechnique de Toulouse, Toulouse, France
- ITRC Software Process Improvement Center, Korea Advanced Institute of Science and Technology, Daejeon, Republic of Korea
- Japan Aerospace Exploration Agency JAXA, Tokyo, Japan
- Japan Electronics and Information Technology Industries Association JEITA, Tokyo, Japan
- Japan Manned Space Systems Corporation, Ibaraki, Japan
- Katholieke Universiteit Leuven, Leuven, Belgium
- Kungliga Tekniska Högskolan, Stockholm, Sweden
- Laboratory for Software Engineering Decision Support, University of Calgary, Calgary, Canada
- Latvijas Universitātes Matemātikas un Informatikas Institūts, Riga, Latvia
- Linköpings Universitet, Linköping, Sweden
- Lulea Tekniska Universitet, Lulea, Sweden
- Medical University of Graz, Graz, Austria
- National College of Ireland, Dublin, Ireland
- National ICT Australia (NICTA), Australian Technology Park, Eveleigh, Australia
- National Technical University of Athens, Athens, Greece
- New Bulgarian University, Sofia, Bulgaria
- Norsk Regnesentral/Norwegian Computing Center, Oslo, Norway
- Norwegian University of Science & Technology, Trondheim, Norway
- Office National d'Etudes et de Recherche Aéronautiques, Chatillon, France
- Polish Japanese Institute of Information Technology, Warsaw, Poland
- Politechnika Warszawska, Warsaw, Poland
- Scuola Superiore di Studi Universitari e di Perfezionamento Sant'Anna, Pisa, Italy
- SEARCH-LAB, Security Evaluation Analysis and Research Laboratory Ltd, Budapest, Hungary
- SEERC, Thessaloniki, Greece
- SQI Software Quality Institute, Griffith University, Brisbane, Australia
- Stichting Centrum voor Wiskunde en Informatica, Amsterdam, The Netherlands
- Stiftelsen SINTEF, Trondheim, Norway
- Tampere University of Technology (Pori), Pori, Finland
- Technische Universiteit Eindhoven, Eindhoven, The Netherlands
- The University of Newcastle upon Tyne, Newcastle upon Tyne, UK
- Tsinghua University, Beijing, China
- Umeå Universitet, Umeå, Sweden
- Universidad Politecnica de Madrid, Madrid, Spain
- Universidad Rey Juan Carlos, Mostoles, Spain
- Università degli Studi di Trieste, Trieste, Italy
- Università di Bologna, Bologna, Italy
- Università di Pisa, Pisa, Italy
- Universiteit Maastricht, Maastricht, The Netherlands
- Universitetet i Oslo, Oslo, Norway
- University of Manchester, Manchester, UK
- University of Queensland, Australia
- Vienna University of Technology, Vienna, Austria
- VTT Electronics, Oulu, Finland

**INTERNATIONAL SOFTWARE ENGINEERING NETWORK (ISERN)**

- Avaya Labs, USA
- Blekinge Institute of Technology, Sweden
- COPPE, Brazil
- Fraunhofer Center for Experimental Software Engineering Maryland, USA
- Fraunhofer Institute for Experimental Software Engineering, Germany
- Free University of Bolzano-Bozen, Italy
- Information-technology Promotion Agency, Japan
- Institute of Software, Chinese Academy of Sciences (ISCAS), China
- Lab for Internet Software Technology, Japan
- Manned Space, Japan
- Japan Aerospace Exploration Agency JAXA, Japan
- Leiden University, The Netherlands
- LERO, Ireland
- Lund University, Sweden
- Massachusetts Institute of Technology, USA
- Microsoft Research, USA
- Nara Institute of Science and Technology, Japan
- Kalemun, Canada
- Naval Postgraduate School, USA
- North Carolina State University, USA
- Northrop Grumman, USA
- Norwegian University of Science and Technology, Norway
- NRC Institute for Information Technology; Canada
- NTT Data Corporation, Japan
- Osaka University, Japan
- Robert BOSCH GmbH, Germany
- Simula, Labs, Norway
- SINTEF, Norway
- R&D Ware, Finland
- Technische Universität München, Germany
- Universidad Politécnica de Madrid, Spain
- Universidad Politécnica de Valencia, Spain
- Università degli Studi dell'Insubria, Italy
- Università degli Studi di Roma Tor Vergata, Italy
- University of Alabama, USA
- University of Alberta, Canada
- University of Auckland, New Zealand
- University of Bari, Italy
- University of Calgary, Canada
- University of Castilla-La Mancha, Spain
- University of Hawaii, USA
- University of Helsinki, Finland
- University of Kaiserslautern, Germany
- University of Maryland-Baltimore County, USA
- University of Maryland-College Park, USA
- University of New South Wales, Australia
- University of Oslo, Norway
- University of Oulu, Finland
- University of São Paulo, Brazil

- University of Sheffield, UK
- University of Southern California, USA
- University of Technology Sydney, Australia
- University Politecnico di Torino, Italy
- University of Uruguay (ORT), Uruguay
- Vienna University of Technology, Austria
- VTT Electronics, Finland

**VISITORS HOSTED**

- Danuta Hübner, European Union Commissioner, January 14
- Michael Ebert, Bosch, Germany, February 4
- Prof. Steffi Hußlein, Anhalt University of Applied Sciences Dessau, at the Bauhaus, Department of Design, Berlin, Germany, March 20
- Dipl.-Psych. Jörn Hurtienne, Center for Human-Machine Systems, Technical University of Berlin, Berlin, Germany, March 20
- Dr. Dietlind Tiemann, Lord Mayor, Brandenburg an der Havel, Germany, April 9
- Mihnea Radulescu, University of Cluj, CS Department, Cluj, Romania, April 15-18
- Dr. Eduardo Almeida, CS Department, Federal University of Bahia, Salvador, Brazil, April 25-30
- Prof. Kosta Beznosow, University of British Columbia, Vancouver, Canada, April 29

- Prof. Manoel Gomes de Mendonca Neto, PCS Department, Federal University of Bahia, Salvador, Brazil, June 1
- Tomas Martines Ruiz, University of Castilla-La-Mancha, Alarcos Research Group, Spain, June 1 - December 31
- Sir Robin Wales, Mayor, London-Newham, UK, July 30
- Musalasoft, Bulgaria, August 25
- Prof. Günther Ruhe, University of Calgary, Canada, September 1
- State Secretary & Member of German Parliament Achim Grossmann & Member of German Parliament Gustav Herzog on the topic of "Electromobility & intelligent energy management", September 14
- Presidents of the ordinary courts of Rhineland-Palatinate, September 17
- Delegation from IKT Engineering, Herxheim, Germany, September 25
- Delegation from Hitachi Power Europe, Duisburg, Germany, October 2
- Japanese Delegation from Bunkyo-ku, with Mayor Mr. Hironobu Narisawa, Bunkyo-ku, Japan, October 19
- Dr. Inah Omoronyia, Dept. of Computer and Information Science, Norwegian University of Science and Technology (NTNU), Trondheim, Norway, October 26 -30
- Dipl.-Psych. Jörn Hurtienne, CS Department, University of Cambridge, Cambridge, UK,

# PROFESSIONAL CONTRIBUTIONS

## LECTURING ASSIGNMENTS

**Dörr, J.:**

Lecture  
Requirements Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2008/2009  
Winter 2009/2010

**Heidrich, J.:**

Lecture  
Software Project and Process  
Management,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2009

**Hussain, T.:**

Lecture  
Steuerungstechnik (Logic  
Control),  
Electical Engineering and  
Information Technology, Uni-  
versity of Kaiserslautern,  
Winter 2009/2010

**Kloos, J.:**

Single Lecture  
Systematisches Testen,  
Computer Science Department,  
University of Kaiserslautern / Fraunhofer IESE  
(Master of Software Engineering),  
September 13, 2009

**Münc, J.:**

Lecture  
Empirical Model Building and  
Methods (2+1),  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2009

Lecture

Process Modeling (2+1),  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2009

**Neisse, R.:**

Lab  
Security Engineering Lab,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2009/2010

**Pai, G.:**

Lecture  
Requirements Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2008/2009  
Winter 2009/2010

**Pretschner, A.:**

Lecture  
Advanced Topics of Software  
Testing,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2009/2010

**Pretschner, A.:**

Lecture  
Security Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2009

**Pretschner, A.:**

Lab  
Security Engineering Lab,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2009/2010

**Rombach, D.:**

Lecture  
Grundlagen des SE,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2008/2009  
Winter 2009/2010

Lecture

Software Project and Process  
Management;  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2009

Lecture

Requirements Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2008/2009  
Winter 2009/2010

Lecture

Product Line Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2009/2010

**Trapp, M.:**

Lecture/Exercise  
Automotive Software Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2009

## EDITORIAL BOARDS

**Bomarius, F.:**

Member, Editorial Board,  
Ph.D. Theses in Experimental  
Software Engineering, Fraun-  
hofer IRB Publishing Com-  
pany, since 2001

**Liggismeyer, P.:**

Editor, it – information tech-  
nology,  
Oldenbourg-Verlag,  
München, since 2003

Member, Editorial Board,  
Lecture Notes in Informatics  
(LNI), Gesellschaft für In-  
formatik GI, Springer, since  
2003

Editor, Informatik – For-  
schung und Entwicklung,  
Springer, since 2000

Member, Editorial Board,  
Ph.D. Theses in Experimental  
Software Engineering, Fraun-  
hofer IRB Publishing Com-  
pany, since 2004

**Luiz, T.:**

Coordinating Editor, Me-  
dizinische Gefahrenabwehr,  
since 2009

**Münc, J.:**

Co-Guest Editor, Software  
Process Improvement and  
Practice Journal,  
John Wiley and Sons, 2006

Co-Guest Editor, Software  
Process  
Improvement and Practice  
Journal, Special Issue on  
Profes 2007  
John Wiley and Sons, 2007

Member, Editorial Board,  
e-Informatica, since 2006

**Pretschner, A.:**

Associate Editor, Software and Systems Modeling, Springer, since 2007

**Rombach, D.:**

Associate Editor, IEEE Transactions on Software Engineering, since 2003

Associate Editor, International Journal of Empirical Software Engineering, Springer-Verlag, since 1996

Member, Editorial Board, International Journal of Software Process: Improvement and Practice, John Wiley and Sons, since 1994

Member, Editorial Board, Informatik: Forschung und Entwicklung, Gesellschaft für Informatik GI, Springer, since 1993

Editor, Editorial Board, Ph.D. Theses in Experimental Software Engineering, Fraunhofer IRB Publishing Company, since 2000

Member, Editorial Board, International Journal of Software and Informatics, Institute of Software, Chinese Academy of Sciences, Beijing, since 2007

**Wessner, M.:**

Member, Editorial Board, Journal of Educational Multimedia and Hypermedia, Association for the Advancement of Computing in Education, Chesapeake, USA, since 2005

**COMMITTEE ACTIVITIES****Adam, S.:**

Workshop Organizer, 1<sup>st</sup> Workshop for Requirements Engineering and Business Process Management, REBPM 2009 in conjunction with SE 2009, Kaiserslautern, Germany, March 3

Member, Program Committee, 10<sup>th</sup> Workshop on Business Process Modeling, Development, and Support, BPMDS'09 in conjunction with CAISE'09, Amsterdam, The Netherlands, June 8-9

**Bauer, T.:**

Workshop Organizer, 2<sup>nd</sup> Workshop on Model-based Testing in Practice, MoTiP 2009 in conjunction with ECMDA'09, Enschede, The Netherlands, June 23-26

**Ciolkowski, M.:**

Member, Program Committee, 2<sup>nd</sup> International Conference on Software Testing, Verification, and Validation, ICST 2009, Denver, USA, April 1-4

Member, Program Committee, Engineering of Autonomic and Autonomous Systems, EASE 2009, Durham, UK, April 20-21

Member, Program Committee, 10<sup>th</sup> International Conference on Product Focused Software Development and Process Improvement, Profes 2009, Oulu, Finland, June 15-17

Member, Program Committee, 16<sup>th</sup> Conference on European Systems and Software Process Improvement and Innovation, EuroSPI 2009, Alcalá, Spain, September 2-4

Member, Program Committee, 3<sup>rd</sup> International Symposium on Empirical Software Engineering and Measurement, ESEM 2009, Lake Buena Vista, USA, October 15-16

**Dörr, J.:**

Organizing Chair, SE 2009, Kaiserslautern, Germany, March 2-6

Workshop Organizer, 1<sup>st</sup> Workshop for Requirements Engineering and Business Process Management, REBPM 2009 in conjunction with SE 2009, Kaiserslautern, Germany, March 3

Member, Program Committee, 5<sup>th</sup> International Working Conference on Requirements Engineering: Foundation for Software Quality, RefsQ 2009, Amsterdam, The Netherlands, June 8-9

Member of Steering Committee, Special Interest Group "Requirements Engineering" of Gesellschaft für Informatik

**Eschbach, R.:**

Workshop Organizer, 5<sup>th</sup> Workshop on Advances in Model Based Testing, A-MOST 2009 in conjunction with ICST 2009, Denver, USA, April 1-4

Member, Program Committee, 2<sup>nd</sup> Workshop on Model-based Testing in Practice, MoTiP 2009 in conjunction with ECMDA'09, Enschede, The Netherlands, June 23-26

Member, Program Committee, The Second International Conference on Advances in System Testing and Validation Lifecycle, VALID 2010, Nice, France, August 22-27

**Gross, A.:**

Member, Program Committee, Workshop on Designing with Care, DwC'09 in conjunction with Pervasive-Health09, London, UK, March 31

**Heidrich, J.:**

Member, Program Committee, 10<sup>th</sup> International Conference on Product Focused Software Development and Process Improvement, Profes 2009, Oulu, Finland, June 15-17

**Jedlitschka, A.:**

Member, Program Committee, 10<sup>th</sup> International Conference on Product Focused Software Development and Process Improvement, Profes 2009, Oulu, Finland, June 15-17

Workshop Organizer, 11<sup>th</sup> International Workshop on Learning Software Organizations, LSO 2009 in conjunction with Profes 2009, Oulu, Finland, June 15-17

Member, Program Co-Chair, 17<sup>th</sup> Annual Meeting of the International Software Engineering Research Network , ISERN 2009 in conjunction with ESEIW 2009, Lake Buena Vista, USA, October 12-16

Member, Program Committee, 3<sup>rd</sup> International Symposium on Empirical Software Engineering and Measurement, ESEM 2009, Lake Buena Vista, USA, October 15-16

Member, Program Committee, VI Experimental Software Engineering Latin American Workshop, ESELAW 2009, São Carlos, Brazil, November 11-13

**John, I.:**

Member, Program Committee, 13<sup>th</sup> International Software Product Line Conference, SPLC 2009, San Francisco, USA, August 24-28

**Klās, M.:**

Session Chair, Session Software Processes in conjunction with SEAA 2009, Patras, Greece, August 27-29

Session Chair, Session Empirical Approaches in conjunction with SEAA 2009, Patras, Greece, August 27-29

**Klaus, A.**

Member, Program Committee, The Second International Conference on Advances in System Testing and Validation Lifecycle, VALID 2010, Nice, France, August 22-27

**Kleinberger, T.**

Member, Program Committee, 3<sup>rd</sup> European Conference on Ambient Intelligence, Aml 2009, Salzburg, Austria, November 18-21

**Liggesmeyer, P.**

General Chair and Program Chair, SE 2009, Kaiserslautern, Germany, March 2-6

Member, Program Committee, European Workshop on Dependable Computing, EWDC 2009, Toulouse, France, May 14-15

Member, Program Committee, Model-Based Verification & Validation in conjunction with SSIRI 2009, Shanghai, China, July 8-10

Member, Program Committee, Conquest Conference, CONQUEST 2009, Nuremberg, Germany, September 18-20

Member, Program Committee, MetriKon 2009, Kaiserslautern, Germany, November 19-20

**Luiz, T.:**

Member, Scientific Program Committee, Wissenschaftlicher Arbeitskreis Notfallmedizin in conjunction with DAC 2009, Leipzig, Germany, May 11

**Münch, J.**

Workshop & Tutorial Chair, Software Engineering, SE 2009, Kaiserslautern, Germany, March 2-6

Co-Organizer, 2. Workshop zur Software-Qualitätsmodellierung und -bewertung, SQMB '09, in conjunction with SE 2009, Kaiserslautern, Germany, March 3

Member, Program Committee, 2<sup>nd</sup> International Conference on Software Testing, Verification, and Validation, ICST 2009, Denver, USA, April 1-4

Member, Program Committee, International Conference on Software Process, ICSP 2009, Vancouver, Canada, May 16-17

Executive Board Member, DASMA, Cologne, Germany, May 25

Member, Program Committee, Software & Systems Engineering Essentials, SEE 2009, Berlin, Germany, May 25-27

Member, Program Committee, Software Measurement European Forum, SMEF 2009, Rome, Italy, May 27-29

Member, Program Committee, 10<sup>th</sup> International Conference on Product Focused Software Development and Process Improvement, Profes 2009, Oulu, Finland, June 15-17

Member, Program Committee, The 4<sup>th</sup> International Conference on Global Software Engineering, ICGSE 2009, Limerick, Ireland, July 13-16

Member, Program Committee, 3<sup>rd</sup> International Workshop on Tool Support Development and Management in Distributed Software Projects (REMIDI'09) in conjunction with ICGSE 2009, Limerick, Ireland, July 13-16

Member, Program Committee, 35<sup>th</sup> EUROMICRO Conference on Software Engineering and Advanced Applications, SEAA 2009, Patras, Greece, August 27-29

Member, Program Committee, INFORMATIK 2009 – Im Focus das Leben, Lübeck, Germany, September 28 - October 2

Member, Program Committee, 4<sup>th</sup> IFIP TC2 Central and East European Conference on Software Engineering Techniques, CEE-SET 2009, Krakow, Poland, October 12-14

Member, Program Committee, 3<sup>rd</sup> International Symposium on Empirical Software Engineering and Measurement, ESEM 2009, Lake Buena Vista, USA, October 15-16

Co-Organizer, Workshop on Information System in Distributed Environment, ISDE 2009 in conjunction with OnTheMove 2009, Vilamoura, Portugal, November 1-6

Member, Program Committee, Workshop on Information System in Distributed Environment, ISDE 2009 in conjunction with OnTheMove 2009, Vilamoura, Portugal, November 1-6

Member, Program Committee, 19<sup>th</sup> International Workshop on Software Measurement, International Conference on Software Process and Product Measurement, IWSM-MENSURA 2009, Amsterdam, Netherlands, November 4-6

Member, Program Committee, MetriKon 2009, Kaiserslautern, Germany, November 19-20

**Pretschner, A.:**

Member, Program Committee, 2<sup>nd</sup> International Conference on Software Testing, Verification, and Validation, ICST 2009, Denver, USA, April 1-4

Member, Program Committee, 5<sup>th</sup> Workshop on Advances in Model Based Testing, A-MOST 2009 in conjunction with ICST 2009, Denver, USA, April 1-4

Member, Program Committee, 6<sup>th</sup> Workshop on Model Driven Engineering Verification and Validation MoDeVVA 2009 in conjunction with ICST 2009, Denver, USA, April 1-4

Member, Program Committee, 5<sup>th</sup> ACM Symposium on Information, Computer and Communications Security, ASIACCS 2010, Beijing, China, April 13-16

Member, Program Committee, Automation of Software Test in conjunction with ICSE 2009, Vancouver, Canada, May 16-24

Member, Program Committee, Workshop on Security and High Performance Computing, HPCS, Leipzig, Germany, June 21 - 24

Member, Program Committee, 2<sup>nd</sup> Workshop on Model-based Testing in Practice, MoTiP 2009 in conjunction with ECMDA'09, Enschede, Netherlands, June 23-26

Member, Program Committee, 47<sup>th</sup> International Conference on Objects, Components, Models and Patterns, TOOLS EUROPE 2009, Zurich, Switzerland, June 29 - July 3

Member, Program Committee, 1<sup>st</sup> IEEE International Workshop on Security Aspects of Process and Services Engineering, SAPSE 2009 in conjunction with COMPSAC 2009, Seattle, USA, July 20-24

Member, Program Committee, 2<sup>nd</sup> International Workshop on Security and Privacy in Enterprise Computing, InSPEC 2009 in conjunction with EDOC 2009, Auckland, New Zealand, September 1-4

Member, Program Committee, Modellbasiertes Testen, MOTES09 in conjunction with INFORMATIK 2009 – Im Focus das Leben, Lübeck, Germany, September 28 - October 2

Member, Program Committee, 12<sup>th</sup> International Conference on Model Driven Engineering Languages and Systems, MODELS 2009, Denver, USA, October 4-9

Member, Program Committee, Symposium on Automotive/ Avionics Systems Engineering, SAASE 2009, San Diego, USA, October 14-16

Member, Program Committee, Workshop on Secure Execution of Untrusted Code, SecuCode 2009, in conjunction with CSS 2009, Chicago, USA, November 9

**Rombach, D.:**

Coordinator, German-Hungarian Cooperation, University of Kaiserslautern, Germany,

Member of the Steering Committee and Chair, 17<sup>th</sup> Annual Meeting of the International Software Engineering Research Network ISERN, Lake Buena Vista, Florida, USA, October 12-13

**Villela, K.:**

Member, Program Committee, SBQS 2009 (VIII Brazilian Symposium on Software Quality), Ouro Preto, Brazil, June 1-5

Member, Program Committee, SBES 2009 (XXIII Brazilian Symposium on Software Engineering), Fortaleza, Brazil, October 05-09

Member, Program Committee, CLEI 2009 (XXXV Latin American Informatics Conference), Pelotas, Brazil, September 22-25

**SCIENTIFIC AND TECHNOLOGICAL ADVISORY BOARDS**

**Eschbach, R.:**

Member, VDI-Fachausschuss "Qualitätssicherung für Software in der Medizintechnik", since 2008

Member, VDI/ VDE GMA Fachausschuss 1.50 Methoden der Steuerungstechnik, since 2008

**Göpfert, B.:**

Member, STAR-Anwenderbeirat, Munich, Germany, since October 2007

**Hussain, T.:**

Member, VDI/ VDE GMA Fachausschuss 1.50 Methoden der Steuerungstechnik, since 2008

**Kerkow, D.:**

Member, VDI-Fachausschuss "Qualitätssicherung für Software in der Medizintechnik", Dusseldorf, Germany, since 2008

Member, Forum MedTech Pharma e.V.; Geschäftsstelle Bayern innovativ GmbH, Nuremberg, Germany, since 2008

Guest member, Normierungsgremium DKE, (VDE, DIN) UK 811.4, Frankfurt, Germany, since 2008

**Klaus, A.:**

Member, VDI-Fachausschuss "Qualitätssicherung für Software in der Medizintechnik", since 2009

**Liggesmeyer, P.:**

Member, Steering Committee, Gesellschaft für Informatik, Germany, since 1999

Chair, GI Special Interest Group "Softwaretechnik", Germany, since 1999

**Münch, J.:**

Member, Committee, Diploma Thesis Awards, DASMA e.V., Germany, since 2005

**Pretschner, A.:**

Member, Steering Committee, A-MOST, since 2008

Member, Steering Committee, Modeling Wizards Master Class

**Rombach, D.:**

Member, Technologiebeirat TBR ("Technology Advisory Board") for the Government of the State of Rhineland-Palatinate, Germany, since 1993

Coordinator, ISERN (International Software Engineering Research Networks), since 1996

Member, Advisory Board, Fraunhofer Center Maryland, College Park, USA, since 1998

Member, Advisory Board, Otto A. Wipprecht-Stiftung, Germany, since 1999

Chairman, Fraunhofer ICT Group, Germany, since 2006

Member, Steering Committee, Fraunhofer-Gesellschaft e.V., Germany, since 2000

Member, Advisory Board, Fraunhofer-Gesellschaft, Munich, Germany, since 2006

Member, Advisor & Expert Group for the Minister President of Rhineland-Palatinate, Germany, since 2002

Member, Board, SEI Process Achievement Award, USA, since 2003

Member, Committee, IEEE Harlan D. Mills Award, USA, since 2000

Member, Advisory Board, KIST (Korea Institute of Science and Technology) Europe Forschungsgesellschaft mbH, Korea, since 2006

Member, Scientific Advisory Board, NICTA (National Information and Communications Technologies Australia), Australia, since 2006

Member, Advisory Board, Business and Innovation Center (BIC), Kaiserslautern, Germany, since 2007

**PARTICIPATION IN DELEGATIONS**

**Rombach, D.:**

Member, Delegation Federal Ministry of Education and Research BMBF, Minister Prof. Dr. A. Schavan, São Paulo, Salvador, Brazil, March 02 - 17, 2009

**MEMBERSHIPS IN INDUSTRIAL ADVISORY BOARDS**

**Münch, J.:**

Member, Advisory Board, SASQIA / OrgaTech GmbH, Lünen, Germany, since 2006

Member, Advisory Board, ACCEL GmbH, Lünen, Germany, since 2006

**Rombach, D.:**

Member, Advisory Board, Stiftung der Gasanstalt, Kaiserslautern, Germany, since 2002

Member, Advisory Board, Stadtsparkasse Kaiserslautern, Kaiserslautern, Germany, since 2004

Chairman of the Board., 1. FC Kaiserslautern (Professional Soccer Club), Kaiserslautern, Germany, since 12/2008

Member, Scientific Advisory Board, UNICATUM, Kaiserslautern, since 2009.



**MEMBERSHIPS IN PROFESSIONAL ASSOCIATIONS**

- ACL** – Association for Computational Linguistics
- ACM** – Association of Computing Machinery
- AGBC** – American-German Business Club Deutschland e.V.
- AMS** – American Mathematical Society
- ASQF e.V.** – Arbeitskreis Software-Qualität in Franken
- BV-Päd.** – Bundesverband der Diplom-Pädagoginnen und Diplom-Pädagogen e.V.
- DASMA** – German Software Metrics and Effort Estimation Association
- DGI** – Deutsche Gesellschaft für Informationswissenschaft und Informationspraxis e.V.
- gc-UPA** – German Chapter of the Usability Professionals' Association
- GDM** – Gesellschaft für Didaktik der Mathematik
- GI** – Gesellschaft für Informatik
- IEEE** – Institute of Electrical and Electronic Engineers
- IMA** – Institute of Mathematics and its Application
- ISSECO** – International Secure Software Engineering Council
- LAP** – Liberty Alliance Project
- OMG** – Object Management Group
- STI** – Software Technologie Initiative e.V.
- Tekom** – Fachverband für technische Kommunikation und Dokumentation
- Weit e.V.**

**KEYNOTES**

- Liggemeyer, P.:**  
"Qualität eingebetteter Systeme", Software Quality Days, Vienna, Austria, January 22
- "Applied Research in Software Engineering and the Fraunhofer Approach", 5<sup>th</sup> India Innovation Summit 2009, Bangalore, India, June 12-13
- "Software-Qualitätssicherung in technischen Anwendungen: Stand Praxis, Standards / Erfahrungen", Conquest 2009, Nuremberg, Germany, September 16-18
- "Entwicklung sicherheitsgerichteter Systeme: Stand der Technik, Herausforderungen und Lösungsansätze", SGS-Kongress, Stuttgart, Germany, October 21
- "A Tool for Risk Management in Large Innovation Projects", European Council on Innovation, Berlin, Germany, November 9-10
- "Embedded Software Engineering: Weichenstellung für die Zukunft", ESE-Kongress, Sindelfingen, Germany, December 10
- Neisse, R.:**  
"Trust Management in Pervasive and Service-oriented Architectures", Workshop on Security and High Performance Computing Systems, Leipzig, Germany, June 24

- "Trust Management in Context-Aware and Service-Oriented Architectures", EUROCAT, Pisa, Italy, September 7
- Pretschner, A.:**  
"Usage Control: From Policies to Mechanisms", FOMSESS Jahrestagung, Karlsruhe, Germany, March 5
- "Distributed Usage Control", Knowledge Engineering: Principles and Techniques Conference (KEPT) 2009, Cluj, Romania, July 3
- Rombach, D.:**  
"IT-Technology as Part of Urban Development Strategies", Conference on Urban Development (UPE 2009), Kaiserslautern, Germany, March 24
- "Design for Maintenance: Use of Engineering Principles & Product Line Technology", European Conference on SW Maintenance (CSMR 2009), Kaiserslautern, Germany, March 25
- "Architekturen und Infrastrukturen für One Stop E-Government", dbb-Kongress 2009, Leipzig, Germany, May 5
- "The Fraunhofer Model: A Successful Model to Speed up Innovation in the ICT Sector", Opening of CeBIT Australia, Sydney, Australia, May 12
- "Global Software Engineering: Criteria for Intelligent Choices", 4<sup>th</sup> IEEE International Conference on Global SE (ICGSE), Limerick, Ireland, July 15

- "Software Product Lines in Practice – A Fraunhofer Experience Report", Practical Product Lines (PPL) Conference, Amsterdam, Netherlands, October 20
- "Software Engineering for Medicine and Health", Fraunhofer USA 15<sup>th</sup> Anniversary Meeting, Crystal City, USA, October 23
- "Software-Messung: Stand der Technik und neue Herausforderungen", Metrikon Conference, Kaiserslautern, Germany, November 19
- Trapp, M.:**  
Workshop Healthcare Diagnostics Products, Schwalbach, Germany, January 22
- "Safety of Embedded Software Systems - Challenges, Chances, and Misconceptions", Embedded World 2009, Nuremberg, Germany, March 3
- 6<sup>th</sup> SafeTRANS Industrial Day, Stuttgart, Germany, May 5
- Workshop NFPinDSML@MODELS09, Denver, USA, October 3
- Kongress Sicherheitsgerichtete Systeme, Stuttgart, Germany, October 21
- External Advisory Board John Deere, Magdeburg, Germany, November 9
- Tailoring Workshop, Mannheim, Germany, November 25

**PRESENTATIONS**

**Adam, S.:**

“IT Capability-based Business Process Design through Service-Oriented Requirements Engineering”, Workshop Presentation, BPMDS 2009, Caise 2009, Amsterdam, The Netherlands, June 9

**Anastasopoulos, M.:**

“Evolving a Software Product Line Reuse Infrastructure”, Workshop Presentation, VAMOS 2009 Workshop, University of Seville, Seville, Spain, January 27-30

“Konfigurationsmanagement und Qualitätssicherung im Spannungsfeld Kosten/Nutzen”, Industry Seminar, 11<sup>th</sup> DWT Symposium VERBINDUNGEN, Wilhelmshaven, Germany, July 1-2

“Controlling Software Product Line Evolution – an infrastructure on top of Configuration Management, Workshop Presentation, IWPSE-EVOL 2009, VU Amsterdam, Amsterdam, The Netherlands, August 24-25

**Bauer, T.:**

“Combining combinatorial and model-based test approaches for highly configurable safety-critical systems”, Presentation, 2<sup>nd</sup> Workshop on Model-based Testing in Practice (MoTiP’09), University of Twente, Enschede, Netherlands, June 23

“TTCN-3 and its role and usage in MBT from the D-MINT perspective”, Tutorial, TTCN-3 User Conference 2009, ETSI, Sophia Antipolis, France, June 03

**Carbon, R.:**

“Effiziente Entwicklung von eGovernment Infrastrukturen”, Konferenz, 10. eGovernment Kongress neueVerwaltung, dbb Akademie, Leipzig, Germany, May 5-6

**Ciolkowski, M.:**

“Empirical Software Engineering - An Introduction”, Talk, Technische Universität Mannheim, Mannheim, Germany, July 2

“The QualOSS Process Evaluation: Initial Experiences Assessing Open Source Processes”, Conference Paper, European Systems & Software Process Improvement and Innovation Conference (EURO-SPI 2009), Alcala de Henares, Spain, September 2-4

“What Do We Know About Perspective-Based Reading? An Approach for Quantitative Aggregation in Software Engineering”, Conference Paper, ESEM 2009, Orlando, USA, October 15-16

“The QualOSS Open Source Assessment Model”, Short Paper, ESEM 2009, Orlando, USA, October 15-16

“Measuring the Performance of Open Source Development Communities: The QualOSS Approach, Presentation, Metrikon 2009, DASMA, Kaiserslautern, Germany, November 19-20

**Dörr, J.:**

“Die Gesellschaft für Informatik – Fachgruppe “Requirements Engineering”, Conference Presentation, Recon 2009, Hood Group, Munich, Germany, March 9

**Eisenbarth, M.:**

“A Decade of Scoping - A survey”, Conference Presentation, SPLC 2009, SEI, San Francisco, USA, August 25-27

“Lessons learned from best practice-oriented process improvement in Requirements Engineering - A glance into current industrial RE application”, Conference Presentation, REET 2009 at RE 2009, IEEE, Atlanta, USA, August 31

“Using Task-oriented Requirements Engineering in Different Domains – Experience of Application in Research and Industry”, Conference Presentation, RE 2009, IEEE, Atlanta, USA, September 02

**Elberzhager, F.:**

“Software Inspections Using Guided Checklists to Ensure Security Goals”, Presentation, SecSE 2009, FIT, Fukuoka, Japan, March 3

“Software Inspektion”, Industrial Seminar, Software Inspektion Seminar, Testo, Lenzkirch, Germany, December 1-3

**Elberzhager F.; Jung, C.,**

“Angeleitete Inspektionen mit Werkzeugunterstützung am Beispiel des Qualitätsaspekts Security”, Presentation, STI Jahrestreffen, STI, Kaiserslautern, Germany, November 12

**Elberzhager F.; Rosbach, A.:**

“Software Inspektion”, Industrial Seminar, Software Inspektion Seminar, Testo, Lenzkirch, Germany, November 3-5

“Verifikation & Validierung”, Presentation, MedTech, EuroCat, Frankfurt, Germany, November 26

**Eschbach, R.:**

“Systematisches Testen und Verifizieren von Software”, Presentation, DIA Seminar, DIA, Heidelberg, Germany, June 5

“Qualitätsmodelle”, Presentation, ViERforES Workshop, Fraunhofer IESE, Kaiserslautern, Germany, September 8

“Qualitätsmodelle für Safety und Security und darauf aufbauende Visualisierungstechniken”, Presentation, 1. Statustagung Innovationsallianz Virtuelle Techniken, VDTc Magdeburg, Magdeburg, Germany, September 18

“Modellbasiertes statistisches Testen”, Präsentation, ITK, IESE, Kaiserslautern, Germany, September 25

“Risikobasiertes Statistisches Testen sicherheitskritischer eingebetteter Systeme in der Medizintechnik”, Presentation, MedConf 2009, Munich, Germany, October 13-15

“SW-Test von Embedded Software”, Industrial Seminar, B. Braun, Melsungen, Germany, November 05

“Risikobasiertes statistisches Testen sicherheitskritischer eingebetteter Systeme, Presentation, 7<sup>th</sup> SafeTRANS Industrial Day, Friedrichshafen, Germany, November 19

“Risikobasiertes statistisches Testen eingebetteter Systeme in der Medizintechnik”, Presentation, Seminar Medizintechnik, EuroCat, Frankfurt, Germany, November 25

“Inspektions- und Review-techniken”, Industry Workshop, Embedded Safety Group, Mannheim, Germany, December 10

“Risk-based Quality Assurance”, Presentation, SQRL Workshop, University of Tennessee, Knoxville, USA, December 10

**Eschbach, R.; Hussain, T.:**  
“Risikobasiertes statistisches Testen”, Presentation, VDI/VDE GMA FA 1.5, VDI/VDE, Frankfurt, Germany, May 15

**Eschbach, R.; Hussain, T.; Kloos, J.:**  
“Systemzuverlässigkeit”, Presentation, Hitachi: Power Europe, Fraunhofer IESE, Kaiserslautern, Germany, October 2

**Eschbach, R.; Klaus, A.:**  
“Define Review, Verification and Validation, Presentation, VDI Fachausschuss, VDI, Frankfurt, Germany, September 16

**Eschbach, R.; Zimmermann, F.; Elberzhager, F.; Hussain, T.:**  
“Vorstellen des Testens, Testprozesse, Teststandards, Normen”, Presentation, DNT-Workshop, IESE, Kaiserslautern, Germany, May 09

**Göpfert, B.:**  
“Aktuelle Entwicklungen und Trends”, Presentation, Fraunhofer Jahrestagung der Fachinformationsmanager 2009, STAR-Anwenderbeirat, Bremen, Germany, October 14

**Groß, A.:**  
“EPC vs. UML Activity Diagram – Two Experiments Examining their Usefulness for Requirements Engineering”, Conference-Presentation, RE 2009, Atlanta, USA, August 31 - September 4

**Heidrich, J.:**  
“Vermessung der Prozess-treue im Qualitätsmanagement”, Conference Paper, Metrikon 2009, DASMA, Kaiserslautern, Germany, November 19-20

“Zielgerichtete Kontrolle von Software-Entwicklungsprojekten”, Workshop, Ausgezeichnete Informationsdissertationen 2008, GI-Fachgruppe Software-Reengineering (SRE), Dagstuhl, Germany, May 18

“Measurement-based Alignment of Software Strategie and Business Goals, Tutorial, EuroSPI, Alcalá de Henares, Spain, September 2

“Measurement-based Alignment of Software Strategy and Business Goals”, Tutorial, Metrikon 2009, DASMA, Kaiserslautern, Germany, November 20

**Heintz, M.:**  
“Real walking in virtual learning environments: Beyond the advantage of naturalness”, Conference paper, EC-TEL 2009, 4<sup>th</sup> European Conference on Technology Enhanced Learning, Nice, France, September 29 - October 2

**Hussain, T.:**  
“Statistical Testing of IEC 61499 compliant software components”, Presentation, INCOM 2009, IFAC, Moscow, Russia, June 03

**John, I.:**  
“Evolutionary Product Line Requirements Engineering”, Tutorial, SPLC 2009, SEI, San Francisco, USA, August 24–28

**Keuler, T.:**  
“Interaction-sensitive Synthesis of Architectural Tactics in Connector Designs”, Conference Presentation, Working IEEE/IFIP Conference on Software Architecture, Cambridge, UK, September 14-17

**Klaes, M.:**  
“Comprehensive Landscape for Software-related Quality Models”, Workshop, SQMB '09 (SE2009), Kaiserslautern, Germany, March 3

“CQML Scheme: A Classification Scheme for Comprehensive Quality Model Landscapes”, Conference Paper, EUROMICRO 2009, Patras, Greece, August 27

**Klaus, A.:**  
“Security Inspection Scenarios - A Facet of Security”, Presentation, VALID 2009, IARIA, Porto, Portugal, September 22

**Klöckner, K.:**  
“Veto”: Eine empirische Studie über die Steigerung der User Experience durch Autonomie”, Conference Presentation, Mensch & Computer 2009, German UPA, Berlin, Germany, September 9

**Kloos, J.:**  
“Zuverlässigkeitsbestimmung mittels statistischem Testen”, Industry Workshop, Embedded Safety Group, Embedded Safety Group, Mannheim, Germany, September 17

“A systematic approach to construct compositional behaviour models for network-structured safety-critical systems.”, Presentation, FACS 2009, UN University, Eindhoven, The Netherlands, November 9

**Kloos, J.; Eschbach, R.:**  
“Themenvorstellung für DNT-Nachfolgeantrag”, Presentation, DNT-Workshop, IESE, Kaiserslautern, Germany, Oktober 9

**Knodel, J.:**  
“Analyzing Architectures with Fraunhofer SAVE – Software Architecture Visualization and Evaluation”, Lecture Software Architectures (SWA), Hochschule Mannheim, Mannheim, Germany, April 3

“From Architecture to Source Code – How to Ensure Architecture Compliance in the Implemented Systems”, Workshop, 11<sup>th</sup> Workshop Software Reengineering (WSR), GI-Fachgruppe Software-Reengineering (SRE), Bad Honnef, Germany, May 4-6

“Fraunhofer SAVE - Software Architecture Visualization and Evaluation”, Workshop, 11<sup>th</sup> Workshop Software Reengineering (WSR), GI-Fachgruppe Software-Reengineering (SRE), Bad Honnef, Germany, May 4-6

“From Architecture to Source Code - How to Ensure Architecture Compliance in the Implemented System”, Presentation, Software and Systems Engineering Essentials (SEE 2009), 4SOFT GmbH, TU Clausthal, Berlin, Germany, May 26-27

**Luiz, T.,**

“Prozessoptimierung der innerklinischen Schlaganfallversorgung”, Presentation, Wissenschaftliche Arbeitstage Notfallmedizin, Deutsche Gesellschaft für Anästhesiologie und Intensivmedizin, Kiel, Germany, February 1

“Ergebnisqualität - Auswertung von Rettungsdienst-einsätzen anhand von Leitstellendaten”, Presentation, Notfallsymposium, Klinik für Anästhesiologie der Universität Mainz, Mainz, Germany, February 28

“Präklinische Prozessoptimierung bei Schlaganfall, Presentation”, Südwestdeutscher Schlaganfalltag, Neurologische Klinik, Westpfalz-Klinikum GmbH, Kaiserslautern, Germany, March 11

“Präklinische Prozessoptimierung bei Verbrennungspatienten”, Presentation, Curriculum Notfallmedizin, Institut für Anästhesiologie und Notfallmedizin, Westpfalz-Klinikum, Kaiserslautern, Germany, March 24

“Notfallversorgung bei geriatrischen Patienten - Aspekte von AAL”, Presentation, Seminar Notfallmedizin, Universität Ulm, Ulm, Germany, April 1

“Medical Emergency Teams”, Presentation, Deutscher Anästhesie Congress, Deutsche Gesellschaft für Anästhesiologie und Intensivmedizin, Leipzig, Germany, May 11

“Notrufnummer 112 – Auswirkungen auf die Hilfsfrist – eine Prozessanalyse”, Presentation, Leinsweiler Gespräche, Arbeitsgemeinschaft Südwestdeutscher Notärzte, Leinsweiler, Germany, June 6

“Dokumentation im Rettungsdienst – Grundlagen, Methoden, Ausblick”, Presentation, Leininger Notarztzirkel, Krankenhaus Grünstadt, Grünstadt, Germany, June 24

“Serious Games in der Notfallmedizin”, Presentation, Fernausbildungskongress, Helmut-Schmidt-Universität, Hamburg, Germany, September 9

“Besonderheiten bei der Notfallversorgung alter Menschen”, Presentation, Fuldaer Notfallsymposium, Klinikum Fulda und Arbeitsgemeinschaft Hessischer Ärzte, Fulda, Germany, September 9

“Leistungsspektrum des Deutschen Zentrums für Notfallmedizin und Informationstechnologie”, Presentation, Initiative Traumanetzwerk Saar-Lux-Westpfalz, Deutsche Gesellschaft für Unfallchirurgie, Pirmasens, Germany, September 16

“Deutsches Zentrum für Notfallmedizin und Informationstechnologie”, Presentation, Advisory Board Meeting, Fraunhofer IESE, Kaiserslautern, Germany, October 8

“Der Notarzt und das Alter – Epidemiologie, Klinik, Entscheidungsfindung mit Hilfe von AAL”, Presentation, Fortbildungsreihe der Sektion Notfallmedizin, Klinik für Anästhesiologie der Universität Heidelberg, Heidelberg, Germany, November 3

**Münch, J.:**

“Determining the Impact of Business Strategies Using Principles from Goal-oriented Measurement”, Conference Paper, 9. Internationale Tagung Wirtschaftsinformatik, Vienna, Austria, February 26

“TAMRI: A Tool for Supporting Task Distribution in Global Software Development Projects”, Workshop, Intl. Workshop on Tool Support Development and Management in Distributed Software Projects, Limerick, Ireland, June 13

“Business Alignment: Measurement-based Alignment of Software Strategies and Business Goals”, Conference Paper, PROFES 2009, Oulu, Finland, June 15

“A Decision Model for Supporting Task Allocation Processes in Global Software Development”, Conference Paper, PROFES 2009, Oulu, Finland, June 16

“Systematic Task Allocation Evaluation in Distributed Software Development”, Workshop, ISDE 2009, Vilamoura, Portugal, November 3

“Measurement-based Alignment of Software Strategy and Business Goals”, Tutorial, Metrikon 2009, DASMA, Kaiserslautern, Germany, November 20

**Naab, M.:**

“Achieving True Flexibility of SOA-Based Information Systems by Adopting Practices from Product Line Engineering”, Doctoral Symposium, SPLC 2009, SEI, San Francisco, USA, August 24–28

**Nass, C.:**

“Veto”: Eine empirische Studie über die Steigerung der User Experience durch Autonomie”, Conference Presentation, Mensch & Computer 2009, German UPA, Berlin, Germany, September 7

**Pretschner, A.:**

“Distributed Usage Control”, Invited Presentation, Bosch CR Software Engineering Seminar, Bosch CR, Schwieberdingen, Germany, September 8

“Do we really need new security mechanisms to deal with the future Internet?”, Invited Panel Diskussion, EuroPKI, CNRS, Pisa, Italy, September 10

“Usage Control Enforcement with Data Flow Tracking for X11”, Conference Presentation, Security and Trust Management Workshop, ERCIM, St. Malo, France, September 23

“Usage Control with Data Flow at and across different levels of abstraction”, Presentation, SPP-Koordination, TU Darmstadt, Darmstadt, Germany, October 1

“Verteilte Nutzungskontrolle”, Presentation, Kuratorium IESE, IESE, Kaiserslautern, Germany, October 8

“Verteilte Nutzungskontrolle”, Presentation, Alumni-Treffen IESE, IESE, Kaiserslautern, Germany, October 28

“Distributed Usage Control”, invited Presentation, Informatik-Kolloquium der TU, TU Dortmund, Dortmund, Germany, November 10

**Rombach, D.:**

“Wie kann der Handel von der Technologiekompetenz in Kaiserslautern profitieren”, Handel in Kaiserslautern, Kaiserslautern, Germany, January 30

“The Fraunhofer Model: A Successful Approach to Speed up Innovation in the ICT Sector”, Invited Presentation, Simula Research Lab, Oslo, Norway, June 15

“Elektronische Heinzelmännchen im intelligenten Haus der Zukunft”, Presentation, Series “Jahr der Wissenschaft 2009”, Kaiserslautern, Germany, July 8

“Towards an Australian-German Research Network – Opportunities and Challenges”, Australia- Europe Workshop, NICTA ATP Reseach Lab, Sydney, Australia, August 18

“Demand-Driven Strategy for E-Government: A German-European Perspective”, Public Seminar Series, NICTA Reseach Lab, Canberra, Australia, August 19

“Smart Energy – Neue Perspektiven der Energieversorgung in der Region”, Zukunftsforum Wörrstadt, Germany, October 26

“Software Engineering for Medicine and Health”, 15<sup>th</sup> Anniversary Meeting, Arlington, USA, October 23

“Software Engineering als Humanwissenschaft”, Rotary-Club, Kaiserslautern, Germany, November 04

“Assisted Living – Technology-based Solutions”, Presentation, WKK-Konferenz, Kaiserslautern, November 12

“Recommendations for Transitioning to an Open Architecture”, Workshop, Open Architecture Eco-Immersion Workshop, John Deere, Des Moines, USA, November 16-18

**Rombach, D.; Bomarius, F.:** “Neue Perspektiven der Energieversorgung in und um Kaiserslautern”, 1<sup>st</sup> Lauterer Energieforum, Kaiserslautern, Germany, July 9

**Schwarz, R.:** “Security by Construction”, Presentation, Bosch Steuerkreis, IESE, Kaiserslautern, Germany, October 1

“Embedded Security – mehr als Kryptografie und TPM”, Presentation, BITKOM Forum Embedded Security, BITKOM, Nuremberg, Germany, October 15

“Security und Security-Prozesse im Bereich der Eingebetteten Systementwicklung”, Invited Presentation, Workshop Bosch CR/AEA3, Bosch CR, Möglingen, Germany, November 26

“Markt der virtuellen Waren in Rheinland-Pfalz und angrenzenden Regionen”, Presentation, Workshop SOAVIWA, Uni Koblenz/Landau, Koblenz, Germany, December 16

**Simon, K.:** “Sicherheitsüberprüfungen” 2008, Presentation, ATIS, FhG, Erfurt, Germany, March 24-26

**Storf, H.:**

“Modelle und Reasoning-Ansätze für die ambiante Notfallerkennung im eigenen Heim”, Conference Paper, 2. Deutscher AAL-Kongress, VDE, Berlin, Germany, January 27-28

“Rule-based Activity Recognition Framework: Challenges, Technique and Learning” Workshop, “PervaSense09: 2<sup>nd</sup> International Workshop for “Situation recognition and medical data analysis in Pervasive Health environments”, London, UK, March 31

“An Event-driven Approach to Activity Recognition in Ambient Assisted Living”, Conference Paper, 3rd European Conference on Ambient Intelligence, Salzburg, Austria, November 18-21

**Trapp, M.:**

“The Apartment Metaphor - Intuitive Navigation for Ambient Assisted Living Applications”, Conference Presentation, British HCI 2009, University of Cambridge, Cambridge, UK, August 31 - September 4

**Zimmermann, F.:**

“Risk-based Statistical Testing: A refinement-based approach to the reliability analysis of safety-critical systems”, Presentation, EWDC 2009, LAAS, Toulouse, Frankreich, May 14

“Risikobasiertes statistisches Testen”, Presentation, TAV-Treffen, TAV, Dortmund, Germany, May 14

# SCIENTIFIC CONTRIBUTIONS<sup>2</sup>

## BOOKS

**Liggesmeyer, Peter:**  
Software-Qualität. Testen, Analysieren und Verifizieren von Software. 2. Aufl. Heidelberg: Spektrum Akademischer Verlag, 2009  
ISBN 978-3-8274-2056-5

## ARTICLES IN BOOKS

**Rombach, H. Dieter; Stefens, Petra:**  
e-Government.  
In: Nof, Shimon Y. (Ed.): Springer Handbook of Automation  
Berlin: Springer-Verlag, 2009, 1629-1643

**Trapp, Sonja:**  
UPSKILLING UML - Blended Learning für Softwarespezialisten.  
In: Wiegmann, Katharina (Hrsg.); Bundesinstitut für Berufsbildung: Innovationen aus Europa. Zur Bilanz der LEONARDO DA VINCI-Pilotprojekte - Teil II  
Bonn, 2009, 211-215 (Impuls 39)

**Trendowicz, Adam; Münch, Jürgen:**  
Factors Influencing Software Development Productivity - State-of-the-Art and Industrial Experiences.  
In: Zelkowitz, Marvin V. (Ed.): Social Networking and the Web  
London: Academic Press, 2009, 185-241 (Advances in Computers Vol. 77)

2) Names of CESE and Fraunhofer IESE members appear in bold.

## ARTICLES IN JOURNALS

**Adam, Sebastian;** Ehresmann, Michael; Krause, Stefan; Schmid, Klaus; Sitou, Wassiou:  
Zwischenbericht des Arbeitskreises Requirements Engineering für Adaptive Systeme.  
In: Softwaretechnik-Trends 29 (2009), 1, p. 8

**Adam, Sebastian; Riegel, Norman; Doerr, Joerg:**  
The Role of Quality Aspects for the Adequacy of Business Processes and Business Information Systems.  
In: International Journal of Business Process Integration and Management 4 (2009), 2, 124-133

**Armbrust, Ove;** Katahira, Masafumi; Miyamoto, Yuko; **Münch, Jürgen;** Nakao, Haruka; **Ocampo, Alexis:**  
Scoping Software Process Lines.  
In: Software Process - Improvement and Practice 14 (2009), 3, 181-197

Ciupa, Ilinca; **Pretschner, Alexander;** Oriol, Manuel; Leitner, A.; Meyer, B.:  
On the Number and Nature of Faults found by Random Testing.  
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## PROCEEDINGS BY EDITORS

**Bomarius, Frank** (Ed.); Oivo, Markku (Ed.); Jaring, Päivi (Ed.); Abrahamsson, Pekka (Ed.): 10<sup>th</sup> International Conference on Product Focused Software Process Improvement. Profes'2009 - Proceedings. (International Conference on Product Focused Software Process Improvement <10, 2009, Oulu>)  
Berlin: Springer-Verlag, 2009  
(Lecture Notes in Business Information Processing 32)  
ISBN 978-3-642-02151-0  
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Ferenc, Rudolf (Ed.); **Knodel, Jens** (Ed.); Winter, Andreas (Ed.): 13<sup>th</sup> European Conference on Software Maintenance and Reengineering. CSMR 2009 - Proceedings: Architecture-Centric Maintenance of Large-Scale Software Systems. (European Conference on Software Maintenance and Reengineering <13, 2009, Kaiserslautern>)  
Los Alamitos: IEEE Computer Society, 2009  
ISBN 978-0-7695-3589-0

**Liggesmeyer, Peter** (Hrsg.); Engels, Gregor (Hrsg.); **Münch, Jürgen** (Hrsg.); **Doerr, Joerg** (Hrsg.); **Riegel, Norman** (Hrsg.); Gesellschaft für Informatik (GI): Software Engineering 2009 - Proceedings: Fachtagung des GI-Fachbereichs Softwaretechnik. (Fachtagung des GI-Fachbereichs Softwaretechnik <2009, Kaiserslautern>)

Bonn: GI - Gesellschaft für Informatik, 2009  
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Wagner, Stefan (Hrsg.); Broy, Manfred (Hrsg.); Deißböck, Florian (Hrsg.); Liggesmeyer, Peter (Hrsg.); Münch, Jürgen (Hrsg.); Technische Universität München. Institut für Informatik:  
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München, 2009

**FRAUNHOFER IESE REPORTS**

**Alves, Vander; Schneider, Daniel; Becker, Martin;** Bencomo, Nelly; Grace, Paul: Comparative Study of Variability Management in Software Product Lines and Runtime Adaptable Systems. Kaiserslautern, 2009 (IESE-Report 007.09/E)

**Anastasopoulos, Michalis; Muthig, Dirk;** Burgos de Oliveira, Thiago Henrique; Almeida, Eduardo Santana; Romero de Lemos Meira, Silvio: Evolving a Software Product Line Reuse Infrastructure: A Configuration Management solution. Kaiserslautern, 2009 (IESE-Report 003.09/E)

**Anastasopoulos, Michalis:** Increasing Efficiency and Effectiveness of Software Product Line Evolution - An Infrastructure on Top of Configuration Management. Kaiserslautern, 2009 (IESE-Report 085.09/E)

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**Armbrust, Ove:** Welche Prozesse brauche ich in 5 Jahren? Strategisches Prozessportfoliomanagement bei der Japanischen Raumfahrtagentur. Kaiserslautern, 2009 (IESE-Report 010.09/D)

**Armbrust, Ove; Ocampo, Alexis; Münch, Jürgen;** Katahira, Masafumi; Koishi, Yumi; Miyamoto, Yuko: Establishing and Maintaining Traceability Between Large Aerospace Process Standards. Kaiserslautern, 2009 (IESE-Report 011.09/E)

**Barkowski, Donald; Schäfer, Christian; Trapp, Mario:** Domain-Specific Modeling as an Enabling Technology for SMEs. Kaiserslautern, 2009 (IESE-Report 048.09/E)

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**Bauer, Thomas; Eschbach, Robert; Hussain, Tanvir; Kloos, Johannes; Zimmermann, Fabian:** Komposition von Benutzungsmodellen: Anforderungen und Konzeption. Kaiserslautern, 2009 (IESE-Report 113.09/D)

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**Ciolkowski, Marcus; Heidrich, Jens; Simon, Frank; Radicke, Mathias:** Empirical Results from Using Custom-Made Software Project Control Centers in Industrial Environments. Kaiserslautern, 2009 (IESE-Report 035.09/E)

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**DIPLOMA AND MASTER'S THESES**

**Hack, Marco;** Schmidt, Gerhard (Supervisor); **Carbon, Ralf** (Supervisor):  
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Schröder, Johannes; **Rombach, H. Dieter** (Supervisor); **Liggesmeyer, Peter** (Supervisor):  
Konzeption einer Model-Driven Development (MDD) Plattform für Requirements Engineering. Kaiserslautern, Techn. Univ., Masterarbeit, 2009

Storck, Michael; **Rombach, H. Dieter** (Supervisor); **Mukasa, Kizito Ssamula** (Supervisor):  
A Tool for Supporting User Interface Specification by Prototyping. Kaiserslautern, Techn. Univ., Dipl., 2009

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Yaco, Michael; **Rombach, H. Dieter** (Supervisor); **Adam, Sebastian** (Supervisor):  
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**Zilch, Stefan;** Knauber, Peter (Supervisor); **Carbon, Ralf** (Supervisor):  
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**PROJECT AND BACHELOR'S THESES**

Becker, Franz; **Liggesmeyer, Peter** (Supervisor); **Rombach, H. Dieter** (Supervisor):  
Building a Platform for Deductive Safety Analysis of Embedded Systems. Kaiserslautern, Techn. Univ., Bachelorarbeit, 2009

Bom, Martin; **Rombach, H. Dieter** (Supervisor); **Liggesmeyer, Peter** (Supervisor); **Landmann, Dennis** (Supervisor):  
Studie über ökologische Faktoren in automotiver Software. Kaiserslautern, Techn. Univ., Bachelorarbeit, 2009

Feth, Denis; **Rombach, H. Dieter** (Supervisor); **Jawurek, Marek** (Supervisor):  
Experiment zur Evaluation von Sicherheitsinspektionen mit Hilfe von Vulnerability Inspection Diagrams und abgeleiteten Inspektionsszenarien. Kaiserslautern, Techn. Univ., Bachelorarbeit, 2009

Hörning, Andreas; **Rombach, H. Dieter** (Supervisor); **Pech, Daniel** (Supervisor); **Silva, Adeline de Sousa** (Supervisor); **John, Isabel** (Supervisor):  
Multiuser Product Line Variability Management Support. Kaiserslautern, 2009  
Kaiserslautern, Techn. Univ., Bachelorarbeit, 2009



# AWARDS

Janotta, Tobias; Keller, Jörg (Supervisor); **Schwarz, Reinhard** (Supervisor): Computergestützte Analyse von CISCO ASA Firewall-Konfigurationen. Hagen, 2009  
Hagen, Fernuniv., Bachelorarbeit, 2009

Kayser, Christian; **Forster, Thomas** (Supervisor); **Rombach, H. Dieter** (Supervisor); **Liggesmeyer, Peter** (Supervisor): Design and Implementation of a Kobra Support for the IBM Rational Software Architect. Kaiserslautern, Techn. Univ., Bachelorarbeit, 2009

Lörscher, Michael; **Rombach, H. Dieter** (Supervisor); **Knodel, Jens** (Supervisor): Evaluation of data model update strategies. Kaiserslautern, Techn. Univ., Bachelorarbeit, 2009

Mickel, Alexander; **Rombach, H. Dieter** (Supervisor); **Liggesmeyer, Peter** (Supervisor); **Mukasa, Kizito Ssamula** (Supervisor): Ein Konzept zum effektiven Auswählen von Prototypingwerkzeugen im Requirements und Usability Engineering. Kaiserslautern, Techn. Univ., Bachelorarbeit, 2009

## HABILITATIONS

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(Research Report. FernUniversität Hagen, Dept. of Mathematics and Computer Science 2/2009).  
Zugl.: Hagen, Fernuniv., Habil., 2008

## INTERNAL AWARDS

**Jochen Heintz**  
IESE-Award 2009 für ausgezeichnete Projektleistungen

**Mario Schmitt**  
IESE-Award 2009 für ausgezeichnete Projektleistungen

**Donald Barkowski**  
IESE-Award 2009 für ausgezeichnete Projektleistungen

**Christian Schäfer**  
IESE-Award 2009 für ausgezeichnete Projektleistungen

**Thomas Bauer**  
IESE-Award 2009 für ausgezeichnete Forschungsleistungen

**Tanvir Hussain**  
IESE-Award 2009 für ausgezeichnete Forschungsleistungen

**Claudia Nass Bauer**  
IESE-Award 2009 für ausgezeichnete Empirie

**Martin Soto**  
IESE-Award 2009 für ausgezeichnete Promotionsleistung

**Balthasar Weitzel**  
IESE-Award 2009 für ausgezeichnete Diplomarbeit

**Tobias Wüchner**  
IESE-Award 2009 für ausgezeichnete Bachelorarbeit

**Dennis Müller**  
IESE-Award 2009 für ausgezeichnete Infrastrukturleistungen

## EXTERNAL AWARDS

**Bauer, Thomas**: ITEA Exhibition Award 2009 for D-MINT Project, ITEA 2 Symposium 2009, Madrid Spain, October 2009

**Rombach, Dieter**: Honorary PhD, University of Oulu, Oulu, Finland, May 2009

**Rombach, Dieter**: The Federal Cross of Merit on Ribbon of the Order of Merit of the Federal Republic of Germany, Staatskanzlei Rheinland-Pfalz, Mainz, November 30, 2009